UMZIMVUBU

LOCAL MUNICIPALITY

UMZIMVUBU LOCAL MUNICIPALITY
FINAL ORGANIC WASTE COMPOSTING STRATEGY

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LIST OF ABBREVIATIONS

AEL	Air Emissions Licence
ANDM	Alfred Nzo District Municipality
C:N	Carbon (C) and Nitrogen (N) ratio
CH_4	Methane
CO_2	Carbon dioxide
COGTA	Department of Co-operative Governance and Traditional Affairs
DEA	Department of Environmental Affairs
DEDEA	Department of Economic Development and Environmental Affairs
DEFF	Department of Environment, Forestry and Fisheries
DNNSOWC	Draft National Norms and Standards for Organic Waste Composting
DWS	Department of Water and Sanitation
ECA	Environment Conservation Act
EIA	Environmental Impact Assessment
EPWP	Expanded Public Works Programme
IDP	Integrated Development Plan
IWM	Integrated Waste Management
IWMP	Integrated Waste Management Plan
IWMSA	Institute of Waste Management of South Africa
MFMA	Municipal Finance Management Act, No. 56 of 2003
MSA	Municipal Systems Act
N_2O	Nitrous oxides

NEM: AQA	National Environmental Management Air Quality Act, No. 39 of 2004
NEM:WA	National Environmental Management: Waste Act, No. 59 of 2008 (as amended)
NEMA	National Environmental Management Act, No. 107 of 1998 (as amended)
NOWCS	National Organic Waste Composting Strategy, 2013
NWIBR	National Waste Information Baseline Report, 2012
NWMS	National Waste Management Strategy, 2011
OWMS	Organic Waste Management Strategy
PIWMP	Provincial Integrated Waste Management Plan
PSC	Project Steering Committee
SALGA	South African Local Government Association
SAWIC	South African Waste Information Centre
SAWIS	South African Waste Information System
UIWMP	Umzimvubu Integrated Waste Management Plan
UOWMS	Umzimvubu Organic Waste Management Strategy
URWCS	Umzimvubu Rural Waste Collection Strategy
WIS	Waste Information System
WMO	Waste Management Officer

EXECUTIVE SUMMARY

Organic waste management is a growing global concern as countries are experiencing increasing waste generation and the associated climate impact. Municipal waste has been managed using a range of solutions, that include technologies such as well-designed landfills, to open dumping and burning of waste. However, with rising consumption, scarce land, and escalating environmental impact, alternative waste treatment mechanisms are needed (World Bank, 2016) .

Composting is considered as an organic waste management strategy and alternative solution to divert organic waste from landfill sites as well as a way to address climate change and agricultural needs. However, it is a solution that has been widely unsuccessful in most developing countries for a number of reasons including technical, financing and policy issues.

The development of the Umzimvubu Organic Waste Composting Strategy (UOWCS) is an important milestone in achieving one of the objectives of the waste management hierarchy as prescribed by the National Waste Management Strategy 2011. To achieve this objective, ULM appointed City Stats Planning (Pty) Ltd to facilitate the development of its first Organic Waste Composting Strategy.

LITERATURE REVIEW

The section discusses the literature related to organic waste compost. It consists of five subsections which include legislative framework, understanding what organic waste is, organic waste compost, methods of composting, composting technologies and organic waste in South Africa: case studies. Legislative framework provides an overview of the relavant legislation, policies, plans, guidelines and municipal sector plans. The second subsection provides an understanding of what organic waste. The third subsection discusses and provides an understanding of organic waste compost, followed by subsection four which discusses different methods of composting organic waste. The fifth subsection discusses techmologies that can be used for composting organic waste. The last subsection discusses how organic waste compost is done in South Africa and it also provides case studies which are helpful in learning the challenges that already exist.

COMPOSTING METHODS & TECHNOLOGIES

Composting can be carried out with varying levels of mechanization which can range from low-technology manually turned piles, to high-technology forced aeration systems in fully enclosed buildings or technologies equipped with bio-filters. The advantageous or best choice is not necessarily the one with high-technology. It depends on the preference of the municipality and taking into account the availability of land and labor. Different municipalities will prefer or select certain methods or technologies depending on their capacity, funding situation and organic waste that will be processed. Other municipalities may prefer a lower cost, manual process, while other may prefer high-technology method. The table below, provides an overview of the different technologies available for organic waste composting.

ORGANIC WASTE IN SOUTH AFRICA: CASE STUDIES

There is a growing focus on organic waste solutions in South Africa. The demand for organic waste is increasing, specifically for clean and homogenous streams, and the market is showing significant potential. The market for alternative waste treatment solutions is becoming more favourable due to:

- Rising landfill costs'
- Limited landfill airspace; and
- Waste generators establishing internal waste diversion targets (GreenCape, 2019).

In South Africa, City of Cape Town and City of Johannesburg Metropolitan Municipalities are already focused on reducing organic waste to landfill. Their target is to reduce the organic waste that is going to the landfill sites by 50% by 2022. This leaves commercial and household kitchens with only few years to solidify a plan to deal with their own food waste. Composting organic waste is a strategy that will not only protect the environment, but ensure that people or their companies, are ahead of the coming tsunami of regulations that will turn their food waste to landfill practice into an almighty problem," (Frankson, 2018).

STATUS QUO

The Status Quo presented the study area with the socio-economic profiles, the current organic waste management systems that are in place in ULM with OWC treatment methods that are applied and can be applied to ULM. The methods include Open

Windrow Composting, Pit composting, Aerated Static Pile Composting as well as the containerised composting.

GOALS AND OBJECTIVES OF THE STRATEGY (ACCORDING TO THE NWOCS)

The purpose of this section is to set out the overall approach of the Organic Waste Composting Strategy (OWCS), including the four priority goals and accompanying objectives for its achievement.

GOAL 1: UNDERTAKE EDUCATION, SKILLS TRANSFER AND AWARENESS.
Objective 1: Conducting education and awareness programmes.
Objective 2: Conduct Capacity Building Initiatives
GOAL 2: UNDERSTANDING, RECORDING AND REPORTING OF ORGANIC WASTE QUANTITIES
Objective 1: Monitor and record the diversion, disposal and treatment of organic waste
GOAL 3: PROVIDE THE NECESSARY SUPPORT STRUCTURE AND FUNCTIONS TO IMPLEMENT COMPOSTING
Objective 1: Providing Support Structure
Objective 2: Providing Financial Support and Incentivisation
GOAL 4: INCORPORATE COMPOSTING INTO MUNICIPAL PLANNING, RESPONSIBILITIES AND CREATE ROLES FOR THE PRIVATE SECTOR
Objective 1: Incorporate Composting into Municipal Planning
Objective 2: Identify responsibilities for reporting opportunities and controls.
Objective 3: Facilitate, enable and guide various levels of Public involvement (PPP).

INSTRUMENTS FOR IMPLEMENTING CHANGE

This section describes the actions and instruments that need to be undertaken to address the current challenges and regulatory framework that could improve the diversion of organic waste from landfill for composting.

IMPLEMENTATION PLAN

This section describes the actions and instruments that need to be undertaken to address the current challenges and regulatory framework that could improve the diversion of organic waste from landfill for composting. The key instruments include but not limited to the following:

CONCLUSION

This Strategy focusses on composting as the organic waste treatment option available to achieve sustainable diversion of organic waste from landfill disposal, via diversion goals and clear plans of action that can be implemented, measured and monitored going forward. It also contributes positively to sustainable development as it will divert organic waste from landfill sites.

The little effort that can be made to implement this strategy will substantially reduce the amount of organic waste going to landfill sites and thus help in saving the landfill airspace. This will result in the reduction of environmental pollution and problems associated with poor landfill operations, amongst other benefits.

1. INTRODUCTION AND OVERVIEW

1.1. PROJECT BACKGROUND

Organic waste management is a growing global concern as countries are experiencing increasing waste generation and the associated climate impact. Municipal waste has been managed using a range of solutions, that include technologies such as well-designed landfills, to open dumping and burning of waste. However, with rising consumption, scarce land, and escalating environmental impact, alternative waste treatment mechanisms are needed (World Bank, 2016) .

Majority (90%) of waste generated in South Africa is being sent to landfill sites for disposal. South Africa has large quantities of organic waste that are being disposed of at the landfill sites and greatly reducing the available airspace. This further contributes to greenhouse gas emissions, as well as numerous other negative environmental impacts.

Composting is considered as an organic waste management strategy and alternative solution to divert organic waste from landfill sites as well as a way to address climate change and agricultural needs. However, it is a solution that has been widely unsuccessful in most developing countries for a number of reasons including technical, financing and policy issues.

Department of Envirornmental Affairs (DEA) which is now Department of Environment, Forestry & Fisheries (DEFF), developed the National Organic Waste Composting Strategy (NOWCS) to provide an overview of the current situation in South Africa regarding organic waste management. It recommends that each Municipality must develop it's own strategy.

The development of the Umzimvubu Organic Waste Composting Strategy (UOWCS) is an important milestone in achieving one of the objectives of the waste management hierarchy as prescribed by the National Waste Management Strategy 2011. To achieve this objective, ULM appointed City Stats Planning (Pty) Ltd to facilitate the development of its first Organic Waste Composting Strategy.

1.2. PURPOSE OF THE PROJECT

The main purpose of this project is to develop an OWCS that will ensure (where feasible) that organic waste generated within Umzimvubu Local Municipality (ULM) is diverted from landfill sites for composting through integrated and sustainable waste management planning.

This Organic Waste Composting Strategy can also facilitate and guide the development of municipal by-laws specifically for organic products, including organic compost and organic fertilizer or the inclusion of the organic waste compost in the waste management by-laws.

1.3. THE VISION OF THE STRATEGY

Ultimately, this Strategy aims to provide a support tool and insight for public and private bodies to use when identifying and evaluating composting opportunities.

1.4. SCOPE OF WORK AND METHODOLOGY

The scope of this project is to strategise the potential of composting as a method to beneficiate organic waste and to help divert organics from landfill disposal. It is also to ensure that the aim of Umzimvubu Local Municipality of being the leader in waste reduction and recycling continues to expand.

The methodology for this strategy followed a four-stage approach incorporating Project Inception; Literature Review; Status Quo Analysis including Stakeholder Engagement Process; and the Development of the Strategy including Goals and Objectives of the Strategy, Instruments for Implementing Change and the Implementation Plan. The strategy was based on the analyses of available desktop information.

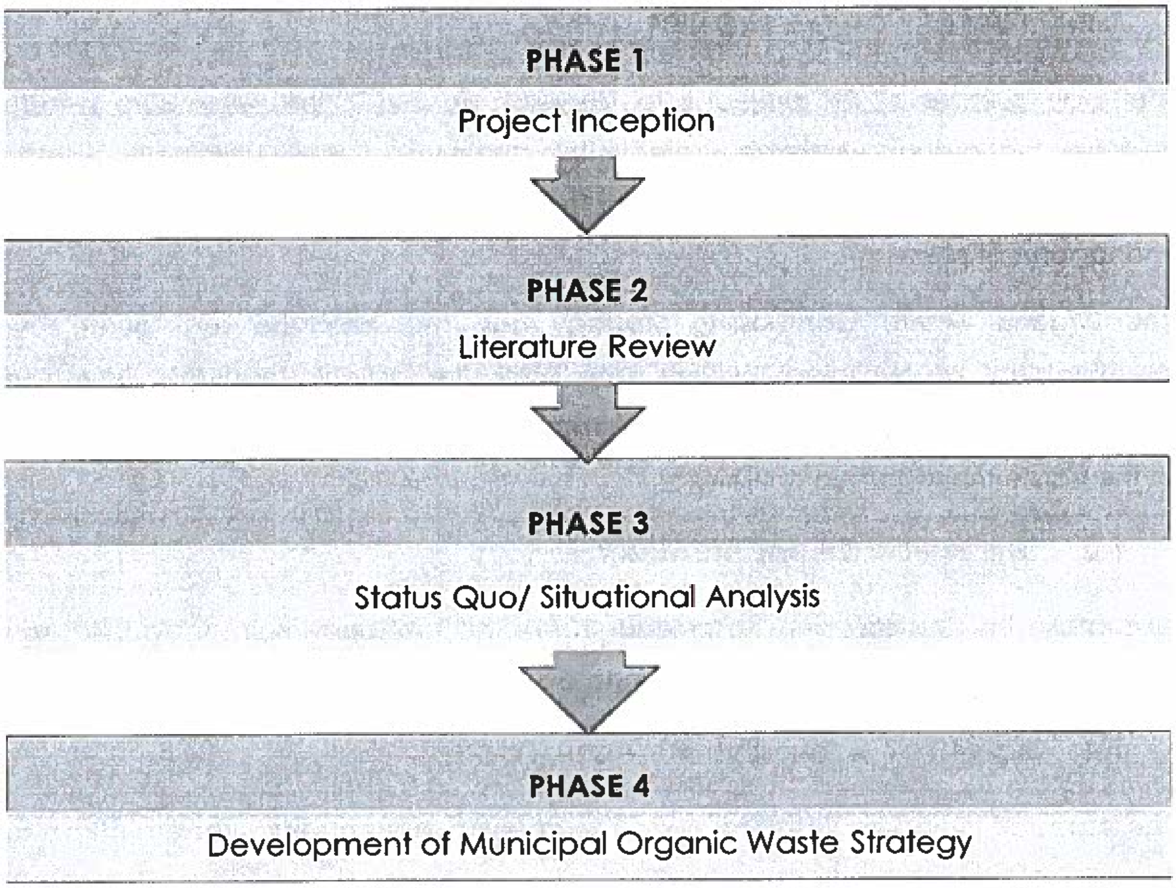

Figure 1: Project Methodology

1.5. CONCEPTS AND DEFINITIONS

The following terms are defined in terms of the National Environmental Management Waste Act (Act 59 of 2008) and Draft National Norms and Standards for Organic Waste Composting 2019.

Compost refers to a product of controlled aerobic, biological decomposition of biodegradable materials. The organic waste undergoes mesophilic and thermophilic temperatures, which significantly reduces the viability of pathogens and weed seeds, and stabilizes the carbon such that it is beneficial to plant growth;

Compostable Organic Waste refers to carbon-based material of animal or plant origin (that is defined as waste in terms of the South African gazetted National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008:) that naturally enhances fertility of soil through a natural degradation process but excludes human made organic chemicals and naturally occurring organic chemicals which have been refined or concentrated by human activity.

Composting refers to controlled biological process in which organic materials are broken down by micro-organisms means biologically degrading organic materials in the presence of oxygen, yielding carbon dioxide, heat and stabilised organic residues that may be used as a soil additive.

Domestic Waste refers to waste, excluding hazardous waste that emanates from premises that are used wholly or mainly for residential, educational, health care, sport or recreation purposes.

Fertilizer refers to any substance which is intended or offered to be used for improving or maintaining the growth of plants or the productivity of the soil.

Garden Waste refers to organic biodegradable waste material generated from the likes of a typical garden or similar vegetation waste generated from municipal parks and gardens;

General Waste refers to waste that does not pose an immediate hazard or threat to health or to the environment, and includes—

a) domestic waste;

b) building and demolition waste;

c) business waste; and

d) Inert waste.

Hazardous Waste refers to any waste that contains organic or inorganic elements or compounds that may, owing to the inherent physical, chemical or toxicological characteristics of that waste, have a detrimental impact on health and the environment.

Landfill Site refers to an appropriately designed, engineered and authorised waste disposal facility.

Municipal Compost refers to the disinfected and stabilised organic fertilizer manufactured by the controlled decomposition of sorted and milled urban waste including fermentable industrial and commercial waste.

Municipal Waste refers to any municipal compost that does not meet the requirements for compost given in these regulations: on the understanding that such waste must meet the minimum requirements for municipal waste as set out in the regulations for the registration of fertilizers.

Offensive Odour refers to any smell which is considered to be malodorous or a nuisance to a reasonable person.

Organic Waste refers to waste of biological origin which can be broken down, in a reasonable amount of time, into its base compounds by micro-organisms and other living things and/or by other forms of treatment;

Organics refers to both processed and unprocessed compostable organic waste;

Recovery refers to the controlled extraction of a material or the retrieval of energy from waste to produce a product.

Recycle refers to a process where waste is reclaimed for further use, which process involves the separation of waste from a waste stream for further use and the processing of that separated material as a product or raw material.

Re-Use refersto utilise articles from the waste stream again for a similar or different purpose without changing the form or properties of the articles.

Storage refers to he accumulation of waste in a manner that does not constitute treatment or disposal of that waste.

Treatment refers to any method, technique or process that is designed to:

a) change the physical, biological or chemical character or composition of a waste;

b) remove, separate, concentrate or recover a hazardous or toxic component of a waste; or

c) destroy or reduce the toxicity of a waste, in order to minimise the impact of the waste on the environment prior to further use or disposal.

Waste refers to any substance, whether or not that substance can be reduced, re-used, recycled and recovered:

a) that is surplus, unwanted, rejected, discarded, abandoned or disposed of;

b) which the generator has no further use of for the purposes of production;

c) that must be treated or disposed of; or

d) that is identified as a waste by the Minister by notice in the Gazette, and includes waste generated by the mining, medical or other sector, but—

i. a by-product is not considered waste; and

ii. any portion of waste, once re-used, recycled and recovered, ceases to be waste.

1.6. LIMITATIONS

It must be noted that there is not much of literature conducted on organic waste composting especially in South Africa. Some of the literature was sourced from the internet which is relavent since it was conducted by consulting companies that are rendering services in waste management.

2. LITERATURE REVIEW

The section discusses the literature related to organic waste compost. It consists of five subsections which include legislative framework, understanding what organic waste is, organic waste compost, methods of composting, composting technologies and organic waste in South Africa: case studies. Legislative framework provides an overview of the relavant legislation, policies, plans, guidelines and municipal sector plans. The second subsection provides an understanding of what organic waste. The third subsection discusses and provides an understanding of organic waste compost, followed by subsection four which discusses different methods of composting organic waste. The fifth subsection discusses techmologies that can be used for composting organic waste. The last subsection discusses how organic waste compost is done in South Africa and it also provides case studies which are helpful in learning the challenges that already exist.

2.1. LEGISLATIVE FRAMEWORK

This section provides an overview of the key legislation, policies, plans, guidelines and municipal sector plans that are relevant for this strategy. The requirements set out in these Act's and Regulations will be adhered to throughout the EIA process of the developing the strategy. The following Acts, Regulations, Policies, By-laws and Guidelines are applicable to the development of the Organic Waste Composting Strategy. However, few of these legislations are discussed to show relevance

Table 1: Relevant Legislation, Policies and Guidelines to the Starategy

LEGISLATIONS, POLICIES AND GUIDELINES	KEY STIPULATION	RELEVANCE
The Constitution of the Republic of South Africa Act 107 of 1996	The South African constitution acts as the supreme law in the country. It sets out the environmental mandate as well the different roles and responsibilities of the different spheres of government. The rights of all people are protected by the Bill of Rights, which also affirms the democratic values of dignity, equality and freedom. The sections listed below are of relevance to Waste Management: Section 24: Everyone has the right to an environment, which is not harmful to their health or well-being.	The Municipalities are responsible for providing solid waste services which includes "refuse removal, refuse dumps and solid waste disposal". Once this 'waste' is removed from the waste stream, the waste then enters the "beneficiation stream" and at that point no longer necessarily forms part of the municipal service. A composting operation does not need to be a municipal function and forms part of the "beneficiation stream".
The National Environmental Management Act (NEMA), Act 107 of 1998 as amended	This is the core legislation of Environmental Management in South Africa and all spheres of government are mandated to give effect to this Act in order to fulfil the environmental rights for all South Africans as stipulated in the South African Constitution.	In terms of NEMA, it is anticipated that most of the OWCS projects would require an Environmental Authorisation (EA). In order to obtain an EA most projects would only require a Basic Assessment (BA) Process. However, if condemned animals and their remnants are to be composted, this would trigger a

[illegible]	[illegible]	[illegible]

The Municipal Systems Act (Act 32 of 2000)	It defines the alternative approaches that may be employed in delivering municipal services and the processes to be followed when such alternatives are considered. The need for integrated planning and performance monitoring of both external and internal mechanisms of service delivery are emphasised in the Systems Act. It also sets out the framework for planning processes and is concerned with the provision of services in a sustainable manner while promoting a healthy and safe environment for all.	It relates to adopting and the implementation of fees/ tariffs by municipalities. "Fees and tariffs" are a mechanism that could be used to promote diversion of organic waste from disposal to re-use, in this case, composting.
National Environmental Management: Air Quality Act (No. 39 of 2004)	This Act focuses on the adverse impacts of air pollution on the ambient environment and sets standards for pollutant levels in ambient air. At the same time, it sets emission standards to minimise the amount of pollution that enters the environment.	In terms of NEM:AQA, if any composting activities include the processing of more than 1 ton of animal matter per day then an Atmospheric Emissions License must be applied for. This process would also run in parallel with the above-mentioned NEMA and NEM:WA processes. However, a decision on an AEL Application would only be processed and issued once a positive EA has been received.

The Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act (No. 36 of 1947)	Its aim is to • to provide for the registration of fertilizers, farm feeds, sterilizing plants, and certain remedies; • to regulate the importation, and sale of fertilizers, farm feeds, seeds and certain remedies, and • to provide for matters incidental thereto.	Compels any facility or operation selling compost to be registered with the Department of Agricultural Technical Services. Furthermore, it provides that wastewater or sewage sludge can be used as an input material into compost, however, the sludge must meet the requirements for total metal and inorganic content.
National Water Act (Act 36 of 1998)	This act is responsible for protecting South Africa's water resources and pollution prevention of water resources. Water uses, as defined in NWA, include discharge of waste or water containing waste into a water resource, disposing of waste in a manner that is detrimental to a water resource or disposing of water containing waste.	Relates to the pollution of a water source and covers aspects such as abstraction, discharge, etc. This Act needs to be considered as part of the site location and any possible water usage as part of the composting process. Composting operations could generate pollutants that need to be managed and prevent pollution of relevant water sources.
The Municipal Finance Management Act (No. 56 of 2003) (MFMA)	The objective of this Act is to ensure the sound and sustainable management of financial affairs within municipalities and other local government institutions.	It restricts Municipal involvement in waste management activities associated with processing and manufacturing, as these are considered to be non-municipal function. It also covers management

		of revenue, transparency, expenditure, assets, liabilities, financial planning.
National Environmental Management Act (No. 107 of 1998): Environmental Impact Assessment Regulations 2014 as amended (GN No. 326 of 2017),	Their purpose is to regulate the procedure and criteria as contemplated in Chapter 5 of NEMA relating to the preparation, evaluation, submission, processing and consideration of, and decision on, applications for environmental authorisations for the commencement of activities, subjected to environmental impact assessment, in order to avoid or mitigate detrimental impacts on the environment, and to optimise positive environmental impacts, and for matters pertaining thereto. They list the activities that requires authorisation before they commence.	They require that an Environmental Authorisation (EA) respectively be obtained for constructing a composting facility, as well as for undertaking actual composting activities and processes.
National Environmental Management Waste Act, (No. 59 of 2008): Waste Classification and Management Regulations 2013	Their purpose is to- (a) regulate the classification and management of waste in a manner which supports and implements the provisions of the Act;	They aim to prohibit a significant portion of certain materials or substances from being landfilled (e.g. garden waste). GNR 615, 2012 states 25% diversion from baseline of separated garden waste (within next 5 years), and 50% within next 10 years, from time of promulgation. The Regulations, when

	(b) establish a mechanism and procedure for the listing of waste management activities that do not require a Waste Management Licence; (c) prescribe requirements for the disposal of waste to landfill; (d) prescribe requirements and timeframes for the management of certain wastes; and (e) prescribe general duties of waste generators, transporters and managers.	promulgated, are going to have a significant impact on solid waste management and related funding.
Draft National Norms and Standards for Organic Waste Composting, 2019	They aim to provide for a national approach to composting and to exempt composting facilities from requiring a Waste Management Licence.	Provide a national uniform approach relating to controlling the composting of organic waste at a facility that falls within the threshold in order to prevent or minimise potential negative impacts on the bio-physical and socio-economic environment.
The National Waste Management Strategy, 2011	The strategy aims to ensure (where viable) that organic waste generated within South Africa is diverted from landfill sites for composting, as one alternative treatment method, through integrated and sustainable waste management planning.	The National Waste Management Strategy (NWMS) advocates for the waste management hierarchy as a necessary approach towards achieving effective waste management and contributing to sustainable development. Organic waste composting has been identified by the NWMS as

		one of the approaches towards achieving the objectives of the waste management hierarchy, amongst other measures.
National Waste Information Baseline Report, 2012	This report aims to model the baseline of waste generation, recycling, treatment and landfilling in South Africa, while making use of existing waste data stored in provincial and national waste information systems, and in public and private reports.	It details the baseline quantities of organic waste that needs to be reported. Organic Waste has been categorised into garden, food and wood waste.
The National Organic Waste Composting Strategy, 2013	The strategy aims to ensure that organic waste generated in the country is diverted from landfill sites for composting through integrated and sustainable waste management planning. It also explores the opportunities for diverting compostable organic waste from landfill disposal.	It provides recommendations which include amongst others the following: • that each Municipality must develop own strategy once waste streams have been quantified. • To link organic component to existing landfill monitoring- organic waste management plan per landfill.

Umzimvubu Local Municipality IWMP, 2019	It's primary objective is to integrate and optimise waste management planning in order to maximise efficiency and minimise the associated environmental impacts and financial costs, and to improve the quality of life for all.	The need assessment of the IWMP recommends that ULM develop a composting strategy and raise awareness on how to compost, the benefits of composting and to encourage home composting and communal composting, particularly in farming communities. This will help divert garden waste from the landfills.
Umzimvubu Local Municipality Rural Waste Collection Strategy, 2020	It's purpose is to analyse the current waste types and volumes generated in the rural villages of ULM.	It provides an overview of available and implementable technologies and opportunities for organic waste management.

2.2. UNDERSTANDING WHAT ORGANIC WASTE IS

Organic waste is defined differently in different laws and strategies. According to National Environmental Management: Waste Act, 2008 (Act No: 59 of 2008): Draft National Norms and Standards for Organic Waste Composting 2019, organic waste is "waste of biological origin which can be broken down, in a reasonable amount of time, into its base compounds by micro-organisms and other living things and/or by other forms of treatment". In other literature, organic waste is defined as any material that is biodegradable and comes from either a plant or an animal. Biodegradable waste is organic material that can be broken into carbon dioxide, methane or simple organic molecules.

Organic waste generally comprise materials that are accepted for disposal at a licensed municiapal general waste landfill site. It includes the following:

- Garden waste (e.g. cut grass, leaves, cut trees, etc.)
- Organic food waste (e.g. vegetables and fruit);
- Paper, cardboard, wool, rags (i.e. organic materials not classified as or contaminated by hazardous materials);
- Animal carcasses, hooves, bone meal, kraal manure, bat manure and other manure (as long as the waste has not been condemned by a veterinary); and
- Sewage sludge (only if the sludge meets the requirements for total metal and inorganic content as prescribed in the Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act (No. 49 of 1996)).

2.3. ORGANIC WASTE COMPOST

Composting is a managed process which utilizes microorganisms that are naturally present in the organic matter and soil to decompose organic material. These microorganisms require basic nutrients, oxygen, and water in order for decomposition to take place at an accelerated pace. The end-product, which is compost, is a dark brown, humus-like material which can be easily and safely handled, stored, and used as a valuable soil conditioner. The composting process is dependent upon several factors, including: the population of microorganisms, carbon to nitrogen ratio (C:N), oxygen level, temperature, moisture, surface area, pH, and time.

Composting is a proven method to minimize organic waste. It is also a sustainable organic waste management solution that can potentially be low cost and require less technical capacity than alternative treatment methods. Various national and international practices have demonstrated the effectiveness of composting organic waste which in turn reduces the amount of waste requiring landfill and the generation of landfill gas. Due to the high percentage contribution of organic waste to the total general waste generated in South Africa, the potential for composting in South Africa is significant and thus was investigated as a diversion alternative.

Composting organic waste, helps in achieving one of the objectives of the waste management hierarchy as prescribed by the National Waste Management Strategy (NWMS) (2011). Waste management hierarchy, is the overall approach that informs waste management in South Africa. The waste management hierarchy consists of options for waste management during the lifecycle of waste, arranged in descending order of priority. The options of waste management are presented in figure 1 below:

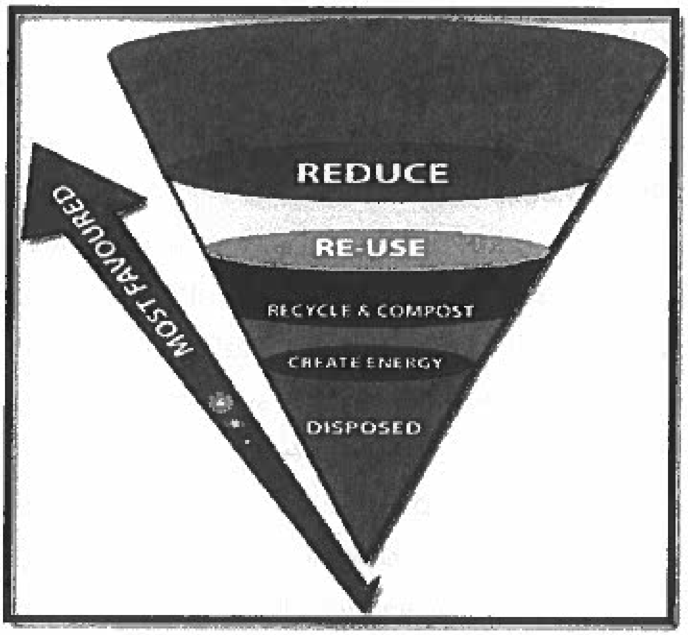

Figure 2: Waste Management Hierachy

The waste management hierarchy provides a systematic and hierarchical approach to integrated waste management, promoting waste recycling, and composting, ahead of safe disposal.

NWMS is structured around eight strategic goals to achieve sustainable waste management in South Africa. For the purpose of this strategy, focus will be on one strategic goal. The focus will be on goal 1 which promotes waste minimisation, re-use, recycling (including composting) and recovery of waste. Waste composting is one of the options to be considered before disposal to the landfill. This goal as explained in the NWMS, aims at diverting particular waste streams from landfills. It is therefore important to put in the measures to control general waste entering landfill sites as this will strengthen the diversion of recyclable and compostable waste from these sites. It further states that it is the responsibility of the municipalities to divert organic waste from the landfills, which they can compost or use in biogas digesters.

Composting has various benefits which include the following:

Environmental and Agricultural benefits:

- composting is a carbon neutral (and potentially even negative) natural degradation process. It reduces methane and toxic leachate generation from landfills as well as waste runoffs and algae blooms, which can disrupt the local ecosystem. With less organic waste going to the landfill, the risk of fire can be reduced (NOWCS, 2013 and Taiwo, 2019).
- Composting is an environmentally compatible fertilizer. It has advantages over inorganic fertilizers because the quality of the soil (poor and sandy soils) is improved and becomes more productive.
- Since compost generally has a pH of 6.5 to 7.0, the same as preferred by most plants, it can modify the pH of soil which may have a pH either below or above this range, and bring it closer to what plants prefer. When added to soil, compost refills nutrients and organic matter, sustains moisture and plant growth, increases plant uptake of fertilizers, prevents soil erosion and reduces water use for growing plants and crops.
- Compost keeps the environment free from unnecessary toxins that may affect health and well-being, thereby increasing the quality of human life.
- It improves the aesthetic quality of the surroundings.

Economic benefits:

- it reduces waste management costs by avoiding landfill fees
- It results in significant cost savings by reducing the need for water, fertilizers and
- pesticides.
- It extends the operational lifespan of landfill sites by diverting organic materials from the waste stream.
- It reduces transportation costs (Taiwo, 2019).

Waste composting does not only help in diverting waste from landfills, it also contributes towards the reduction of greenhouse gas emissions (CO_2, CH_4 & N_2O) in the landfills which will then contribute to the reduced impacts of climate change and global warming (NWMS, 2011).

Since South Africa is commitmented to ahieve sustainable development, the country aims at "balancing the broader economic and social challenges of a developing and unequal society while protecting our environmental resources". There is a need to eliminate the unnecessary use of raw materials and the need to support sustainable product design, resource efficiency and waste prevention. Less and better managed waste is a key component of sustainable environmental management (NOWCS, 2013).

2.4. COMPOSTING METHODS & TECHNOLOGIES

Composting can be carried out with varying levels of mechanization which can range from low-technology manually turned piles, to high-technology forced aeration systems in fully enclosed buildings or technologies equipped with bio-filters. The advantageous or best choice is not necessarily the one with high-technology. It depends on the preference of the municipality and taking into account the availability of land and labor. Different municipalities will prefer or select certain methods or technologies depending on their capacity, funding situation and organic waste that will be processed. Other municipalities may prefer a lower cost, manual process, while other may prefer high-technology method. The **Table 2** below, provides an overview of the different technologies available for organic waste composting with description, advantages and disadvantages. It must be noted that the duration is for the time taken for the compost to be completed.

Table 2: Overview of the different methods/ technologies available for organic waste composting (NOWCS, 2013 and World Bank, 2016)

TYPE OF COMPOSTING TECHNOLOGY	DESCRIPTION OF TECHNOLOGIES	ADVANTAGES	DISADVANTAGES
Aerated/ Open Windrow Composting	Composting takes place in the open air with organic materials structured in rows of long piles of waste known as windrows. The waste feedstock is mechanically shredded and placed into long windrows on a solid, non-permeable surface. Water may be added, depending on the moisture content of the waste.	• It is a relatively low capital waste treatment process • Saleable product • Land application when convenient • Improves nutrient qualities	• Green waste dependent on the weather conditions • Collection infrastructure impacts waste types received • There can be respiratory / health issues associated with bio aerosols from turning compost, & some odour issues • High use of water
Aerated Static Pile Composting	Composting with static piles of organic materials that are aerated internally with blowers. It is suitable for a relatively homogenous mix of organic waste and works well for larger quantity generators of yard trimmings and compostable municipal solid waste (e.g. food scraps, paper products), such as local governments, landscapers, or farms;	• It produces compost relatively quickly (3-6 Months) • The core of the pile retains its warm temperature during cold climate	• It does not work well for composting animal byproducts • It may require significant cost and technical assistance to purchase, install, and maintain • Water may evaporate in warm climate

In-Vessel Composting	Composting via a mechanized machine that processes organic materials and then requires compost to mature outside the machine for two weeks. Large amounts of waste can be processed without taking up as much space and it can accommodate virtually any type of organic waste	• Completed rapidly, resulting in product stabilisation / sanitation in 3 to 4 days • Relatively small footprint allows entire process to take place within a controlled environment (inside a building) • Maintain a rapid decomposition process year-round regardless of external ambient condition	• Requires active management to ensure a good mix of materials is processed, in order to develop and maintain good quality compost outputs • Potential for odour issues • High use of water
Vermicomposting	Composting in bins where worms process organic materials. Red worms in bins feed on food scraps, yard trimmings, and other organic matter to create compost. The worms produce worm tea that can be used to fertilise plants;	• It is cheaper and more sustainable • It helps the soil to have better structure, more body and a healthier general appearance	•
Anaerobic Digestion	It focuses on the biological degradation (process operates in the absence of oxygen) of biodegradable wastes by microbes under controlled conditions.	• It has potential for treating a variety of organic waste streams • Greenhouse gas and harmful gases are prevented • It has the potential for energy production	• Requires on-going management and monitoring • Health and safety issues can arise at AD plants • Significant odour issues

			• Quality is often insufficient for the digestate to be used as soil enhancer
Earth Cycler Composting Machine	This is a composting machine that can process up to 5000kg of organic waste per month. It can process all food waste including fish, bones, dairy, cooked food, egg shells and cartons, as well as manure, garden waste and waste paper. It is cost and energy-efficient.	• Automated. • Measurement & control. • Low labour requirement. • Includes shredder. • Small footprint. • Remote software management. • High composting temperature. • Plug n Play.	• Lifting bin required • manual loading system.
Mechanical biological treatment (MBT)	It combines both mechanical and biological treatment methods (open windrow composting, materials recycling facilities, anaerobic digestion and in-vessel composting). These are supported by a combination of pre-treatment and sorting techniques at the beginning of the process, and a selection of emissions control and quality control techniques at the end of the process.	• Conserving resources and reducing emissions harmful to the environment • Reduce volume and more rapid waste stabilisation • Stabilisation of the waste reduces side-effects at the landfill site • Hazardous waste contaminants will not reach municipal landfill sites due to	• Potential for odour issues • A variety of occupational health and safety issues • Dry recyclables separated out during the process will be of poor quality • Demand fixed tonnages of waste

		the sorting of the waste prior to treatment	
Pit composting	For pit composting, holes or trenches are dug to bury your waste. The organic materials gradually break down over a period of six months to a year. This method comes at no cost but requires extra labor for digging.	• Can be sited where you plan to make a new planting bed or garden • Materials are out of sight • Requires no construction and minimal labor • No turning is necessary • Holds as much organic matter as you have • Good for any area	• Takes six months to a year before matter breaks down • Cannot harvest the compost • Cannot do hot composting
CONTAINERISED COMPOSTING			
Closed Bins Composting	These are closed bins that are usually made from recycled plastic with lids to cover. They can come in different shapes (from square to cylindrical). These bins typically have no bottom, so that it is easy to harvest the compost materials.	• Good for small spaces because of their size and appearance	• The containers also hold a limited volume of material. • They cannot be used for hot composting, because the closed bin makes it difficult to maintain the required temperature.
Bokashi composting	Bokashi composting is a process of fermentation that quickly and easily converts	• Relative low cost. • Easy to implement.	• Complex at higher volumes.

	food waste into highly productive compost. The key to the bokashi process is fermentation. Through fermentation, bokashi composting generates garden friendly microbes, yeast and fungi. These microorganisms are vital building blocks of a healthy and productive soil structure.	• Low training requirement. • No power requirement. • A natural, safe and eco-friendly fermentation process • Suitable for a wide range of food waste, including hard-to-compost foods • 2 week fermentation period.	
Open Bins Composting	These types of bins typically use either wire fencing or wood to create a neat, structured area to stockpile the organic matter. The openness of the bin/s allows for easy turning and harvesting of materials and for air to enter and circulate, speeding up decomposition.	• Simple to construct • Holds large amounts of organic matter • Good for hot composting • Materials are tidy and partially hidden • Easy to turn materials and harvest compost • One-bin system fits in most areas	• Can be expensive • Compost isn't completely hidden • Three-bin system requires a lot of space
Tumblers Composting	Tumblers are usually made out of plastic and are less labor-intensive method. As closed units that keep materials out of sight, they are suitable for any area.	• Good for small spaces because of their size and appearance • Easy to turn materials	• Harder to harvest compost • Volume is limited • Cannot do hot composting

	They are normally attached to a support structure that raises them slightly above the ground so that the whole unit can be turned either with a handle or by hand. Homemade versions can be made from a 210l drum with a tight-fitting lid.		
Piling Composting	This is a method where a heap of mixed, compostable materials are piled up. It does not require any additional materials, other than a pitchfork for turning. The openness of the pile makes that task easy. Piling is another great option for hot and cold composting.	• Requires no construction • Good for hot or cold composting • Easy to turn materials • Easy to harvest compost • Can make varying amounts of compost	• Not desirable in small spaces because of its appearance

2.5. ORGANIC WASTE IN SOUTH AFRICA: CASE STUDIES

There is a growing focus on organic waste solutions in South Africa. The demand for organic waste is increasing, specifically for clean and homogenous streams, and the market is showing significant potential. The market for alternative waste treatment solutions is becoming more favourable due to:

- Rising landfill costs'
- Limited landfill airspace; and
- Waste generators establishing internal waste diversion targets (GreenCape, 2019).

"In South Africa, City of Cape Town and City of Johannesburg Metropolitan Municipalities are already focused on reducing organic waste to landfill. Their target is to reduce the organic waste that is going to the landfill sites by 50% by 2022. This leaves commercial and household kitchens with only few years to solidify a plan to deal with their own food waste. Composting organic waste is a strategy that will not only protect the environment, but ensure that people or their companies, are ahead of the coming tsunami of regulations that will turn their food waste to landfill practice into an almighty problem," (Frankson, 2018). Below, are the case studies for CoCTMM and CoJ MM on how they are diverting their organic waste from landfill sites.

2.5.1. CITY OF CAPE TOWN METROPOLITAN MUNICIPALITY

Western Cape Province generated an estimate of 489 293 tonnes of MSW organics and 299 574 tonnes of commercial and industrial organics in 2015. The organic MSW makes up to 20% of the total MSW generated which is 2 387 353 tonnes. Projections for MSW organics generation were made using the average annual population growth rate of 2.1 % for the Western Cape Province. From this, it was projected that MSW organics generated in 2018 was estimated to increase to more than 520 650 tonnes and to increase to 554 729 tonnes by 2021. It was also projected that an estimate of about 318 626 tonnes of commercial and industrial organic waste was generated in 2018 and 339 366 tonnes by 2021. CoCT municipality was projected to generate 362 200 tonnes of MSW organics in 2018, which is expected to increase to 384 410 tonnes by 2021. It is expected that CoCT will continue to generate 70% of organic

- According to Western Cape IWMP (2017 – 2020) CoCT has alternative organic waste treatment options which include one wastewater sludge treatment project (Northern Works Bio-solids Project), two biomass, solid organic waste treatment such as anaerobic digestion, or a mechanical biological treatment facility.

Shopping centres in CoCT are investing in organic diversion. There are few companies that are considering in-house composting and these include the following:

- The N1 City mall is one of the malls in Cape Town to establish a bio-digester to treat in-house organic waste streams. The containerised investment worths about R3.5 million and Has the capacity to process 0.6 tonnes of restaurant organic waste per day. It takes up a space of only three parking bays (GreenCape, 2019).
- Growthpoint which is the South Africa's largest property investment holding company, has publicised its zero organics to landfill target by 2022. To achieve this, Growthpoint is developing a strategy that includes an organic waste specific beneficiation component (GreenCape, 2019).
- The V&A Waterfront has also shown it's contribution towards diverting organic waste from landfill sites. It launched its onsite material recovery facility in January 2018 to separate and divert waste from landfill. The investment worths around R17 million and has an average of 75 tonnes a month of organic waste. Key to its success has been the implementation of a green lease system that requires tenants to separate waste at source (GreenCape, 2019).

2.5.2. CITY OF JOHANESBURG METROPOLITAN MUNICIPALITY

City of Johannesburg (CoJ) generated an estimate of over 2.3 million tonnes of domestic waste in the 2018/19 financial year. An estimate of approximately 1 973 951 tonnes was disposed at the Pikitup landfill sites and private landfills and 83 104. 32 tonnes was diverted (Pikitup, 2019). Organic waste is estimated to be approximately 38% of the municipal solid waste (Taiwo *et al*, 2016).

The amount of waste that is being generated in the city is rising at a fast pace due to the significant growth, in population as well as in the average income of the residents. An estimate of 93% of waste in the city is disposed of at the four operational landfills.

This causes the landfill sites' airspace to deplete fast, with the estimated cumulative remaining airspace expected to last for 10 years if there are no implemented interventions. When all the local landfill sites are closed, waste will have to be exported to long distance destinations at much higher cost. The CoJ was mindful of its need to align to the paradigm shift of waste management approaches and implement sustainable waste diversion strategies to augment waste disposal to landfill (CoJ, 2017). The projections of remaining airspace per landfill site are presented in the **table 4** below

Table 4: Projections of remaining airspace per operating site (Pikitup, 2019)

Landfill Site Name	Remaining Airspace (m^3)	Remaining Lifespan (Years)	Estimate Closure Date
Robinson Deep	943 433	4 years and 2 months	August 2023
Goudkoppies	3 073 348	10 years and 7 months	January 2030
Marie Louise	149 857	4 Months	October 2019
Ennerdale	618 830	6 years and 7 months	June 2026

2.5.2.1. SOLUTIONS FOR ORGANIC MSW IN CITY OF JOHANNESBURG

City of Johannesburg (CoJ) has embarked on a waste management planning and review process in order to better manage the solid waste stream. The process involved data collection, environmental impact assessments (EIA) as well as public participation. An analysis of solid waste stream in Johannesburg demonstrated that more than half of the waste strems, was organic waste (Sehlabi and McKay, 2016). This organic waste was from household gardens, parks and sports fields which were increasing the waste that is disposed of at the landfill sites. To address this challenge, CoJ then opted on composting this organic waste which would save landfill airspace, reduce transport costs and, through sales of the endproduct, increase municipal income (Sehlabi and McKay, 2016).

The CoJ method to compost otganic waste is called the Panorama Composting Plant which was commissioned in 1995 and became operational in 2003. This plant is currently owned and operated by PIKITUP (an integrated waste management service provider to the CoJ). The plant uses a highly mechanized, centralized aerobic composting system. The Panorama Composting Plant contributes positively to sustainable development as it does divert waste from landfill sites, but this is only on a small scale. (Sehlabi and McKay, 2016) The Panorama composting plant has the capacity to process approximately 17 000 tons of green waste per annum into compost (Pikitup, 2019). The composting process utilizes only clean organic material. The plant produces other products such as mulch, potting soil, unscreened compost and top dressing and is currently operating at full capacity. There are 48 garden waste transfer sites in CoJ, available to the public to dispose of light garden waste(Pikitup, 2019).

3. STATUS QUO/ SITUATIONAL ANALYSIS

3.1. STUDY AREA

The ULM is a Category B local municipality situated within the Alfred Nzo District Municipality in the north-western part of the Eastern Cape Province. The municipal area covers an area approximately 2506 km². The municipality is characterized by rural areas with majority of the population reside in these rural areas. The municipality has two main service centers which are Mount Frere (KwaBhaca) and Mount Ayliff (eMaxesibeni) respectevely.The locality is presented in the figure below:

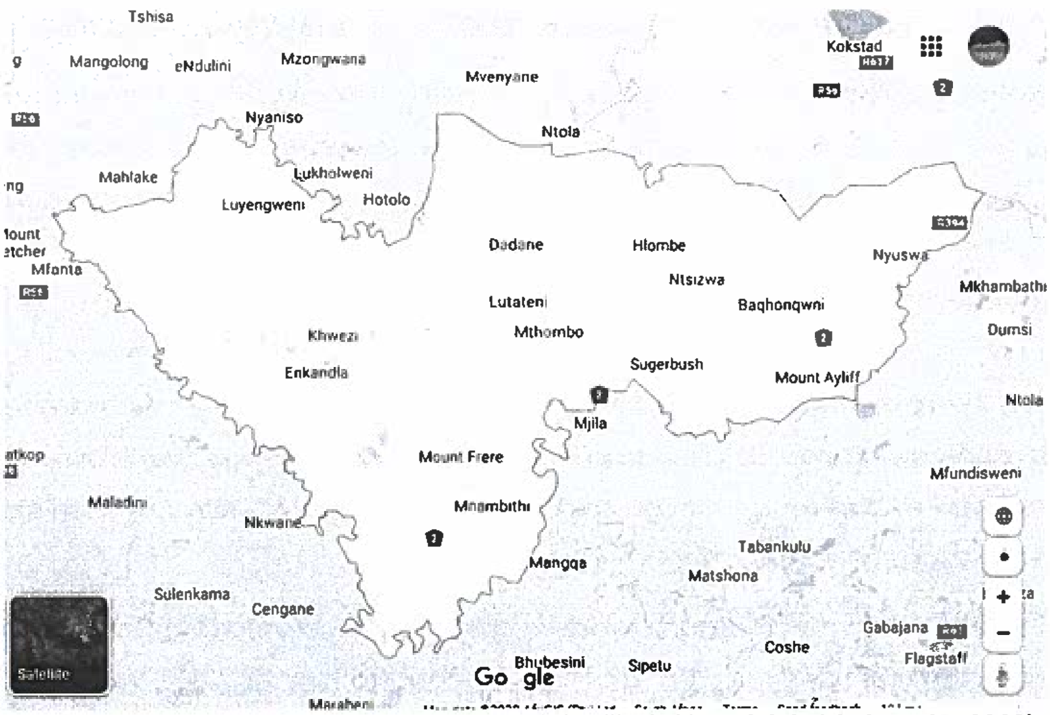

Figure 3: Locality for Umzimvubu Local Municipality (AfriGIS (Pty) Ltd, Google, 2020)

3.2. SOCIO- ECONOMIC PROFILE

3.2.1. POPULATION DISTRIBUTION

In order to obtain a better understanding of the areas likely to generate the most organic waste in ULM, the current population together with household distribution data was evaluated. The total population of ULM was estimated to be 199 620 in 2016 as indicated in the Community Survey 2016 (Stats SA, 2018). The annual population growth rate of ULM is estimated to be 0.85%. According to UML IDP (2019/20) the municipality has an estimate of 90% or more of the population residing in rural villages.

3.2.2. EDUCATION LEVEL

When it comes to education level, the residents in the municipality has low levels of educational achievement, with only 7.1% of the population having completed matric or higher. This has implications on the employment sector, as individuals that have not reached or achieved a certain level of educational, are often faced with difficulities to get into the formal employment market. "This has further bearing on the nature of investment activity that will be feasible and sustainable in the area. Without the provision of adequate education and training, a skills deficit may constrain future development within the umzimvubu area" (ULM, 2019). See below for average educational attainment levels of residents of the ULM area.

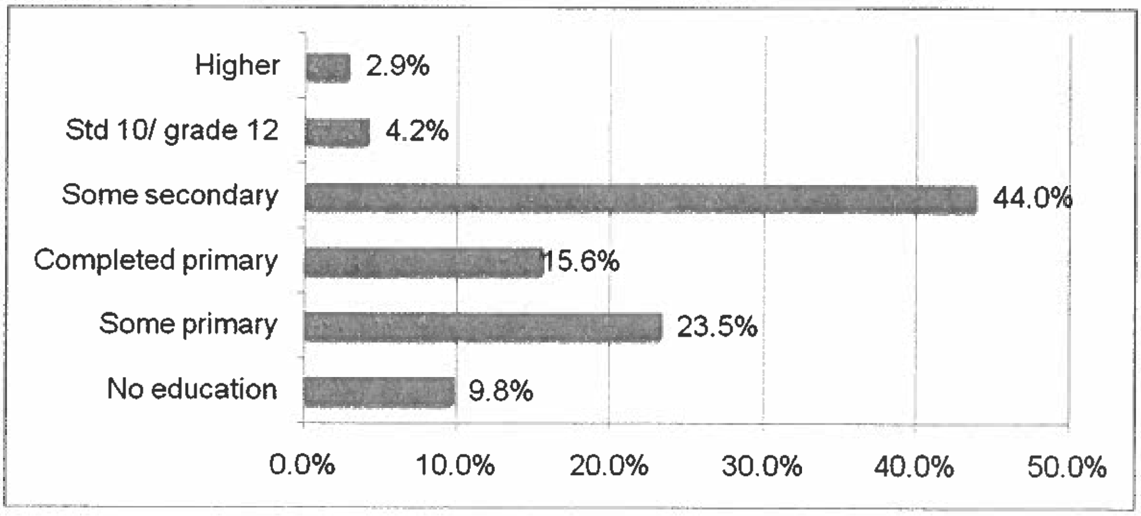

Figure 4: level of education and literacy for ULM (ULM, 2019/20)

3.2.3. EMPLOYMENT LEVEL

The working age population of ULM is estimated to be approximately 118 122 individuals. However, given the low levels of functional literacy in the area (adult population that has gained at least a grade six level of education), the quality of the Umzimvubu labour is compromised, giving rise to a small base of employable individuals from the area. The employment status for ULM is categorized as employed, unemployment and not economically active. The percentage of the unemployed group is 11.6%, while the unemployed group is 26.6% and the 61.7% of not economically active group. This shows a low level of employment in the ULM area.

Household income

The ULM ousehold income is concentrated and compressed in the lower brackets with a cumulative 65.4% of all households earning less than R1 600 per month.

Table 5: The distribution of households per different income categories in the ULM (ULM, 2017).

Average income	Percentage
None income	16,3%
R1 - R4,800	7,2%
R4,801 - R9,600	14%
R9,601 - R19,600	25,7%
R19,601 - R38,200	21,1%
R38,201 - R76,4000	6,9%
R76,401 - R153,800	4,7%
R153,801 - R307,600	2,8%
R307,601 - R614,400	1%
R614,001 - R1,228,800	0,1%
R1,228,801 - R2,457,600	0,1%
R2,457,601+	0,1%

3.3. CURRENT ORGANIC WASTE MANAGEMENT SYSTEMS

The information on current organic waste management systems in ULM was mostly derived from municipal IDP 2019/20, IWMP 2019,as well as RWCS, 2020. The Rural Waste Collection Strategy of the municipality was mostly used in this section. Even though it does not include the urban area of the municipality, it's results were used for the whole municipality since the municipality is characterized by rural areas with an estimate of over 90%.

3.3.1. EXISTING ORGANIC WASTE DIVERSION

According to ULM IDP, 2019/20, the municipality collects an estimated 11% of the sorted and unsorted municipal waste from households, suitable properties and businesses to waste facilities (GCB-) for recycling and final disposal. This 11% of waste collection is taking place in 2 urban centers or towns (Mount Frere and Mount Ayliff) and 8 rural areas. This means that the rest of the rural areas are not serviced and have to resort to other methods to deal waste. The reason for not servicing the rural areas is "reportedly due to the high costs associated with providing such a service to largely inaccessible, sparsely populated areas" (ULM, 2019/20)

The study conducted for rural waste collection indicated that the residents in the rural areas of ULM burn their waste which is done through digging a pit and dump all waste in the pit then burn and close the pit. In the urban area of ULM waste is disposed of at the Mount Frere and Mount Ayliff landfill sites. Some of the recyclable materials are then reclaimed on site by recycling co-operatives(ULM, 2020).

It is also indicated that residents indicated that they do not formally make compost, but they use the food waste to feed their animals and they re-use the remainder of the harvested crops to fertilise the soil for the next planting season. This means that different types of waste including organic waste in the larger part of the municipality are not disposed of at the landfill sites (ULM, 2020).

Site inspection in the Mount Free and Mount Ayliff landfill sites was conducted in May 2020 by one of the consultants to prove that there are different waste streams disposed of in the two landfill sites. There is currently areas desinated for waste sorting in both landfill sites. However, there are still some waste streams such as cardboards and plastics that are still disposed to be covered and compacted. See the pictures below for waste sorting in the two landfill sites.

Figure 5: Sorting of plastic and cardboard waste at Mount Ayliff Landfill Site

Figure 6: Sorted plastic in Mount Ayliff Landfill Site

Figure 7: Sorted tyres at Mount Ayliff Landfill Site

Figure 8: Recyclable waste sorted at the Mount Ayliff Landfill Site

Figure 9: Plastic waste sorted for recycling at Mount Frere Landfill Site

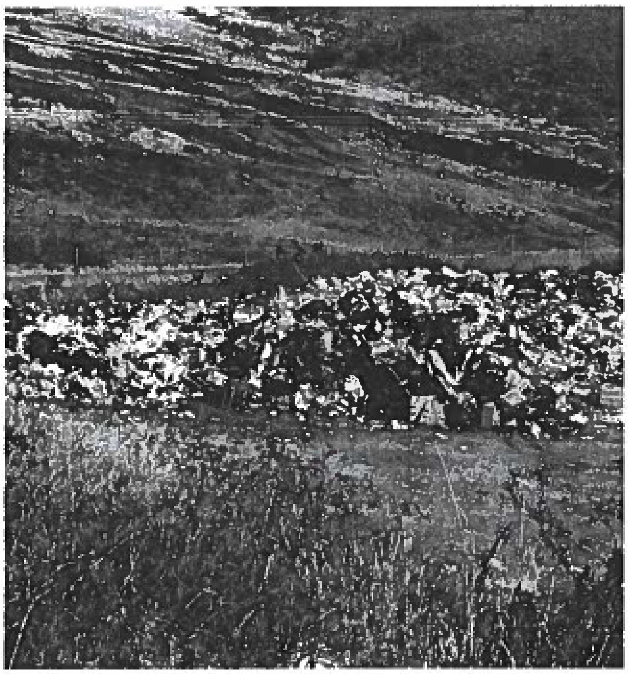

Figure 10: Unsorted waste that is to be overed at the Mount Frere Landfill Site.

Currently, only recyclable waste such as plastics, paper, metal and glass diverted from being covered at the landfill sites. There are designated areas for sorting of recyclable waste in the landfill sites. Organic waste that is collected from households is not separated or sorted from the waste that needs to be disposed and compacted. It is then recommended that a site/ area in the landfill sites be designated for organic waste sorting so that it can not be covered and compacted but turned into compost.

3.3.2. GENERATION RATES AND REMAINING LIFESPAN OF LANDFILLS

This section discusses the generation rates of general waste with more focuson organic waste and it duscusses the remaining lifespan of the landfill sites of ULM.

3.3.2.1. GENERATION RATES

The ULM Waste Streams Analysis, 2017, includes an analysis of waste generated in ULM. The analysis was based on the two typical waste stream breakdowns, namely, "one for a high density, lower income area" and "one for a low density, higher income area'. For the high density, lower income area, the majority of waste generated include rubble, soil and ash (47%) as well as organic matter (40%). On the other hand, low density higher income area, also showed that rubble, soil and ash (28%) as well as organic matter (21%) are the majority of waste generated. Organic waste is the second highest waste generated in ULM. This is also true according to the RWCS . It shows that organic waste in ULM is estimated to be over 38% of the total domestic waste generated in rural areas, which means it is the most generated waste in the municipality (ULM, 2020). See the figures below for the waste streams in ULM.

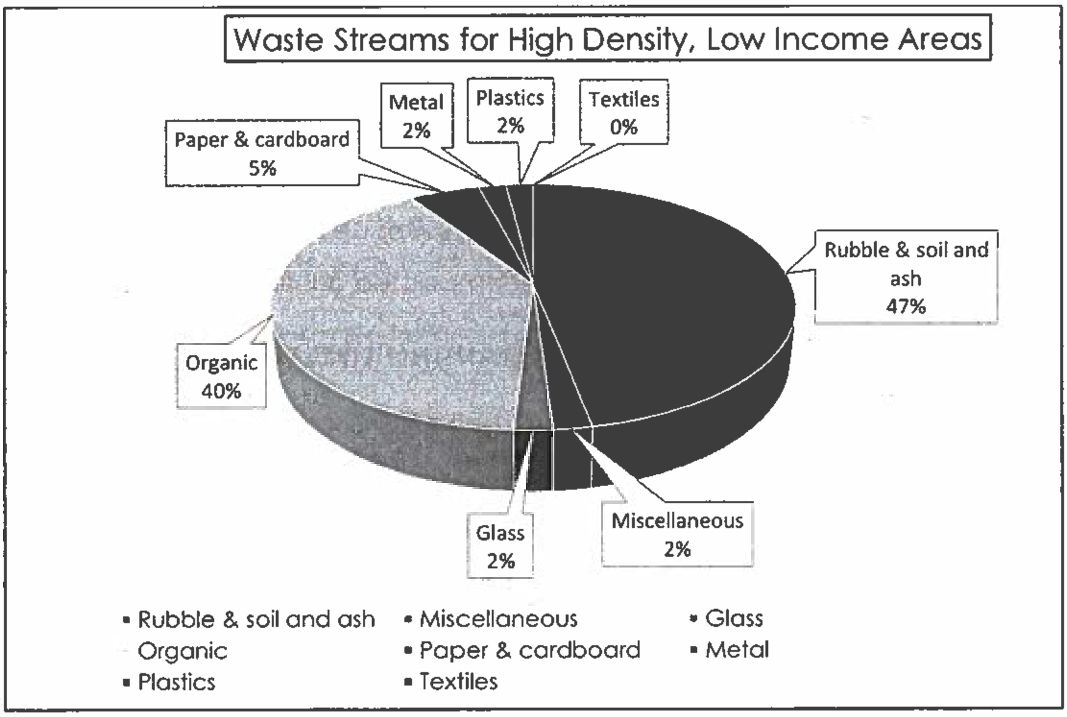

Figure 11: Breakdown of waste streams for high density, low income areas

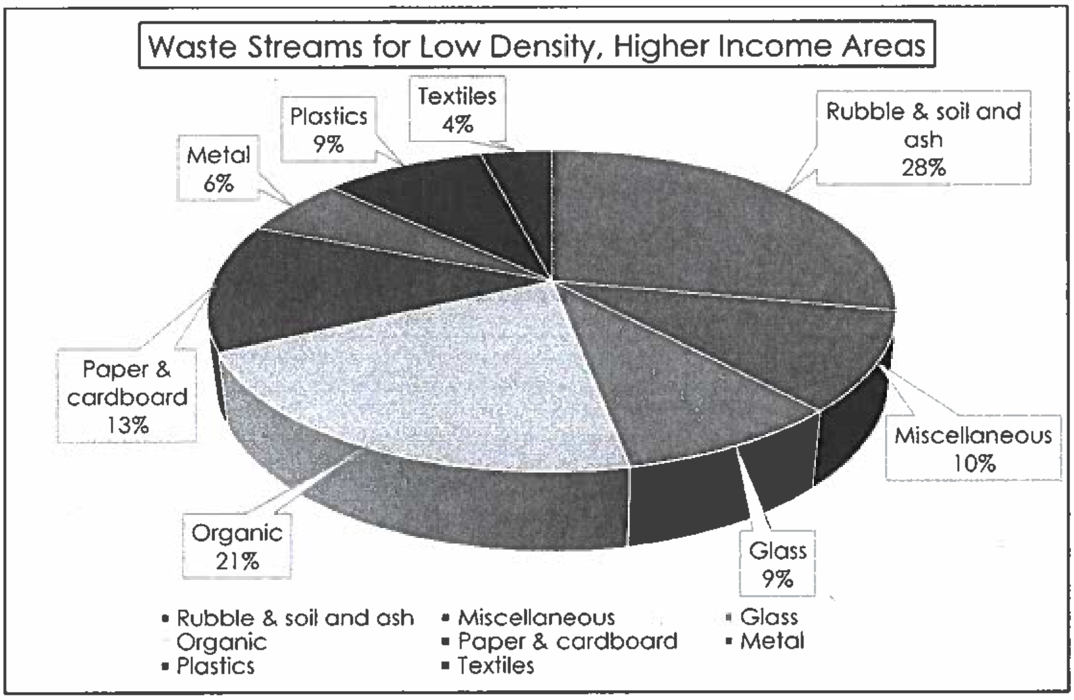

Figure 12: Breakdown of waste streams for low density, higher income areas

It was reported that in 2019, an estimate of approximately 49 000 tonnes of waste was generated in UML per year, with 5 400 tonnes of waste disposed of at the landfill sites

(ULM, 2019). The 5 400 tonnes is an estimate of the 11% of the waste collected by the municipality in the urban areas. It was further reported that waste generation in ULM will reach 53 000 tonnes per year by 2029. This means that if the municipality will still be collecting 11% of waste generated, then 5 830 tonnes will be disposed of at the landfill sites (ULM, 2019).

From the above waste generated in ULM, the assumption is that in 2019, organic waste generated in ULM is estimated to be approximately 18 620 tonnes (38 %) per year. The organic waste that was disposed of at the landfill sites is estimated to be approximately 2 052 tonnes per year. The future organic waste generation will then reach 20 140 tonnes per year in 2029, with 2 215 tonnes per year going to the landfill sites. This is a lot of waste that will contribute in making the ladfill sites to be full quick or filling the airspase of the landfill sites quick.

3.3.2.2. REMAINING LIFESPAN OF LANDFILLS

In ULM, there are two landfill sites (G:C:B-) that are owned and management by the municipality. They are located in Mount Ayliff and Mount Frere. These landfill sites are licensed in terms of the National Environmental Management: Waste Act (Act 59 of 2008), as amended, (NEMWA) as reported in the municipal IDP and IWMP. They both accept only general waste.

From the section above, it was learned that waste generated is increasing every year as the population increases. However, the landfill airspace is decreasing every year as the waste generation increases. This means that landfill sites will reach their capacity quick.

The availability of the landfill airspace of Mount Ayliff was calculated using 50% of population disposing of their waste at this landfill site. The landfill airspace for Mount Ayliff was determined as two years and assuming the same for Mount Frere landfill site it then means the Municipality might not have enough airspace on landfills to service the entire ULM (ULM, 2020).

This shows and proves that promoting the diversion of organic waste from landfill sites is important for a number of reasons, which among them is the fact that we are fast running out of landfill space (ULM, 2020) and it is essential to prevent adverse environmental effects (Frankson, 2018). If the airspace runs out, the municipality will be forced to construct new landfill sites which do not come cheap. The cost and sighting of new landfills are very challenging and this is happening all over South Africa.

The URWCS (2020) has shown that if waste composting at home is encouraged, there will be less waste going to the landfill sites. The following table presents how the total waste in the rural areas that is going to the landfill sites can be reduced when organic waste composting is implemented. The waste generation rates were calculated for four scenarios, namely;

- No organic waste is separated at households;
- 25% of rural households separate their organic waste;
- 50% of rural households separate their organic waste; and
- 75% rural households separate their organic waste.

Table 6: Waste generation rates for four scenarios (ULM, 2020)

DESCRIPTION	WASTE TO LANDFILL/WEEK (tonnes)
Total waste generation	336.94
25% of rural area compost	294.82
50% of rural area compost	252.70
75% of rural area compost	210.59

This table indicates that if organic waste composting in the municipality is encouraged and implemented, there will be less waste going to the landfill sites for disposal. The organic waste that will be diverted from landfill sites will be more than this as the urban part of the municipality is not included in this study.

3.3.3. OWC TREATMENT METHODS APPLIED & THAT CAN BE APPLIED IN ULM

This section provides an analysis of the organic waste composting methods that are used and can be used for organic waste management in ULM. This are being presented in the table below:

Table 7: Organic waste composting methods that are used and can be used in ULM

TYPE OF COMPOSTING TECHNOLOGY/ METHOD	DESCRIPTION OF TECHNOLOGIES/ METHODS	APPLIED/ CAN BE APPLIED IN ULM	VIABILITY OF OPTION FOR ULM
Open Windrow Composting	takes place in the open air in large, elongated, uniform prism shaped 'piles' of waste known as windrows. The waste feedstock is mechanically shredded and placed into long windrows on a solid, non-permeable surface. Water may be added, depending on the moisture content of the waste.	This type of composting is currently not used in ULM	• This technology is viable and can be implemented in the ULM because it is an option that is being practiced and / or under development in South Africa and it has a strong potential for contributing to advanced integrated solid waste management in South Africa. • Other municipalities such as City of Johannesburg (CoJ) are already using it. ULM can even learn from CoJ or even visit the municipality for benchmarking.
Pit composting	For pit composting, holes or trenches are dug to bury waste. The organic materials gradually break down over a period of six months to a year. This method comes at no cost but requires extra labour for digging.	This type of composting is partially used/ applied in ULM. RWCS indicated that there are some people in the rural areas that they dump all waste in the pit then burn and close the pit.	• This method of composting can be applied or implemented in ULM or any area because it is easy to implement and it is already partially being applied in ULM. Once the waste is buried, there won't be any work to be done until the soil is ready to be planted

		They are however, not formally make compost.	and it does not require money. One can put as much organic material as they want.
Aerated Static Pile Composting	Composting with static piles of organic materials that are aerated internally with blowers. It is suitable for a relatively homogenous mix of organic waste and works well for larger quantity generators of yard trimmings and compostable municipal solid waste (e.g. food scraps, paper products), such as local governments, landscapers, or farms;	This type of composting is currently not used in ULM	Static pile composting can be implemented at a central point in both rural and areas and managed by a nominated or elected person.
Earth Cycler Composting Machine	This is a composting machine that can process up to 5000kg of organic waste per month. It can process all food waste including fish, bones, dairy, cooked food, egg shells and cartons, as well as manure, garden waste and waste paper. It is cost and energy-efficient.	This type of composting is currently not used in ULM	It can easily be implementable in ULM or any area because it is not expensive and because it can process all food waste including fish, bones, dairy, cooked food, egg shells and cartons, as well as manure, garden waste and waste paper.
Closed Bins Composting	These are closed bins that are usually made from recycled plastic with lids to cover. They can come in different shapes (from square to cylindrical). These bins can typically have or have no bottom (so that it is easy to harvest the compost materials).	This type of composting is currently not used in ULM	This type of composting can be easily implementable in ULM or any area because it is cheap, doable and good for small spaces because of their size and appearance.
Bokashi composting	Bokashi composting is a process of fermentation that quickly and easily converts food waste into highly	Relative low cost. Easy to implement.	Two step process. 2 week fermentation period.

	productive compost. The key to the bokashi process is fermentation. Through fermentation, bokashi composting generates garden friendly microbes, yeast and fungi. These microorganisms are vital building blocks of a healthy and productive soil structure.	Low training requirement. No power requirement. A natural, safe and eco-friendly fermentation process Suitable for a wide range of food waste, including hard-to-compost foods	Complex at higher volumes.
Open Bins Composting	These types of bins typically use either wire fencing or wood to create a neat, structured area to stockpile the organic matter. The openness of the bin/s allow for easy turning and harvesting of materials and for air to enter and circulate, speeding up decomposition.	This type of composting is currently not used in ULM	This method of composting is viable and can be implemented in ULM. This is because it is simple to construct, not expensive and it can be done at the backyards. One can reuse wood or fence to construct the structures for this method.
Tumblers Composting	Tumblers are usually made out of plastic and are less labour-intensive method. As closed units that keep materials out of sight, they are suitable for any area. They are normally attached to a support structure that raises them slightly above the ground so that the whole unit can be turned either with a handle or by hand. Homemade versions can be made from a 210 litres drum or smaller with a tight-fitting lid.	This type of composting is currently not used in ULM	This method of composting is viable and can be implemented in ULM. This is because the tumblers are good for small spaces which means it can be used by anyone even people in urban areas with small yards. One can use an unused drum at home for this method.

Piling Composting	This is a method where a heap of mixed, compostable material is piled up. It does not require any additional materials, other than a pitchfork for turning. The openness of the pile makes that task easy. Piling is another great option for hot and cold composting.	This type of composting is currently not used in ULM	This method is viable and can easily be implemented in ULM. It is, however, less desirable in small urban and suburban locations. Piles work in larger landscapes. This method can easily be implemented in rural areas where the yards are big. Since, ULM is mostly rural, it can be considered as one of the options for composting.

The composting methods identified in the table **Table 7** above are the most feasible and can be implemented by anyone in the municipality. Implementing these methods of composting will help in opening spin off opportunities such as the setting up of community gardens which make use of the locally produced products. Even though implementation of these composting methods does not create job opportunities, it has the potential of improving food security for the residents of ULM. This is an opportunity that can easily be implemented in the rural areas of the municipality since the municipality is not providing waste collection services in these rural areas.

If the municipality is intending to provide the waste services to the rural areas, it is recommended that the residents be educated of the importance of composting so that organic waste is not collected to be disposed of at the landfill sites. This will then help in permanately diverting organic waste from the landfill sites. This will not add any costs to the municipality.

3.3.3.1. PILOT PROJECTS FOR ORGANIC WASTE RECYCLING

This section discusses the organic waste recycling projects that can be used to test their viability in the ULM. The projects will be explained including the infrastructure or resources needed as well as cost estimates. These projects will include the individual (home composting) and communal projects which can be implemented during the 2020/21 financial year.

3.3.3.1.1. BOKASHI COMPOSTING

As explained in the methods and technology section, this type of composting uses closed bins that are usually made from recycled plastic with lids to cover. Bokashi fermentation is the process of turning food scraps and kitchen waste into compost. The anaerobic process, in its most basic form, is all about fermenting organic matter in an acidic environment so it can be quickly assimilated into the soil again. Usually anaerobic composting has negative by-products, but Bokashi is a closed bucket system that allows composters to reap the benefits without the negative side effects.

The process all occurs in a system so there are no insect or rodent issues, no putrid odors, and minimal (if any) greenhouse gasses produced. Bokashi is also beneficial because you can add all types of food waste including meat, cheese, dairy and bread. Unlike traditional composting, you don't have to worry about mixing greens and browns in any specific ratio. It is one of the most affordable composting systems and the entire process takes two weeks instead of months.

This type of composting can be used by individuals in their households for their home gardens and can be done as a community project for people involved in community gardens. It can be centralized to support community gardens for food security. This can be easily implemented in the rural and urban areas.

To start with this composting project, about 20 to 50 households can be chosen to participate. To make it easier, the municipality can purchase the Bokashi kits which are available in all the provinces but mostly in the Gauteng Province. Bokashi composting can cost up to R570.00 Inclusive of Value Added Tax (VAT). Below are the amounts for different number of households that can be used.

Table 8: Estimated costs for the Bokashi Kits for household use

Number of households	Total cost for the Bokashi Kits
20	R 11 400.00
30	R 13 100.00
40	R 22 800.00
50	R 28 500. 00

The Bokashi kit (**Figure 13 below**) includes:

- 2 x 25L food waste recycling bins with taps
- 2 x bin strainers
- 1 x 2kg Earth Bokashi bran

Figure 13: Bokashi kit

3.3.3.1.2. EARTH CYCLER COMPOSTING MACHINE

This composting machine was developed by a South African company called Earth ProBiotic. This machine can process up to 5000kg of organic waste per month. It can process all food waste including fish, bones, dairy, cooked food, egg shells and cartons, as well as manure, garden waste and waste paper. This composting solution has been implememnted across South Africa, Botswana, Zambia and Mozambique.

The Earth Cycler is a fantastic solution for all businesses or organizations where a vast amount of organic waste is generated. It is especially useful organizations where organic waste is a major environmental issue.

The Earth Cycler can process all food waste including fish, bones, dairy, cooked food, egg shells and cartons, as well as manure, garden waste and waste paper. It is cost and energy-efficient. It consumes a maximum of 30kWh/month, requires no added heat or air and it measures inputs and outputs so that food waste volumes can be tracked and reduced. The Earth Cycler can be remotely managed and receive over-the-air software updates, as well as feed data to online dashboards. Figure 14 below, show how Earth Cycler Machine looks.

Figure 14: Earth Cycler Composting Machine

The municipality can purchase this machine to be used either at the landfill site or at a site that is deemed suitable. It can be centralized to support community gardens for food security as well as landfill nursery. As recommended in section 3.3.1. above, there is a need for a site/ area in the landfill sites to be designated for organic waste sorting so that it can not be covered and compacted but turned into compost. With this, organic waste that is disposed of at the landfill site can be sorted and be turned into compost through the Earth Cycler Machine. The costs and specifications are included in Annexure A below.

3.3.3.1.3. COLLECTION AND TRANSPORTATION OPTIONS

For collection and transportation of organic waste particularly in town, the municipality can dedicate a day where organic waste can be collected to be disposed of at the site chosen for composting. The residents can also be provided with a green wheely bin for organic waste to reduce confusion. Each household would then be provided with one wheely bin for organic waste. This can safe time for sorting waste at the landfill sites.

3.4. CHALLENGES ON ORGANIC WASTE MANAGEMENT IN ULM

Organic waste in ULM is not really managed. It has been learned in the previous sections that the municipality is only rendering waste collection services to approximately 11% of the total population which is mostly in the urban areas of the municipality. The little percentage that receives the waste collection service does not separate their waste at home. This means that all types of waste streams are disposed of at the landfill sites. This pose a challenge in that waste that can be diverted from the landfill sites, is being disposed of at those landfill sites. Organic waste is one of the waste categories that can easily be separated from all other waste categories. Seperating organic waste from other waste categories and reuse it for composting, can help in saving the landfill airspace and lifespan.

Another challenge is that the residents do not have much knowledge and information on composting. This then makes it difficult for the residents to consider composting. It is recommended that the municipality educate or make the residents aware regarding organic waste composting especially at home.

4. STAKEHOLDER ENGAGEMENT

As part of the development of the OWCS, the consultant identified stakeholders and engaged with them.

The purpose of this stakeholder engagement process was to:

- Ensure buy-in and ownership of the Strategy by the relevant stakeholders
- Get consensus on the set targets and action plan to be incorporated into the Strategy

The following platforms were planned to communicate and get input from stakeholders throughout the duration of the study.

- Project Steering Committee (PSC) – This committee comprised of representatives from all key departments within the ULM, relevant officials from ANDM, DEAET and DEFF. The PSC ensures easy access to and meaningful participation by key stakeholders. The draft OWCS report was sent to all members of the PSC to guide the process, review work done and supply any information required. This PSC could not sit due to the Coronavirus (COVID-19) pandemic restrictions.

- Public Workshops – There were three planned public meetings/ worshops which were not conducted due to the Coronavirus (COVID-19) pandemic restrictions.

5. GOALS AND OBJECTIVES OF THE STRATEGY (ACCORDING TO THE NWOCS)

The purpose of this section is to set out the overall approach of the Organic Waste Composting Strategy (OWCS), including the four priority goals and accompanying objectives for its achievement. This is to ensure that organic waste generated within ULM is diverted from landfill sites. Below is a table with summary of the goals and their objectives.

Table 9: Goals and objectives of the strategy

GOAL 1: UNDERTAKE EDUCATION, SKILLS TRANSFER AND AWARENESS.
Objective 1: Conducting education and awareness programmes.
Objective 2: Conduct Capacity Building Initiatives
GOAL 2: UNDERSTANDING, RECORDING AND REPORTING OF ORGANIC WASTE QUANTITIES
Objective 1: Monitor and record the diversion, disposal and treatment of organic waste
GOAL 3: PROVIDE THE NECESSARY SUPPORT STRUCTURE AND FUNCTIONS TO IMPLEMENT COMPOSTING
Objective 1: Providing Support Structure
Objective 2: Providing Financial Support and Incentivisation
GOAL 4: INCORPORATE COMPOSTING INTO MUNICIPAL PLANNING, RESPONSIBILITIES AND CREATE ROLES FOR THE PRIVATE SECTOR
Objective 1: Incorporate Composting into Municipal Planning
Objective 2: Identify responsibilities for reporting opportunities and controls.
Objective 3: Facilitate, enable and guide various levels of Public involvement (PPP).

GOAL 1: UNDERTAKE EDUCATION, SKILLS TRANSFER AND AWARENESS.

Objective 1: Conducting education and awareness programmes.

Public and Municipal awareness and education campaigns and programmes regarding certain waste should include composting of organic waste. Home composting in urban and rural areas, as well as possible communal composting within the rural or lower-income areas should be encouraged as a means to divert organic and garden waste from the general waste stream and create a usable 'product' which is beneficial for the individual and/or the community at large.

Conducting awareness and education campaigns and programmes on organic waste composting will ensure that the resindents understand what composting means, what kind of waste fall under organic waste, their role as residents and why they need to consider composting. This will assist with separation at source as well as diversion of organic waste from landfill.

Objective 2: Conduct Capacity Building Initiatives

Capacity building on organic waste composting within the municipality is required. This can be more effective if the councillors are provided with better and proper education on organic waste management and composting. This will ensure that composting becomes part of ward priorities which will then be incorporated in the IDP.

There is limited information regarding home composting in South Africa. However, development of a user-friendly, easy to read and comprehendible pamphlet / flyer on making compost and the benefits thereof is therefore required.

GOAL 2: UNDERSTANDING, RECORDING AND REPORTING OF ORGANIC WASTE QUANTITIES

Objective 1: Monitor and record the diversion, disposal and treatment of organic waste

Recording of detailed organic waste categories or types is required in order to understand where feedstock is available, and where compost is being produced and/or required. Once an understanding has been achieved, opportunities can be identified and facilitation between feedstock generators and compost producers can take place.

Capacity building within municipalities is required in order to ensure organic waste quantities are measured, recorded, and monitored accurately. To assist with this capacity building, workshops to make the residents understand the current waste generation and disposal context within the municipality and to teach them on how to quantify, measure, record and monitor waste quantities easily and practically per stream should be conducted.

GOAL 3: PROVIDE THE NECESSARY SUPPORT STRUCTURE AND FUNCTIONS TO IMPLEMENT COMPOSTING

Objective 1: Providing Support Structure

The development/ inclusion of organic waste composting in the waste management By-laws will result in responsible parties to control, manage, audit and regulate operations.

Objective 2: Providing Financial Support and Incentivisation

It is widely recognized that composting and other organic waste treatment and recycling methods are considered financially non-viable without appropriate support and incentivisation. The municipality can look into or investigate on government and private funding / subsidisation sources to help promote and implement organic waste treatment facilities. Government fundings include but not limited to Department of Trade and Industry (DTI), Development Bank of South Africa (DBSA), Municipal Infrastructure Grant (MIG), grant / green funding, employment opportunity funding.

GOAL 4: INCORPORATE COMPOSTING INTO MUNICIPAL PLANNING, RESPONSIBILITIES AND CREATE ROLES FOR THE PRIVATE SECTOR

Objective 1: Incorporate Composting into Municipal Planning

In order to meet the organic waste diversion goals, it is important to ensure that organic waste composting strategy forms part of /included in the municipal IDP. This will help in identifying viable composting projects to be included in the IDP. This will also help to address the identified composting challenges and to enhance the opportunities provided by the composting within the municipality. Budget for the composting projects will also be set aside if they are included in the IDP. In this way, organic waste composting will then form part of the Service Delivery and Budget Implementation Plan (SDBIP) of the municipality.

Objective 2: Identify responsibilities for reporting opportunities and controls.

There is a need for the Waste Management Department/ Unit of ULM to identify a responsible official to "champion" the beneficial use of organic waste like any other waste.

Objective 3: Facilitate, enable and guide various levels of Public involvement (PPP).

In order to shift from traditional collect, transport and disposal systems, towards the waste treatment hierarchy an acknowledgement is required that waste minimisation requires multiple role players. ULM should assess the need for expertise from private industry and consider various partnership (Public Private Partnership) scenarios, if required.

6. INSTRUMENTS FOR IMPLEMENTING CHANGE

For the municipality to be able to implement the strategy at large, there are actions and instruments that need to be undertaken. These actions and instruments will also help in addressing the current challenges that the municipality is facing regading the diversion of organic waste from landfill sites.

This section describes the actions and instruments that need to be undertaken to address the current challenges and regulatory framework that could improve the diversion of organic waste from landfill for composting. The key instruments include but not limited to the following:

- Education and awareness on organic waste composting is the first step that needs be considered. The municipality needs to develop and distribute education material (posters/ flyers) to enhance capability in composting or conduct workshops for the residents. Public buy-in is essential for the implementation of this strategy. The level of public buy-in will be determined by the communication between the ULM and the public, the knowledge the public has about organic waste composting, how convenient it is for the public to take part in the initiatives, the sense of pride the public takes in their environment, and the example set by the municipality.

- Municipality needs to develop or include organic waste composting in the waste management by-laws to ensure that composting is taken serious and is implemented.
- Organic waste champion needs to be elected or deployed to oversee the process of implementation of composting in the municipality. The champion needs to assist in reporting the challenges that the municipality and the residents are facing.
- The champion needs to evaluate and provide specific reporting on feedstock availability for further beneficiation within the municipality.
- The municipality to identify and designate an area in the two landfill sites for organic waste sorting.
- ULM needs to consider involving private companies that are within waste management for partnership in constructing and/or manage composting facility/ies.
- Waste Management Department/ Unit needs to report, under the IWMP's, projects proposed to be undertaken to beneficiate organic waste (in this instance) by means of composting operations. This then needs to be included in the municipal IDP's.
- Waste Management Department/ Unit needs to record organic waste volumes produced within the municipality that will eventually be reported/ send to SAWIS as part of the municipal waste volumes that are reported to SAWIS.

7. IMPLIMENTATION PLAN

The section presents an implementation plan to assist the ULM in meeting the goals and objectives of the strategy outlined in Section 4 above. The implementation plan contains a number of projects and respective actions which, need to be implemented to achieve the goals and objectives strategy.

If the plan is to be successfully implemented, responsible stakeholders will need to carefully plan for success. This includes aspects such as ongoing monitoring, meeting target dates, financial planning, legislation and policy compliance, the undertaking of feasibility studies and education and awareness both in the public domain and within local authorities. The identified projects have been prioritised and span a period of 5 years.

Table 10: Implementation Plan for the ULM OWCS for period of 2021-2025

	ACTION	YEAR TO BE IMPLEMENTED END					PRIORITY	PERFORMANCE INDICATOR
		1	2	3	4	5		
		2021	2022	2023	2024	2025		
1	Regulating Organic Waste Composting	X					High	Development of OWC by-laws or incorporate them in the waste management by-laws
2	Designation of OWCS champion	X					High	The champion to oversee the process of implementation of composting in the municipality.
3	Prioritizing the OWCS into municipal planning	X	X	X	X	X	High	Incorporate OWCS into the municipal IDP and ensure that the projects for part of it and are implemented.
4	Designating an area for organic waste sorting	X					High	Identify and designate an area in the two landfill sites for organic waste sorting.
5	Public education and awareness programmes	X	X				High	Develop an education and awareness programme, guides and information packs.
		X	X	X	X	X	High	Raising and education on composting at household levels or through workshops on an on-going basis.
6	Home composting bins programme	X	X				Medium	Municipality to purchase home composting bins to assist the residents to start the programme
7	Home Composting programmmes	X	X	X	X	X	High	Promote and implement home Composting programmmes
8	Registration of people joining the programmes	X	X	X	X	X	Medium	Registration of people who are interested in implementing the programme. The register will assist in monitoring progress and volumes of compost.

9	Recording of organic waste volumes	X	X	X	X	X		Recording of organic waste volumes produced within the municipality that will eventually reported to SAWIS
10	Identification and seeking Government funding / subsidisation sources.		X	X	X	X		Municipality to identify and seek Government Funding / subsidisation sources to help for establishment of organic waste composting facilities (grant / green funding, employment opportunity funding, etc.).
11	Publication of articles regarding composting	X	X	X	X	X		Publishing the success stories and challenges of composting articles in the municipal newletter.
12	Holding composting competitions		X	X	X	X		Holding composting competitions to reward people who are effectively implementing home composting

8. CONCLUSION

This Strategy focusses on composting as the organic waste treatment option available to achieve sustainable diversion of organic waste from landfill disposal, via diversion goals and clear plans of action that can be implemented, measured and monitored going forward. It also contributes positively to sustainable development as it will divert organic waste from landfill sites.

The little effort that can be made to implement this strategy will substantially reduce the amount of organic waste going to landfill sites and thus help in saving the landfill airspace. This will result in the reduction of environmental pollution and problems associated with poor landfill operations, amongst other benefits.

A record-keeping or recording the organic waste from household will assist the municipality to know the volumes of all waste streams. This will help the municipality to properly plan for waste management within the municipality.

It is of great importance that this strategy be reviewed to update the status quo and to assess progress of implemention against the goals and objectives outlined in this strategy. This can be reviewed after 5 years or when the need arises since there is no specific timeframe for it's review.

The success of this Strategy is dependent upon commitment by ULM nad it's residents, as well as the private companies that are within ULM to meaningfully take their responsibilities towards diverting organic waste from landfill sites.

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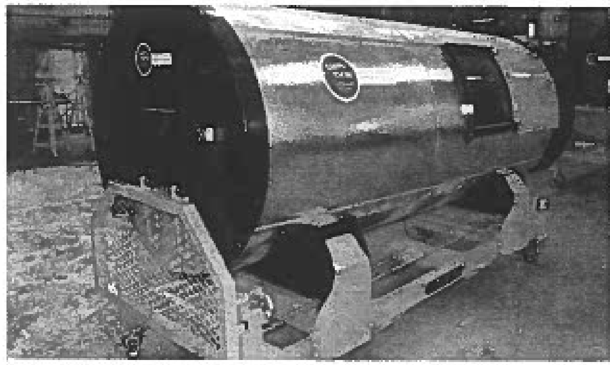
ANNEXURE A

THE COSTS AND SPECIFICATIONS FOR EARTH CYCLER MACHINE

		
	Earth Cycler	**Heron IVC**
Processing Capacity	<5,000kg per month	<50,000 kg per month depending on unit.
Country of Manufacture	South Africa	South Africa
Short Description	An automated flow through composter comprising a composting vessel with input and output hatches and a separate macerator for shredding carbon inputs (e.g. cardboard).	An automated industrial scale flow through composter comprising a wheelie bin lifter, pre-feed macerator and scalable composting vessel.
Feed type	All food waste plus carbon input (cardboard, newspaper and paper). Carbon is sourced from on-site sources (vs. delivered to site). Garden waste can be added.	
Power Requirement	1 phase, 220v 16A industrial connection.	3 phase 340v 36A.
Energy use/month	100kWh	600kWh
Pre-feed macerator	Included	Included
Remote Data Access	Yes	Yes
Data logging	Yes	Yes
Live dashboard	Yes (additional R500/month applies)	Yes (additional R500/month applies)

Over-the-air software updates	Yes	Yes
Construction material	Epoxy coated mild steel.	Epoxy coated mild steel. Tool steel macerator blades. Stainless steel mixing and feed auger.
Size (L x W x H)	3.5m x 2m x 1.7m	$12m^3$ - 6m x 1.5m x 2m $18m^3$ - 8m x 1.5m x 2m $24m^3$ - 10m x 1.5m x 2m
Work space (L x W)	5m x 3m	$12m^3$ - 10m x 5m $18m^3$ - 12m x 5m $24m^3$ - 14m x 5m
Pricing (ex VAT)	Purchase: R350,000 Rental: R8,800 (48 months) - includes macerator/shredder.	$12m^3$: R28,800 (rent), R1,150,000 (purchase) $18m^3$ R34,700 (rent), R1,350,000 (purchase) $24m^3$ R38,500 (rent), R1,550,000 (purchase) - 60 month rental for all above machines.
Optional Extras (ex VAT)	Bin Lifter: R22,800	

APPROVAL OF THE POLICY

The Municipal Council has approved this policy and amendments thereof.

AUTHENTICATION

The amendments of the policy and or the new policy was adopted by the Council on the 29-01-2021

As per Council Resolution number UMC: 359/2020/2021

Signed off

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Mr. G.P.T. Nota

Municipal Manager

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Cllr. N.F Ngonyolo

Speaker of the Council