
# Illegal waste disposal in selected protected areas of the Cape Flats, South Africa*.*

**By:** Luvuyo Buhle Prudent Mdepha

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**Supervisor:** Mr R Mulaudzi
**Co-supervisor:** Mr R Domoney
**Co-supervisor:** Professor K. Shale

**Cape Town District 6 Campus**
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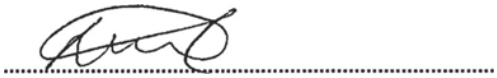
## Declaration

I, Luvuyo Buhle Prudent Mdepha, declare that the contents of this dissertation/thesis represent my own unaided work, and that the dissertation/thesis has not previously been submitted for academic examination towards any qualification. Furthermore, it represents my own opinions and not necessarily those of the Cape Peninsula University of Technology.



**10/12/2022**

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## Abstract

People tend to litter with little thought of the effects of their waste on the environment and the overall health of humanity. The production of waste is an unavoidable consequence of most processes. The after-effects of the “I don’t care” ideology by individuals are one of the main reasons for indiscriminate waste disposal in the environment. Municipal Solid Waste (MSW), a specific category of waste, when left in the environment unattended to; carbon dioxide, carbon monoxide, ammonia, hydrogen sulphide, and particulate matter amongst others are generated over time, and can easily enter the environment or emitted into the air or discharged into water bodies.

The study aims to assess the impact of illegal solid waste disposal in Wolfgat Nature Reserve and Macassar Dunes Conservation Area located around the Cape Flats. This project will bring forth solutions to minimise waste disposal that is detrimental to the environment through qualitative research. Many studies focus on the issue of MSW dumping on open land resources due to rapid population growth and urbanisation whereas little is known about the indiscriminate dumping of MSW on protected land resources due to rapid population growth and urbanisation, thus the interest in the study areas.

Possible solutions to be thought of will add to preliminary data obtained from a pilot study. Furthermore, partnering with Nature Reserve to tackle environmental and waste education at schools and surrounding communities. Lastly, public awareness about waste to members of the community to address indiscriminate waste disposal in the community and in the reserve.

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# 1) Chapter 1: Introduction

People tend to litter with little thought of the effects of their waste on the environment and overall health of humanity (Thompson, 2009). The after effects of the "I don't care" ideology by the public are one of the main reasons of indiscriminate dumping of wastes in the environment (Nwafor *et al*, 2019). Once waste is left in the environment unattended to; carbon dioxide, carbon monoxide, ammonia, hydrogen sulphide, particulate matter amongst others are generated over time, and can easily enter the environment or emitted into the air or discharged into water bodies (Nwafor *et al*, 2019). Protected Areas (PA) or Conservation Areas (CA) in the Cape Flats are inundated with anthropogenic activities that are constantly causing harm to the environment, by eliminating indigenous fauna and flora species. Whether it being poaching, open land dumping, land invasion and/or vandalism, the environment and its indigenous species are slowly being eradicated. Not known to many as PA or CA respectively; Wolfgat Nature Reserve (WNR) and Macassar Conservation Area Dunes (MDCA) have been treated as open land where MSW would be illegally disposed of by some individuals.

The sudden development of informal settlements near the PA and its respective counterpart, CA, has increased the fears of their wellbeing as there have been studies that associated the indiscriminate dumping of waste to the exponential growth of a population (Amoah and Kosoe, 2014). A clean environment does not just happen but it is created, kept clean and always good to behold due to its aesthetic value. Apart from the aesthetic value, a beautiful environment has numerous psychological healing characteristics (Menatti, and Rocha, 2016). The impact of a clean environment on the quality of life and wellbeing is very enormous especially towards trying to preserve our environment (Igboji, 2015). On the other hand, an unclean environment is not only frustrating but a nuisance; moreover, the impact of indiscriminate disposal of wastes is a worrisome health issue for living species (Olokor, 2001). Unfortunately, people enjoy food, drink, clothing, but lack the drive to manage the end products of these resources which in most cases end up being dumped in the environment (Nwafor *et al*, 2019).

## 1.1 Background

The growth of population due to urbanization means a great deal of waste will be generated and discarded; unfortunately this poses a serious environmental challenge (Guerrero *et al,* 2013; Moghadam *et al,* 2009). Some studies have reported that inadequate knowledge on waste management remains a concern and the increase in the use of technology further results in other types of waste (Guerrero *et al,* 2013). Technological advancement has yielded issues such as mass production of plastic, ocean floor exploration and prospecting which result in major pollution. Although the impact of technology is not uniform all over the world, because not all countries are developed, and use of technology is not uniformly distributed but the impact is felt globally (Halit, 2002). According to Zohoori and Ghani (2017), two thirds of solid waste is dumped into the environment with little or no treatment indiscriminately. As a result, the waste is found on open land, in streets, rivers and in drains, contributing to flooding of drainage systems, breeding of insect and rodent vectors and the spread of diseases resulting in a degradation of urban environment.

## 1.2 Waste management challenges

There are numerous types of waste discarded in the environment, the focal study of the paper being municipal solid waste (MSW), which comprises of all waste materials apart from hazardous waste, liquid waste and atmospheric emissions (Beliën, *et al,* 2012). MSW which will be the focal point of this proposal is defined as the range of garbage arising from animal and human activities that are discarded as unwanted and useless (LeBlanc, 2018).. Waste removal is a basic service that is meant to be provided by the local municipality of a particular region and discarded in authorised landfill sites. Solid waste must be managed systematically to ensure environmental best practices as management is a critical aspect of environmental hygiene and needs to be incorporated into environmental planning (LeBlanc, 2018).

In developing countries, there are various matters that may lead to waste management issues. For instance, the inadequate knowledge of waste and/or the corruption of individuals attempting to cut corners to meet standards (Nwabuzor, 2005). In addition, developing countries have difficulties with low technical experience within the expertise of Waste Management and low funding resources. This results in the ineffective and inefficient management of solid waste (Amoah and Kosoe, 2014). Funding for waste management usually

covers collection, transfer and final disposal (Moghadam *et al*, 2009). Some developing countries such as South Africa budget for SWM; however, lack the proper management plan which is a major drawback for the efficient management of waste (Amoah, and Kosoe, 2014). The collection of waste in some areas depends on the economic status and waste management plans in place. Middle and low income households are provided with one dustbin by the local municipality and the municipal waste is removed once per week (Chatsiwa, 2015). The areas around Wolfgat Nature Reserve (WNR) and Maccasar Conservation Area Dunes (MDCA) which are the focal point for the proposal for example; fall under the middle and low income households.

## 1.3 Laws governing waste management

Laws are there to govern people, making known what's right from wrong, and preventing unruliness of citizens. According to Gondwana (2019), National Environmental Management: Waste Act, No. 59 of 2008, states that "*The Waste Act supports the waste management hierarchy in its approach to waste management, by promoting cleaner production, waste minimisation, reuse, recycling and waste treatment with disposal seen as a last resort in the management of waste*". Thus, the South African National Waste legislation serves a number of purposes such as protecting the health of South African citizens, keeping the environment clean and stipulates measures that people and companies must prevent pollution and ecological degradation (Gondwana Group, 2019). Furthermore, the law states that person's found guilty of illegal dumping are to be fined R5000 whereas companies are to be fined more (Gondwana Group, 2019). In the backing of the national waste management act, the CCT Waste Integrated Waste Management by-law states "*no person may drop, throw, deposit, spill, dump, store or in any other way discard, any litter or waste into or onto any public place, municipal drain, land, vacant erf, stream, water course, street, road, wetland, coastline or on any place to which the public has access, or otherwise dispose of it nor may they allow a person under their control to do so*" (Dittke, 2020).

Waste generators who fail to comply with an IWMP in terms of the CCT waste by-law are guilty of an offence (Dittke, 2020). Where on conviction, persons found guilty would be liable for the payment of a minimum fine of R500 but not exceeding R10 000, or the imprisonment for a minimum period of 6 months but not exceeding 2 years, or to both; fine and imprisonment (Dittke, 2020). The court of law may in addition to any penalty imposed, orders a person to

repair and finance the damage, make good the loss, rehabilitate (Dittke, 2020). In most cases, guilty parties go unnoticed because nobody is willing to report the matter, people or residents are paid off to keep quiet and as such communities in close proximity continue to have dumped waste illegally.

## 1.4 Land invasion and socio-economic challenges

Land invasion is an ever-growing issue, as a targeted piece of land may either be; protected land, serve part of a historical site or open land reserved for pre-planned economic activity. Land invasion may be a result of government's slow response in addressing the issue of lack of housing. Informal settlements in urban environments are one of the main contributors in the dumping of waste illegally, because these settlements aren't recognized by the municipality and don't have the proper road infrastructure for MSW collection. Thus, residents resorting to the illegal disposal of waste on open land.

Land invaders who currently occupy the land next to WNR at the intersection of Baden Powell and Swartklip road (Erf 18370), are partially being protected by the ESTA (Extension of Security of Tenure, Act 62 of 1997). The act basically states that "*people whom resided on land on or after 4 February 1997 with permission from the owner, have a secure legal right to carry on living and using that land*". Where these residents only started residing on the plot of land which was earmarked for development well after the year 1997. The law also states that people who earn more than R5000 (after tax deductions) are not protected by this law (Moolman, 2018) but the issue is, majority of the residents of the informal settlement are unemployed which means the municipality cannot remove them. There are discrepancies within the law, incongruities which see the law being taken advantage of. Once people invade land, and are there for more than 30 days, by law they are to be provided with basic services such as water and electricity (Moolman, 2018). Yet, the removal of waste is not included in those basic services of which may result in a big waste issue in the WNR since it's in close proximity. According to ESTA, the owner of the land has the right to the removal of the people if they;

- Damage property;
- Help others build shelters unlawfully on the land and or;
- Harm or threaten other people on the land.

The two former have been breached, yet not much can be done as people's human rights are at the forefront. The increase in illegal waste disposal on WNR may be attributed to the land invaders residing on the plot of land, as these residents do not have means for their waste to be collected. As a result, may lead to the pollution and degradation of MDCA and WNR.

## 1.5 Waste impact on environment and human health

Recycling, sanitary landfills and incineration all play a role in the removal of waste, as they are the solutions in decreasing waste in the environment. However, the effects of toxins in garbage and the sheer physical mass of these toxins cause concern for municipalities and waste disposal agencies in many places (Xaxx, 2018). Billions of waste is generated annually by households, with more than half of the waste discarded illegally by people. Illegally disposed waste generates toxic substances that easily enter the environment for example; through leachate into soil and water, and affect the health of plants, animals and humans.

### 1.5.1 Human health

Several studies have shown that the types of waste that's constantly dumped is residential waste (household waste), and/or commercial waste (industrial and agricultural waste) (Beliën *et al*, 2012). This is the kind of waste that consists of organic waste, plastic, paper, glass and/or metal. This waste when left unattended to in the environment attract flies, rats, and other creatures that, in turn, spread diseases (Alam, and Kafeel, 2013). Furthermore, these are the main human health risks as these insects and rodents are disease vectors (Abdul, 2010), that make their way to the households which are in close proximity to any environment. This then lead to the transmission of the disease to the human population either via direct contact and/or indirectly. Diseases such as cholera, jaundice and/or diarrhoea whereby most the cases of cholera are found in one of the two community's (Abdul, 2010). Water is a natural resource, essential to life but in an unhealthy environment it becomes directly or indirectly the cause of illness or death to humans (Kafando, *et al*, 2013). Contaminated water may be a product of pollution due to the interaction with solid waste in the informal settlements. The water is discarded anywhere and is played with by children which may result in the spread of disease vectors (malaria, diarrhea, cholera, amoebiasis) (Kafando *et al*, 2013). Unfortunately, informal settlements have of one or few functioning tap(s), of which, should the water source be contaminated all the residents would be exposed to possible illnesses.

### 1.5.2 Environmental impacts

Disposal of waste on PA's or CA's could have detrimental effect on indigenous plant and animal species. Anthropogenic disturbances such as residential development (illegal informal settlement development that's in close proximity with indigenous species) and waste disposal on PA or CA's, is slowly leading to the dwindling number of the specie population. Solid waste is a permanent danger to natural resources and animals especially in the Nature Reserves as animal species roam freely. For instance, plastic waste pollutes the soil, reduces infiltration of rainwater, clog pipelines and drains for storm water and wastewater discharge (Kafando *et al,* 2013). Heaps of waste made of organic matter, contributes significantly to the greenhouse effect (Kafando *et al,* 2013) counteracting the purposes of a nature reserve, which serves to clean and purify the air while animals roam freely. Solid waste and domestic sewage, are rich in organic waste, mineral substances, nitrogen, phosphorus and potassium, carries material in suspension which pollutes the water which comes into contact with in informal settlements (Kafando *et al,* 2013). The polluted water results in ecosystem degradation (Kafando *et al,* 2013) which is observed in the study area.

## 1.6 Research questions or Hypotheses

1) What is the cause of the indiscriminate dumping of waste in the Nature Reserve?
2) How much waste is discarded in the nature reserve on a monthly basis by the local communities?
3) Is MSW dumping related to the absence/missing waste collection services?
4) Does indiscriminate dumping of waste have economic, environmental and human health implications on protected areas?

## 1.7 Aims and Objectives

– The overall aim of this project will be to assess the impact of illegal waste dumping in the PA around Cape Flats.

- To achieve the overall aim, the following objectives will be used:
- To identify the source of illegal solid waste dumping and the types thereof;
- To asses environmental and health impact of solid waste dumping on the PA's;
- To assess communities KABP (awareness) about illegal dumping in the study area and;

- To recommend possible and effective waste measures to preserve cleanliness on the nature reserves.

## 1.8 Delineation

The study area that is to be investigated is the MDCA and WNR, which are located in the Cape Flats, in Khayelitsha and Mitchell's Plain. The Reserves are at the end of the intersection of Swartklip road and Baden Powell road, on the left and right hand side respectively. The Reserves boarder the communities, of which the communities are in close proximity. The main parameter of the study is to investigate the prevalent dumping issue that is faced by the Reserve. Which is accompanied by the illegal removal of plant and animal species by the community members of the surrounding communities either for firewood and sport. These anthropogenic activities could have a detrimental effect on the land as the indigenous species are removed to make way for informal settlements, effects that may cause flash floods due to lack of infiltrative soil structure. The communities neighbouring the study area are known to have a high crime rate and high gangsters rate. There are no funds backing the study but because of relations with Reserve employees they are willing to have a helping hand with the study. The Reserve is not fenced, so dumping is a constant problem.

## 1.9 Significance of study

The importance of the study is that the nature reserves that are being degraded are a natural beauty for the area diverting from the norm of the area (such as the high crime rate, gangsters and drug related issues).

- The significance of the study is to ensure the protection of the nature reserve and sustainable management of the area as an educational centre for the current generation and the future generation
- To preserve the species and organisms found within the area and protect them
- By insuring the better management and sustaining of the area it will attract tourists thus bring in revenue for the people within the nearby communities

## 1.10 Expected outcomes

Short term expectation; raise the community awareness about waste dumping in the reserve by conducting a presentation with community leaders, publishing a publication on a journal based on the issues of waste on the reserve and conference presentation. Decreasing the amount of

waste seen in the Reserve. Preserving the cleanliness of the Reserve after the enlisted waste pickup crew has done their job. Long term expectation; Try and gather information if a waste container could be placed in an ideal location away from the Reserve, to prevent dumping in the Reserve and suggest possible amendments to by-laws.

# 2) Chapter 2: Literature Review

The issue of improper solid waste management is one that concerns the entire world and needs to be addressed urgently (McAllister, 2015). According to studies, there is still a lack of knowledge regarding waste management, and the increased use of technology leads to the creation of new types of waste (Guerrero *et al,* 2013). Although the use of technologies is not uniform around the world, its impact is felt globally (Halit, 2002).

Waste production is unavoidable, but illegal waste disposal on land resources is a serious issue (Ferronato and Torretta., 2019), especially on protected land i.e. nature reserve where it may lead to environmental degradation. Two thirds of solid waste (SW) is disposed indiscriminately on the open environment, according to Zohoori and Ghani (2017), without any treatment. There have been reports of SW being dumped carelessly around homes and/or streets which attracts flies that indirectly result in diarrhea in children as reported in Accra, Ghana (Boadi, and Kuitunen., 2005).

The focus of the study, solid waste (SW), is the assortment of garbage resulting from human and animal activity that is dumped as undesirable and/or unwanted (LeBlanc, 2018). SW, which is often known as Municipal Solid Waste (MSW), can be further classified into two main categories: (Belin, *et al,* 2012) Residential and commercial waste MSW can also be divided into organic, plastic, paper, glass, and metal waste categories (LeBlanc, 2018). Several waste items are dumped in the environment after serving their original use. These wastes might be classified as hazardous waste, liquid waste, or air emissions (Belin *et al,* 2012).

In developing countries, various matters hinder MSW management (Nwabuzor, 2005), particularly inaccessible residential quarters due to poor road infrastructure i.e. Accra, Ghana no roads prevent SW collection prior to transportation to waste management facilities (Achankeng, 2003). This results in the ineffective and inefficient management of solid waste. Funding for waste management usually covers collection, transfer and final disposal. Some developing countries such as South Africa budget for SWM however lack law enforcement, and constant environmental education making it a drawback for the efficient management of SW.

## 2.1 Sources of Solid-waste

Solid waste (SW) originates from numerous sources once its intended purpose has been fulfilled, but the manner in which it is handled after its use makes it problematic as the waste is disposed of haphazardly, with no regards to the environment. Non-point sources of illegal waste disposal include individuals who litter, scrap pickers who dispose recklessly and/or people from different neighbourhoods disposing illegally in solid waste hotspots (Ferronato, and Torretta., 2019). Whereas point sources of waste disposal include MSW or CW from residential areas or businesses respectively (Loehr, 1974). For instance, formal settlements and informal settlement.

South Arica's projected population for the year 2021 was estimated to be 60.14 million people according to Statistics South Africa (Stats SA) (2021). Land resources in SA either being congested by residential/business dwellings, invaded land or open land resources. Stats SA's General Household Survey indicates that 79.3% of households in South Africa live in formal dwellings, while 13.9% of households live in informal dwellings (SERI, 2018).

Informal settlements do not have the privilege of having their waste collected due to socio-economic infrastructure issues, i.e. no proper road infrastructure – unpaved, unnamed and/or unnumbered roads, making waste collection impossible which leads to people resorting to dumping waste indiscriminately. Large quantities of waste may be placed in inaccessible areas, prior to its transport to the nearest official municipal landfill site (Achankeng, 2003). Formal settlements have waste disposal services in place but the residents' attitude towards waste management, similar to those of informal settlement dwellers, that hinders efforts of local municipalities to clean waste

## 2.2 Effects of solid waste on human health & environment

Even though there's means to deal with SW, however billions of waste is generated annually by households, with more than half of the waste discarded illegally by people (Zohoori and Ghani., 2017). Uncollected or poorly mismanaged MSW generates toxic substances that easily enter the environment through leachate into soil and water, and affects the health of plants, animals and humans (Han et al. 2014). The effects of toxins in garbage and the sheer physical mass of these toxins cause concern for municipalities and waste disposal agencies in many places (Xaxx, 2018).

Disposal of waste in the environment could have detrimental effects on indigenous plant and animal species, especially in a Protected Area (PA) or Conservation Area (CA). Anthropogenic disturbances such as agricultural practices, introduction of invasive species, overpopulation and waste disposal in the environment, is slowly leading to the dwindling number of species populations. Solid waste is a permanent danger to the natural environment where ecosystems are meant to thrive without hindrances. Instead, uncollected waste that remains stagnant in certain locations causes issues. Plastic waste pollutes the soil, reduces infiltration of rainwater, clogs pipelines and drains for storm water and wastewater discharge (Kafando *et al*, 2013).

### 2.2.1 Impact of solid waste on soil and indigenous plant species

Urbanization has directly and indirectly increased the burden of solid waste on land (soil predominantly), which is harmfully affecting soil properties and its yield (Srivastava *et al*, 2015). Soil a dynamic natural body on earth, is composed of organic materials, minerals and living organisms (Srivastava, *et al*, 2015). It's a protective layer laid over ground water which mitigates the impact of several harmful pollutants i.e. leachate (Goswami and Sarma., 2008). Dumping of SW does not include maintenance costs on the soil but the damaging costs are felt by indigenous fauna and flora and the country's economy, trying to rehabilitate those damages (Han et al. 2014).

SW constantly dumped without taking any precautions is a major cause of soil and groundwater pollution (Ferronato and Torretta., 2019). As it contain significant quantities of major and secondary nutrients besides containing pollutants, trace elements and soluble salts (Goswami and Sarma., 2008). Leachate is considered an environmental pollutant because it is highly concentrated mixture of SW and natural rainfall (Goswami and Sarma., 2008). As rainfall percolates through the waste itself and migrates through soil strata, finally into the groundwater which pollutes underlying and adjacent aquifers (Deshmukh, and Aher., 2018). Leachate contents may vary as it may consist of large amounts of organic content, heavy metals and or inorganic salts (Sharma *et al*, 2018). In a study conducted in Tamil Nadu, India concluded that the harmful nature of leachate alters the quality of the parameters of groundwater namely: electrical conductivity (EC), total dissolved solid (TDS), chloride ($Cl^-$), and sulphate ($SO_4^{-2}$) concentrations (Nagarajan et al. 2012). A small amount of leachate can severely affect a considerable portion of groundwater which is unsuitable for domestic use, thus there is a need

for soil cover to prevent such issues (Alam *et al,* 2017), something the Cape Flats cannot afford. As the Cape Town Metropole is predominantly covered by aquifers, let alone the Cape Flats, as the Metropole was rich in seasonal and perennial wetlands, varying in size and ecological function (Deacon, *et al,* 2021). The possible leaching of MSW into the groundwater could lead to a mass contamination of aquifers in future. The exponential population growth and the associated urban congestion and sprawl, has consequently led to an estimated 97% of all wetlands lost some within the Metropole, primarily due to draining and infilling (Deacon, *et al,* 2021).

Plants are negatively affected by excess salts in soils, as too much Na (sodium) can be detrimental to soil structure (Khaled and Fawy, 2011). Excessive sodium in plants impairs the ability of plants to take up adequate moisture, causes undersized growth and prevents cell development (Khaled and Fawy, 2011). Electrical conductivity (EC) of the soil solution is related to the dissolved solutes (dissolved salts) content of soil and is often used as a measurement of soil salt content (Sharma *et al,* 2018). Of which leachate contributes, as it pollutes soil and groundwater due to the combination of waste and water through percolation. Soil plays a big role in preventing groundwater from being contaminated thus the need for its presence and protection. Therefore, there is an urgent need to create public awareness on waste management, its pollution sources, prevention of soil quality destruction and improved soil fertility status (Deshmukh and Aher., 2017)

### 2.2.2 Impact of waste on human health

MSW when left unattended in the environment, attracts flies, rats, and other insects that, in turn, spread diseases (Alam, and Kafeel, 2013) i.e. diarrhea cases due to flies in Accra (Boadi, and Kuitunen., 2005). Furthermore, these are the main human health risks as these insects and rodents are disease vectors, spurring from MSW (Abdul, 2010). Transmission of ailments to the human population either via direct contact. Animal vectors, making their way to nearby communities, doing so due to anthropogenic disturbances to the environment. For instance, the spread of the COVID-19 virus, some experts believe the cause was a consequence of ecological disturbances caused by mankind (Yeh, 2020). Unfortunately, informal settlements have only one or a few functioning tap(s), of which, should the water source be contaminated all the residents would be exposed to possible illnesses as a result of the poor attitude towards waste management.

## 2.3 Laws governing waste management

The existence of laws, acts or policies are there to govern people and prohibit unruliness. Laws are needed for the prevention of illegal deeds, accompanied by acts to serve a number of purposes, such as protecting the health of SA citizens, keeping the environment clean and stipulating measures that people and companies need to follow to prevent pollution and ecological degradation (Gondwana Group, 2019). Laws in other regions i.e. Brazil deem the indiscriminate dumping of solid waste as an environmental crime since 1998 (Alfaia, *et al*, 2017). In South Africa, illegal waste disposal in the environment is common, with little policing. As people's poor attitude towards proper waste management contributes to the issue of waste. This issue in Cape Town costs the Metropole R350 million a year (Cape News, 2019).

### 2.3.1 Legislation, Acts and Policies governing waste on protected and conservation areas

South Africa has one of the best laws on paper, notably environmental laws. Namely, the Environmental Conservation Act 73 of 1989 (ECA) which handles the safeguarding of ecological processes, natural beauty and the preservation of biotic diversity in the natural environment (Republic of South Africa, 1989). Section 19(1) of ECA states that no person is permitted to discard waste indiscriminately on any land, water body and or site that the public has access to. Rendering it illegal for South African citizens to dispose of waste in any form on protected land.

Furthermore, National Environmental Management (NEM): Waste Act 59 of 2008 was established to regulate waste management in order to protect human health and the environment (Department of Environmental Affairs and Tourism, 2009), yet the absence of law enforcements has seen laws broken. Section 26(1) and (2) prohibits people from discarding waste knowingly as this may infringe on the next persons' constitutional right.

Cape flats residents take these laws frivolously as the indiscriminate disposal of solid waste in the environment or protected environments is still common. Thus the need for the constant enforcement of laws and awareness campaigns to prevent degradation of the environment before it is too late. Waste management officers or health officers are permitted by law to provide enforcement of the law by issuing compliance notices (Republic of South Africa, 2004; City of Cape Town, 2021)

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## 2.3.2 Penalties and fines

Table 1:Penalties and fines. Source: IWM, 2009. Open By-laws South Africa. [online] Open By-laws South Africa pg.22. Available at: <https://openbylaws.org.za/za-cpt/act/by-law/2009/integrated-waste-management/eng/> [Accessed 7 January 2021]

| **Section** | **Offence** | **Fine** |
|---|---|---|
| Section 15(1) | Littering or dumping under 1m³ | R 500 |
| | Littering or dumping over 1m³ to 3m³ | R 1000 |
| | littering or dumping over 3m³ to 5m³ | R 1500 |
| | Littering or dumping over 5m³ to 7m³ | R 2000 |
| | litter or dumping over 7m³ to 8m³ | R 2500 |
| Section 12(b) | Conveying of an uncovered load which results in spillage of load—Spillage under Spillage under 1m³ | R 500 |
| | Spillage over 1m³ to 3m³ | R 1000 |
| | Spillage over 3m³ to 5m³ | R 1500 |
| | Spillage over 5m³ to 7m³ | R 2000 |
| | Spillage over 7m³ to 8m³ | R 2500 |
| | Conveying of an unsecured load which results in spillage of load—Spillage under 1m³ | R 500 |
| | Spillage over 1m³ to 3m³ | R 1000 |
| | Spillage over 3m³ to 5m³ | R 1500 |
| | Spillage over 5m³ to 7m³ | R 2000 |
| | Spillage over 5m³ to 7m³ | R 2500 |

# 3) Chapter 3: Research design and Methodology

The methodology of a research is a strategy of inquiry which moves from the underlying assumptions of a study to research design and data collection (Myers, *et al,* 2000) which is composed of key elements such as observations, questions, hypotheses, experiments, analyses and conclusions (Marczyk, *et al,* 2005). The research design can be referred to as the plan used to examine the question of interest in a study (Marczyk *et al,* 2005). The type of research design and method to be conducted in the study will be a qualitative design.

The design will be field research that serves as a qualitative method of collecting data aimed at observing, interacting and understanding phenomena in the natural environment (Bhat, 2019). Part of the field research will include direct observation, informal interviews and analysis of documents. Instruments such as a camera (to capture moments of interest), binoculars, boards to write and stationery will be the tools used to identify and note the waste in its natural state.

## 3.1 Data Collection

In order to guarantee the study is carried out in a manner which does not infringe on people's rights and in an ethically accountable method, the approval from CPUT and the City of Cape Town's Biodiversity Management was required and approved. This ensured risk minimization to the fauna and flora in the PA & CA as well as the people in the adjacent communities who were part of the study. It was vital as this would help with the decision making based on the data collected. By setting out guidelines and safety precautions this ensured indigenous species and people's safety were not harmed during the recording of data.

*Figure 1: Waste clean-up with CPUT students at WNR. Photo Credit: Reginald Domoney, 2019*

*Figure 2: Type of waste collected at WNR. Photo Credit: Reginald Domoney, 2019*

Figures 2 & 3 are from a pilot waste collection project, that I carried out with the help of third year Environmental Management students, Mr Domoney (lecturer) and the WNR interns in 2019 that helped inform the study and lay the groundwork for the current research. The CCT annually spends R350 million on the clean-up of illegal waste in and around the Metro (Cape News, 2019), which has effects on the City's aesthetics, community health and services. Part of the money goes towards EPWP (extended public works program) that collects waste in and around the CCT as well as within the PA's.

### 3.1.1 Interviews

Particularly important step, involves determining the content and structure e.g., open-ended and close-ended parts of questionnaires; a mode of obtaining important data (Marczyk *et al,* 2005). Informal one-on-one interviews with Reserve workers and staff members took place in a casual setting where the aim of the interview was to gain information from their perspective.

Structured interviews will be conducted using a standardised questionnaire with the help of EPWP staff, security and reserve employees from WNR distributing questionnaires to the two communities located within close proximity of indiscriminate dumping hotspots. A randomised and representative percentage will be covered for statistical purposes (Mouton, 2013).

### 3.1.2 Data Analysis and Waste characterisation

Exploratory research analysis methods will be used in the formulation of research question from detailed literature analysis (Hancock and Algozzine, 2007). All data collected through structured interviews and WNR waste collection data will be analysed through descriptive statistical analysis through the use of MS Excel 2013 and/or any other statistics software i.e. IBM SPSS that will be applicable to the study (Dye *et al,* 2000).

In order to extrapolate the qualitative data from the questionnaires and secondary data retrieved from WNR, qualitative methods were applied i.e. qualitative content analysis and narrative analysis methods of technique were used. These methods entailed a thorough interpreting of the data to display how waste affects MCAD & WNR environmentally and economically.

Two ways as recommended and previously used by Abramowitz and Sun (2012), will be replicated in the characterisation of waste streams from indiscriminate dumps (1) physically and (2) visually. This exercise will involve physical spread of waste dumps and identification and categorisation of different materials into (a) recyclable, (b) compostable, (c) general, or (d) hazardous waste. This will include tracing waste labelling which classifies the waste source and materials into recognised waste stream classes.

The use of Microsoft excel to generate tables, and SPSS to test for independence of variables from the response of respondents. The further use of the Chi-square test of independence to determine whether two categorical (or nominal) variables of interest are likely to be related or not related. Aim of the Chi-square test is being able to identify whether the difference between

the actual and predicted data is due to chance or is there a link between the variables under reflection. As Chi-square test gives us a way to determine if hypothesis is plausible or not.

The formula for Chi-square test is

$$X_c^2 = \frac{\sum(O_i - E_i)^2}{E_i}$$

Where c is degrees of freedom, O is observed value, and E is the expected count.

An example of Chi-square procedure, for examining the differences between **Residence and whether someone would report guilty individuals**. Equal number of individuals in these 2 areas indicated that they would not report guilty individuals, and roughly equal number stated that they would report guilty individuals, and for both areas, there is a significant difference between those who would report guilty individuals and those who would not report them. It seems residence does not influence reporting guilty individuals. Therefore the chi-square test indicated that area of residence and reporting of individuals independent.

**Reside * Would you report guilty individuals?**

*Table 2 Observed values only*

| | | Reside | | |
|---|---|---|---|---|
| | | Macassar | Tafelsig | Total |
| Would you report guilty individuals? | No | 17 | 17 | 34 |
| | Yes | 67 | 55 | 122 |
| Total | | 84 | 72 | 156 |

*Table 3: Observed values and Expected Values*

| | | | Reside | | |
|---|---|---|---|---|---|
| | | | Macassar | Tafelsig | Total |
| Would you report guilty individuals? | No | Count | 17 | 17 | 34 |
| | | Expected Count | 18.3 | 15.7 | 34.0 |
| | Yes | Count | 67 | 55 | 122 |
| | | Expected Count | 65.7 | 56.3 | 122.0 |
| Total | | Count | 84 | 72 | 156 |
| | | Expected Count | 84.0 | 72.0 | 156.0 |

**Chi-Square Tests**

| | Value | df | Asymptotic Significance (2-sided) | Exact Sig. (2-sided) | Exact Sig. (1-sided) |
|---|---|---|---|---|---|
| Pearson Chi-Square | .259[a] | 1 | 0.611 | | |
| Continuity Correction[b] | 0.099 | 1 | 0.753 | | |
| Likelihood Ratio | 0.258 | 1 | 0.611 | | |
| Fisher's Exact Test | | | | 0.698 | 0.376 |
| N of Valid Cases | 156 | | | | |

In the SPSS results above the Chi-square test is conducted as in steps below.

Ho: Residence and reporting guilty individuals are independent

H1: Residence and reporting guilty individuals are not independent

$$Expected\ count\ = \frac{(Row\ Total) * (Column\ Total)}{Total\ Number\ of\ Observations}$$

$$E_1 = \frac{34 * 84}{156} = 18.31$$

$$E_2 = \frac{34 * 72}{156} = 15.69$$

$$E_3 = \frac{122 * 84}{156} = 65.69$$

$$E_4 = \frac{122 * 72}{156} = 56.31$$

The test statistic is calculated below.

$$X_c^2 = \frac{\sum(O_i - E_i)^2}{E_i} = \frac{(17 - 18.31)^2}{18.31} + \frac{(17 - 15.69)^2}{15.69} + \frac{(67 - 67.69)^2}{67.69} + \frac{(55 - 56.31)^2}{56.31}$$

$$= 0.259$$

Using the 5% level of significance, the critical value on the chi-square table is 3.841. This value is greater than the test statistic. Therefore the test statistic falls in the rejection region. We accept the null hypothesis and conclude that residence and reporting guilty individuals are independent.

### 3.1.3 Validity and reliability

In order to ensure limited error, the following will ensure a high level of quality in data collection as well as reliability and validity thereof:

- Permission has been granted by the Wolfgat Nature Reserve to carry out on-site study
- Ethical clearance granted from both City of Cape Town's Biodiversity Management and Cape Peninsula University of Technology
- The questionnaire and checklist will both be tested in a separate area that will be included in the final study.
- All supporting staff (EPWP) were briefed and trained by the Department of Solid Waste to share information and pamphlets about SW.

### 3.1.4 Ethics

The research will neither use humans nor animals for the biological experimentation. Only questionnaires will be used to get information from community members and the following issues will be taken into consideration:

- Confidentiality, privacy and anonymity of participants will be ensured.
- Consent will be obtained in writing from all participants.
- Standardised consent form and confidentiality forms from CPUT will be used for the above purpose and ethical clearance will be applied for within CPUT structures

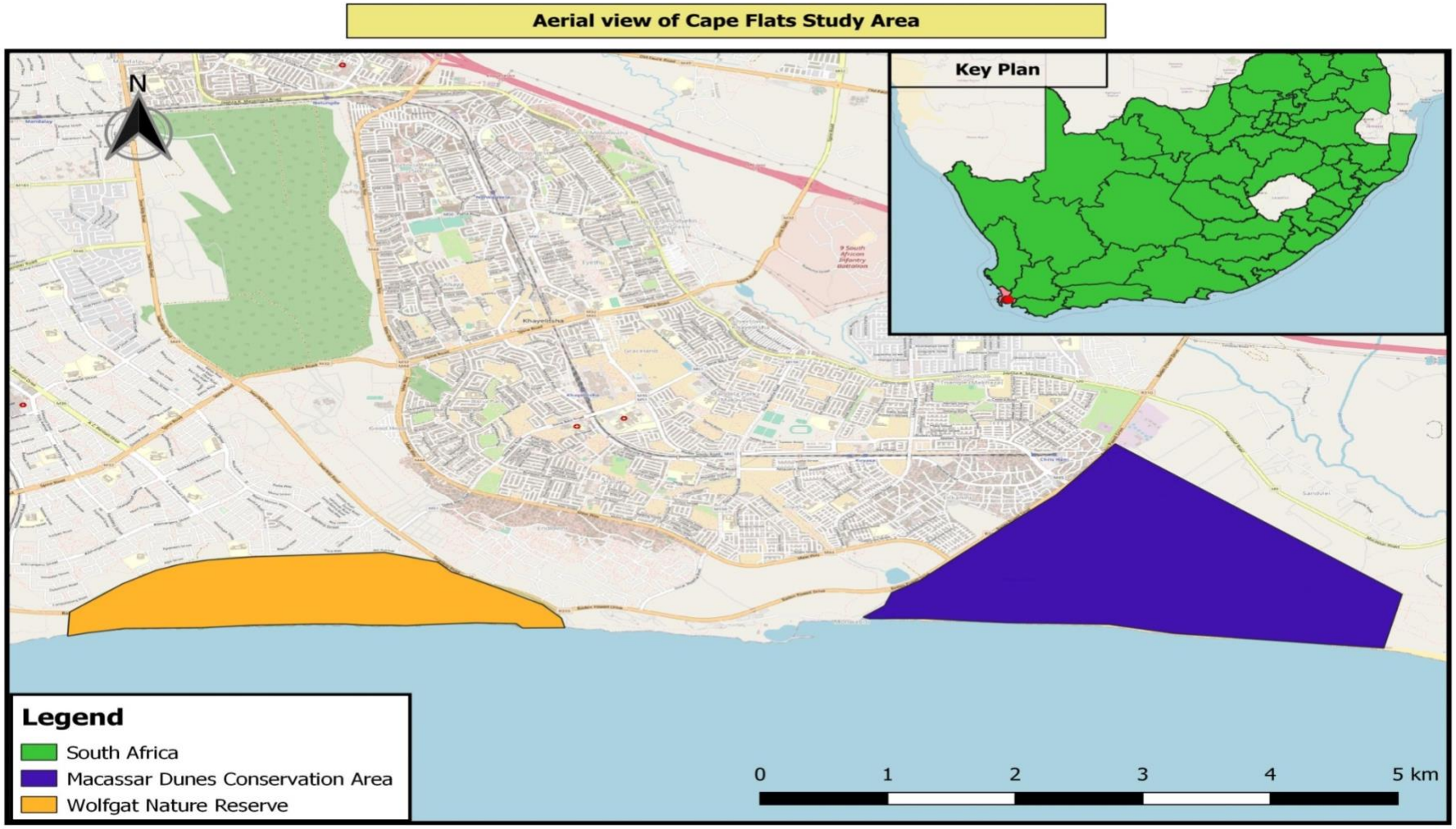


*Figure 3: Map of study site*

## 3.2 Study area

The Cape Town Metro has different vegetation types such as the Fynbos, Strandveld dunes and Renosterveld whereby the vegetation type for the study area is Strandveld dunes. The Wolfgat Nature Reserve (-34.066° S and 18.640° E) covers 261.84 hectares and the Macassar Dunes Conservation Area (-34.067° S and 18.707° E) covers 1116 hectares (CCT Nature Reserves and other protected areas, 2019). The nature reserve hosts a spectacular coastal limestone cliff along Baden Powell Drive. The Nature Reserve comprises of Cape Flats Dune Strandveld and conserves approximately 170 different plant species (CCT Nature Reserves and other protected areas, 2019). The Strandveld is an endemic vegetation type which is uniquely found along the West Coast, North of False Bay and Cape Flats. Plants such as the Restios, succulents, annuals and geophytes are common (Marot, 2010) as well as evergreen shrubs, perennial daisies, *Mesembryanthemum*, (*Vygies)* and *Zantedeschia aethiopica* (Arum Lillies). A colony of *Larus dominicanus* (Kelp Gulls) nest on the limestone cliffs and *Haematopus moquini* (African Black Oystercatchers) scurry along t

he rocky and sandy shores (CCT Nature Reserves and other protected areas, 2019).

The Wolfgat Nature Reserve and Macassar Dunes Conservation Area falls within the CFR (Marot, 2010). The CFR in South Africa is the smallest and richest of the six floral kingdoms in the world, and it is the only one to be found entirely within one country according to Myers, *et al, (*2000). He furthermore states the CFR has been identified as one of the worlds "hottest" hotspots of biodiversity (Myers, *et al,* 2000). The reserves possess intrinsic value and potential to attract tourists.

The increase in the population over the years has led to the Khayelitsha and Mitchell's Plain community's growing towards the Nature Reserves. With population growth in a low-income community; gangsterism, crime and drugs is an issue. With lack of knowledge of the Reserve, people of these communities keep destroying the Reserves which has an aesthetic value and may bring monetary value in the form of tourism. The CA and NR are a boundary between the communities and the ocean where erosion is slowly taking place on the fringes of the Nature Reserves and near the beach shores on figure 1.

## 3.3 Population Size

The Cape Town Metro is located at the south-western tip of the African continent in South Africa. A developing country which is located between latitude 30.5595° S and longitude 22.9375° E with a land area of 1,22 million km²m and an estimated population size of 4 686 518 WCG - Health., (2020). The population size for the respective communities bordering the focal study sites are; Khayelitsha where Macassar, has an estimated population of 447 120 and Mitchell's Plain where Tafelsig is, has an estimated population of 625 554 according to WCG (Health)., (2020). The Cape Town Metro has one of the lowest unemployment rates in SA which is at 26.5% (STATSSA, 2021), whilst unemployment in the Macassar and Tafelsig areas is high.

## 3.4 Sample size

The focal study areas are between Macassar (informal settlement) and Tafelsig (formal settlement) whereby due to settlement differences, service delivery differs as well. Getting different perspectives and reasons for dumping was much needed thus necessitating data collection in both areas. The inclusion of 60 EPWP staff from both communities assisted in data collection,

Due to COVID restrictions, the amount of questionnaires distributed in both communities had to be reduced for safety precautions for both EPWP staff and community members who participated in the data collection. The project totalled a number of 150 questionnaires being distributed, where 75 was for the Macassar community and 75 for the Tafelsig community.

## 3.5 Instruments used

- ✓ Binoculars (2)
- ✓ Camera (1)
- ✓ Questionnaires ($\pm 150$)
- ✓ Pencils and pens
- ✓ Masks
- ✓ Sanitizers (for EPWP)

# 4) Chapter 4: Results and Discussion

The aim of retrieving primary and secondary data respectively from the Khayelitsha & Mitchell's Plain community's, and the CoCT's reserves' is to illustrate the issue and impact of illegal MSW disposal on the environment, especially on the Cape Flats nature reserves and conservation areas, as well as on the residents from the communities. The data consists of questionnaires, surveys and solid waste management data from the City of Cape Town's WNR. The solid waste management data from CoCT's NR & CA includes amount of solid waste collected in tons per scheduled day and the costs for the collection and transportation to a landfill site.

There were limitations to the research i.e. the COVID-19 pandemic, where safety precautions were to be maintained both with staff and the community which limited the collection of information. The help of the EPWP staff in the distribution and collection of data as seen in Figures 1 were employed by the CoCT's WNR. EPWP staff underwent a mandatory Waste Management Awareness Campaign with the Waste Management Department of CCT. Critical information was shared about the importance of reducing waste, how improper waste management is immensely affecting the Municipality and efforts taken by the Municipality to increase awareness. The EPWP are also accompanied by security as a safety measure, as the crime in the areas is high.

There are many factors and sources that lead to waste disposal in the two areas, Residents of the Macassar's informal settlements had issues with the collection of their waste i.e. the distance of the waste container from their homes, the waste container often being locked as seen in figure 1 below, people from other locations disposing illegally and the uncertainty on which day waste would be collected. The community of Tafelsig, with the presence of backyard dwellers or additional families on one plot, meant that more waste would be generated and discarded. The waste produced would not be sustained by one bin for an entire week and would be emptied on the reserve that's behind their homes i.e. figure 2. The waste collection trucks often do not collect waste if found next to the collection bin. Upon no collection, people venture into the reserve and dump illegally.

Figure 4: Questionnaire distribution next to locked MSW (Macassar) container. Source Luvuyo Mdepha

Figure 5: MSW dumped from backyards (Tafelsig). Source: Luvuyo Mdepha

The illegal waste disposals on the respective CA and NR are on the account of the communities in close proximity, approximately 10 to 20 metres in distance. The difference between the two study areas selected is that the Tafelsig, Mitchell's Plain community which fringes on the WNR, is made up of formal settlements (with backyard dwellers) whereas the Macassar, Khayelitsha community which fringes on the MDCA and WNR is made up of informal settlements. Figure 6 below, exhibits 53% of the people who answered the questionnaires reside in Macassar, Khayelitsha whereas 47% reside in Tafelsig, Mitchell's plain.

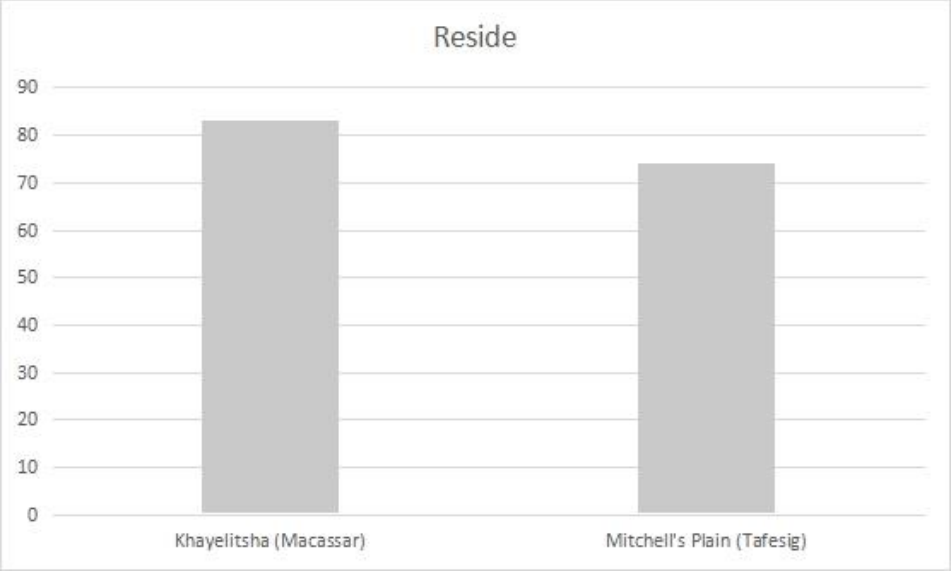


*Figure 6: Where respondents reside*

Apart from wanting to know where respondents reside, getting different views was imperative from both young and old generation as generational differences may give a sense whether attitude towards waste management was the same or different among the age groups. As represented in figure 7 below, 41% of the age group that answered questionnaires were in their 30's making up the majority, 20% in their 40's, 14% in their 50's, 11% in their 60's, 10% in their 20's and 2% was either in their 70's or teenage years respectively.

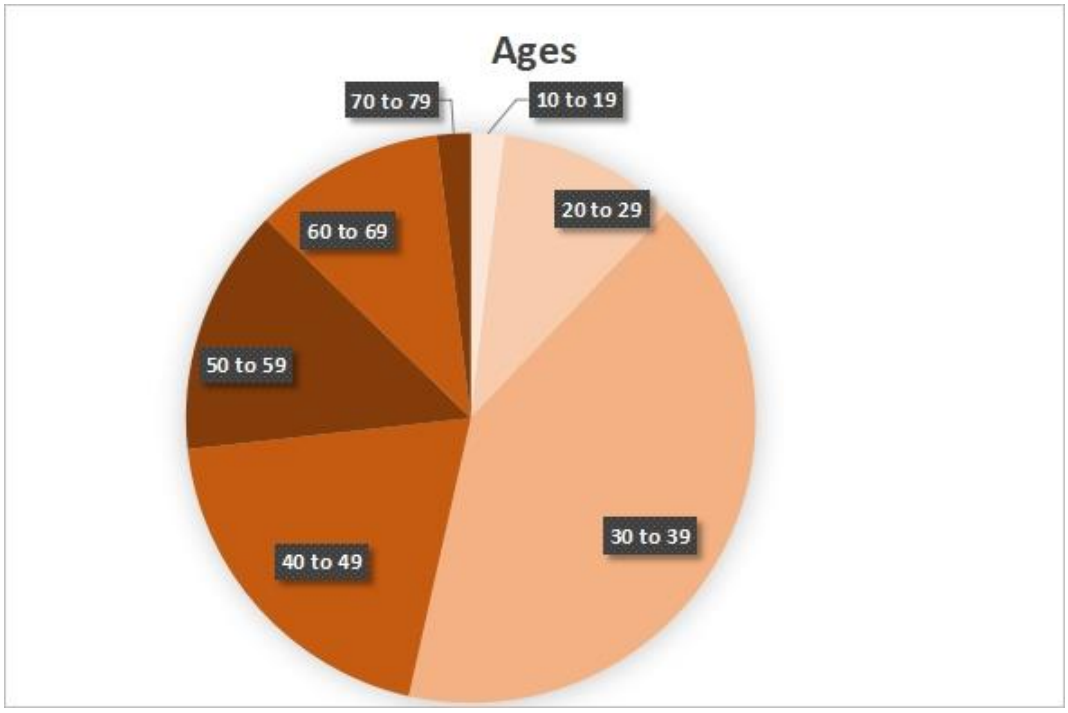

*Figure 7: Age groups*

Forty four per cent (44%) of respondents were female and as to 56% who were male as illustrated in figure 8. Both areas experience a similar set of socio-economic challenges i.e. high unemployment, low income and high crime rate. Consequently, when discussing proper solid waste management it is not a priority as compared to trying to eradicate the socio-economic challenges within an individual's household. Making it a hard topic to discuss amongst solid waste departments and communities.

*Figure 8: Respondents' gender*

This indicates the majority of respondents (56%) were males as to females whom made up (44%).

The MSW collected from the NR and CA was either delivered to the Strandfontein waste drop-off site or the Coastal Park landfill site. Most of the waste collected included paper, plastic and/or cardboards, followed by organic waste, e-waste and other i.e. textiles as represented in figure 9 below. Fortunately, due to the drop-off site being available to the greater community, reserve employees are able to deliver solid waste to the facility without much charges incurred, whereas waste delivered to the coastal park landfill site is measured and costs are incurred per kg.

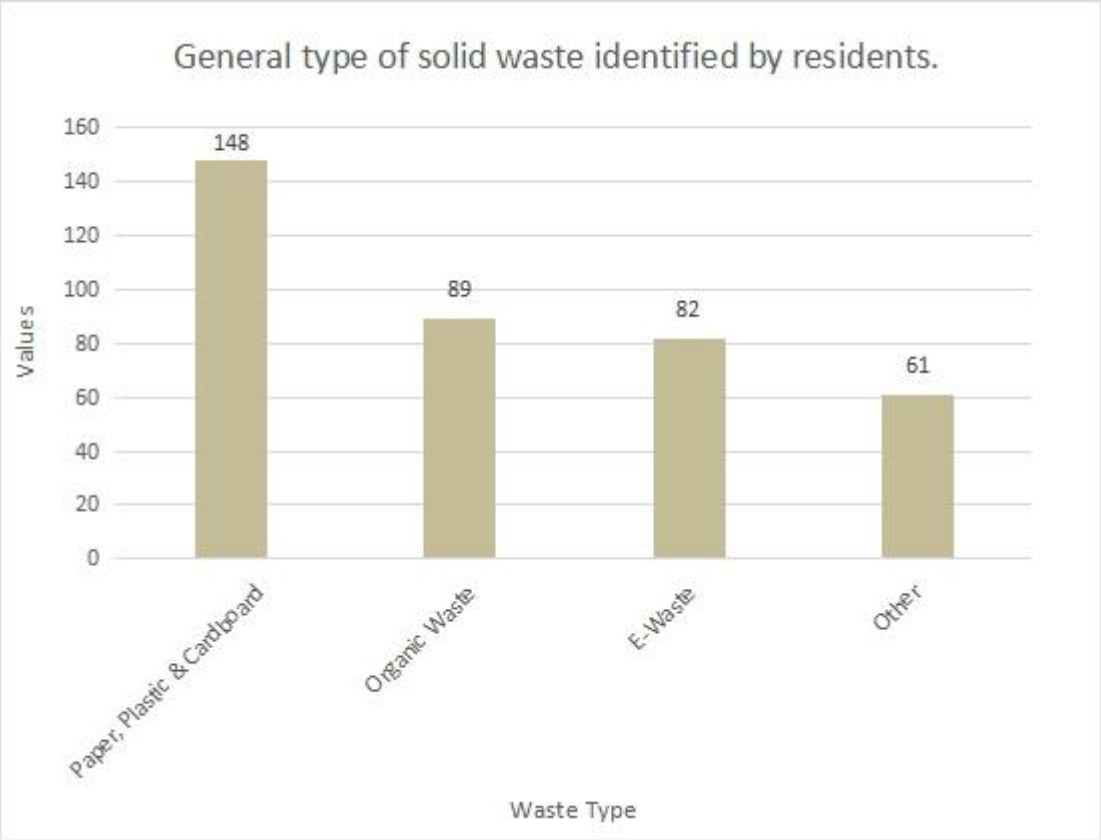


*Figure 9: Types of waste identified*

Paper, plastic and cardboard (PPC) was the most selected amongst all the options presented through which the chi-square test a value of 0.011 was recorded thus accepting the null hypothesis. Organic waste & e-waste recorded a value of 9.239 and 21.345 respectively thus rejecting the null hypothesis of the cause of waste in the protected land (human population) meaning there is an association between organic waste & e-waste and the residents of the two communities. The Mitchell's Plain and Khayelitsha communities are a host of homes, schools,

businesses and more, which could be considered as a source of waste. Both the NR and CA are 10 – 20 metres in distance to the two communities, WNR and MDCA both are freely accessible to the public, meaning perpetrators can enter the reserves at any entry and dump as they please without being caught.

The Tafelsig community, considered a formal settlement, have their waste collected weekly between Monday - Tuesday (Monday specifically). As displayed in Table 2, asked whether the community members knew when waste collection day was for the Tafelsig community, the majority of its residents knew collection day was on a Monday whilst a few were unclear. The Macassar community, considered to be an informal settlement, does not have proper road infrastructure for waste collection nor do they have a definite day for waste collection, thus a waste container is put in place. Asked whether which day their waste container was collected: a third of respondents either stated waste is collected between Monday or Tuesday, Wednesday or Thursday and/or the waste was never collected, with a small percentage not answering. Table 2 below, demonstrates residents of the informal settlement's confusion about the waste collection, a factor for dumping of waste illegally for some.

*Table 4: Waste collection days*

| **Waste collection days** | **Macassar** | **Tafelsig** |
|---|---|---|
| Monday – Tuesday | 26 | 70 |
| Wednesday – Thursday | 27 | 1 |
| Friday – Sunday | 0 | 1 |
| Never | 26 | 2 |
| Not answered | 4 | 0 |

The Macassar community's confusion on when waste collection day was or the Tafelsig community not adhering to collection day, the solid waste that was discarded carelessly on the land has directly affected the people and environment.

Demonstrated in figure 10 below, 75.2% of respondents agreed solid waste hotspots had affected them, chi-square test further corroborating that as a value of 8.086 was recording thus rejecting the null hypothesis on whether waste has implications on people's health. Signifying the association between residents and the issue of waste affecting their health, some of the verbal responses from the respondents included sickness, mainly child illnesses as children often played within the reserves with the solid waste since they did not know the consequences. Feeding into the review compiled by Ziraba, *et al*, (2016), stating there is an indication to show that solid waste, (i.e. biodegradable waste, medical waste etc) are potential sources of pathogenic organisms such as viruses, bacteria and fungi

Twenty two point three per cent (22.3%) disagreed and 2.5% were not sure whether waste affected them. The dumping of solid waste is prevalent and would always end up being discarded indiscriminately on the reserve because it is nearby.

When asked about the severity of illegal waste dumping on the CA or NR as displayed in figure 11 below, majority of respondents rated the severity 10/10 (47%), followed by those that rated the severity of illegal waste disposal 5/10 (14%). When observing the graph, majority of respondents rated 5 to 10, which meant that illegal waste disposal on the land was quite severe A study conducted in Pradesh, India proved that municipal solid waste hotspots do affect soil properties as soil depths ranging from 0.5 m to 1.5 m illustrated contamination from solid waste (Sharma, *et al*, 2018). An issue seemingly observed by residents when it comes to the environment, as displayed in figure 12 below, 91% of people felt solid waste was affecting the land use, the CA and NR. Where testing for chi-square exhibited a value of 3.930, rejecting the null hypothesis on whether waste has implication on the environment. Signifying the association between residents and their view that the land use is being affected by indiscriminate MSW disposal.

Eight per cent (8%) felt otherwise and 1% did not know. The MSW illegally disposed in the CA and NR gives unaesthetic look to parts of the nature reserve, ominous smells which attract flies and rodents due to solid waste hotspots. Decreasing interest in the fauna and flora that's near the community which may be used for recreation and education, inadvertently degrading the natural recreational facility which is CA and NR.

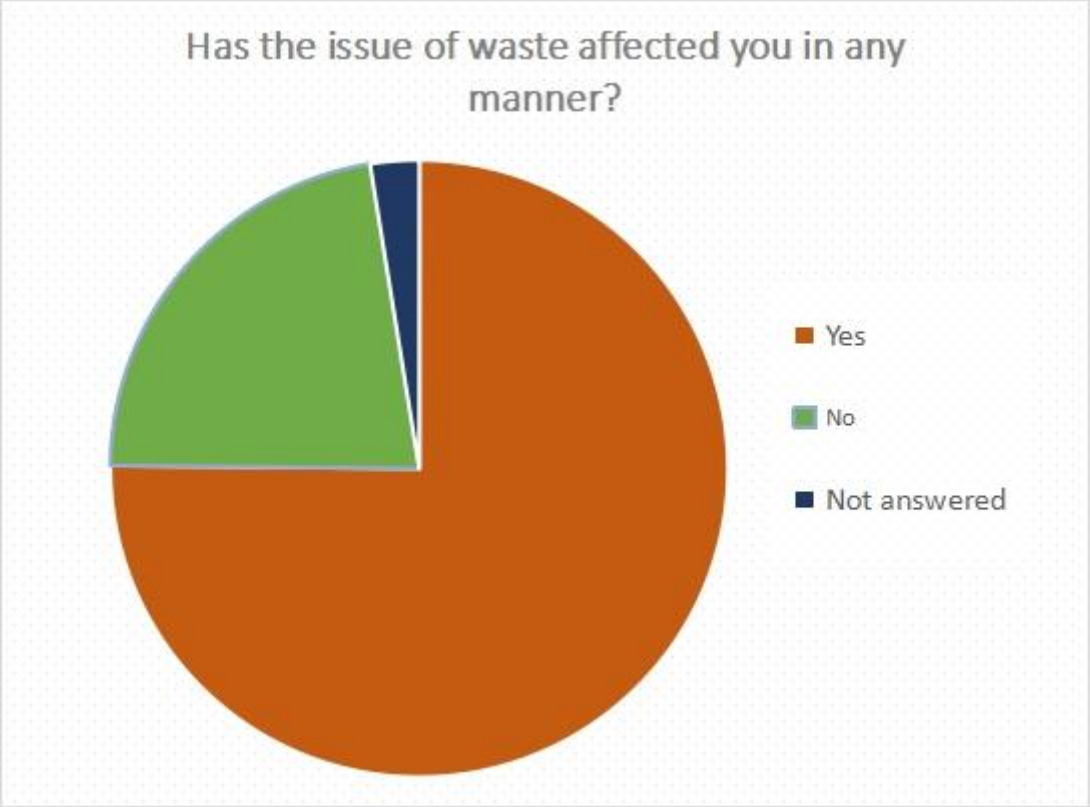


*Figure 10: Waste affecting human population*

The above chart illustrates the amount residents of the two communities who were vs. those who were not affected by waste illegally dumped in the reserves. Those affected made up majority, via tally system through questionnaires.

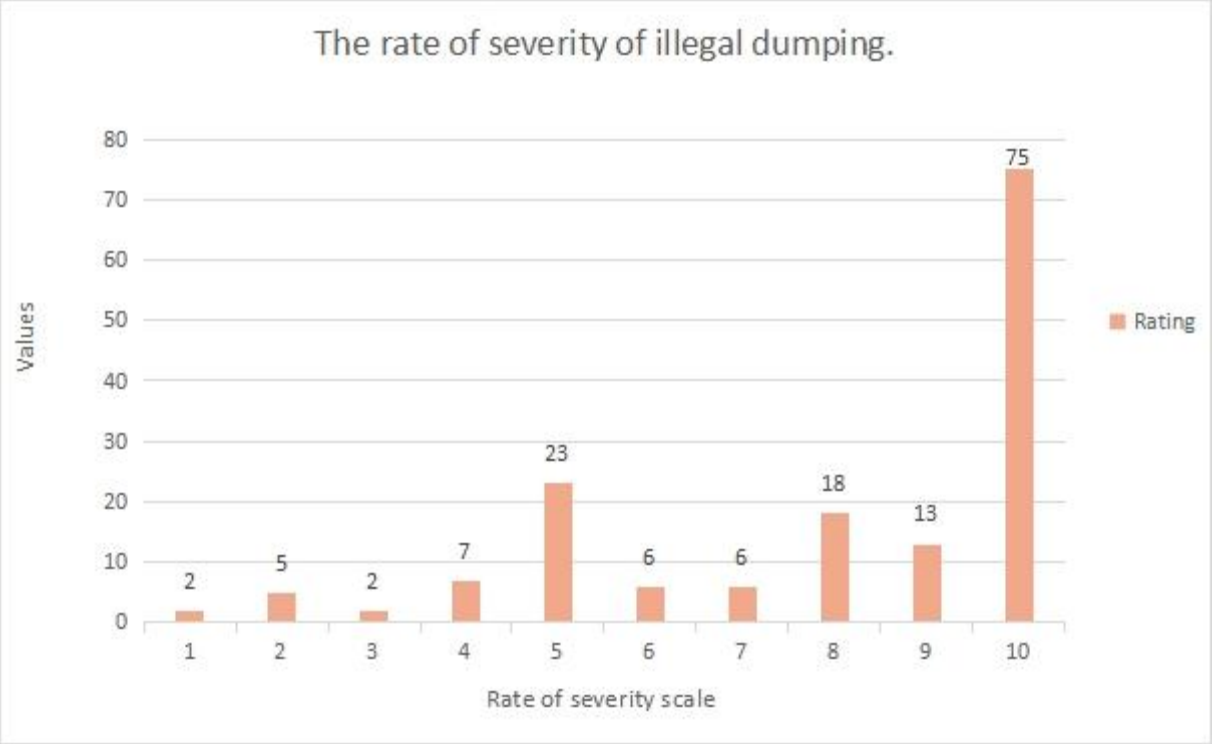


*Figure 11: Severity of illegal waste dumping*

The above bar chart represents the severity of indiscriminate dumping rated by the respondents of the two communities. The amounts were gathered by the EPWP, tallied and charted for representation. One on the scale represents a low severity of dumping and 10 representing high severity of illegal MSW dumping.

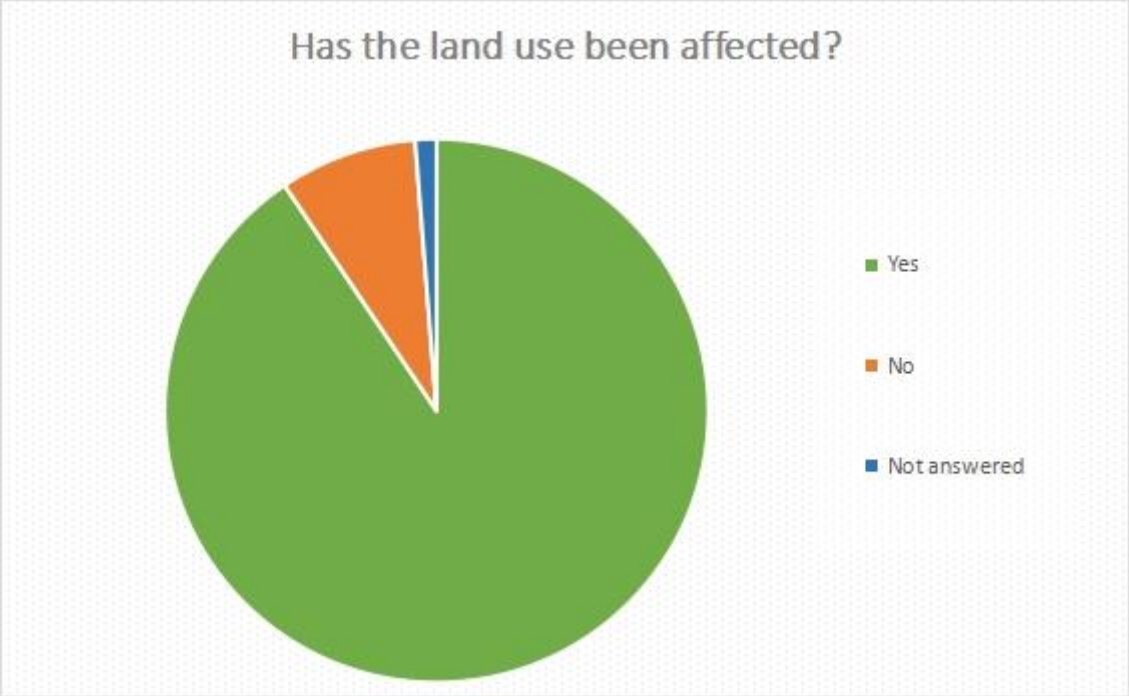


*Figure 12: Issue of altered land-use (due to waste) affecting respondents*

The above pie chart represents the opinions of respondents who felt the land use (recreational purpose) was affected affected by illegal solid waste disposal.

The sources of MSW may vary but in most cases being from the two communities' residents. When the residents were asked during the process of data collection, most were honest in pinpointing of perpetrators. The majority of the respondents stated it was community members (themselves or their neighbours); others stated it was drug users who would get paid a fee for the removal of their waste which would end up being dumped in the reserves. Residents listed various reason for the dumping i.e. placing the blame on the lack of staff, the changing in the lifestyle of community members, not enough space in the bins and or the forgetting to put blackbins out for collection.

One of the important questions was getting the opinion of the residents as to why people resorted to illegal dumping or in rare cases why they themselves disposed of waste illegally in the reserve. As shown in figure 13, the listed reasons for illegal waste disposal included missing the collection truck, people from other areas, and lack of awareness on the implications of solid waste dumping, people not caring about the law and or not knowing about the nearest drop-off site or it being too far.

Eighty seven point two per cent (87.27%) of respondents ticked ‘do not care’ as the main reason as shown in figure 13 below, which was quite alarming and the chi-square test further substantiating with 12.985 test stat meaning there is association between the resident and their attitude towards MSW. MSW has numerous negative implications on human health as experienced by some residents and the environment, yet people do not care about the end product of their MSW which was detrimental to biotic life once left unattended. In the case of indigenous plant species found in the study areas, the scattered waste could tamper with growth. MSW that interacts with water i.e. precipitation could deteriorate the soil quality as leachate is formed from rain and its interaction MSW, which percolates through the soil and is often absorbed by the soil itself.

Some residents have lost faith in community leaders and councillors as calls and complaints about illegal waste disposal have prompted no response, particularly in the Tafelsig community. The presence of reserve rangers is often disregarded as their duty was known to serve and protect the nature reserves to a certain extent. Vile comments are always spewed at rangers when clearing waste from hotspots.

The lack of presence by the waste management officers in areas such as Khayelitsha and Mitchell’s Plain gives residents the sense of lawlessness. Their absence has somewhat prevented numerous anonymous reporting, as residents were eager to help identify guilty parties. The number of officers would be a start to eradicating and eliminating the issue of waste on the Reserve and within the communities. The increase in calls to the proper law enforcement authorities would provoke their presence in and around the communities, meaning guilty individuals would notice their actions are being monitored.

A missing component was the education/awareness of the waste aspect within the communities, as some residents were not familiar with the implications, and it showed as 72.2% of residents believed “lack of awareness on implications of solid waste” was the reason for dumping as shown in figure 13. Although the chi-square test, tested otherwise as the 0.790 test stat meant the hypothesis was accepted, meaning there’s independence. Ideally meaning the lack of education did not mean residents should dump. The waste management department does make efforts to eradicate solid waste through awareness and education, but their message is often not

heard. The ones that miss the message often do not care about the message but rather are more interested in the freebies that came with the message. Every so often the middle to low income residential communities get visited from the department itself and campaigns are held sporadically but what may be required are constant visits and someone to be held accountable. Residents of the two communities often stated that people outside of the two communities dumped waste on the CA and NR, where 68.18% of respondents believed this was the reason for dumping as shown in figure 13. The reserve is vast and has many entry points where anybody may enter and do as they please, the NR being partially fenced off recently has not done much to stop the efforts of dumpers, as people have found ways to either enter or found other entry points that have not been closed off.

Unknown too many, there was a drop-off site close by called the Strandfontein municipal drop-off site located in Strandfontein. About 60.15% of respondents felt not knowing of its location was the reason for dumping as displayed in figure 13. The purpose was for the greater community of Mitchell's Plain and possibly Khayelitsha to drop their waste sustainably without charges incurred on them. This way waste would not be dumped on open spaces but unfortunately respondents who knew about it felt it was far, and would require transportation for the delivery of waste to the drop-off site as distance is plays role.

Through informal interviews with the Macassar residents, reasons for dumping were concluded to be the distance from the informal settlement to the waste container thus missing the collection truck wherein some cases for missing the collection truck was waste collectors' attitude towards the residents from the informal settlements, reported as being impolite and often shouted at for not being able to get to the waste collection truck in time.

Residents reported that their waste was being left behind if not at collection site thus "missing the collection truck" made 39.12% as shown in figure 13 below. This often resulted in some residents of the informal settlement dumping on the reserves or leaving the waste next to the container for the next collection scheduled day, where dogs tear the black bag material looking for food thus leaving waste scattered. This becomes problematic for the human population as the scattered waste attracts rodents and pests that are disease vectors. Residents with children

cited identifying ringworm impressions on their children; this may be from direct interaction with solid waste

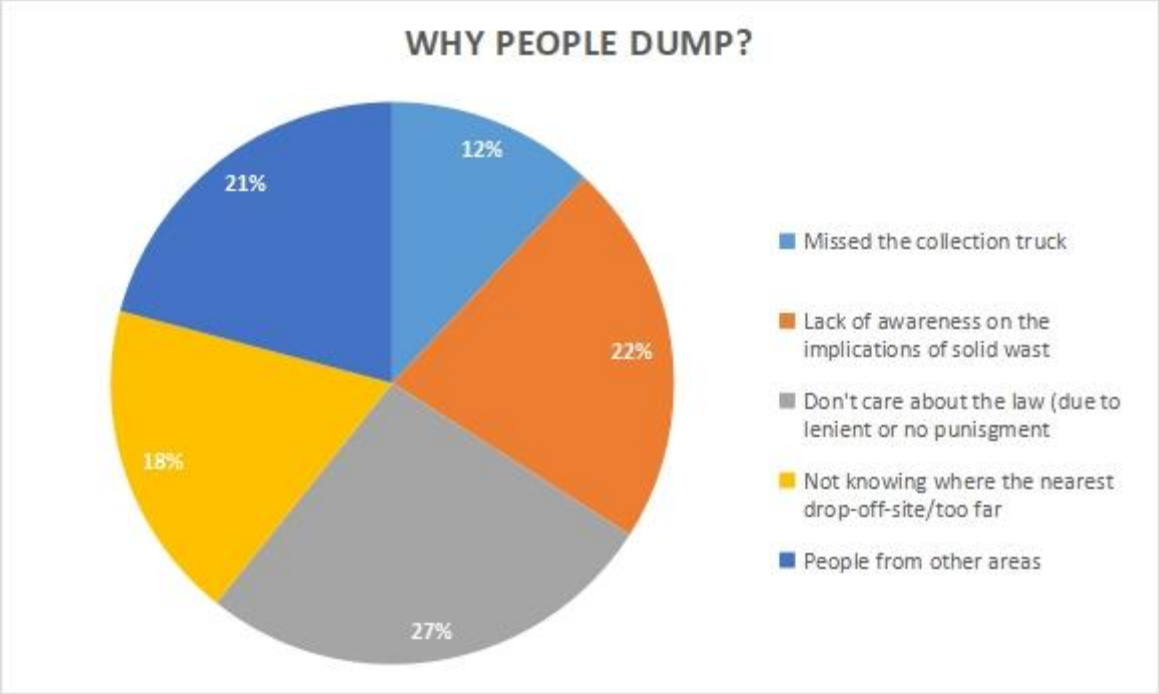


*Figure 13: Reasons as to dumping*

From the information shared by the respondents from the two communities through questionnaires, it is evident that the residents have seen a number of individuals dump waste indiscriminately. As exhibited in figure 14, 73.3% admitted to seeing individuals dumping in the reserve, 24.2% claimed they had not seen any individuals dump and 2.5% were not sure. Displayed in figure 15, 75.2% of respondents were very open to reporting guilty parties but unfortunately did not know how or did not have the correct contact details. Residents willing to report perpetrators are a big deal, given that that they themselves are putting their lives and families at risk by doing so. Those who answered "no" made 21% as they were fearful of the implications of reporting some community members. Lastly 3.8% were unsure, as they were open but fearing for the lives at the same time.

Asked whether respondents would help eliminate waste (displayed in Figure 16) 87.3% were more than willing to help eliminate the issue of waste, citing reasons such as it would help reduce sickness in their kids, create jobs for the communities as unemployment was high in the area and would make the environment cleaner. A mere 5.7% said "no" as they had responsibilities to attend to such as job hunting or going to work and 7% were not sure whether to help or not as shown in figure 16 below. In light of the majority of respondents' openness to helping eliminating solid waste in and around the community, 83.4% of the respondents agreed that they would be open to reusing items that were illegally dumped in the CA and NR as shown in figure 17, that may be reusable, 8.3% did not answer or stated "no", for fear of the origins of the items respectively.

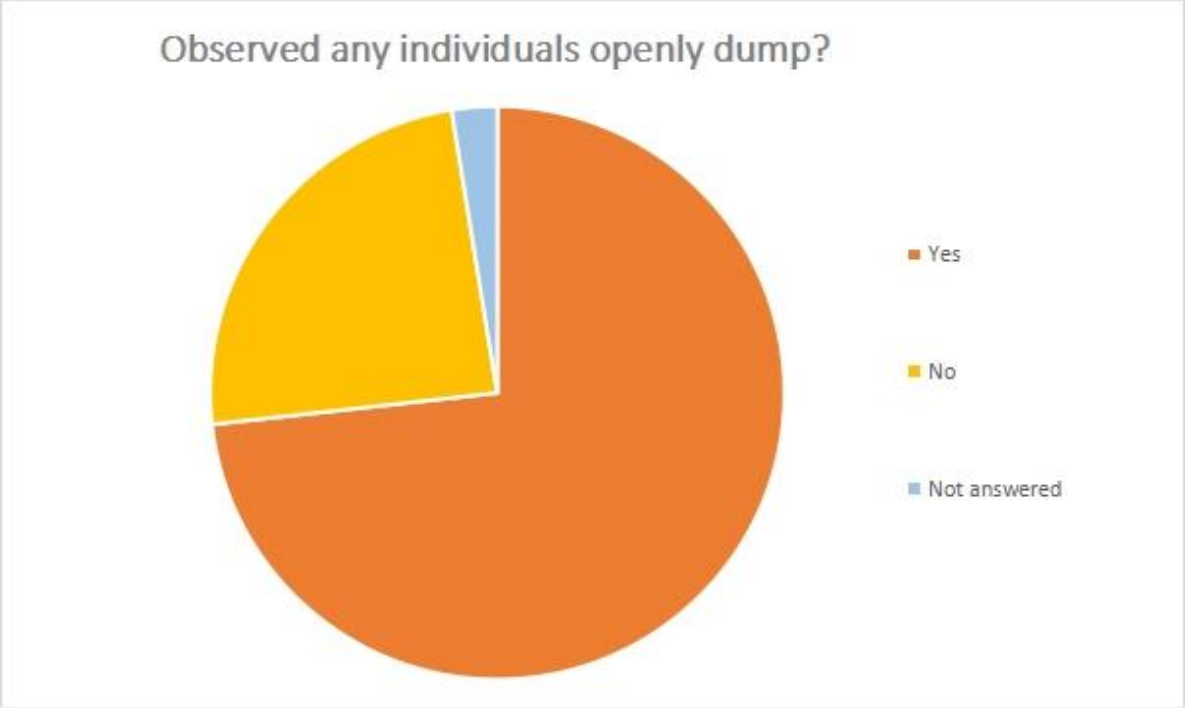


*Figure 14: Witnessing of dumping in Reserves*

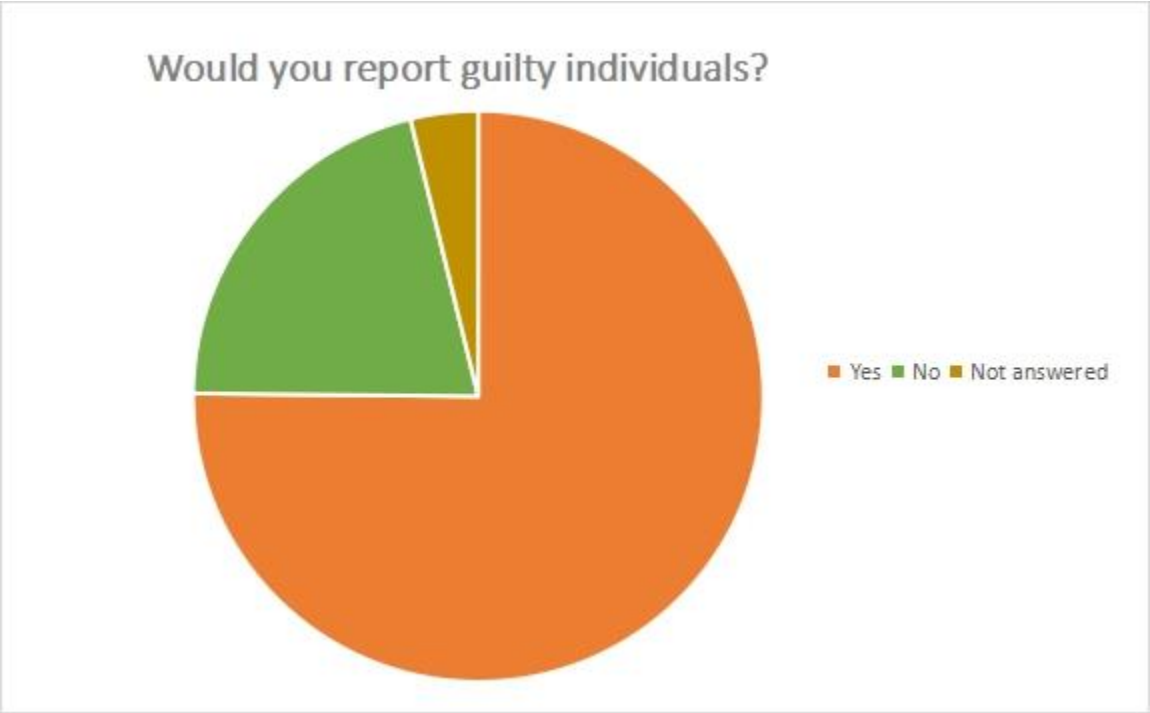


*Figure 15: Reporting of dumping*

The above chart displays the amount people open to reporting individuals who indiscriminately dump in the reserve and near residents houses. Where majority said yes (75%), they were open

to reporting, For safety and personal reason, some residents said no (21%), and some not being sure about either (3.8%).

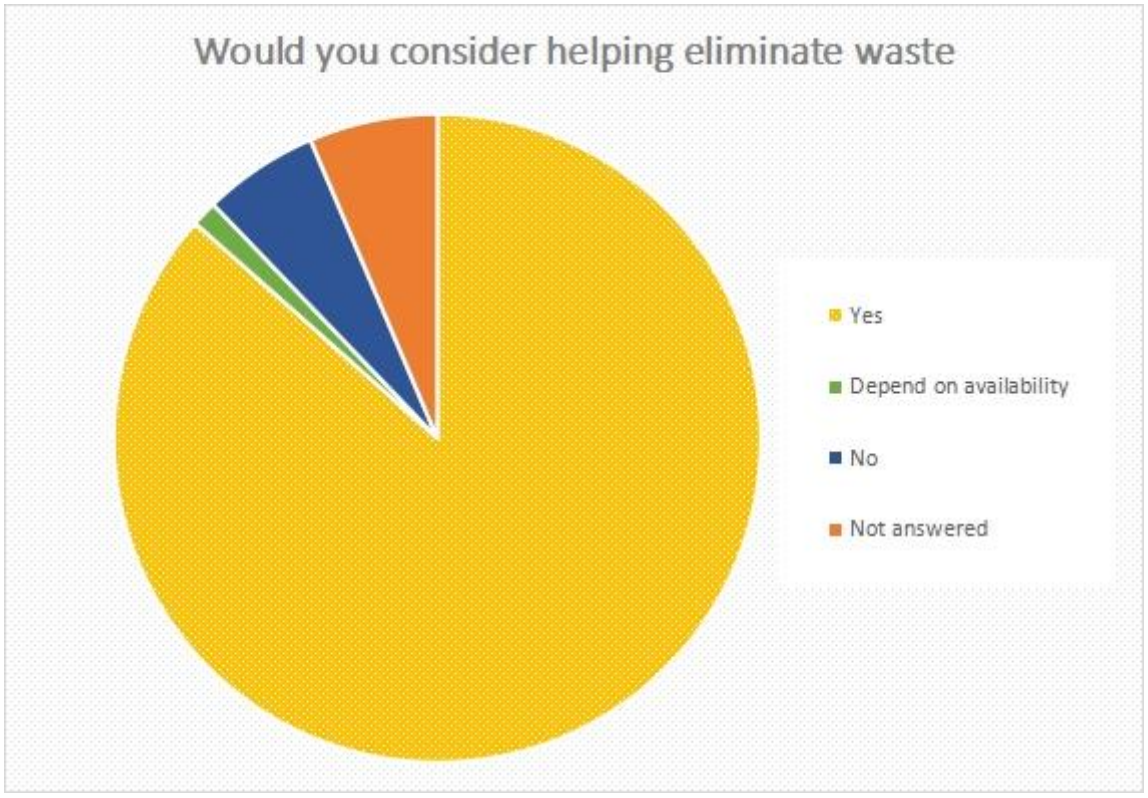


*Figure 16: Help remove waste from Reserve and community*

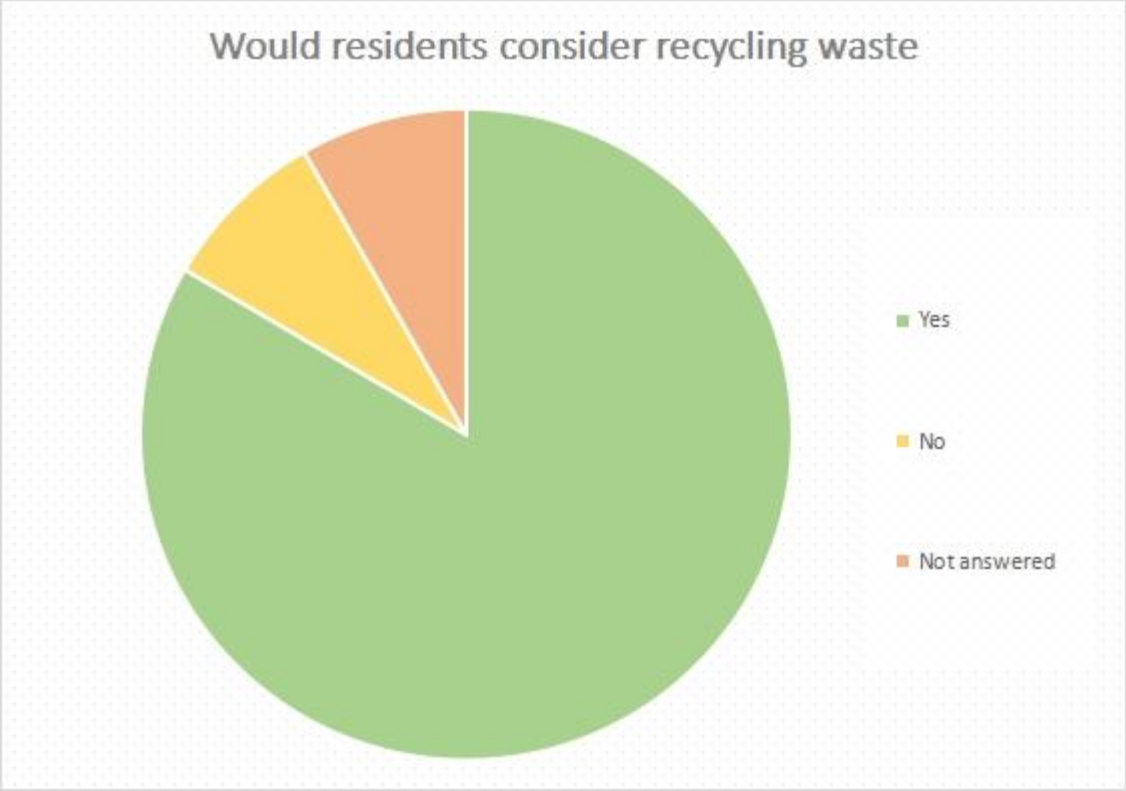


*Figure 17: Recycling of solid waste*

Table 3 below is a representation of the amount of MSW collected over a 5 year period in the MDCA and WNR by Reserve employees and EPWP staff. The totals of the waste collected was divided into quarters within a year where the SW included materials such as paper, plastic, cardboard, organic waste, e-waste and rubble. SW collected would either be delivered to the waste drop-off site in Strandfontein drop-off site without costs whereas, once limits exceeded at the drop off site, SW would be delivered to the Coastal Park landfill site in Muizenberg (costs would be incurred). Furthermore, approving the theorized hypothesis that MSW indiscriminately dumped has economical cost implications on the environment, ideally WNR. According to WNR/MDCA, a blackbag equated to 1 ton of waste, where a ton was equal to 1016 kg.

In particular quarters, SW collection data was not recorded. For instance, in 2017 certain quarters that displayed no SW data recorded was either due to EPWP contract ending (thus fewer waste clean-ups), SW not being recorded when delivered to the drop-off site or landfill site, clean-ups not being scheduled or staff taking off for festive season thus giving rise to dumping. Yet, the amount of SW collected over the 5 years increased gradually. The costs increased year-by-year for the Reserves, where there instances of decrease during the year of

2019. The decrease in the 2019 period was attributed to awareness campaigns and community waste management drives.

Comparing the April - June and the July - September quarter with the October - December quarter from 2017 to 2021, shows dumping of MSW being prevalent, relatively at the end of the year. As the average amount of waste delivered to the drop-off site in Strandfontein in the April to June quarter being 6.2 tons from 2017 – 2020, July – September quarter averaging 10 tons for the same period whereas the October - December period averaging more than double, 167.2 tons of waste collected and delivered to the waste drop-off site. Highlighting how the October - December quarter exhibiting high dumping amounts in the Reserves.

The average amount of waste delivered to the Coastal Park landfill site between the April – June quarter compared to the October – December quarter from 2017 – 2020, exhibited the end of the year as peak period for waste dumping. An indication of weather season's playing a role in dumping, for instance the July/September quarters are a winter season, where generally in Cape Town Western Cape, winter seasons are wet, windy and cold. An aspect that would deter individuals from dumping but not stop them entirely, whereas the October/December quarters along with the January/March period, are summer seasons which usher in clear skies, sunlight and minimal rainfall in Cape Town Western Cape, meaning less individuals being deterred by weather conditions making dumping prevalent. Another factor of high costs would be due to the festive season where majority of people are home for holidays, including lockdown regulations easing off in 2021, people are prone to dumping as it was relatively easy for residents or for anyone to the enter the reserve as majority of employees were on holiday.

As waste collection, transportation and drop-off was frequent during October/December period. Whereby an average 21 419.01 kg was collected in October – December for transportation to the landfill site compared to 13 165.496 kg of waste collected in April – June quarter. Comparing the costs incurred for the two quarters, the average cost paid by the Reserve for the clearing of waste and delivery to the to the landfill site amounted to the average R30 139.46 whereas the April – June quarter averaged R 16 085.96 over the five year period. This is according to the amount of waste collected and delivered to the drop-off site, landfill site and the cost incurred as seen in the table below. That being said; lockdown regulations were eased towards the end of the year 2021.

*Table 5: MSW collection dates data. Source: City of Cape Town, WNR.*

| | Waste collection data | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2021 | | | | 2020 | | | | 2019 | | | | 2018 | | | | 2017 | | | |
| **Months (Quarters)** | **Oct – Dec** | **Jul – Sep** | **Apr – Jun** | **Jan – Mar** | **Oct – Dec** | **Jul – Sep** | **Apr – Jun** | **Jan – Mar** | **Oct – Dec** | **Jul – Sep** | **Apr – Jun** | **Jan – Mar** | **Oct – Dec** | **Jul – Sep** | **Apr – Jun** | **Jan – Mar** | **Oct – Dec** | **Jul – Sep** | **Apr – Jun** | **Jan – Mar** |
| **Weight in tons (strandfontein)** | 667 (bags) tons | 12 tons | 11 tons | 42 tons | 47 tons | 13 tons | 39 tons | 15 tons | 84 tons | 1 ton | / | 6 tons | / | 1991 (bags) tons | 12 tons | 11100 (bags) tons | 37 tons | 793 (bags) tons | / | 68 tons |
| **Weights in kg (Coastal park landfill site)** | 106103.64 kg | / | 47986 kg | 28580 kg | 926.02 kg | / | / | 674.98 kg | 66.02 kg | / | 65.480 kg | 664.366 kg | / | / | 17776 kg | / | / | / | / | / |
| **Costs of waste delivered to landfill** | R84949.02 | / | R31115.10 | R15860.80 | R33456.30 | / | / | R9342.6 | R32292.30 | / | R38510.50 | R3617.4 | / | R4448.00 | R10654.20 | / | / | / | / | R8642.20 |

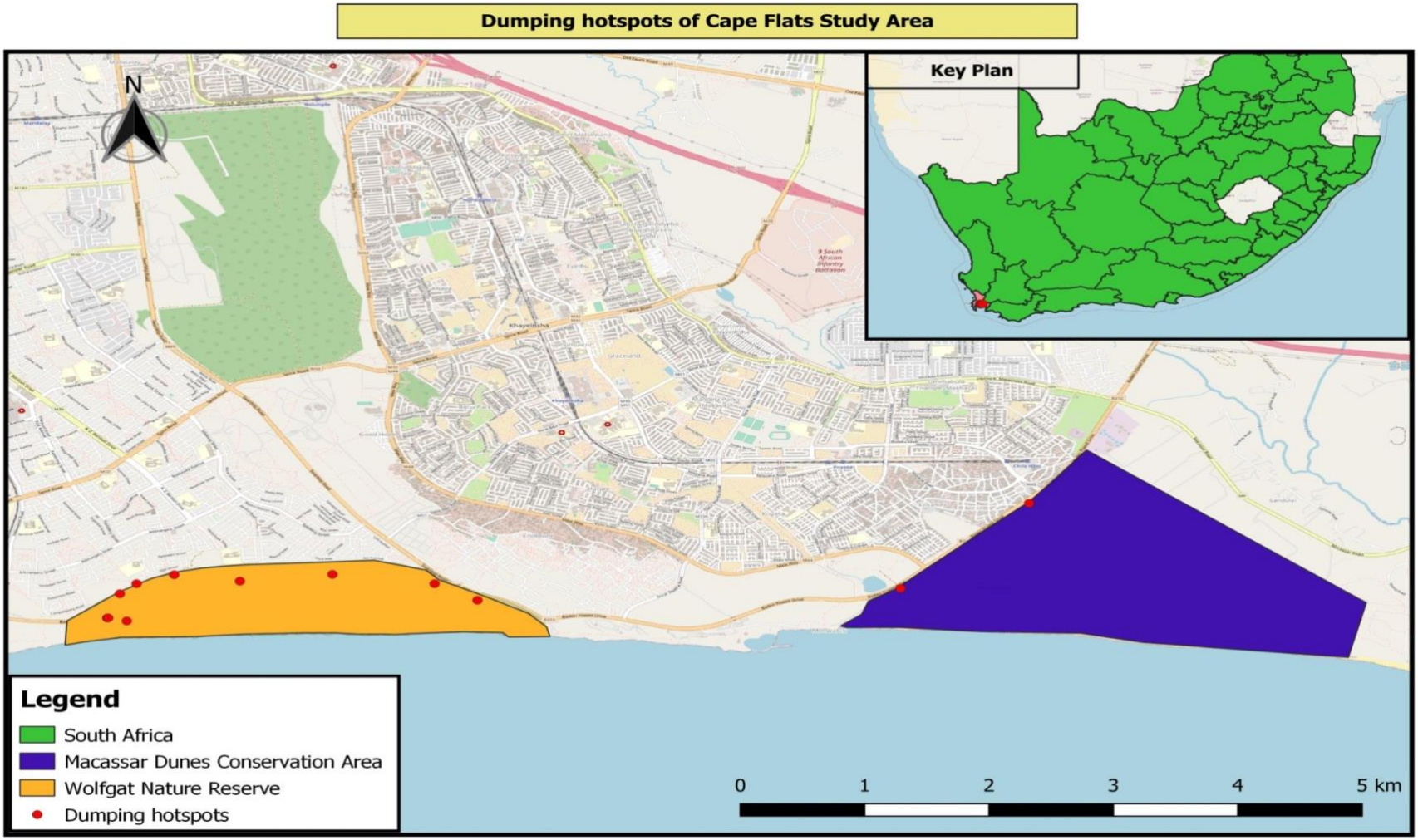


*Figure 18: Dumping hotspots of Cape Flats Study Area. Source: QGIS by Luvuyo Mdepha*

# 5) Chapter 5: Recommendation

Solid waste has been a recurring issue over the years, and to some degree decreased the aesthetic value of the WNR and MCAD. Reserve employees conduct countless clean-ups which lead to more waste being dumped, making solid waste clean-ups a regular phenomenon. Instead of countless clean-ups, a solution needs to be found to avoid money loss and reserves pollution due to waste. The employment and involvement of EPWP helps tremendously as people from the two communities are employed by the Municipality and helps keep their communities clean. It reduces the waste in the environment and helps share the message of keeping the environment clean with neighbours. Their employment benefits their community and the protected areas, the staff capacity increases by 60 individuals meaning more work is completed and the community benefits as waste is removed by people known as residents. The downfall would be that it is not sustainable as it enables only the temporary employment of staff for only 6 months and the changing of personnel annually. This means that from July – December the understaffed rangers are to collect illegally dumped solid waste from in and around these protected areas themselves.

A possible solution would be an initiative of getting community members involved i.e. by allocating spots for communities' to guard/monitor, keep clean and keep area's safe from illegal dumping by eradicating waste. This restores responsibilities on communities, in the case of the PA; residents working with reserve employees to report dumping whereas in the case of CA', co-responsibility, programmes and constant visits by officials would increase awareness. Job employment would be alleviated with park and recreation facility maintaining by community members as incentives could be offered to communities for the unemployed for services rendered as most community members in the two communities are unemployed.

Big signs indicating no duping allowed in the protected areas. The planting of indigenous Strandveld fauna on the dumping spots in and around the community, then leasing its care to community members. An example is illustrated in figures 19 and 20, where a community member took the initiative to create a garden in his backyard by utilizing reusable items to create a sustainable environment.


*Figure 19: Tafelsig resident's garden*

*Figure 20: EPWP staff on the left and male owner of the garden on the right*

As part of a previous study, Mdepha (2019), gathered recommendations to mitigate solid waste hotspots, and some of these may be implemented. A City of Cape Town Municipal waste drop-off site in Imizamo Yethu, Hout Bay, which was under the leadership of site foreman Bill Qhavana who oversaw the waste drop-off site. It ran a co-operation with the Imizamo Yethu community members which was a partnership between the jobless community members and the City of Cape Town waste drop-off site (Mdepha, 2019).

The group of jobless community members were provided with a workstation, vehicle and skills. The group went around the community, nearby restaurants and homes collecting waste on a daily basis. Waste was sorted systematically by the group, reusable material was placed on one side to be sold and recyclable materials were placed in big bags to be transported away to landfill sites (Mdepha, 2019).

*Figure 21 a & b: System being used to sort solid waste. Photo Credit: Reginald Domoney*

The money gained from selling the recyclable material goes to the group of unemployed individuals. The environment is cleaned and in turn jobless people are able to provide food for their families. An NGO called Thrive does the awareness by reaching out to schools and educating children about waste and organizing field trips to the waste drop-off site (Mdepha, 2019).

In the Mitchell's Plain and Khayelitsha communities, the nearest waste drop-off site is unknown to the majority of respondents and is mainly known by building contractors and City of Cape Town employees. If what is being done at Imizamo Yethu could be implemented in Mitchell's Plain and Khayelitsha, it could help in reducing waste in the Reserves and supplying jobs to the unemployed. The long-term solution would be that the waste management department could form partnerships with the reserves for environmental/waste management education within schools and the communities.

In comparison the Tygerberg Nature Reserve (TNR) located in the Bellville area, was fenced off and dumping was prevalent but limited and controlled (Mdepha, 2019). The TNR community members were very interested and invested in the cleanliness of the Reserve. The community members of Khayelitsha and Mitchell's plain were not as interested due to socio-economic challenges they already face, some do not know that the reserves exist so increasing the communities interest in the CA and NR would help. The fencing for WNR was slowly

being carried out but there was a fear that thieves would start removing the fencing for economic profit or vandalism.

As a worst case scenario, were the Reserve to be destroyed by the illegal waste disposal, there is a facility in Westlake, Cape Town where plant species indigenous to Cape Town are preserved. For the rehabilitation process plants species could be retrieved from the City of Cape Town facility to rehabilitate the Reserve. In order for the worst case scenario to not occur the sustainability of reserves is crucial, of which Lewine Walters, Zandisile Biko, Noxolo Sidzumo, Jerome September and many other Reserve employees are trying to achieve, to ensure reserve permanency.

# 6) Chapter 6: Conclusion

Economic growth, rapid urbanization and industrialization is continuously growing and going on in developing countries like South Africa, India and China to attain developed status. The quantity and quality of solid waste has changed due to these issues and particularly the development of cities, making SWM a problem. Thus the dumping of waste illegally has become prevalent in South African society, costing municipalities large amounts of money trying to maintain a healthy environment for residents in accordance with the constitution.

The finances used to eradicate solid waste hotspots in SA cities are resources that could have possibly been used elsewhere in society, such as, the proper maintenance of sports fields (playing grounds). In middle to low income communities there is a shortage of open spaces for playgrounds. In some cases, playgrounds are dumping hotspots where community members dispose of waste indiscriminately. This hurts the community members the most, as the children of the community either play with the waste or to avoid the waste they play in the streets where they often are involved in accidents. Community members and the municipality play a vital role in shaping the SWM system but often it is seen only as the responsibility of the local authorities, a false perception that need to be eradicated. As citizens need to be considered co-responsible, together with the authorities, in managing solid waste. Solid waste management is the responsibility of the municipality and its citizens. Public participation in waste management is required yet there is generally a lack of responsibility towards waste in our communities.

The sources of waste may vary, in particular middle to low income areas as it could be from the residents with the poor attitude towards waste management, residents from neighbouring areas, companies hiring people to dump or individuals who litter constantly. All of these have contributed significantly to the burden of waste on the natural environment and killing indigenous fauna and flora. A burden that's also affecting landfill sites, as maximum capacities are almost reached. Being that no other locations for sanitary landfill sites are being located, due lack of spacing for new sanitary landfill sites. Open dumping is common but poses the threat of being a health risk to humans, a threat to the environment and its aesthetic values. There are many challenges for the SWM system such as lack of resources, infrastructure, suitable planning, leadership, and public awareness. There is a need to encourage community awareness about SWM and change the attitude of people towards waste, as this is fundamental to developing proper and sustainable waste management systems. As the waste could be treated

as raw materials for goods (as mentioned in recommendations) manufacturing and or composting. If SWM is managed in an appropriate manner, then not only does it mitigate the negative effects but it could also help in meeting the demand of energy and employment.

This research studied the impact of solid waste dumped in the Cape Flats protected area and conservation area, which serves as recreational area for the public. It is known solid waste is indiscriminately dumped by residents from surrounding communities. These communities have proper waste management plans in place but the poor attitude by residents towards waste management, waste awareness not reaching everyone and the absence of law enforcement fuels dumping. By raising awareness initiatives in the communities on a regular basis, increase law enforcement presence and increase knowledge on waste, it would slowly eradicate the issue. SA's waste legislations were set to protect people's health and prevent the degradation of the environment in order to reduce, reuse or recycle waste. Yet, indiscriminate dumping is still prevalent. Some individuals' mentality towards waste management needs to change, either with stiff penalties and fines or constant awareness campaigns with community involvement and constant check-up.

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# 8) Appendices

## 8.1 COVID avoidance Rules


To avoid the contraction or spread of COVID-19, these are some the rule to adhere to while conducting study at Wolfgat Nature Reserve and Macassar Conservation Area Dunes.

Rules:

1. When entering premises make sure to sanitize at all times.
2. Carry hand sanitizer on person.
3. Avoid big groups of community members, interview individuals 1-by-1 at a 1.5 m distance.
4. Carry out interviews with staff in open setting, at a 1.5 m distance, to avoid the spread of COVID-19.
5. Minimize movement around the workplace facility to avoid the spread of COVID-19 or placing staff at risk.
6. Follow the entry and exit protocols of the facility at the entry before commencement of study.
7. Wear a cloth face masks at all times. No proceedings to take place if person(s) don't have a mask.
8. Physical/social distancing of 1.5 m distance must always be observed and practiced at workplace or in public.
9. Adhere to workplace COVID-19 rules and regulations at all times.
10. Sign a register, on each visit to the reserve workplace, to keep record of health.
11. Precautions of handwashing/sanitization, wearing of cloth face mask, and social distancing will be adhered at all times.
12. To ensure staff/students health is at best interest, the university doesn't allow any staff or student at a places that don't have or follow COVID-19 rules and regulations.

## 8.2 Data collection plan


**Work Plan** – for field research with EPWP

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**9:00**: Arrival at EE Centre.

**9:10 – 9:30**: - Greetings;

- Introductions;
- Background of study;
- What's to happen in the field;
- Give thanks to the EPWP group for assistance.

**9:40**: Surveying the EPWP group.

**9:55 – 10:10**: Short recess (period for Q's and A's).

**10:10**: Questionnaires handed to community (with the help of EPWP)

**11:00 – 11:30**: Break.

**11:30 – 12:30**: Finishing up.

**13:00**: Thanking the group for their effort and contribution towards the study.

**13:10**: Close off (end of field research).

## 8.3 Questionnaire


My name is Luvuyo Mdepha, a Masters Candidate in Environmental Management, currently studying at the Cape Peninsula University of Technology, District six campus. This project is about the illegal solid waste disposal on protected areas within the Cape Flats. The study site is situated between Khayelitsha and Macassar. The study will thus focus on Solid Waste Management in the Wolfgat Nature Reserve and Macassar Dunes Conservation Area.

### 1. GENERAL INFORMATION

| | |
|---|---|
| **Gender** | |
| **Age** | |
| **Reside (location)** | |

**1. The general type of solid waste that you identify constantly?**

☐ - **Paper, Plastic and/or Cardboards** ☐ - **Organic waste**

☐ - **E-Waste** ☐ - **Other**

**2. How often is your garbage (solid waste) collected?**

☐ - **Monday or Tuesday** - **Wednesday or Thursday** ☐

☐ - **Friday – Sunday** - **Never** ☐

**3. Has the issue of waste affected you in any manner?**

_____

**4. On a scale of 1 – 10, rate the severity of illegal waste dumping on the Reserves.**

_____

_____

5. **Have you seen individual(s) openly dump in the reserve? And how often?**

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6. **Would you report guilty parties to authorities if you spot them dumping illegally in the Reserve?**

---

7. **Why do you think people dump in the Reserves'?**

- ☐ - **Missed the collection truck**
- ☐ - **Lack of awareness on implications of solid waste**
- ☐ - **Don't care about the law (due to lenient or no punishment)**
- ☐ - **Not knowing where the nearest drop-off-site or to far**
- ☐ - **People from other areas**

8. **Do you feel waste has affected the land use?**

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9. **If yes, in your opinion how so?**

---

10. **Who do you think is the source/cause of waste disposal in the reserve.**

---

11. **Would you consider helping eliminate waste in the reserve?**

---

12. **From the waste disposed of illegally in the Reserve, would you consider reusing or recycling if given the opportunity? Yes, or No.**

---

13. **Any recommendation(s) or suggestion(s) about dealing with the waste issue in the Reserves?**

---

## 8.4 Permission to conduct study

Cape Peninsula
University of Technology

16 November 2020
Ms/Mrs. Glanville
Department of Environmental Management
Biodiversity Branch
City of Cape Town

**RE: Permission to Conduct Research Study**

Dear Mr/Ms. Glanville:

This letter serves to confirm that Mr LBP Mdepha is a registered student within our Faculty and the Department of Environmental and Occupational Studies. As part of their requirements, he has completed a research project to be able to get his qualification, the title of the proposed study is "*The impact of illegal waste disposal in the National Protected Areas: A case study of the Cape Flats*". His proposal is currently undergoing internal approvals inclusive of ethical clearance and we will inform you as soon as all these processes are concluded.

I hope that the City of Cape Town will allow him to recruit 200 individuals from the Macassar informal settlement and Tafelsig, Mitchells Plain who are above the age of 18 years to anonymously complete a 2-page questionnaire (copy enclosed). Due to the nature of the study, he also requests for the permission to obtain waste records from Wolfgat Nature Reserve (Rocklands) for use in his research study. I would appreciate it if you can allow him to conduct interviews with City officials from the Nature Reserve.

The survey results will be pooled for the thesis project and individual results of this study will remain absolutely confidential and anonymous. Should this study be published, only pooled results will be documented through permission from the City of Cape Town. No costs will be incurred by either your institution or the individual participants.

Your approval to allow him to conduct this study will be greatly appreciated. You may contact any of the supervisors at my email address: shalek@cput.ac.za and/or 4kshale@gmail.com

Thanking you in advance.

Sincerely,

Prof Karabo Shale

Acting Assistant Dean and Research Manager: Faculty of Applied Sciences

## 8.5 BMB permission to conduct study granted by CoCT WNR

CITY OF CAPE TOWN
ISIXEKO SASEKAPA
STAD KAAPSTAD

DIRECTORATE: SPATIAL PLANNING AND ENVIRONMENT
DEPARTMENT: ENVIRONMENTAL MANAGEMENT
BIODIVERSITY MANAGEMENT BRANCH, CONSERVATION SERVICES UNIT
**Penelope Glanville**
Senior Professional officer: Knowledge manager
T: +27 21 444 9624
E: Penelope.Glanville@capetown.gov.za

**ATT:** *Luvuyo Mdepha* **20.04.2021**
**Contact email:** lmdepha@gmail.com
**Affiliated institution:** CPUT
MTech: Environmental Management
Student number: *215285530*
*Supervisor: Professor K. Shale*

Dear Luvuyo

**PERMIT AND LAND OWNERS PERMISSION TO CONDUCT RESEARCH ON CITY OF CAPE TOWN NATURE RESERVES.**
**Title:** *The impact of illegal waste disposal in the Protected Areas: A case study of the Cape Flats.*

The Biodiversity Management Branch of the City of Cape Town (the Branch) has granted landowners permission for research to be conducted at Wolfgat Nature Reserve and Macassar Conservation Area. This permission allows you to conduct the following activities, from **20 April 2022 to 01 January 2023**:

1. It is mandatory that before the final thesis is published or shared publicly, that the Biodiversity Management Branch is provided a draft publication for ethical considerations and to ensure that the City of Cape Town is not portrayed in a negative light.
2. Only the approved questionnaire with correct Nature Reserve name can be used.

This permission has been granted on the following conditions:

- You inform the Site Manager of your access and activity on site:

**Lewine Walters**
Biodiversity Area Coordinator : Wolfgat Nature Reserve
**Tel:** 021 400 3856 | **Fax:** 021 400 3855 | **Cell:** 082 900 8630 |
**Email:** LewineMegan.Walters@capetown.gov.za |

- The researcher will need to arrange with Nature Reserve management if staff may accompany him/her on the reserve.
- The locations of the survey and one site work are to be communicated to the reserve manager.
- Any changes to your methods will require an updated version of this permit and thus need to be submitted in writing to the Branch for consideration via Penelope.Glanville@capetown.gov.za.
- Access to the Nature Reserves is subject to the City of Cape Town By-laws and the Cape Nature Conservation Ordinance No 19 of 1974 as amended by Act No 3 of 2000.

**This permission is valid from 20 April 2022 to 01 January 2023.** The City of Cape Town reserves the right to terminate this approval at any time without further notice. A progress report will be required at the end of this term to support extension of this permission period if required.
The Branch must be provided with a copy of the final report on the findings of this research, as well as any project metadata, spatial data, photographs to allow for further analysis and monitoring for management purposes.

**In addition: Please note that the following is NOT allowed at this site:**

1. Introduction into or removal of, picking of or damaging of flora, fauna, nests, etc.
2. Damaging or destruction of municipal property, fences or any natural objects
3. Dogs, vehicles, any weapons, catapult, bow-and-arrow, traps, explosives, poison or any other object or thing of this kind that could be used in hunting or exercising control over any animal
4. Littering or dumping of rubbish
5. Pollution of water
6. Lighting of fires, no smoking
7. Creating a disturbance, nuisance or hindrance to any visitor, animal, bird, etc.
8. Hindrance or obstruction of any authorised officer in the execution of his duties
9. Camping or staying on site overnight

Any transgression of any of the above conditions or those imposed by CapeNature will result in the cancellation of this permission. The City of Cape Town reserves the right to withdraw this permission at any time.

Your entry to and activities on this site are undertaken at your own risk.

Any queries regarding this permit please contact the Branch via Penelope Glanville at telephone number 021 444 9264 or email: Penelope.glanville@capetown.gov.za.

**Regards**

.....on behalf of CD 20.04.2022

**Clifford Dorse**

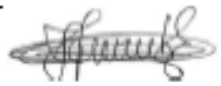
**Chairperson of the Biodiversity Management Branch Ecological Management Committee**

## 8.6 Provisional Ethical Clearance from CPUT

Cape Peninsula University of Technology

**Statement of Permission**

Data/Site permit is required for this study.

| | |
|---|---|
| **Reference no.** | 215285530/01/2021 |
| **Surname & name** | Luvuyo Mdepha |
| **Student Number** | 215285530 |
| **Degree** | Masters of Environmental Health |
| **Title** | The impact of illegal waste disposal in the National Protected Areas: A case study of the Cape Flats |
| **Supervisor(s)** | Prof K. Shale and Mr R Mulaudzi |
| **FRC Signature** |  |
| **Date** | 14/01/2021 |

Cape Peninsula University of Technology

P.O. Box 1906 - Bellville 7535 South Africa -Tel: +27 21 953 8677 (Bellville), +27 21 460 4213 (Cape Town)

**Provisional Ethics Approval Letter** **Reference no:** 215285530/01/2021

| | |
|---|---|
| **Office of the Chairperson**<br>**Research Ethics Committee** | **Faculty of Applied Sciences** |

On 11 January 2021, the Faculty Research Ethics Committee of the Faculty of Applied Sciences granted provisional ethics approval to Luvuyo Mdepha for research activities related to a project to be undertaken for a degree (Masters of Environmental Health) at the Cape Peninsula University of Technology. The study can begin once a site permit is obtained from the local municipality.

| | |
|---|---|
| **Title of project:** | The impact of illegal waste disposal in the National Protected Areas: A case study of the Cape Flats |

**Comments (Add any further comments deemed necessary, e.g. permission required)**

1. Human subjects are not involved in the proposed study.
2. This permission is granted for the duration of the study.
3. Research activities are restricted to those detailed in the research proposal.
4. The research team must comply with conditions outlined in AppSci/ASFREC/2015/1.1 v1, CODE OF ETHICS, ETHICAL VALUES AND GUIDELINES FOR RESEARCHERS.

| | |
|---|---|
| | **11/01/2021** |
| **Signed: Chairperson: Research Ethics Committee** | **Date** |