# Coping with Weather in Cape Town: Use, Adaptation & Challenges in an Informal Settlement.

Kris AGBOR TABI

2968674

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Supervisor: Prof. Sally Peberdy

Co-Supervisor: Mandy Carolissen

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# ABSTRACT

The concern that weather variability and climate change has raised nowadays puts every society or community on the alert. This is arguably the most persistent environmental threat to global stability in vulnerable communities in recent times. City dwellers are now experiencing increased variable weather episodes such as frequent flooding, heat waves and drought with increased wind and storm activities. Unfortunately, the aftermath of these weather irregularities are felt most severely by vulnerable urban poor residents with the least mechanisms to cope.

This study focused on the residents of Enkanini in Makhaza, an informal settlement in the greater Khayelitsha Township of Cape Town, South Africa. It documented the challenges they encounter with respect to weather, seeking to understand their adaptive strategies. Emphasis was also placed on the vulnerable nature of their dwellings and their ingenuity in coping with the variable weather pattern in Cape Town. Qualitative and quantitative methods were used to analyse field data, using codes derived from themes and SPSS respectively. Ethnographic methodology guided the researcher to participate overtly in the activities of the community over an extended period, watching what happened, listening to what was said and asking questions pertaining to their vulnerability to the vicissitudes of the prevailing weather in the informal settlement.

Findings from the study revealed that over 62% of the dwellings do not conform to the City's Disaster Risk Management Centre and Fire & Rescue safety regulations and that over 80% of the residents do not adapt very well to weather-related episodes. It also identifies the most challenging weather episodes to be floods during winter and shack fires during summer; amidst other health concerns that occur all year round.



## KEY WORDS

Vulnerability, Adaptation, Poverty, Weather Variability, Informal Housing, Survival, Ingenuity, Resilience, Climate Change, Global Warming.

# DECLARATION

I, Kris AGBOR, declare that *Coping with Weather in Cape Town: Use, Adaptation & Challenges in an Informal Settlement* is my own unaided work. It has not been submitted before for any degree or examination at any other university and all sources used or quoted have been indicated and acknowledged by complete references.

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Signature of candidate

_____day of _____ 2013

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# ABBREVIATIONS

1. ABM: AbalaleBasemjondolo
2. BNG: Breaking New Ground
3. CBD: Central Business District
4. CCT: City of Cape Town
5. CMA: Cape Metropolitan Area
6. ESIS: Emergency Servicing of Informal Settlements
7. HDI: Human Development Index
8. IPC: International Poverty Centre
9. IPCC: Intergovernmental Panel on Climate Change
10. KDP: Khayelitsha Development Program
11. PPA: Poor People's Alliance
12. RDP: Reconstruction and Development Programme
13. S: Southerlies (Wind)
14. SANCO: South African National Civic Organisation
15. SAWS: South African Weather Service
16. SSE: South South-Easterlies (Wind)
17. SSW: South South-Westerlies (Wind)
18. SW: South-Westerlies (Wind)
19. UNDP: United Nations Development Programme
20. W: Westerlies (Wind)

# Chapter I

# BACKGROUND AND OVERVIEW

## *1.1 INTRODUCTION*

The climate of the world is changing and will continue to change in coming centuries at rates projected to be unpredicted in current human history. Mounting scientific evidence suggests that climate change poses a significant threat both to humans and the wider environment (IPCC, 2012). Although it may have benefits in some parts of the world, most studies suggest impacts - such as increases in extreme weather events, rising sea levels, flooding and droughts which threaten human health and life both now and in the future (IPCC, 2007: 674). Climate is not just about temperature but includes precipitation,[1] wind and other climate characteristics. The threats it poses are entangled especially with dynamic weather phenomena such as temperature change and fluctuations in rainfall and wind patterns. The risks associated with the effect of climatic change are real but highly uncertain as humans interact with the weather.



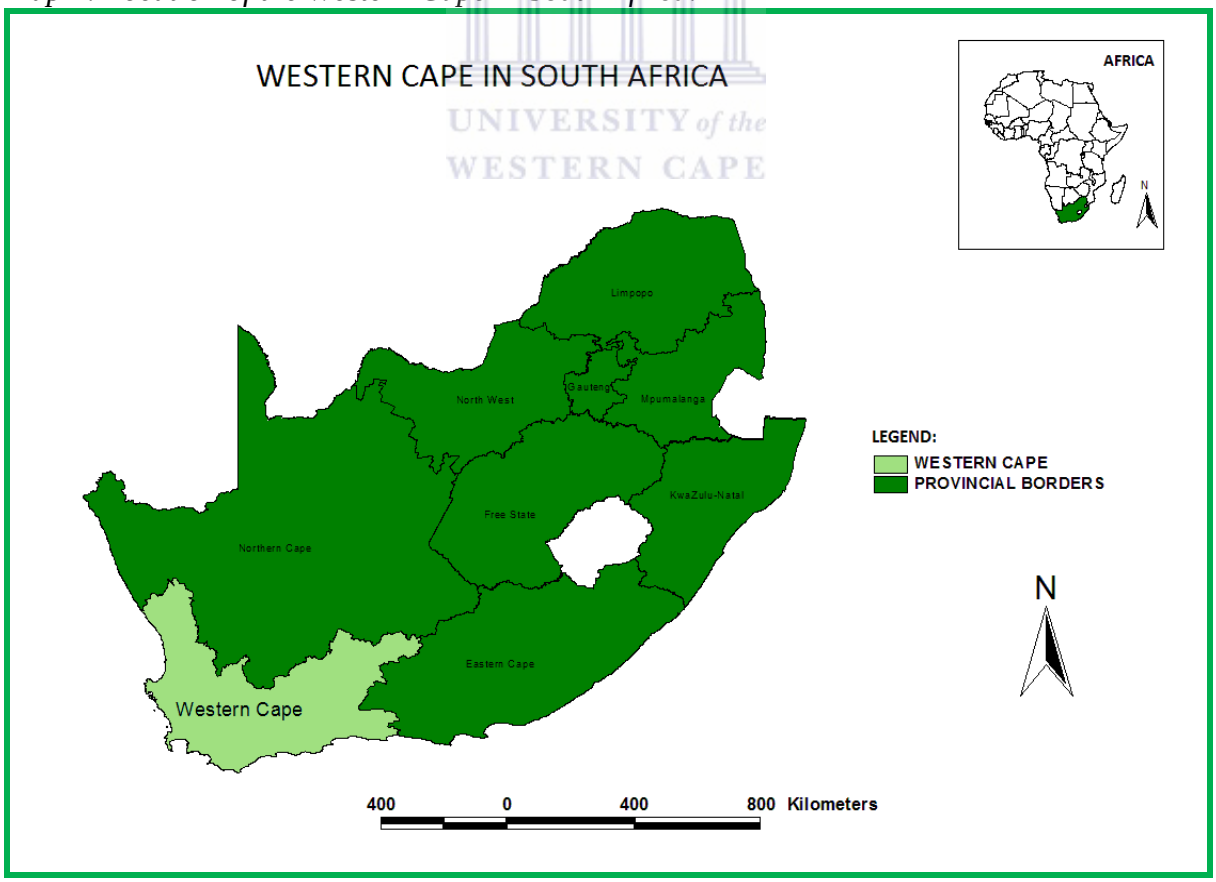
The weather has been a topic of conversation from time immemorial, and of late, it is probably the most common dialogue between people but even at this conventional level, it is contentious (Boia, 2005). For instance, some people take the stance that they are a lot more comfortable with the weather when it is warm whereas others hold on the opinion that they are more comfortable with the weather when it is cold. This therefore makes the weather phenomenon complicated and uneasy to conform to, due to its largely subjective nature. Although people or communities by instinct are fundamentally adaptive when it comes to dealing with the weather, they often find it very difficult to cope with the variability of weather elements[2] in respective seasons. As a result, the challenge of living in cities turns out to be enormous and coping with the city weather is becoming an issue of major concern to city dwellers (for instance, due to the urban heat island effect and increase of the heat index[3] over land areas). City-dwellers have also generally found very little defence against very hot

[1]Rainfall, snow, hail, haze, sleet, drizzle, fog.
[2]Precipitation (rainfall, snow, hail, haze, sleet, drizzle, fog), temperature, humidity, wind, atmospheric pressure, visibility and lightening.
[3] A combination of temperature and humidity that measures effects on human comfort.

or cold weather, massive winds, heat waves, sudden flashes of lightening or thunderstorms and have had limited success in adjusting to the effects of hurricanes and tornadoes.

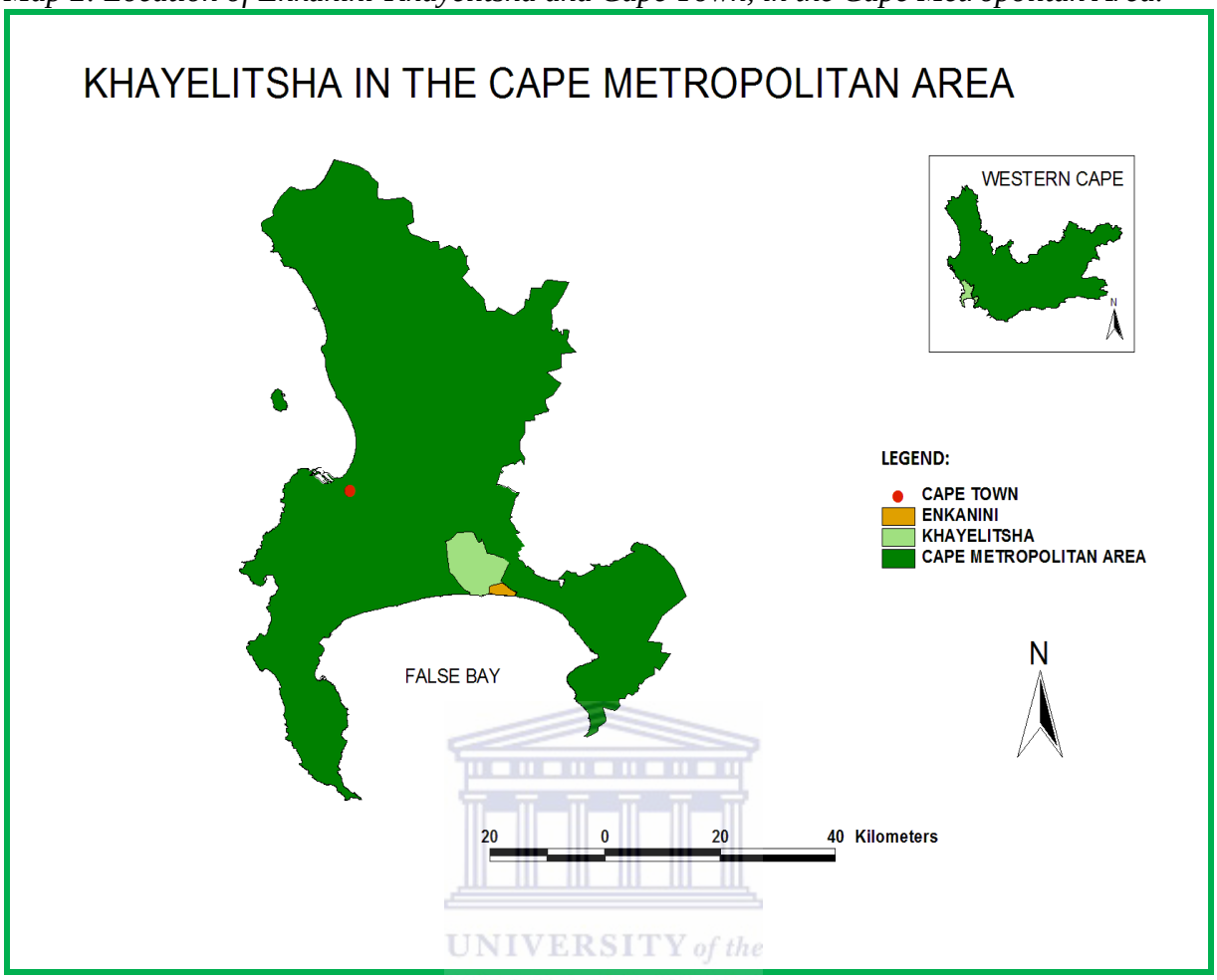
Amidst all these concerns, there is a general acceptance that people of the lower income category in most cities are more vulnerable than those of a higher income category in cities predominantly due to the location of their settlements and their adaptation potential to the city's weather (Boia, 2005). This study focussed on the vulnerable residents of Enkanini in Makhaza, an informal settlement in the Khayelitsha Township that truly exemplifies distinctive characteristics of an informal settlement in Cape Town. The study area (Enkanini) can be identified in Map 3 below, showing its position relative to the entire Khayelitsha Township and the Cape Town Central Business District (CBD) in the Cape Metropolitan Area of the Western Cape Province in the Republic of South Africa. Map 1 highlights the location of the Western Cape Province in South Africa relative to other provinces. The second map (Map 2) highlights the Enkanini informal settlement in the greater Khayelitsha Township, relative to the Central Business District (CBD) of Cape Town in the Cape Metropolitan Area (CMA).

*Map 1: Location of the Western Cape in South Africa.*




Source: Author's Compilation using ArcGIS.

*Map 2: Location of Enkanini-Khayelitsha and Cape Town, in the Cape Metropolitan Area.*






Source: Author's Compilation using ArcGIS.

## *1.2 STATEMENT OF THE PROBLEM*

The scale of the informal settlement challenge in Cape Town is visible for all to see. Before the announcement of the 'Breaking New Ground' (BNG) policy in 2004, no specific national policy existed regarding informal settlement management, maintenance and upgrading (Department of Housing, 2004). This contributed to the proliferation of informal settlements which principally emanated as a short fall of formal housing delivery because the responsibility of addressing the situation was solely a mandate of the national Department of Housing at that time. In addition, the local governments were only involved in housing provision at the level of implementation since they had very little input into policy formation at that time.

Due to a failure of the national housing program (between 1994-2004) to keep up with the continuous growth of informal settlements, local governments were desperately left to deal

with the problem on their own. They had no specific mechanisms in place to fulfill such a herculean task at the time (Department of Housing, 2004:10). With no concrete policy on informal settlements, the City of Cape Town officials were subsequently faced with the challenge of an increasing number of informal settlements and an increasing demand for basic services in such communities. As a result, the city set-forth some servicing projects to deal with the urgent service needs of these informal settlements such as clean water supply, proper sanitation facilities, adequate drainage systems and refuse removal structures (Pottie, 2003). This was also a response strategy to the frequent fires, floods and protests that plagued these mushrooming informal settlements much of the time (Van Niekerk & Hugo, 2002). These servicing projects officially started as a coherent city-wide project known as the Emergency Servicing of Informal Settlements (ESIS) project at the beginning of 2004 (Nick, 2006:232). It literally divided settlements into two categories:

- Those that were suitable for further upgrading, and
- Those that were located on 'encumbered land' which was not suitable for permanent settlement because it was either located in a flood plain, an electricity pipe servitude, or on landfill sites.

At this juncture, many homeless people were caught-up between living in a shack and a BNG or a Reconstruction and Development Programme (RDP) house. A decision had been reached that henceforth,



- If they took matters into their own hands by invading or occupying encumbered land, they faced possible evictions with nowhere else to stay.
- If people waited for the government to build them a BNG or an RDP 'starter' house, they could wait in their existing overcrowded shacks or backyard rentals until the government finally builds them a house and provides them with tenure security.

Enkanini, the case study of this research is one of those informal settlements in Khayelitsha that is located on an 'encumbered land'. When translated from IsiXhosa, it literally means 'staying here by force'. As its name implies, most of the inhabitants in the settlement occupied it illegally due to overcrowding in their previous locations from the greater Khayelitsha (mainly Khanya Park, Tembeni, Site B and Harare). According to some commentators, their exodus was precipitated by reports which stated that if past housing delivery rates were projected into the future, some of them would still be waiting for their houses in 2032, (City of Cape Town, 2006). Therefore, in their eventual quest for housing, they moved to new vacant grounds and erected their dwellings. The dwellings are mostly made from prefabricated structures called bungalows or 'Wendy houses'. The main

construction materials used for their dwellings are zinc, iron sheets, plywood and cardboard which unfortunately render the residents highly vulnerable to the prevailing weather pattern of the area. Information regarding their vulnerability relative to construction materials has been detailed under the housing section that follows. Some of the problems they encounter during the wet cold winter months include, but are not limited to intense cold, inadequate protection against dampness, inability to properly insulate their dwellings, flooding and shack fires. During the hot summer months, there is an increase in discomfort levels or heat stress and high risk of shack fires which have increasingly become well-known and transferred to neighbouring dwellings by prevailing winds in this settlement. There are other health problems which are also of major concern. These will be examined in the following chapter.

The entire terrain of Enkanini ranges between 0-10m above sea level as it cascades into the False Bay beach line. This is also a densely populated settlement (Figure 9a). The construction materials used for the dwellings also make the community vulnerable to external stressors due to climate variability. These residents tend to be vulnerable throughout the year. Although the residents of Enkanini have been coping with this variable weather pattern for as far back as when they inhabited this settlement some twenty years ago, the increased effect of climate change has aggravated the frequency of weather episodes such as floods, storm activity, heat waves and a changing rainfall pattern in the entire region of Cape Town. The livelihoods[4] of these residents is now threatened and they have become vulnerable more than ever before since most of them have reached their coping and adaptation threshold due to their low income levels coupled with the intolerable nature of their dwellings.



## *1.3 THE RESEARCH QUESTION*

The research question of the study is as follows:
How do vulnerable shack-dwellers in informal settlements, though faced with a challenging weather pattern, adapt to, and make use of such variable weather in respective seasons?

## *1.4 AIM AND OBJECTIVES OF THE STUDY*

The overall aim of the research was to investigate challenges encountered by the vulnerable informal settlement residents of Enkanini with respect to weather variability, by

[4] Used in this study as 'people, their capabilities and their means of living, including food, income and assets.'

understanding their adaptive strategies and how they use their ingenuity in coping with variable weather patterns in respective seasons. Apart from the overall aim, the following objectives were also formulated to guide the study in answering the research question:

- To investigate how vulnerable informal settlement residents use their ingenuity in coping with the weather for their survival.
- To examine detailed challenges the informal settlement residents encounter with respect to weather threats.
- To explore their adaptive strategies.
- To understand the adaptation dilemmas of informal settlement residents considering the nature of their housing (shacks) and their survival schemes during unusual weather episodes.

## *1.5 RATIONALE AND BACKGROUND*

Weather [5]and climate[6] have a profound influence on life on earth. They constitute part of the daily experiences of human beings and are essential for health, food production and the general well-being of people. Many scholars consider the aspect of global warming[7] as a matter of concern because it has given birth to climate change. [8] Global warming and global climate change are already a reality, threatening the lives of hundreds of millions, extinction of uncountable species of plants, animals, and fish and very possible, the extinction of man. The Nobel Prize-winning Intergovernmental Panel on Climate Change (IPCC) in its final report of 2007 stated that climate change is now a "certainty" and warned that unless action is taken, human activity could lead to "abrupt and irreversible changes" that would make the planet unrecognizable.[9] Climate is not just about temperature but includes precipitation,[10] wind and other climate characteristics. However, global warming is objective and quantifiable, while climate is less so. The climatic characteristics or weather elements[11] and



[5]The state of the atmosphere with respect to wind, temperature, cloudiness, moisture and pressure.
[6]Defined by the World Meteorological Organisation (WMO) as 'the statistical description in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands or millions of years' (WMO, 2007:312).
[7]The observed and projected increases in the average temperature of earth's atmosphere and oceans (IPCC, 2007c: 214).
[8]A statistically significant variation to either in the mean state of the climate or in its variability, persisting for an extended period (typically decades or longer) (IPCC, 2007: 215).
[9]IPCC, 2007, Climate Change 2007: Impacts, Adaptation and Vulnerability.www.ipcc.ch (accessed January 21, 2011).
[10]Rainfall, snow, hail, haze, sleet, drizzle, fog.
[11]Precipitation (rainfall, snow, hail, haze, sleet, drizzle, fog), temperature, humidity, wind, atmospheric pressure, visibility and lightening.

their accompanying effects (increased or decreased amounts in rainfall, extreme sunshine, high temperatures and strong winds) usually pose a threat to the wellbeing of people and communities, forcing them to devise coping mechanisms to enhance their livelihood.

According to the Intergovernmental Panel on Climate Change IPCC report (IPCC, 2007) on climate change and regional climate projections, some of the most vulnerable regions of the world in both preparedness for the consequences of climate variability and their ability to recover from disasters include the Amazonian Basin, Africa, South East Asia and Central America with cities including Rio de Janeiro, São Paolo, Cairo, Johannesburg, Cape Town, Egypt, Casablanca, Beijing, Mumbai, Dhaka, Phnom Pehn, Hanoi, Mexico City and Guadalajara (Kushner, 2009). A large percentage of the urban poor populations in these cities typically live in informal squatter settlements. Most of their dwellings are haphazardly built, usually without any authorization from the government department of housing. A host of others without houses live in old abandoned dilapidated buildings awaiting demolition by the local housing departments. Therefore in an event of unusual weather episodes, such as floods, heat waves, increased wind or storm activity or even droughts, these vulnerable residents tend to be helpless and they usually do nothing but sit and watch as nature take its destructive course on their livelihoods (Kushner, 2009).

Extreme weather events with destructive forces such as hurricanes and tornadoes do not prevail in South Africa. The country's climatic conditions range from Mediterranean in the South Western corner, to temperate in the interior Plateau and subtropical in the North East, with a desertic small area in the North West.[12] However, some unusual weather conditions (extensive flooding, drought, strong winds with destructive forces and minor heat waves) have plagued the nation in the past two decades. For example; the extreme precipitation of 11-16 February 1996 which was one of the four significant events during the 1995/96 rainfall season over Southern Africa (Crimp & Mason, 1998). Extensive flooding and related damage were recorded at this time with historical records showing one of the highest flood peaks of the past century. Worthy of note is the fact that during this period of unusual weather, most of the people affected were informal settlement residents occupying disaster-prone areas such as flood plains, hillsides and low-lying coastal locations in the Western Cape, Northern Province, Ladysmith and Mpumalanga (Rouault & Richard, 2003).

With all this in mind, this study focuses on residents of Enkanini, an informal settlement located in the south eastern corner of the greater Khayelitsha Township in Cape Town, South

[12] www.sa-venues.com (accessed on 17 Feb, 2011).

Africa. Cape Town has a Mediterranean climate with mild winters (rare possibility of snow fall) and sunny summers. The city's weather is also influenced by the Table Mountain Range[13] and it is characterized by average winds and varying temperatures. Lately, the city has experienced an increase in variable weather conditions such as increased inundations during winter, extreme heat and drought during summer and also some devastating wind-driven fires especially during the hot, dry and windy summer months.[14] Unfortunately, the most affected group of people in the city have been the residents of informal settlements in Townships since their dwellings are often constructed from cardboard, plywood and corrugated iron roofing sheets. The aftermath of these weather irregularities are felt most seriously by these vulnerable informal settlement residents occupying 'encumbered land'[15] as a means of dealing overcrowding in some of their previous locations from the other parts of Khayelitsha mainly Khanya Park, Tembeni, Site B and Harare.

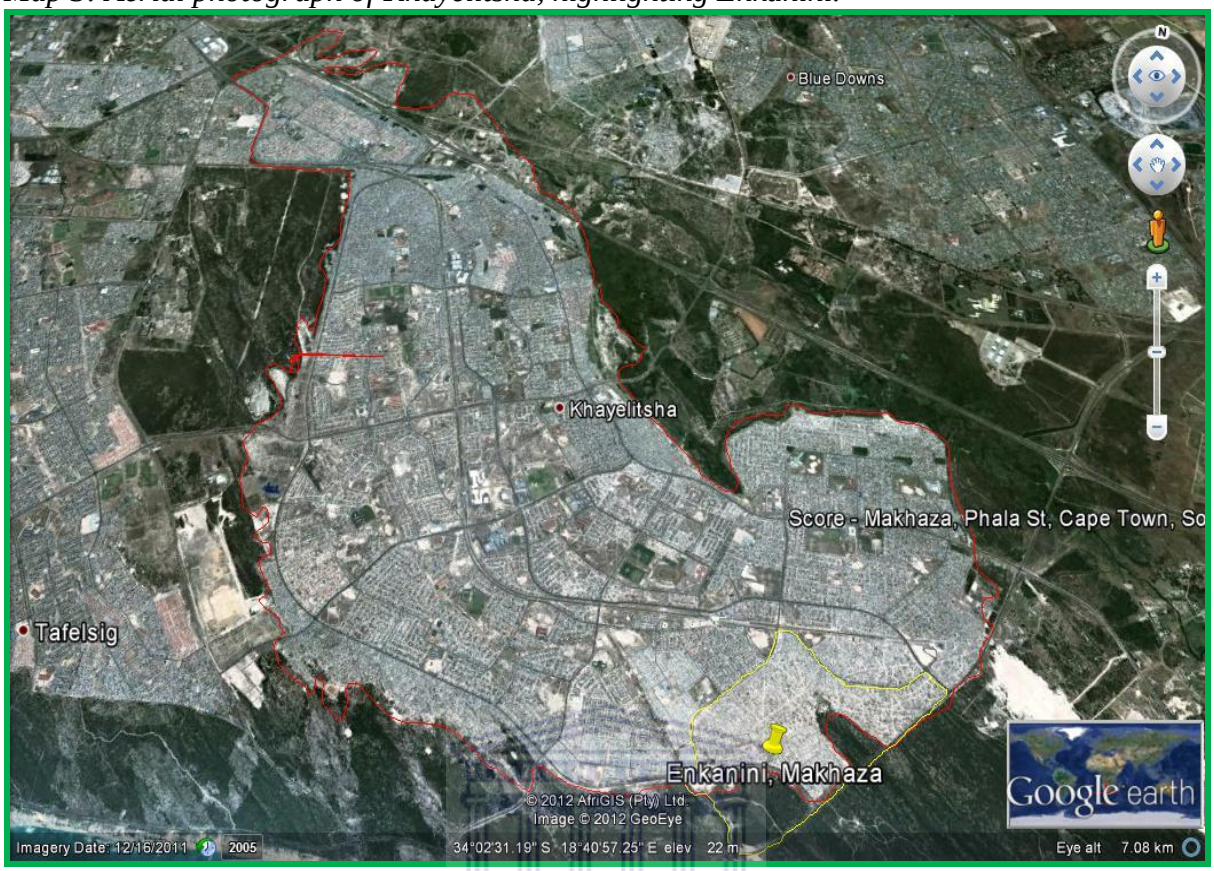
## *1.6 DEMARCATION OF THE STUDY AREA*

Ideally, a study such as this should have represented all the informal settlements in the entire Cape Metropolitan Area, since they experience objectively similar challenges to weather variability. Due to its massive size and an ever-increasing number of informal settlements, this study limited its scope to the inhabitants of Enkanini in Makhaza, an informal settlement in the greater Khayelitsha Township. Khayelitsha is one of the largest black Townships in South Africa. It is rated the third biggest Township following Soweto (South Western Township) in Johannesburg and Mdantsane Township in East London (Dyantyi and Mthandazo, 1998). Map 3 below shows an aerial photograph demarcating the entire Khayelitsha Township and highlighting the Enkanini informal settlement in the south eastern corner of Khayelitsha.



[13]Cape Town's prominent landmark, which is also a significant tourist attraction.
[14]www.mg.co.za, (accessed 17 January, 2011).
[15]Land not suitable for permanent settlement because it is either located in a flood plain, an electricity pipe servitude, or on landfill sites.

*Map 3: Aerial photograph of Khayelitsha, highlighting Enkanini.*




Source: Author's Compilation using Google Maps.



## *1.7 SIGNIFICANCE OF THE STUDY*

The Isandla Institute in partnership with the City of Cape Town commissioned 'The Bibliography of Cape Town Research 1994-2004' as part of a visioning project called *Cape Town 2025* that aimed at promoting innovative and collective strategies for a future city that would be firmly founded on the principles of equity, dignity sustainability and integration (Pirie, 2005). This bibliographic repository about research published in Cape Town consists of a list of over 1000 publications featuring journal articles, theses, research reports, seminar papers, chapters and books. In essence, it comprises a considerable stock of research knowledge about Cape Town (i.e. its places, people and problems ) all aimed at helping researchers target their efforts better and spending less time hunting for completed work.

After crosschecking the Cape Town bibliographic database to avoid any repetition, this study was strategically developed. Its focus is distinctive and substantial because it attempts to identify the challenges encountered by residents in informal settlements, with respect to seasonal weather variability in their dwellings. It also endeavours to connect theoretical social concepts such as urban poverty, vulnerability and resiliency vis-a-vis scientific

concepts like weather variability, climate change and global warming, to a larger extent. Captivatingly, the study x-rays a case in an informal settlement because although informal settlements may seem cohesive and tightly-knit, they often times are not, and embody a myriad of social problems either caused by marginalization, social exclusion, vulnerability or poverty, that can only be fully understood when living in such communities. As a result, they have become a research hub that draws attention to studies related to socio-societal problems such as crime, drugs, alcoholism, domestic violence, community conflict and dependence on from state. This study is probably the first of its kind, to be conducted in Enkanini and since it adopts the ethno-methodological approach of inquiry, it will be significant because it intends to bring to light, the link between the nature of informal housing, vulnerability to variable weather episodes and the role of policy (i.e. the role of the provincial Department of Housing and the City of Cape Town's Disaster Risk Management Centre) to their welfare.

Furthermore, this study is relevant because it will act as a foundation for subsequent research in this field of research and will also increase the body of existing literature around vulnerability to weather variability in informal settlements in Cape Town. Lastly, as a young researcher, the ethnographic methodology will give the researcher a good idea of the actual scenario on the ground, since the researcher will have to participate overtly in the people's lives and be present in the community over a long period of time, listening to what ordinary people say during certain situations, watching what they do and how they deal with their challenges.



## *1.8 ORGANISATION OF THE DISSERTATION*

This study has been divided into five chapters. Chapter one is the introductory chapter to the research proper. This chapter has presented introductory issues in order to provide a broad background to the research and insight into the main research theme. An overview of the study area (Enkanini) is also mapped with reference to the entire Khayelitsha Township and the Cape Town Central Business District in the Cape Metropolitan Area (CMA). The research question, problem statement, aim and objectives are also presented in this chapter.

Chapter two presents a concise review of literature on the nature of vulnerability in informal settlements with regards to weather variability. It is followed by an examination of key terminologies which anchor the conceptual framework of the study and are used to situate the research subject in a varied body of conceptual arguments. The main part of this literature review balances arguments around the challenges of variable weather patterns in

poor communities concerning the vulnerability, adaptation and coping mechanisms of marginal low income communities to weather variability.

Chapter three provides a detailed description of the research methodology adopted for the study. The study employed both the qualitative and quantitative research methods. Ethnography was the principal methodology and the case study design guided in identifying the relevant example for the study. This chapter furthermore provides the tools and methods of the data-collection process and summarises the indicators which have been used for data analysis. It also identifies limitations of the study and the major problems encountered prior to, and during data collection as well as during analysis of the results. It likewise points out aspects of ethical compliance during the entire research process.

Chapter four presents an in-depth data analysis of the results of the research using the indicators that were identified in the methodology. The Statistical Package for Social Sciences (SPSS) was the principal software used in analysing the quantitative data. The qualitative interviews were transcribed into thematic headings, identified for subsequent analysis and cross-validated to eliminate any bias. Most of the data is presented using descriptive statistics in the form of tables, charts, graphs and histograms. They were subsequently interpreted by attaching meaning and significance to the trends they portrayed.

Chapter five is the last section of the study. It provides a conclusion and summary of the key findings and identifies the relevant implications of the study. At the end of this chapter, recommendations for further research have been made.

# CHAPTER II

# LITERATURE REVIEW

## *2.1 INTRODUCTION*

After providing an overview of the context in which this study is situated, in addition to the aim and objectives of the study, this chapter continues with an examination of the literature on vulnerability to weather variability in informal settlements. Here, it examines the concepts that are related to the study by contextualising the relevant markers which such concepts highlight in recent studies. This has been achieved by paying keen attention to theoretical arguments on vulnerability analysis in relation to some of the challenges encountered during variable weather episodes and the seasonal adaptation strategies adopted by such communities at risk.

The following section provides an in-depth review of the main literature. Due to the inter-relationship of key concepts and in order to reach a clearer understanding, this review has been divided into four main sections. The first section looks at the broad literature including key issues surrounding informal housing, vulnerability, exposure, coping strategies, adaptation, poverty and weather variability both at the global and local scales. This is followed by a second theme of concepts which include; resilience, risks, challenges to weather variability, global warming and climate change, all in the context of the case study in Enkanini-Khayelitsha, in Cape Town. The subsequent section examines two fundamental models of vulnerability that help in situating the theoretical framework of the study whilst the last section will present the analytical framework which has informed and framed the overall analysis of the literature.

It is generally accepted that the relationship between people and weather over the years is a good determinant of the degree to which communities have adapted to a continuously changing weather pattern. This nexus may be positive or negative, depending on how well people adapt to, and make use of the respective weather elements for their livelihood. Boia, (2005: 32), defines a livelihood as comprising ‘the capabilities, assets including both material and social resources and activities required for a means of living.’ He adds ‘it is sustainable when it can cope with and recover from stresses and shocks and

maintain or enhance its capabilities and assets both now and in the future while not undermining the natural resource base' (Boia, 2005:33). Kasperson et al., (2005) iterate that weather and climate variability is one of the most complex environmental challenges world communities face today and its impact encompasses physical, economic, political and ethical issues. Although public and political opinion may be divided regarding what drives weather variability, the science is undeniable. As a result, this has prompted academics and policy-design researchers[16] unlike never before to explore the adaptive strategies to this variability at multiple fronts in assessing such risks, reducing vulnerability by deriving mitigative and adaptive solutions to climate impacts.

## *2.2 INFORMAL HOUSING, VULNERABILITY, ADAPTATION AND COPING MECHANISMS OF POOR COMMUNITIES TO WEATHER VARIABILITY.*

This section examines informal settlements in urban centres from a global and local perspective, identifying the characteristics of their geographical locations relative to the city centres in which they occur. It then attempts to identify perspectives pertaining their meaning, existence and the challenges the residents encounter, whilst maintaining focus on issues related to weather vulnerability.



### 2.2.1 INFORMAL HOUSING

Every year, the world's urban population increases by about 70 million people which could be equivalent to about 7 new mega-cities (UN-HABITAT, 2011: 118). All these people need to be provided with shelter, employment and a range of other services. This therefore puts these host cities under constant stress, to meet the demands of their ever-growing populations. Unfortunately, due to the stretched capacity of most urban economies, they are unable to meet up with more than a fraction of their needs especially in developing countries. As a result, the informal sector tends to provide most of the new employment and even housing to a larger extent, in what is commonly known as informal settlements or slums in some parts of the world (UN-HABITAT, 2011). Informal settlements around the world have been known for containing more than half the population of their host cities or towns, with vast expanses of informal housing units. The UN-HABITAT (2003: 31) defines informal

[16]See for instance, UN-HABITAT (2005a), Adger (2006), Davis (2006), Nick (2006), IPCC (2007), Aven (2011), IPCC (2012).

housing as 'housing that does not conform to the laws and regulatory frameworks that have been setup in the city where it occurs.' They add that this unconformity to the city guidelines may be due to one or more of the following reasons:

- Being built on land intended for another use (even though the building itself may conform to the standards laid down in the regulations).
- Not conforming to all of the standards laid down for that part of the city.
- Not being subject to planning permission or building inspection (even though it may be eligible).

  Being built on land not owned by the occupier and without permission of the owner.

  (UN-HABITAT, 2003:162).

The UN-HABITAT (2005b) further emphasises that most informal housing units in urban centres are found in the peripheries of such towns or cities, on marginal land areas that have been illegally occupied by people who are desperate for housing. Their observation underscores that more often than not, these land areas are situated in locations such as; railway reserves, canal and river banks, steep (and unstoppable) slopes, flood-prone/ swamplands and garbage landfill sites, which are unsuitable for human habitation or any other purpose (UN-HABITAT, 2005b:83).

To understand the global extent of the informal housing challenge, other authors[17] state that over 989 million people lived in informal housing world-wide in 2005 and they constituted about 38% of the global urban population. Cardona (2011) specifies that informal housing crises can be identified in practically all parts of the world but with greater concentrations in cities of the developing world. He also adds that about 50 % of the world's informal housing was identified in the south central and eastern Asia, 14% in Latin America and 17% in sub-Saharan Africa (Cardona, 2011:88).

There is a general consensus that, with population increases, urbanisation, and an increasing shortage in urban housing delivery, the population of informal housing in Africa is rapidly increasing, compared to a decreasing population in Latin America due to housing regularisation laws and informal housing improvements. In Asia, the proportions appear to have fallen, although the absolute numbers have increased, due to their overall economic conditions (UN-HABITAT, 2005a: 94). It should be noted that the great majority of these informal houses are located in informal settlements in most of their host urban cities. The terms used to describe such settlements around the world include; self-help or self-built

[17] See for instance, Ayala & Jiménez (2005), Davis (2006), Werthmann (2009), Cardona (2011).

settlements, spontaneous settlements, marginal settlements, squatter areas and slums. In other languages, the terms include; *barrios, tugurios, favelas, bidonvilles, gecikondus* and *kampungs* (UN-HABITAT, 2003).

The UN-HABITAT (2011: 46), defines an informal settlement as 'an area that combines to various extents, the following characteristics; inadequate access to safe water, inadequate access to sanitation and other infrastructure, poor structural quality of housing, overcrowding and insecure residential status.' Gilbert & Varley (1991: 32), add that most informal settlements come to existence as a result of organised 'invasions' of land which may have occurred overnight (especially in Latin America) or as a result of a gradual process of occupation and incremental growth. Examples of such informal settlements include; Villa El Salvador in Peru which started as an informal invasion of peri-urban land in the Lima municipality (Gilbert & Varley, 1991: 34) and Ashaiman in Ghana which extended due to incremental growth in the city of Tema (UN-HABITAT, 2005b: 68). Other examples include informal settlements in Phnom Phenh (Cambodia), Daravi (Mumbai, India), Orangi (Karachi, Pakistan), Guayaquil (Ecuador), Cartagena (Columbia) and the Tondo foreshore of Manilla in the Philippines (UN-HABITAT, 2008: 146). Worthy of note here is the fact that in most of these cities, the informal dwellings are constructed with very rudimentary building materials made out of recycled or impermanent supplies such as straightened oil drums, used corrugated metal sheets, plastic and canvas sheets, cardboard cartons, traditional wattle, daub, and discarded timber (UN-HABITAT, 2003).



In South Africa, the situation is fairly similar, since recent studies conducted by the South African Government suggest that approximately 35% of informal housing structures are located within pockets of informal settlements, 55% are located on the periphery of urban settlements whilst 10% are peri-urban and can be identified in major cities such as Johannesburg, Cape Town and Durban (South African Government Information, 2010a). According to the City of Cape Town's report on informal dwelling count (City of Cape Town, 2006: 10), 'informal settlements represent about 50% of the metropolitan gross housing backlog that has continuously affected South African metropolitan cities.' The report further defines an informal settlement as 'any unplanned settlement on land which has not been surveyed or proclaimed as residential, consisting mainly of informal dwellings (shacks),' where an informal dwelling is defined as 'a wooden or iron structure which does not meet basic standards of safety in building' (City of Cape Town, 2006: 5). Although the South African Constitution grants all of its citizens the right to adequate housing and basic services such as access to clean water, electricity, education and healthcare services, the

government's efforts in delivering housing subsidies to the urban poor has suffered a very huge backlog of approximately 1.2 million houses (City of Cape Town, 2007: 12). And in 2005, there were still approximately 8.5 million people living in informal housing in South Africa (City of Cape Town, 2007: 10).

This scenario is not different in the city of Cape Town, which is where the case study for this research is located. Here, the housing backlog has become an issue of principal concern to city planners in the Disaster Risk Management Centre (DRMC), Fire and Rescue Services (FRS) and the Department of Housing (DoH) especially. This is because the housing backlog has rendered most of the low income Capetonians living in informal settlements, vulnerable to the dynamic weather episodes that prevail in the city. The government's efforts in delivering housing subsidies in the Western Cape Province suffered a huge backlog of approximately 600 000 houses, of which 500 000 are in the Cape Metropolitan Area and the number has been rising since then (City of Cape Town, 2007: 12). Adding to that scenario, findings from a report published by the City of Cape Town's information and knowledge management department reveal that the number of informal settlements has grown higher, since the first count was made in 1993 (City of Cape Town, 2006: 6). There was an increase from 50 to over 200 informal settlements in 2005 and the informal dwellings as well, have increased from 28 300 in 1993 to 98 031 in 2005 (City of Cape Town, 2006). The informal housing conditions are worsened by economic decline, increasing inequality, loss of formal-sector jobs, rapid immigration, poor governance and exclusionary actions (City of Cape Town, 2007).

As a result of this housing backlog, many low income Capetonians are urged to move away from their usually overcrowded homes and resort to the risky and insecure form of housing, erected in informal settlements and backyard dwellings which may be closer to better livelihood facilities, have low or no rental rates and requires a very minimal service charge. Others have never had access to formal housing, overcrowded or otherwise, but have from their arrival in the city had to live in informal settlements.

With an increase in the likelihood of unusual weather episodes in the Western Cape, such as increasing in average temperatures, shifts in the rainfall patterns and the variable effect of the prevailing winds, residents of these informal settlements tend to face numerous challenges. For example, increased temperatures will increase the heat stress levels, which also predispose shack fires. Increased intensities of heavy rainfall events would also increase flooding, which exacerbates their vulnerability because their shacks easily get washed away or destroyed during flood events. Since these informal settlement residents are already at the

brink of the limits of their coping abilities, the added influence of a changing climate in Cape Town may further push them beyond their coping capacities. Therefore understanding their vulnerability becomes a critical assignment and pertinent.

### 2.2.2 VULNERABILITY

The word 'vulnerability' has been used in various ways by numerous scholarly communities around the globe and the occasional disagreement about its appropriate definition has frequently caused misunderstanding in interdisciplinary research. Originally, it is derived from the Latin word *vulnerare* which means 'to be wounded' and it describes the potential to be harmed physically and/or psychologically. The concept of vulnerability was introduced in the 1970s within the discourse on natural hazards and disaster by O´Keefe et al. (1976). In their argument, they insisted that socio-economic conditions are the major cause of natural disasters, by illustrating in their work that the occurrence of disasters increased over the 50 years period of their empirical data, paralleled by an increasing loss of life. As the concept developed, Watts and Bohle (1993:38) argued similarly by developing the 'social space of vulnerability,' which is constituted by exposure, capacity and potentiality. As a result, research on social vulnerability extended to a variety of fields, most especially in the natural and social sciences. Since then, each field has defined the concept differently, as it is manifested in a host of definitions and approaches in respective disciplines.[18]



Amidst the myriad definitions, some common threads have been identified that run through most of the available frameworks that attempt to examine the concept. For instance, Blaikie et al. (1994:32), describe it as 'the characteristics of a person or group of people, to anticipate, cope, resist and recover from the impacts of natural hazards.' On the other hand, Kelly and Adger (2000: 335) illustrate vulnerability in terms of 'the ability or inability of individuals and social groupings to respond to, that is, to cope with, recover from or adapt to any external stress placed on their livelihoods and wellbeing.' They emphasized, 'vulnerability does not exist in isolation but only with respect to some specific impact or set of impacts and that the terms vulnerability, adaptation and coping are intrinsically related and inseparable (Kelly and Adger, 2000: 332). Adger, (2006) further refers to vulnerability as people's exposure to external risks, shocks and stresses and their ability to cope with and recover from the resulting impacts. To be a lot more precise, he defines it as 'the state of

[18] For example, Blaikie et al. (1994), Alwang et al (2001), Cannon, (2006), Füssel, (2007), Twigg, (2007), Heltberg et al. (2008), Oliver-Smith A., (2009), Gaillard, (2010), Cardona, (2011).

susceptibility to harm from exposure to stresses associated with environmental and social change and from the absence of capacity to adapt' (Adger, 2006:268). Unlike the host of definitions identified above, the Inter-Governmental Panel on Climate Change (IPCC, 2007: 6) provides a system-orientated definition of vulnerability, which states that,

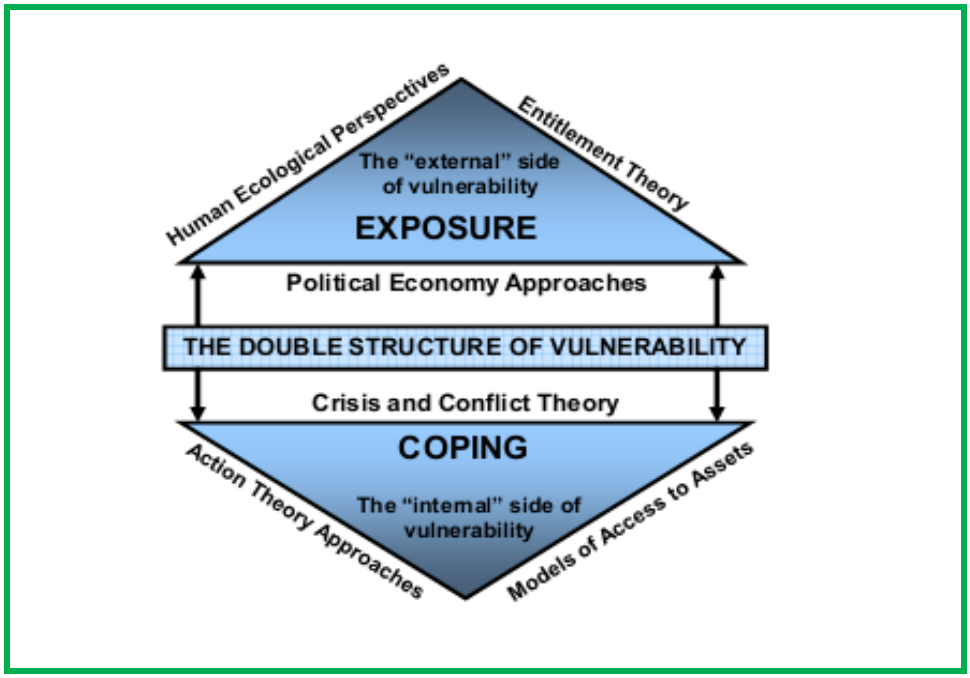
> vulnerability is the degree to which a system is susceptible to and unable to cope with the adverse effects of climate change, including climate variability and weather extremes; and that vulnerability is a function of the character, magnitude and rate of climate change and variation to which a system is exposed, the sensitivity and adaptive capacity of that system.

The Working Group II of the IPCC emphasised the need for vulnerability research and therefore devoted the entire volume of their 2007 publication (IPCC, 2007) to vulnerability with regards to climate change, since most urban communities in developing countries would relate to it.

For an in-depth understanding of the concept of vulnerability, this study examined Bohle's later work in 2001, after he had developed the concept of the 'social space of vulnerability' in his collaboration with Watts in 1993 as indicated above. In his famous framework to analyse vulnerability, he distinguished between 'internal' and 'external' vulnerability and specified how these two facets function together, to create the pressure on a particular vulnerable group or community (see Figure 1).



**Figure 1: Double structure of vulnerability.**




Source: Adapted from Bohle, (2001: 6).

According to Bohle's (2001) interpretation of Figure 1 above, external exposure comprises of human ecology perspectives and entitlements perspectives. He further elucidates that human ecology includes the structural, political and economic constraints on livelihoods and choices available to a community, whilst entitlements perspective looks more at the actual livelihood bundles of a community and the choices and control available to them (2001:3). From his viewpoint, these are the external limitations on a community and all works that could be categorised under a political economy framework can be identified here. His interpretation goes on to show the other facet of the structure, which is internal vulnerability. He alluded that internal vulnerability focuses on assets, coping mechanisms and adaptations. By this, he referred to the actions taken by vulnerable communities in order to adjust to the circumstances they encounter. The internal constraint of vulnerability analysis is relevant to the case study in Enkanini because a great deal of the inquiry to follow this research will focus on it, since it includes assets, coping strategies and adaptation techniques of vulnerable households. It is also relevant because livelihood change, coping and social capital are all integrated in this facet of vulnerability. At the end his analysis, Bohle (2001) also remarked that too little research has focused on the internal side of vulnerability and that both sides should be taken into account in order to effectively understand vulnerability and to gain a more integrated understanding of the multiple structure of vulnerability (Bohle, 2001:7).

To put the concept of vulnerability in context, a Swiss Re Sigma Study in 2002 found that out of the forty worst catastrophes between 1970 and 2001, all but two were in developing countries and half were climate related (Swiss Re Sigma Study, 2002).[19] Generally, vulnerability manifests itself in developing countries due to a lack of resources and capacity to respond on time. In these countries, low income communities are also more vulnerable to unusual weather episodes like those associated with variable weather patterns and climate change in the long run. Furthermore, the lack of Early Warning Systems (EWS) increases their vulnerability to floods, storm surges, cyclonic winds and heavy rains. It has also been established that in the cities of most developing countries, the poor live in unplanned squatter dwellings often located in flood plains and marginal lands which represent the only available place for them, most of the time. These cities often lack adequate infrastructure such as fire services, dykes, Early Warning Systems (EWS) to help them cope when a disaster strikes (Kelly & Adger, 2000). There is also an absence of resources to invest in disaster-proof buildings which can limit the effect of damages that accompany most

[19]Swiss Re sigma study, 2002, High flood loss burden for insurers in 2002. (Accessed through www.reliefweb.int on 17 January 2011).

weather-related disasters. More so, the absence of insurance, savings and credit makes it almost impossible to substitute or compensate for most of the things destroyed during such unusual weather episodes. Apart from the frequently highlighted physical vulnerabilities in particular regions and sub regions on the globe, it is clear that poor/underprivileged communities around the world are particularly vulnerable to variable weather patterns and in addition, will suffer disproportionately from the impacts of a changing climate.

On a micro scale, many underprivileged communities in Cape Town have also experienced a significant number of disasters and unusual events associated with variable weather within the last decade. Some of them include the Cape Flats floods (1994 and 2001), the Manenberg wind storms (1999 and 2002), the South Peninsula fires (2000), the Joe Slovo informal settlement fires (2000, 2004, 2005), cut-off low severe storms (2003, 2004, 2005) and recurrent severe drought (2002-2005) (Holloway et al. 2008). Also, due to rapid urban growth specifically in the informal settlements, the exposure of impoverished families to personal and infrastructure loss due to informal dwelling fires has increased in the City. According to Holloway (2005: 22), more than 41,000 informal homes were damaged by fires between 1990 and 2004, particularly in Khayelitsha - the Township where this case study of Enkanini is situated. Following Kelly and Adger's (2000:186) emphasis (as indicated above) that '…the terms vulnerability, exposure, coping strategies and adaptation are intrinsically related and inseparable,' in the following section, the last three concepts will be examined both independently and also in relation to how they complement each other in adding meaning to the understanding of vulnerability. Exposure traces the external side of vulnerability, whereas coping strategies and adaptation address the internal side of vulnerability (Bohle, 2001).



### 2.2.2 (A) EXPOSURE

Exposure identifies the external facets of vulnerability, mostly economic vulnerability and structural constraints encountered by vulnerable communities. Most vulnerability studies conducted previously which focussed on exposure were rooted in political economy frameworks. Their structural restrictions had very limited options presented to the powerless and in most cases, vulnerable communities.

More recent literature on vulnerability has developed the concept of exposure in more detail. For instance, an investigation conducted by the IPCC (2012:43) on vulnerability to climate change indicated that, 'both climate change and globalisation create '*winners*' and

'*losers*' and it is often the same countries, regions, communities or households who are the '*losers*' in both,' due to their exposure and vulnerable nature of infrastructure. Recent studies by Leichenko & O'Brien (2008) that examined the double exposure of certain community groups with regards to climate change and economic globalization greatly focussed on exposure. Findings from the studies emphasised that the combined impacts of both of the processes should be considered in order to identify the most vulnerable groups (Leichenko & O'Brien, 2008: 26). They also added that the study brought to light, the role of economic exposure in enabling full comprehension of the concept of vulnerability. Exposure to both economic factors as well as environmental factors such as hazards, weather variability and climate change in the long run increases the vulnerability of unprotected groups and communities thereby rendering them helpless more often to the prevailing conditions. The concept of double exposure and the role of both environmental and economic exposure in creating greater vulnerability are particularly identifiable in the case of Enkanini. Improper policy implementation, inadequate follow-up and the continuous exposure of the residents to variable weather episodes, leads to a continuous cycle of vulnerability in the settlement. This is coupled with their strained and often unsustainable financial circumstances. Furthermore, exposure to wider economic forces such as lack of entrepreneurial skills and job opportunities is paramount in increasing vulnerability in Enkanini. This is because most of the residents indicated that they lacked the appropriate financial resources to help them adapt during unusual weather episodes, (see chapter 4).



### 2.2.2 (B) COPING STRATEGIES

With regards to vulnerability, coping strategies particularly address the procedures and choices made by individuals and vulnerable communities during circumstances of unusual stress in their surrounding environment. Scoones, (1998) demonstrates the problems of seeing vulnerable communities as passive victims of disaster through an understanding that coping strategies represent the local people as active agents of the change they encounter in their surrounding environments. He therefore provided an alternative to some earlier representations of vulnerable groups and communities globally. In his report, coping strategies include things like seeking wage employment, taking on migrant labour, diversification of subsistence activities, withdrawing children from school so that they can contribute to household earnings as well as liquidating assets such as livestock, land or tools (Scoones, 1998: 26). However, other authors (Blaikie et al., 1994, Devereux & Coll-Black,

2007, Ziervogel & Zermoglio, 2009) have pointed out that many of these coping strategies are effective in the short term, but often have the effect of increasing vulnerability in the longer term, thereby worsening the impacts of further hazards on vulnerable groups. Therefore, coping mechanisms should comprise changes made by the vulnerable people or communities in order to widen 'the portfolio of income-earning activities to offset and reduce vulnerability' (Blaikie et al., 1994: 6).

But Eriksen et al. (2011) mainly caution that households adopting a variety of strategies in order to cope during times of stress may possibly become more vulnerable when these strategies comes at the expense of active specialisation in a single more profitable activity. As a result, hazards can develop mutually reinforcing shocks, with each one leaving the community ever more vulnerable to the next event. An example of one such coping strategy in the case of Enkanini was the dwelling fire that ravaged an entire section of the informal settlement due to a short circuit from illegal (unauthorised) electricity cable connections in some dwellings. Therefore the coping strategy of illegal cable connections left the community even more vulnerable than they were before the dwelling fires, thereby causing a long term worsening of their situation.

### 2.2.2 (C) ADAPTATION/ ADAPTIVE CAPACITY



Adaptation has origins in species biology where an adaptation within an individual or a species gave it competitive advantage over its counterpart, thus perpetuating its survival. The IPCC's (2007), definition of adaptation infers that it is where adjustments are made to improve the ability of a system to cope specifically with climate change or variability. According to the IPCC (2007: 6), 'adaptation is the adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.' In the vulnerability context, adaptation is something that allows a group or a community to cope better with risk and to survive or improve into the future. It is also something that enhances the sustainability of a group or an entire community. Furthermore, Smit et al., (2001: 282) styled it as 'adjustments in ecological-socio-economic systems in response to actual or expected climatic stimuli, their effects or impacts.' Smit & Wandel, (2006: 282) highlighted that adaptations can be 'anticipatory or reactive,' 'autonomous or planned' and that the term adaptation is generally used where the change has enabled better coping strategies of a system. Where this occurs, it allows such a system to survive or reproduce further, thus it is normally employed only for positive change.

In the same vein, other authors (Vogel & O'Brien, 2004; Vogel et al., 2006; Gallopín, 2006; UNFCCC, 2007; Bunce et al., 2010) agree that it is a change in livelihood or access profiles which can take place either before, during or after a stressful event, but has the effect of enhancing the individual or community's ability to cope over the longer term.

Kelly & Adger (2000: 188) further define adaptation to weather variability as 'the adjustment of a system to moderate the impacts of a threatening weather, to take advantage of new opportunities or to cope with the consequences.' Although adaptation has the potential to reduce the negative impacts of climate change, the ability to adapt is particularly related to socio-economic characteristics. Therefore, the likelihood of adaptation needs to be carefully analysed, given that developing countries are at a clear technological, financial and institutional disadvantage. It is also important to recognize that no single adaptation strategy can be encouraged, given the uniqueness of each country's situation. This is clearly recognized in the COP7 report (UNFCCC, 2007) which emphasizes the lack of a 'one size fits all formula' for adaptation. For that reason, this study allows for inductive inquiries in relation to the coping strategies, livelihood experiences and challenges encountered in Enkanini, as will be examined in later chapters. Exposure, coping strategies and adaptation; all of which are sub-concepts within vulnerability analysis helped to orient the study to a more meaningful direction (particularly during data collection) as will be pointed out in subsequent chapters.



### 2.2.3 POVERTY

The analysis of poverty as a concept in this study is imperative because the case study of Enkanini is located in the informal and low income segment of the greater Khayelitsha Township in Cape Town. Poverty is a pretty clear reality; if you do not have enough to eat, to clothe yourself or to afford decent housing, you are poor. But some of these elements are subjective; does one need three meals a day or would two be enough? How much housing is needed to live a decent life? How much more in order to have some privacy? Defining poverty is much more difficult than just relying on the immediate evidence of goods and services. Dembitzer, (2009) describes it as a very 'slippery concept' because it does not have specific measures and cannot be determined through mere observation. In its simplest form, poverty can be observed as the lack of basic needs such as adequate and nutritious food, basic clothing, housing, clean water and health services. Poverty does not explain certain types of attributes which people do or do not have and it is used to describe a cluster or a large

number of conditions. There are disagreements and controversies that exist as to stating the precise nature of poverty. Budlender (1998:26) argues 'the basis of poverty is greatly influenced by the individual's background, experience and environment.' She is of view that poverty is not only about the lack of money but also more centrally about the scarcity of valuable and favourable occasions which allow people to build decent lives for themselves (Budlender, 1998). Sen (2001:16), on the other hand defines poverty as 'the lack of freedom of opportunity.' According to his definition, if you have the opportunity to do your own thing, to develop yourself, to make a choice, you become free and cannot be regarded as poor (Sen, 2001). For clarity, other authors (Blackburn, 1991; Dinitto and Dye, 1983; Harlan et al., 2006) have classified poverty under absolute and relative concepts.

Absolute poverty as a concept rests on the idea that it is possible to define a minimum standard for physical survival and that the needs of the poor do not change over time. It consists of a situation where the mortality rate is high, malnutrition is chronic, housing is of sub-human standards and employable skills are extremely rudimentary due to weak or absent entrepreneurship (Blackburn, 1991). Precisely, the World Bank's definition in 2008 is that 'absolute poverty describes someone who lives on less than $1.25 per day' (World Bank, 2008: 39). Based on the World Bank's definition, it implies that there are about 1.25 billion people in poverty across the globe (World Bank, 2011: 40). But the Brazilian-based International Poverty Centre (IPC, 2008) estimated in 2008 that there were considerably more poor people in the world than that-close to 1.7 billion.[20]

According to Blackburn (1991:9), relative poverty on the other hand implies that 'poverty is about being poor in comparison to the standards of living of others and about being unable to do things that are generally accepted in the community.' For instance, if a person thinks their neighbours have much more than they do, then they are poor. The Food and Agricultural Organisation (FAO, 2009) suggests that more than two billion people worldwide are affected by absolute and relative poverty and they suffer from '*hidden hunger'* which it defined as survival on a very limited diet, eating the same kind of food almost every day without sufficient vitamins and minerals.[21]

With a vivid picture of what poverty looks like, one can tell that there are many groups of poor people all over the world, who face different threats or vulnerabilities to weather variability and climate change though they do not form a homogeneous group. The

[20] www.International-Poverty-Centre;Jobs, jobs, jobs, the poverty challenge, November 2008. Accessed 17 June 2011.
[21] FAO, 2009, Paper submitted to the World Food Summit, Treviso, Italy. (www.directrelief.ca, accessed 17 February 2011).

poor of the world particularly include the pastoralists of northern Kenya and southern Ethiopia whose Pastures have dried-up, the low status tribe of the Sahelian Belt who have been historical victims of the endogenous slave trade, the untouchables of India who are denied economic opportunities, the people who suffer from chronic mental problems in Northern Bengal because their wells have been poisoned by chemicals, the Niger Delta inhabitants of the Eastern States of Nigeria whose fish have been poisoned by leakages from oil wells, the people who have become refugees in camps in the eastern part of the Democratic Republic of Congo because of ethnic fighting in Rwanda and Burundi, the child-soldiers of Burma(Myanmar) who are kept in slavery by the military junta and the slum dwellers of all the mega cities in the Amazon Basin, Africa, Latin America and most of Asia (for example Rio de Janeiro, São Paolo, Cairo, Johannesburg, Cape Town, Egypt, Casablanca, Beijing, Mumbai, Dhaka, Phnom Pehn, Hanoi, Mexico City and Guadalajara) (Dembitzer, 2009).

Some people of the groups and communities listed above are poor because they are trapped by racial prejudices, others by customs and religion and others by the geography of the areas in which they live. They are particularly vulnerable to weather variability because they have the least available resources to adapt and cope with it. They become vulnerable because they are known for occupying disaster-prone locations such as flood plains, low-lying coastal areas and marginal dry lands that are particularly susceptible to the manifestation of bad weather episodes. The challenges they encounter include increases in floods and inundations in low-lying locations due to increased rainfall; drought in areas with prolonged delay of rainfall; and coping with extreme heat during the day and cold at night due to fluctuating temperature ranges. Their shacks are also destroyed by increased wind and storm activities and there is sometimes widespread destruction of their shelters by wind-driven fires. These threatening weather conditions affect them the most due the poor nature of their dwellings (shacks), poor planning and the proximity of these haphazard homes to one another.

Research on weather (climate variability) has taken several approaches and the weather debate often relates to global warming, focusing on greenhouse gas emissions and ozone layer depletion on a global scale. The aspect of coping with weather or the challenge of variable weather patterns to urban poor communities has often been overlooked and minimised. Most weather-related studies have tended to focus on direct physical, chemical or biological effects. However, ‘a full assessment of the consequences for human well-being clearly need evaluation of the manner in which society is likely to respond through the

deployment of coping strategies and measures which promote recovery and the longer term adaptation on local scales' (Kelly & Adger, 2000: 325-326).

On a national perspective in South Africa, many challenges regarding poverty can still be seen. Since the ANC-led government took power in 1994, the United Nations Human Development Index of South Africa has been falling, whereas it was steadily rising until the early-1990s (HDR, 2010). Besides, the life expectancy at birth for the total population in South Africa is only 49.2 years (CIA, 2011). In addition, in 2009 South Africa ranked 85$^{th}$ on the Human Poverty Index amidst the 135 countries for which the index was calculated (HDR, 2010). The poverty levels were also evaluated after reports from the Human Development Index (HDI) indicated that South Africa occupied the 129th place out of the 182 countries that supplied data for the survey (Human Development Report (HDR), 2010: 18). Besides all these indicators that many residents of the country still live beneath the poverty line, South Africa is also renowned as one of the most unequal societies of the world. According to a UN-HABITAT report in 2009, South Africa had a GINI coefficient of 65 as of the 2005 ranking, followed by Brazil, making it one of the most unequal counties in the world (UN-HABITAT, 2009: 32). This inequality is partially ascribed to the heritage of the apartheid system and largely to the failing policies of the current regime to bridge the growing divide between the rich and poor.



This reflected strongly in the study area of Enkanini-Makhaza, where most of the informal settlement residents construct their dwellings (shacks) illegally on disaster-prone sites which have not been approved by the city management and without any authorisation from the council of the City of Cape Town. Most of these shacks are constructed with substandard housing materials (corrugated roofing sheets, plank, polythene bags and plywood) that cannot withstand any severe weather irregularity or episode, thereby making them particularly fragile to the dynamic and variable weather pattern of the Mother City (Cape Town).

## *2.3 RESILIENCE OF POOR COMMUNITIES, CHANGING WEATHER PATTERN & VARIABLE CLIMATE.*

### 2.3.1 RISK & RESILIENCE FRAMEWORK

Early studies of risk and resiliency focused on disadvantaged children facing adverse conditions to explore the effects of risk and protective factors on the children's adjustment (Rutter, 1987; Garmezy, 1993). Kirby & Fraser (1997) later postulated that the study of risk factors need to include an examination of people's immediate social networks (parents, other family members), and more distant environments or macro systems (e.g. political climate) whilst Genero et al., (2001) advanced that it should further consider aspects of racism as well as conditions pertaining to living in risky neighbourhoods, as well as aspects of environmental vulnerability.

Blaikie et al, (1994:35) define risk principally as 'a function of the perturbation, stressor, or stress and the vulnerability of the exposed unit.' In this way, it directs attention to the conditions that make exposure unsafe, leading to vulnerability and to the causes creating such conditions. Since then, significant efforts have been advanced in order to understand resilience over the past decades. For instance, in his most recent work, Greene (2007) highlighted risk factors and protective elements as relative and dynamic processes which can be applied in the same framework. By this he implied that appropriate policy must aim to improve the long term security and livelihood potential of vulnerable communities by addressing the ability of such societies and individuals to cope with the risks they encounter and the protective elements they adopt, during such precarious circumstances (Greene, 2007). Ziervogel & Calder (2003) and Anseeuw and Laurent (2007) also alluded to the fact that mitigation measures targeted at vulnerable communities must address the issue of long term risk reduction, and to do this they need to target successful coping mechanisms already employed by local communities to be developed for long term sustainability.

Significant efforts have been advanced in order to understand resilience over the past decades. Also, the continuous research of risk and protective processes carries great potential in expanding the developmental theory of resiliency by further suggesting useful avenues for further intervention. Resilience research originated in the field of biology, more specifically in research on ecosystems, examining their sustainability over time despite various shocks or perturbations (Holling, 2001; Folke et al., 2002; Janssen et al., 2006). Aknowledging that

there are several definitions of resilience, Fraser et al. (1999) initially discussed three domains of resilience that were common across the array of definitions they had come across. These included:

- Experiencing success despite exposure to risk;
- Adapting to risk in order to maintain competence in adverse conditions; and
- Having a positive adjustment to trauma or other negative experiences.

Although much of this research has centred on examining individual resilience, more recent studies (for example Conger & Conger, 2002; McCubbin, et al. 2002; Queiro-Tajalli & Campbell, 2002) have conceptualised resilience for vulnerable households and destitute communities with regards to changing weather patterns. Coleman & Ganong, (2002) also acknowledged that understanding community resilience is important if we are to master how to develop independent support mechanisms during times of environmental stress especially those caused especially by changing climate patterns. They also added that it provided interventions that maximised optimal responses especially to environmental adversity under the challenges faced by low-income households. Furthermore, there is a general consensus that family resiliency provides the theoretical framework for examining family/community coping and adaptation strategies. More so, the study by McCubbin, et al. (2002) indicated that family love and mutual support, as well as faith, help stressed families to cope and retain meaning in spite of lack of control over life circumstances that result either from weather-related circumstances or economic poverty (McCubbin, et al., 2002: 108).



Therefore, in order to understand how people cope with risks affecting their lives, it is appropriate to apply a risk and resiliency framework. This framework is also applied in this study, in order to fully comprehend how the residents of Enkanini deal with their vulnerability to the prevailing weather conditions of the informal settlement. In addition, findings from this study indicate that despite the internal pressures encountered, many low-income families are able to achieve their objectives, meet basic needs, and overcome the probabilities for failure. For instance, even with low incomes and the struggles of acquiring and maintaining government grants, a high proportion of economically disadvantaged families in Enkanini are able to caution their family members away from violence and crime involvement. More than that, they have also encouraged their children to go to school, live in their own homes, and engage in developmental activities in nearby community centres. They have also withstood the adverse weather-related effects, although not completely, as will be examined in Chapter 4.

## 2.3.2 CHALLENGES FOR POOR COMMUNITIES FROM CHANGING WEATHER PATTERNS & VARIABLE CLIMATE.

Poor communities from around the world are constantly threatened by the variability of the weather they experience from year to year. That the global climate is changing is currently undisputed. There is a general consensus that even without the effects of climate change variable weather upsets the livelihood of poor people. Thus, the poor try hard every day to improve on the strategies that will help them cope as well as adapt to the vicissitudes of their prevailing weather although unfortunately, their ability to cope has been recorded to be diminishing (IPCC, 2012: 97). Therefore, the added effect of a projected changes in weather and climate pattern, will further strain their coping capacities, unless real efforts are made to supplement them. Climate change is arguably the most persistent threat to global stability in the coming century and it refers to 'a statistically significant variation either in the mean state of the climate or in its variability, persisting for an extended period (typically decades or longer)' (Kushner, 2009: 4). Climate on the other hand refers to 'variations in the mean state and other statistics (Standard Deviations, the occurrence of extremes) of the climate on all temporal and spatial scales beyond that of individual weather events' (IPCC, 2001: 87).[22]

Already, many parts of the world have been identified to be observing different weather characteristics from what used to exist in previous decades. For instance, El Nino Southern Oscillations (ENSO) episodes over the past two decades have been both unprecedentedly large (for example, 1997/98) and prolonged (for example, 1991/94), extensive riverine catastrophes (for example, Mozambique) and also, coastal flooding (for example, Orissa) have led to many tens of thousands of pre-mature deaths (Trenberth & Hoar, 1997). Furthermore, after thorough warning from weather forecasters of the National Weather Service (NWS), USA in August 2005, Hurricane Katrina moved through southern Florida as a category 1 hurricane, depositing rainfall amounts approaching 50cm (20 in.) in places and bringing its share of wind damage. Katrina intensified within a few days to an extremely rare category 5 hurricane in the Gulf of Mexico, and then ravaged southern Louisiana (including New Orleans), Mississippi and Alabama (BBC, 2005).

Although, such extreme weather conditions do not prevail in South Africa, some abnormal weather conditions have plagued the nation; such as the extreme precipitation of 11-16 February 1996 over South Africa, which was one of the four significant events during the 1995/96 rainfall season over Southern Africa (Crimp & Mason, 1998). Extensive flooding

[22]IPCC, 2001:87, Working Group I: *The Scientific Ba*sis.

and related damage were recorded at this time with historical records showing one of the highest flood peaks of the past century. Drought[23] was also a regular and recurrent feature of South African climate. The Standardised Precipitation Index[24] was linked to the probability occurrence of dry or wet events and according to a retrospective analysis of the spatial extension and intensity of drought in South Africa since 1921, the eight most severe droughts at a six (6)-month time scale for the summer rainfall region of South Africa happened in 1926, 1933, 1945, 1949, 1952, 1970, 1983, & 1992.[25]

In the Intergovernmental Panel on Climate Change Third Assessment Report (TAR), (IPCC, 2001), they assessed the capacity of the world to cope with, and adapt to the inevitable impacts that climate change will bring. It found, not surprisingly, that the impacts of climate change are not evenly distributed, and that the people who will face the worst of the impacts are the vulnerable communities that struggle to adapt and least able to cope with the associated risks (IPCC, 2007: IPCC, 2012). Therefore this study will critically examine the challenges, coping abilities and adaptation strategies of the residents of Enkanini, since they constitute a section of the urban poor in Cape Town.

## *2.4 MODELS FOR ASSESSMENT*

After examining the different dimensions through which weather variability contributes to the vulnerability of the urban poor or informal settlement residents, it becomes important to situate this study in a theoretical framework for analysis. To achieve this, the researcher examined two models of social vulnerability that have informed vulnerability analysis. The models also identify vulnerability through weather variability or environmental factors, which is the main focus of this research. The models further add clarity to the dynamics of vulnerability's double structure as postulated by Bohle, (2001). The two models used for the theoretical assessment include; the Risk-Hazard (RH) Model and the Pressure and Release (PAR) models, as will be examined in the following sections.

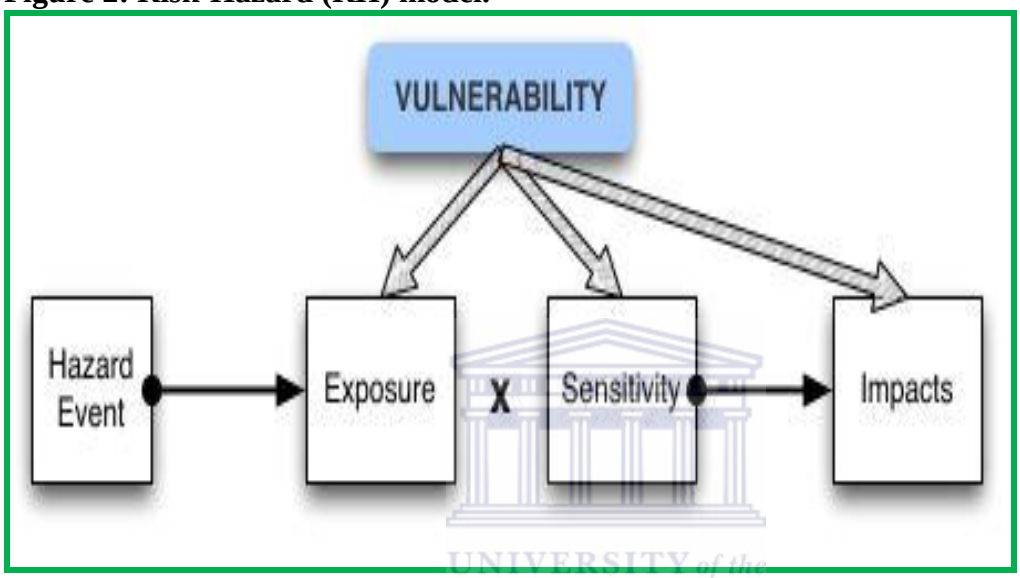
### 2.4.1 RISK-HAZARD (RH) MODEL

The Risk-Hazard (RH) model strives to identify the impact of a hazard as a function of exposure to the hazardous event and the sensitivity of the entity exposed (Turner et al., 2003).

[23] A drought is a shortage of precipitation over an extended period.
[24] An index that allows monitoring the intensity and spatial extension of droughts at different time scales (3, 6, 12 and 24 months).
[25] Rouault and Richard, 2003. (Water S.A Vol. 29 No. 4 October 2003). Accessed through www.wrc.org.za

Since its development, the model has been applied in a series of environmental and climate impact assessments. This is a major reason why it was also considered during the initial stages of data collection for this research. Kates, 1985 and Burton et al., 1978; as cited in Turner et al., (2003: 8076) indicated that it was well recognised because it essentially emphasised exposure and sensitivity to environmental perturbations and stressors since it works from the hazard to the impacts, as seen in Figure 2 below.

**Figure 2: Risk-Hazard (RH) model.**






Source: Turner et al., (2003: 8075).

Figure 2 above, illustrates the impact of a hazard event as a function of exposure and sensitivity. The chain sequence begins with the hazard event and ends with the impacts, and the vulnerability concept is noted implicitly as represented by grey arrows.

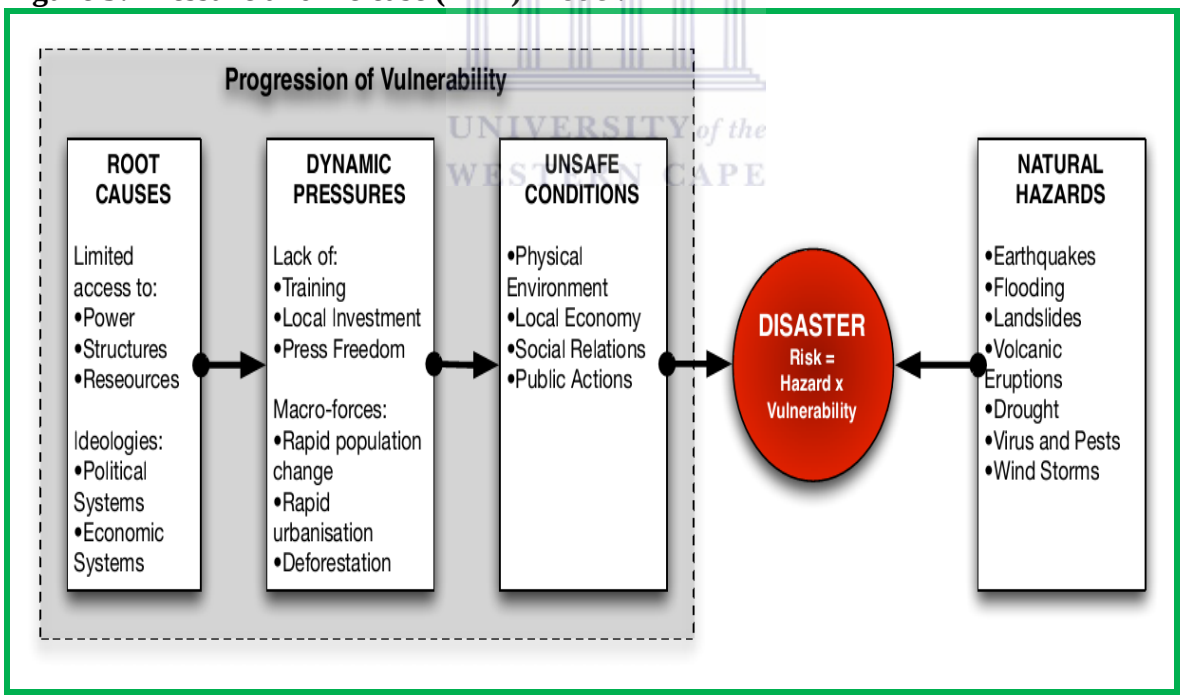
However, several inadequacies became apparent after its inception and some authors criticised it for overemphasising the social, economic and political processes and structures that lead to vulnerable conditions. For instance Janssen et al., (2006) argued that it does not treat the ways in which the systems in question amplify or attenuate the impacts of the hazard. Blaikie et al., (1994) also added that the model does not address the distinction among exposed subsystems and components that lead to significant variations in the consequences of the hazards, or the role of political economy in shaping differential exposure and consequences. These criticisms led to the development of the Pressure And Release (PAR) model as is examined in the next section.

### 2.4.2 'PRESSURE AND RELEASE' (PAR) MODEL

After much criticism of the Risk-Hazard (RH) model, another theoretical framework for social vulnerability analysis was developed, based on an original research by Blaikie et. al. (1994). According to the model, structural disadvantage creates vulnerability and the hazard or shock forms a further pressure on an already marginalised community (Blaikie et. al., 1994). Thus, recovery and mitigation should target both the physical hazard and the socio-economic and political circumstances of a community, drawing together physical mitigation and long term adaptation. Just like the Risk-Hazard model, it considered exposure to the surrounding environment that introduced unsafe conditions to the vulnerable inhabitants or communities. This aspect also informed this research during field observation and data collection by understanding the root causes of vulnerability in Enkanini. The model largely understands vulnerability as the intersection between socio-economic pressure and physical exposure as could be seen in Figure 3 below.



**Figure 3: Pressure and Release (PAR) Model.**




Source: Blaikie et al., (1994: 38).

Figure 3 above, shows the progression of vulnerability with a disaster as the intersection between socio-economic pressures on the left and physical exposures (natural hazards) on the right. Used mainly to address social groups facing environmental disaster events, the model

emphasises distinctions in vulnerability by different exposure units such as social class and ethnicity. It also distinguishes between three constituents on the social side (root causes, dynamic pressures and unsafe conditions) and one component on the natural side (natural hazard), which renders the people or communities vulnerable. It as well suggests some of the main root causes to comprise 'economic, demographic and political processes', which affects the allocation and distribution of resources between different groups of people in a society at large. Dynamic pressures translate economic and political processes in local circumstances (such as migration patterns). According to Blaikie et al., (1994), unsafe conditions are the specific forms in which vulnerability is expressed in time and space, such as those induced by the physical environment, local economy or social relations in risk-prone environments.

In essence, the Pressure and Release model was thought to be of relevance to this study since it was observed that the structural disadvantages of the informal resident's dwellings was related to their vulnerability as it further created seasonal shocks in their livelihood.

## *2.5 ANALYTICAL FRAMEWORK*

Vulnerability analysis is used to assess the relationship between weather-related episodes and the nature of housing in Enkanini and how it renders the informal dwelling residents vulnerable to seasonal variations of the prevailing weather. In Enkanini, the most frequent natural hazards are climatic in nature and they include; frequent flooding, heat waves and cold waves, increased wind and storm activities and dwelling fires. This study traces their vulnerability at the community level, by identifying their challenges, coping strategies, adaptations techniques and the uses of their ingenuity, all with regards to the seasonal variation of the challenges they encounter. This study further documents the nature of their housing and the role it plays over their exposure to the prevailing changing weather patterns of the settlement.

### 2.5.1 VULNERABILITY ANALYSIS

As indicated in the analytical framework, vulnerability analysis is employed in order to document the coping strategies of residents in the Enkanini informal settlement. This was done by investigating the challenges encountered and the adaptation techniques the residents adopted, as well as the changes which occurred during the period of inquiry. This approach for analysing vulnerability was proposed by Endfield & Tejedo, (2006) and later supported by O'Brien et al., (2009) and they both adopted it for assessing communities potential to cope

with environmental change over time. It therefore guided this study in its structure, by identifying the basis of the strategies related to weather variability and environmental risks/hazards inquiry.

Vulnerability analysis originated from the framework for analysing natural hazards showing how, a natural hazard, such as an earthquake, volcano, drought or flood becomes a disaster once it impacts on a community which is vulnerable to the hazard (Blaikie et.al., 1994; Smith, 2009). According to Blaikie et.al., (1994: 38), 'some of the factors which create vulnerability to natural hazards include political, economic and social factors, in addition to physical factors such as proximity to, or frequency of, natural hazards.' Endfield & Tejedo, (2006: 8) also added that vulnerability is greater among environmentally, politically, socially or economically marginal groups, whose ability to adapt and to recover from environmental changes and biophysical events can be limited or constrained. Furthermore, Adger, (2006) is of the view that most recent vulnerability studies focus on three main areas. These include; vulnerability to climate change and variability, sustainable livelihoods and vulnerability to poverty, and lastly vulnerability of social-ecological systems (Adger, 2006:268). This research focuses on the first area of his categorisation, since it relates most closely with vulnerability to climate change or variable weather conditions on the residents of Enkanini. It also includes aspects of vulnerability to poverty to a lesser extent, as was indicted in the poverty section above. Therefore, vulnerability analysis is thought to be the most relevant analytical framework for this research, because it integrates both physical and human systems, their weaknesses and thresholds. It also allows for a combination of response and adaptation strategies and gives more analytical weight than being a purely descriptive research. In doing so, the concept of vulnerability is, as Adger (Adger, 2006: 268) affirms, 'a powerful analytical tool for describing states of susceptibility to harm, powerlessness, and marginality of both physical and social systems, and for guiding normative analysis of actions to enhance well-being through reduction of risk.'



## *2.6 SUMMARY*

In order to fully comprehend how the informal settlement residents of Enkanini cope with, make use of, and adapt to the challenges of prevailing weather episodes they encounter, a wider reading of how other informal settlement residents around the world deal with this phenomenon was necessary. This brought to light the fact that most of these informal settlement residents around the world are vulnerable, especially to their environmental

conditions, since most of them are rated ‘poor’ and are of the low income category. It was also identified that vulnerability to weather variability is a vital and rapidly growing field of study, since approximately two billion people in the world encounter weather-related or environmental problems on a daily basis which also involves loss of life. Therefore the reviewed literature above has been identified as relevant in contributing to the understanding of vulnerability to weather variability on a global perspective. It has also enabled the research to be situated in an appropriate context through constructing a thorough, detailed, vulnerability assessment of the informal settlement residents of Enkanini in the Khayelitsha Township of Cape Town, South Africa.

The study also used a multi-disciplinary approach in establishing a relationship between the physical and social systems, since it examined the effects of three weather elements (temperature, rainfall & wind) on the residents, thereby positioning the study between aspects of the physical and social sciences. This assessment of vulnerability to weather variability through ethnography aimed to avoid the problems of applying conventional wisdom through assumptions and also by totalising the poverty discourse to the actual weather-related scenarios encountered in informal settlements. Hence the reviewed literature above was selected as the theoretical basis for this research since much of it reflects on concepts related to the broader theme of this research. For example, the knowledge fields of informal housing, vulnerability & its related concepts, poverty, risk and resilience, challenges to variable weather and a changing climate were all discussed and differentiated highlighting their applicability to this research as identified. The concepts also provided a useful conceptual framework for understanding the upsurge of the vulnerability with increasingly negative effects in some informal communities worldwide.

A distinction was also drawn between internal and external vulnerability as proposed by Bohle (2001), after formalising his double structured “social space of vulnerability”. This was later examined through the Risk-Hazard (RH) model and the Pressure and Release (PAR) model as constituents of the theoretical and analytical frameworks. The limitations of the Risk-Hazard (RH) model were also discussed, concluding with the introduction of Pressure and Release model and how it guided the analytical framework. The following chapter will discuss the research methodology that this study adopted, by highlighting the sampling procedures, description of the instruments used, methods of analysis and some of the research limitations.

# CHAPTER III

# RESEARCH DESIGN AND METHODOLOGY

## *3.1 INTRODUCTION*

This chapter provides an in-depth overview of the empirical data collection process and the methods of analysis used during the research inquiry. A comprehensive discussion of the study has been laid down, regarding the research design that was used to gain access to all the relevant information that was needed. It further outlines how the study design was conceived as well as the sampling procedures that led to the identification of the case study in Enkanini. It also provides a detailed description of the research instruments used, including the research tools employed during the actual data collection process. Lastly, it mentions the respective techniques adopted during the data analysis, the research limitations and the challenges encountered throughout the research process.

## *3.2 RESEARCH APPROACH*



Based on the indicators used in other studies for measuring vulnerability (Leichenko, 2008 and O'Brien, 2009), a single research approach – either quantitative or qualitative – was not an adequate methodology for the data collection process. For that reason, although the study is more inclined to qualitative research, some quantitative methods have been applied to collect and analyse important climatic data. The quantitative method of analysis has also been used for a better understanding of the trend of the climatic or weather parameters in Cape Town over a fifty years period. The researcher implemented this approach so as to obtain a detailed understanding from the multiple sources of information during the data collection procedure. This was facilitated by the use of interviews, as well as structured and semi-structured questionnaires.

Creswell (1998:15) describes the perception behind qualitative research as, '…an inquiry of understanding based on distinct methodological traditions of inquiry that explore a social or human problem. The researcher builds a complex, holistic picture, analyses words, reports detailed views of informants, and conducts the study in a natural setting.' He further advances that there are eight main areas of concern which the qualitative researcher must pay

adequate attention to. According to him, the first and most important aspect of qualitative research is that the nature of the research question must observe a 'how' or 'what' pattern. This study observes that aspect of a qualitative research, since it seeks to understand 'how' the inhabitants of Enkanini cope with the seasonal variability of weather in their informal settlement. He further adds that the research topic should have been examined in other studies, with the demonstration of an in-depth literature review. This current study also falls into that context, since it has identified similar studies that had been conducted earlier, through related references in the literature review.

He later pointed out the need to understand the individual in their natural settings, through a detailed study. This aspect was the basis of the ethnographic part of the study and all of its procedures were observed during the data collection procedure. During that period, the researcher spent many hours every day with the informants, in the settings of their dwellings for extensive data collection. As a result, the researcher discovered a wide range of issues during the data collection process. This was possible due to interaction with the respondents, as part of the exploratory study.

Routio (2004) also argues that a thorough search of literature ought to be the starting point of any exploratory study. He pointed out that in the process; the researcher tries to situate the research into a previously used theoretical model and that in the rare case where no previously used model is suitable, the exploratory case study research could look at the object alternatively, from a different perspective as that revealed in the literature.



## *3.3 RESEARCH DESIGN*

Several research approaches on environmental vulnerability and impact studies (Bohle, 2001; Young et al., 2006; O'Brien et al., 2009) have been used, to establish a relationship between environmental challenges, weather variability and vulnerability both on global and local scales. Some of these studies (Blaikie et al., 1994 and Turner et al., 2003) have individually been criticised for one methodological limitation or the other. A common criticism identified is an overemphasis on the social, economic and political structures that lead to the vulnerable environmental conditions in such impact areas. This overlooks the agency of vulnerable individuals and communities. There is also the criticism of the case study design which highlights that these findings cannot always be generalised. Bearing all this in mind, this study therefore adopted both the qualitative and quantitative research designs. The ethnographic design was the principal methodology for collecting and analysing the data

while the case study design was a supplementary method that guided the researcher in selecting the Enkanini case study.

### *Ethnographic Research*

Ethnography involves the researcher participating, overtly, in people's lives for an extended period of time, watching what happens; listening to what is said, asking questions-in fact, collecting whatever data is available to throw light on issues that are focus of the research (Fetterman, 1998). In micro-ethnography, which is the case with this research, it entails the study of narrowly-defined cultural groupings or communities. It usually begins with the identification of a problem the community encounters, a review of the literature in connection to the problem culture, and the identification of variables of interest. These are usually variables perceived to be significant by members of the community. Then, the ethnographer goes about gaining access to the community, which in turn sets the stage for *cultural immersion* of the ethnographer in the culture. Usually, the ethnographers live in the communities for months or even years, in order to fully understand the problem. Gobo, (2008: 36) further adds '…the middle stages of the ethnographic method involve gaining informants, using them to gain yet more informants in a chaining process, and gathering of data in the form of observational transcripts and interview recordings.'



### *Case Study Methodology*

The case study methodology involves an in-depth, longitudinal examination of a single instance or event, or a place: a case. It provides a systematic way of looking at events such as collecting data, analysing information and reporting the results. This enables the researcher to gain a sharpened understanding of the situation and what might become important to look at, more extensively in future research. Creswell (1998:272), also identifies the case study design as 'an exploration of a 'bounded system' (bound by time and or place) or a case (or multiple cases) over time through detailed in-depth data collection involving multiple sources of information and rich in context.'

Yin (1994) argues that case studies can be either single or multiple-case designs, with the single cases used to confirm or challenge a theory, or also to represent a particular case. He further states that they are ideal for revelatory studies where the observer tries to understand a phenomenon which previously was inaccessible. According to him, these kinds

of studies require careful investigation in order to avoid misrepresentations. Although case studies have generally been criticised for the fact that their findings can hardly be generalised; this argument questions the ability of findings of one case study to be valid externally. Moreover, reporting of such findings could be highly selective, resulting in biased conclusions. But according to Yin's (1994), argument, these biases can been minimised by not identifying this as the critical question but rather observing how well the researcher manages to generate theory from the research findings. In a nut shell, Agar (1996) claims that both ethnography and case study research methods are particularly suited for exploratory research, since they draw on a wide range of qualitative and quantitative methodologies that move from 'learning' to 'testing' although research problems, perspectives, and theories emerge and shift. Although case studies have been criticised because their findings cannot always be generalised, the advantage of a case study design in the context of this study as Denzin and Lincoln (2000:436) argue, lies in the premise that it allows the researcher to develop understanding of the individual case - here Enkanini.

## *3.4 DATA COLLECTION INSTRUMENTS*



The data collection process made use of both primary and secondary data sources as detailed below:

- *Primary data* was collected from field observation notes during participant observation, digitally recorded semi-structured interviews, questionnaires with open/close-ended questions and photographs.
- *Secondary data* was collected from appropriate text books, journal articles, government publications, documentaries and relevant websites in relation to the research topic. Climatic/weather data for Cape Town was requested from the South African Weather Service (SAWS). The Climatic/Weather Data for Cape Town, obtained from the South African Weather Service was used as a gauge in comparing vulnerability and actual weather episodes that occur in respective seasons.

The following section will present a brief description of the data collection process with the different data collection tools,

### *Ethnographic research and field notes.*

After identifying Enkanini as an informal settlement in Khayelitsha that truly portrayed the characteristics of a vulnerable informal settlement with a variable weather

pattern, the researcher had the opportunity to participate directly in the resident's lives for an extended period of time (over a year). This enabled the researcher to focus on their daily interactions by watching what happens regarding their coping strategies; listen to what is said during times of weather distress, ask questions and make notes regarding some of the challenges they encounter. These observations specifically occurred during the weekends, since it gave the researcher the opportunity to meet with most of the household heads, especially on Sundays, although the researcher intermittently visited Enkanini during weekdays. Biases were minimised by numerous sources of data collection.

### *Document Review*

For a better understanding of vulnerability to weather variability in Enkanini, a number of policy documents from the City of Cape Town were central in highlighting this issue. Key publications from the City of Cape Town's Department of Housing included; General Household Survey Analysis for Cape Town (City of Cape Town, 2007); Informal Dwelling Count (City of Cape Town, 2006); Characteristics of Households Living in Poverty, (2005); Informal Settlements -Western Province (City of Cape Town, 2011). The South African Risk and Vulnerability Atlas, (2010) was also consulted. These documents shed light on the housing crisis in Cape Town as well as the future of informal settlements, including solutions for the future. Pamphlets from the Disaster Risk Management Centre and Fire & Rescue Services (Appendix 6) supplied by the researcher also served as a guideline to measure how well informal settlement residents understood their vulnerability both during winter and summer and the approach of the City of Cape Town to the issue.

Climatic data for the Enkanini area was requested from the South African Weather Service (SAWS). The climatic data of the study area that was requested from SAWS helped highlight the trend of weather parameters that were used to measure vulnerability in Enkanini. It included three weather parameters that were highlighted to increase the vulnerability of people in informal settlements. The data included the mean monthly temperature ($^{o}$c) and rainfall (mm) over a fifty-year period (1960-2010) and Wind Roses over an eighteen-year period (1992-2010). The Wind Rose data was the most current that was available for the study area and no data was available before 1992. All of the temperature and rainfall data were translated into graphs before analysing trends whereas the Wind Roses were analysed without any further translation and they provided valid information on the state of weather in Enkanini.

### *Structured Questionnaires and Key Informants*

The survey was comprised of questionnaire-based interviews with one hundred and two (102) heads of households that had been identified at the preliminary stage of the research through chain sampling. The one hundred and two structured questionnaires were administered only to heads of households in Enkanini. It consisted of both open-ended and closed-ended questions and the respondents were informed as to how to complete them. The respondents who could not complete the questionnaires on their own were informed as to the purpose of the survey and the researcher completed it for them, ensuring that they fully understood the questions (see Appendix 7 for questionnaire).

The survey also included six (6) key informants who assisted in the sampling procedure, by identifying residents from areas that had been affected by unusual weather episodes such as floods or fires. Then, there were two (2) ward councillors; one from Ward 95 and the other from Zwézwé who also constituted the survey.

Subject to their availability, specific appointment dates were set to meet with the word councillors for interviews. Their interview questions were all open-ended questions and the researcher tried to probe as much as he could, to get all the required information especially in line with the research questions (See Appendix 5). The interviews, just like the questionnaires were designed to be very straight forward and brief in order not to make the respondents bored.



### *Photographs*

Photographs also constituted one of the instruments used in obtaining relevant information during the data collection process. The photographic tool was instrumental in capturing relevant scenarios that related to key concepts within the framework of the research. With consent from the informants, photographs were taken with a digital camera all through the research process but most especially during participant observation and data collection stages. The contents of all the photographs were reserved strictly for purposes of the research.

## *3.5 SAMPLING PROCEDURES*

A vivid understanding of sampling in qualitative research by Neuman (2000:196),
indicates that sampling is less rigorous in qualitative research than it is in quantitative research, since understanding of the concept is more important than the sample size. He clarifies that by highlighting that…

> …Qualitative researchers focus less on a sample's representative or on detailed techniques for drawing a probability sample. Instead, they focus on how the sample or small collection of cases, units, or activities illuminates social life. The primary purpose of sampling is to collect specific cases, events or actions that can clarify and deepen understanding" (Neuman, 2000:196).

The choice of Enkanini as a case study for the research was informed by a number of reasons. Central to this is the fact that the researcher had been visiting a friend there and got familiar with the residents to a point that he felt comfortable and safe anytime he was there.

Secondly, after a detailed examination, the researcher identified that Enkanini stands out as a better example compared to other informal settlements in Khayelitsha because of its proximity to the False Bay Beach. Its nearness to the shoreline renders it particularly vulnerable to the effects of wind and flooding. Coupled to that, the water table is also very high, so much so that any minor rainfall event can lead to flooding. The researcher was also impressed by the way that the residents used their ingenuity to deal with the prevailing weather-related events that rendered them vulnerable. Some of the strategies included; using sandbags to prevent flood water from getting into their homes, building their dwelling on stilts to avoid wet floors from floods and using out door drum fires to keep warm.



With the above reasons in mind, the data collection for the study focused on three target groups, which were considered vital in answering the research objectives. The choice of these target groups will be discussed in a later section of this chapter. The sampling procedures used included convenience sampling and chain sampling and will be individually examined below.

### *Convenience Sampling*

Convenience sampling is a non-probability research technique where by a researcher gathers data from the population (Neuman, 2000:199). The researcher simply gathers data from people he identifies nearby, although researcher bias may result in inaccurate data. It is mostly used for preliminary studies, as well as for research that cannot be representative as a smaller portion of the larger population. For instance, where the researcher is realistically unable to undertake a random sample of the population, and where the profile of the whole population is not known when attempting to assess trends in human development.

Although this sampling procedure seems the easiest for researchers, it has so many flaws. It is therefore not recommended when the researcher expects unbiased results. Consequently, researchers use alternative methods of sampling, such as random or systematic sampling to gain a better understanding of common trends in the population. Creswell, (1998) indicates that even though it is not the most accurate sampling method, convenience sampling is one of the most widely used forms of sampling and according to him without convenience sampling, many research projects would never take the right start.

### *Chain Sampling*

Chain or snowball sampling involves using well informed people to identify important cases or informants who have a great deal of information about a phenomenon. It is based on the assumption that the participants are likely to know others who share the characteristics that make them eligible for inclusion in the study. The researcher followed this chain of contacts in order to identify and accumulate all the cases needed for the study. In addition chain sampling uses a small pool of initial informants to nominate other participants through their social networks, who meet the eligibility criteria and could potentially contribute to the specific study. It also uses recommendations to find respondents within the range and skills earmarked by the study.



Nevertheless, the success of this sampling technique depends greatly on the initial subjects identified for the study. Consequently, it becomes critical to correlate with the most popular and honourable members of the community in order to create opportunities for the chain to grow, but bearing in mind the credible and dependable reputation of members of the chain. One of its pitfalls is that of community bias, where the first participants are usually likely to have a strong impact on the sample, making it inexact, and therefore producing varied and inaccurate results. Having highlighted the sampling procedures adopted for this study the next section will go through the steps that guided the acquisition of research data. Since participant observation was an omnibus field strategy for ethnography, the researcher shared as intimately as possible in the life and activities of the informal settlement residents of Enkanini-Khayelitsha in order to develop an insider's view of what goes on in the community, pertaining to their challenges related to weather variability.

At the outset, six (6) *Key Informants*[26]were identified based on *convenience sampling.* This was done with the assistance of two of the researchers' friends who live in Enkanini and were also keen to learn more about their settlement. It took a little longer than anticipated because the researcher did not want the representation to be biased, although the key informants were identified through convenience sampling. With assistance from the identified six (6) key informants, the researcher identified the ward councillor of Ward 95, who oversees Kuyasa, Umrhabulo Triangle, Monwabisi and Enkanini Informal Settlements (Mr Mpucuko Nguzo). He also assisted the researcher in identifying the former ward councillor of Zwézwé, (a neighbouring informal settlement of Enkanini) who preferred his identity to be kept anonymous. These were the officials with the most valid information about Enkanini that could guide the researcher in identifying vulnerable households. After a briefing with copies of the information sheet and consent forms of the intended research, subsequent meeting arrangements were made for their respective dates of interview as seen in Figure 4.

**Figure 4: Interview with an informant.**


Source: Author's Photograph (2011-10-07).

Figure 4 shows an informant that learns how to reduce flood and fire risks during an interview session.After the ward councillors had highlighted perpetually vulnerable areas in Enkanini, the researcher and the key informants embarked on a transect walk into the community, to identify potential interviewees. This was a rigorous process, since it entailed

[26]People who know a lot about the culture of their community and for reasons of their own, are willing to share all their knowledge with the researcher.

walking all through the community in a bid to identify residents who had been victims of any weather-related episode.

The chain sampling technique was also implemented at this stage, in an instance where the researcher came in contact with a resident who had encountered either flooding or a shack fire. In a case where the neighbours had relocated, the researcher probed, to find out if they were aware of their neighbour's new location. If they confirmed that they knew it, the researcher indicated the place of relocation on his field note and tried to locate them later. After all the 102 households were identified, the researcher scheduled interviews with them at a convenient day, venue and time.

The digitally recorded semi-structured interviews conducted with all the informants were grounded on the Emic Perspective. The emic perspective is usually the main focus of ethnography since it is an ethnographic research approach to the way the members of a given culture perceive their world (Fetterman, 1998:17). The questions were also designed to probe the informants so as to obtain the best information. The structure of the interview questions was basic and direct. The style was also friendly for the exercise to be comfortable for both the informants and the researcher. Furthermore, the questions were designed to probe the informants so as to obtain the best information from them. Worthy of note is the fact that the interview questions were designed and conducted in a tactful manner that focussed on the main research main question and main objectives. For instance; some of the questions asked if informants had ever been victims of any chaotic weather episode such as Floods/inundations, fires, wrecking storms and how well they adapted to it. With their consent, photographs were taken at the end of the exercise and all the information was treated as confidential, reserved only for purpose of the research. Field notes were taken all through the observation and data collection phases of the research.



## *3.6 METHODS OF ANALYSIS*

Data analysis has been described by Mouton (1996) as involving two main steps. The first step involves reducing the collected data to manageable proportions and the second step is the identification of patterns and themes inherent in the data with specified variables in the data set, thus giving sense to the data. This is also supported by De Vos et al. (2002) who defined data analysis (qualitative) as the process of bringing order, structure and meaning to the mass of collected data. It is a messy, ambiguous, time-consuming, creative and fascinating process, and it does not proceed in a linear fashion.

The nature of this study employed both qualitative and quantitative methods of analysis. After the collection of qualitative data, the data was first roughly classified into major thematic headings for analysis. The digitally-recorded interviews alongside the qualitative open-ended questionnaires and notes from the researcher's notepad were transcribed. This transcribed material was later read time and over again with close attention being given to the different themes that have been identified for subsequent analysis. They were then coded in a tabular form into main indicators for subsequent analysis. Analysis of the data was done mainly through a pattern-matching logic. Yin, (1994) proposes that this pattern is used where the empirical data is compared with one or several alternative predictions. Though Yin argues against this analytical tool for a descriptive study, he states that patterns matching it 'is still relevant as long as the predicted pattern of specific variables is defined prior to data collection' (Yin, 1994:106). In this research, the case study data obtained from questionnaires was analysed in comparison with the climatic data for the study area. In essence, the physical climatic data for mean monthly temperature, rainfall and wind speed were compared with the most vulnerable season and the prevailing impact to the inhabitants. The pattern-matching logic was done in conjunction with a repeated observation technique. The analysis was done with the use of data collected from the various sources, allowing repeated observation of the responses and data collected by triangulation.



Quantitative data was analysed using the Statistical Package for Social Sciences (SPSS); a process which involved a series of steps from coding the data, entering the data into data sheets for analysis, cleaning, and finally running for frequencies and cross tabulations. Univariate analysis was done for single variables in order to determine frequencies, central tendencies, dispersions and comparisons. Bivariate analysis of the data included the combination of two different variables in order to describe relationships and trends running through defined operationalised indicators (Babbie & Mouton, 2001). The Microsoft Excel programme was also used to run some bar and flow charts. The data analysis was mainly descriptive. This allowed presentation of data in a more accurate and summarised manner, making a better understanding of the complex interactions between the weather parameters and seasonal vulnerability in Enkanini. The descriptive statistics presents the analysed data, making use of frequency tables, charts and bivariate analysis techniques.

According to Marshall and Rossman (1995), during the step of interpretation of the data, it is important that the researcher searches for other plausible explanations for these data and the linkages among them. These explanations must then be identified and described, to demonstrate how and why the explanation offered is the most plausible. Creswell (1998)

argues that at this point in the analysis process, researchers need to step back and form larger meanings of what is going on in the situation or sites and look into more micro interpretations of the particular dynamics. This was a major tool used in the analysis and interpretation of the data discussed.

## *3.7 RELIABILITY, VALIDITY AND ETHICAL CONSIDERATIONS*

The reliability and validity of the quantitative data was ensured by the collection of data from different available sources. The triangulation technique was used to ensure that the qualitative data could be compared and accepted if there was no significant difference, or discarded if significant differences could not be scientifically accounted for. A pilot questionnaire study was used to test the questionnaire. Although a total of twelve questionnaires were scheduled for the pilot study, only ten pilot questionnaires were tested in the study area and the other two were administered to lecturers in the department. This was to test the time it would take to complete each questionnaire, to test the questions and also because the researcher wanted to get the opinion of someone who is well informed about the topic. The information sheet and consent forms which provided a summary of the research process were also given to the researcher's colleagues for their evaluation. Certain proposals and recommendations from some lecturers as to the ability of the questionnaire to collect the relevant data were effected. This ensured that the data collection tools were able to collect reliable data.



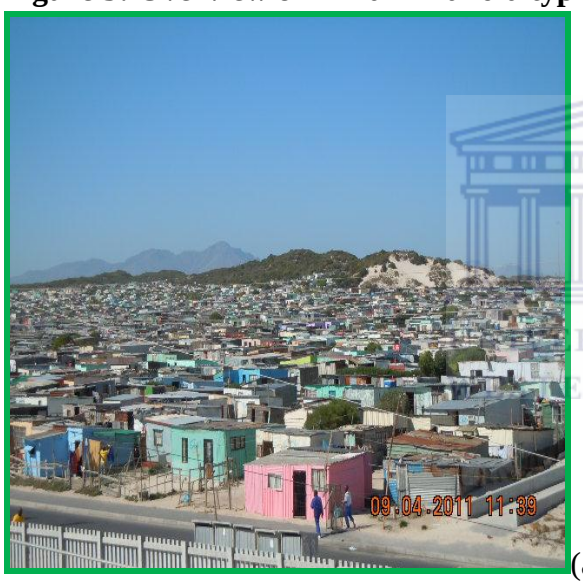
A paramount ethical consideration to any kind of research that involves people is consent. Therefore, permission to conduct interviews, administer questionnaires and collect photographs was sought from the informants/respondents selected for the study. They were all requested to complete consent forms prior to any interview or questionnaire completion. They were also aware that participation in the research was voluntary and that they could withdraw from the study at any stage of interviews or questionnaire response. The confidentiality and anonymity of informants/respondents was also maintained. In a nutshell, the entire research was conducted with integrity, legitimacy and all standards of scholarly conduct were adhered to, all through the research process.

## *3.8 STUDY AREA*

Located in the Cape Metropolitan Area of the Western Cape Province in South Africa, Khayelitsha is situated some 26km from the Central Business District (CBD) of Cape Town on the white dunes of the Cape Flats at approximately 10m above sea level (Map 2). It is

bordered to the North by the N2 highway, to the South by the False Bay coast and to the West by Mitchell's Plain. The size of its population is often disputed, with varying estimations from about two million people and above (Zandile, 2005). It is made up of formal and informal settlements. The formal settlements are located in the original area of Khayelitsha that was built by the government in power, during the time of its formation in order to entice people to move to the area. The formal settlements include Bongweni, Ikwezi Park, Khulani Park, Khanya Park, Tembani, Washington Square, and Zolani Park. The informal settlements are created by the residents themselves as a way of dealing with the housing backlog in Khayelitsha due to the increasing problem of overcrowding in their households and in the entire Township. Some of the informal settlements include Site B, Site C, Green Point, Litha Park, ***Enkanini-Makhaza*** and Harare.

**Figure 5: Overview of Enkanini and a typical dwelling unit.**



(a)


(b)

Source: Author's Photograph (2011-04-09).

The study focussed on Enkanini, which is one of the informal settlements located to the South Eastern corner of Khayelitsha as photographed on Figure 5(a) above. Most of the dwellings in this settlement are constructed on the shallow sandy soils of the area, usually with no proper foundations and using very cheap and rudimentary building materials such as corrugated roofing sheets and planks. Figure 5(b) is the picture of a typical dwelling unit in Enkanini and it is an example of a dwelling made from straightened oil drums, corrugated metal sheets and discarded timber. The settlements low-lying location (0-10m above sea level) renders it highly susceptible and is regularly exposed to the effects of the prevailing

weather pattern (floods/inundations, heat waves, wind/storm activities and cold) in relevant seasons as seen in Figure 6.

**Figure 6: A wind-blown and a fire-consumed dwelling unit.**

(a) (b)

Source: Author's Photograph (2012-01-28).

Figure 6(a) shows a dwelling that has been blown down by the strong winds that prevail in the settlement while Figure 6(b) was captured when these two young boys returned to their dwelling after a fire incident that occurred the previous night. They came to search for any remaining valuables that were not consumed by the fire.

Established in 1983 as a multifunctional dormitory town, there is virtually no significant economic activity other than in the service sector. The inhabitants of this settlement are particularly of the low income category and live a barely subsistence life. Most of the residents are unemployed and the few that are self-employed rely on selling meat, chicken, braai sausages, vegetables and fruits along the streets of the settlement (Fox, 2007:37). Spazas (house shops), taverns and taxi businesses are also popular but are mostly owned by people living in the formal settlements.

**Figure 7: A Spaza shop in Enkanini**


Source: Author's Photograph (2011-11-12).

Figure 7 shows an example of a Spaza shop (Mandi's Place). The board in front the shop indicates items in stock for the week.

This study therefore identified the adaptation of residents living in informal dwellings in this settlement and investigated the challenges encountered by the residents of this vulnerable community with respect to weather threats and explored their coping strategies. It also sought to understand why these residents with a lower social class become resilient and determined to survive in these conditions, despite the challenges encountered with the variable weather patterns in the settlement.

## *3.9 LIMITATIONS OF RESEARCH*

One of the greatest challenges the researcher encountered was to fully integrate in the Khayelitsha Township and identify an informal settlement with residents that are affected by the variable weather pattern of Cape Town. Bearing in mind that the researcher only speaks English and no other South African indigenous language, it took a lengthy period of time before the he fully understood how the community operates and to win their trust. On several occasions, the researcher was denied access to dialogue with random members of the community during participant observation in the early phase of the research, although they eventually became friendly at a later stage after seeing the researcher in the community regularly. Some of the residents also thought the researcher works for the government and that he had been sent on a special mission. In that regard, such residents requested that the

researcher gives them something, in exchange for any information they shared about their livelihood or community.

When the researcher first contacted Mr Mpucuko Nguzo (ward councillor for ward 95 which includes Kuyasa, Umrhabulo Triangle, Monwabisi and Enkanini informal settlements) telephonically regarding his interest in conducting a study in Enkanini, he indicated very little interest and asked who the researcher represented but after a one-on-one briefing with the research information sheet (Appendix 3), he became very interested in the study. He later indicated to the researcher that he initially thought the researcher was one of those journalists who looked only after their company's interest. When the researcher indicated to him that the research was for academic purposes, he became more active and found it exciting.

Another problem encountered during the research process was the inability to secure any dialogue or interview with City of Cape Town officials of the Provincial Housing Department, Disaster Risk Management Centre and Fire & Rescue Services. During a background literature search, the researcher came in contact with two pamphlets (Appendix 6) produced by the City of Cape Town. They displayed how residents of informal settlements should protect themselves against floods and fire and a toll free number to call during emergency. Unfortunately, none of the City officials were available for an interview despite numerous attempts by the researcher to contact them. Since the pamphlets were very informative, the researcher made copies and distributed to all residents who were interviewed. It was a challenge because the researcher thought every household in the community needed one but due to financial constraints there were limited colour copies.

# CHAPTER IV

# DATA ANALYSIS AND PRESENTATION OF RESULTS

## *4.1 INTRODUCTION*

Mouton (1996:56), describes data analysis as involving 'the reduction of collected data to meaningful proportions and identification of patterns and themes inherent in the data with specific variables that give sense or meaning to the data.' This chapter presents the findings of both qualitative and quantitative data gathered during the study.

It focuses on seasonal challenges encountered with respect to weather variability; by understanding the adaptation strategies of the vulnerable urban poor residents of Enkanini in Makhaza, Khayelitsha-Cape Town. Emphasis was laid on the vulnerable nature of their dwellings (shacks) and their ingenuity on coping with the variable weather patterns during winter and summer. This is important because during these seasons, for instance in winter, there is an increase in variable weather conditions such as recurrent flooding, unusual rainfall patterns, cold and increased wind & storm activity, while the summer months are accompanied by drought, fires and increased sunshine & heat episodes. The aftermath of these unusual weather conditions pose a threat to the inhabitants of Enkanini, considering the nature of their dwellings and consequently renders them vulnerable to climatic catastrophes.

As a result, the analysis and presentation of results focused on parameters like; the most challenging season, how the weather affects them, how well the residents understand their vulnerability to weather, and how well they adapted to it. It also includes related issues such as; their encounter with severe weather conditions, if they found their internal living spaces satisfactory in terms of weather threats, the nature of construction materials used and conformity of their shelters to the City of Cape Town's Disaster Risk Management Centre (DRMC) and Fire & Rescue Services (FRS) regulations. It likewise included an analysis of health, economic status and quality of life, using adaptation to the weather elements (temperature, rainfall & wind) as a gauge.

Analysing qualitative data entailed bringing order to the data, organizing it into patterns, categories, and basic descriptive units. The digitally recorded semi-structured interviews and notes from field observations were first transcribed and classified into major

thematic headings alongside the open/closed-ended questionnaires. The transcribed material was read time and again with close attention given to the different themes that were identified for subsequent analysis. All data collected from respective sources were cross-validated and triangulated during analysis, to eliminate the bias inherent.

All the quantitative data derived from questionnaires were harmonized with the climatic/weather data for Cape Town, obtained from the South African Weather Service (SAWS) to identify vulnerable seasons and the months when the residents were most at risk. The quantitative data obtained from questionnaires was analysed using Statistical Package for Social Sciences (SPSS) software as follows; coding, entering data in to data sheets for analysis, cleaning and finally running frequencies and cross-tabulations.

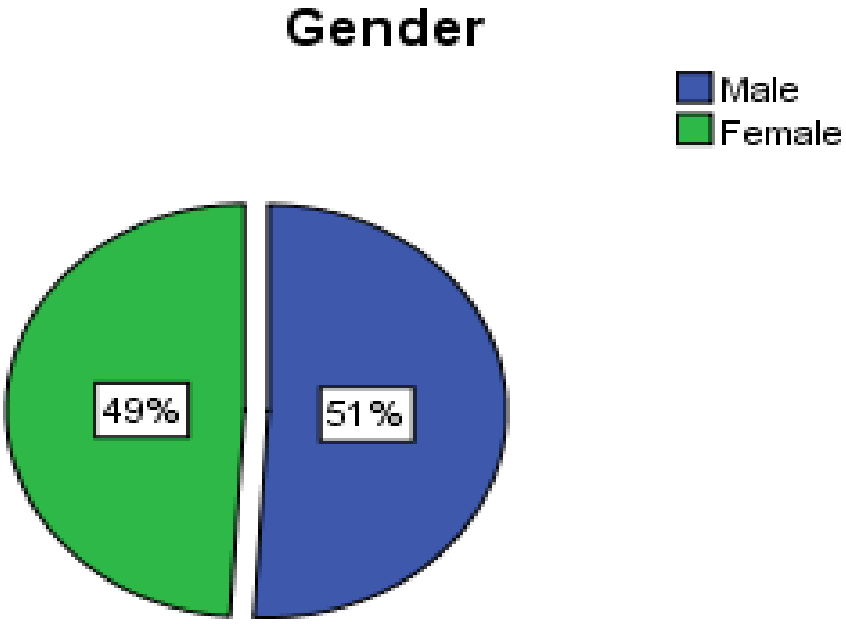
Finally the analysed data was presented using descriptive statistics, making use of frequency tables, charts, graphs and histograms to enhance better interpretation. The interpretation involved attaching meaning and significance to the analysis by explaining the descriptive patterns, and looking for relationships and linkages among descriptive dimensions.

## *4.2 DEMOGRAPHIC CHARACTERISTICS OF THE SAMPLE*

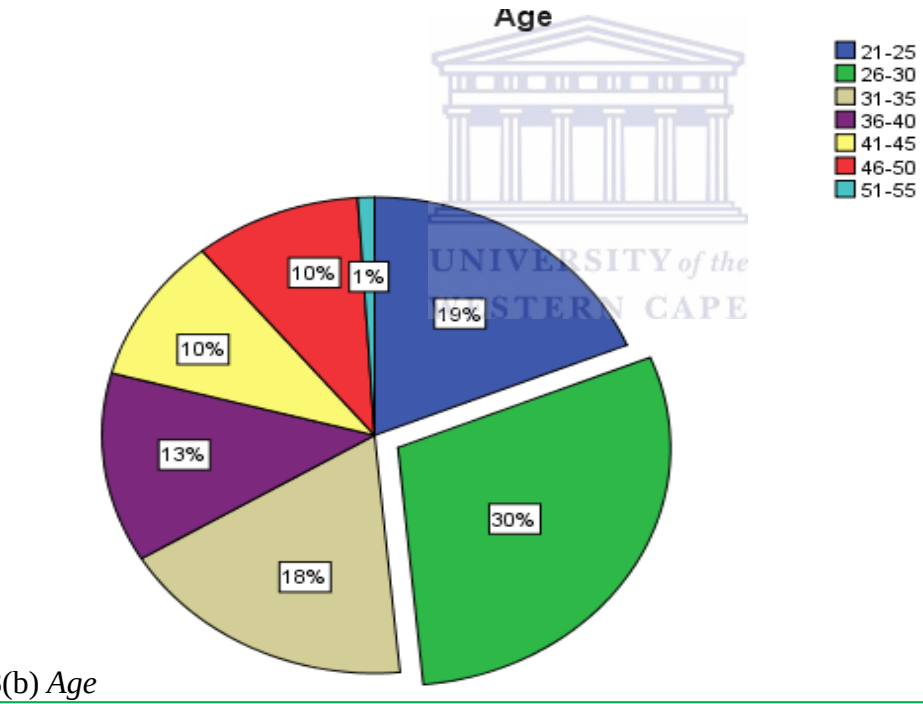


The study sample consisted of one hundred and two (102) households in Enkanini-Makhaza, with six (6) key informants. The ward councillor of ward 95 and the former ward councillor of Zwézwé also constituted the study sample. Figure 8 below gives an illustration of the demographic characteristics of the sampled population. Out of the one hundred and two (102) households interviewed, there were fifty two (52) males and fifty females (50) that constituted 51% and 49% of the sample population respectively (8a). Their ages ranged between 21years and 55years (8b). The age group of 26-45years constituted up to 90% of the sample population, while the age group of 46-55 constituted the remaining 10% of the sample. The 31-35 age group consisted of 18% of the sample. There was also the 36-40 age group that consisted 13% of the sample, whereas the 41-45 and 46-50 age groups both consisted of 10% of the sample. The least represented age group was 51-55 years, as it only constituted 1% of the sample. In all, approximately 67% of the sample was made of the active age group between 21-35years.

**Figure 8: Demographic Profile of Sample.**

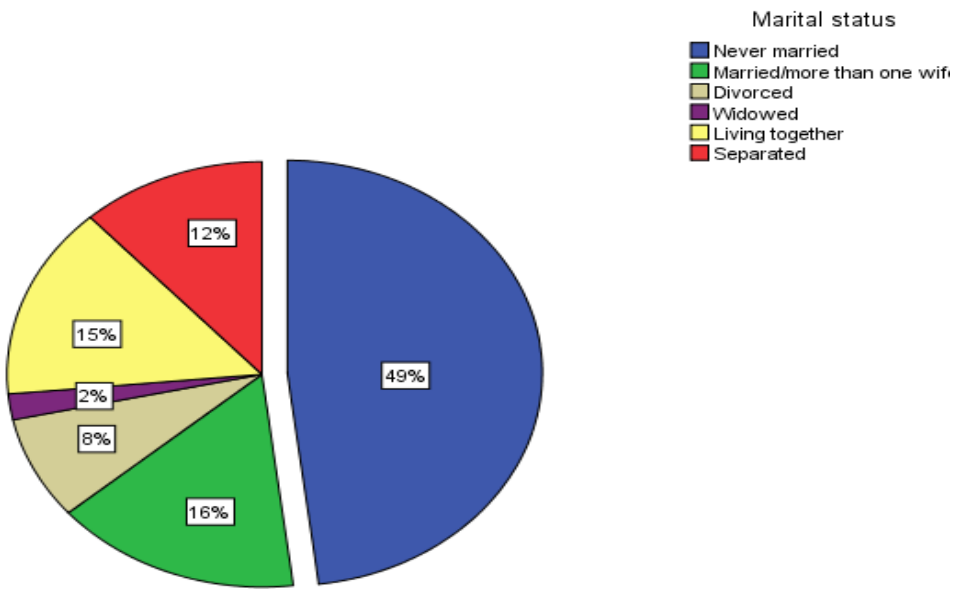



8(a) *Gender*

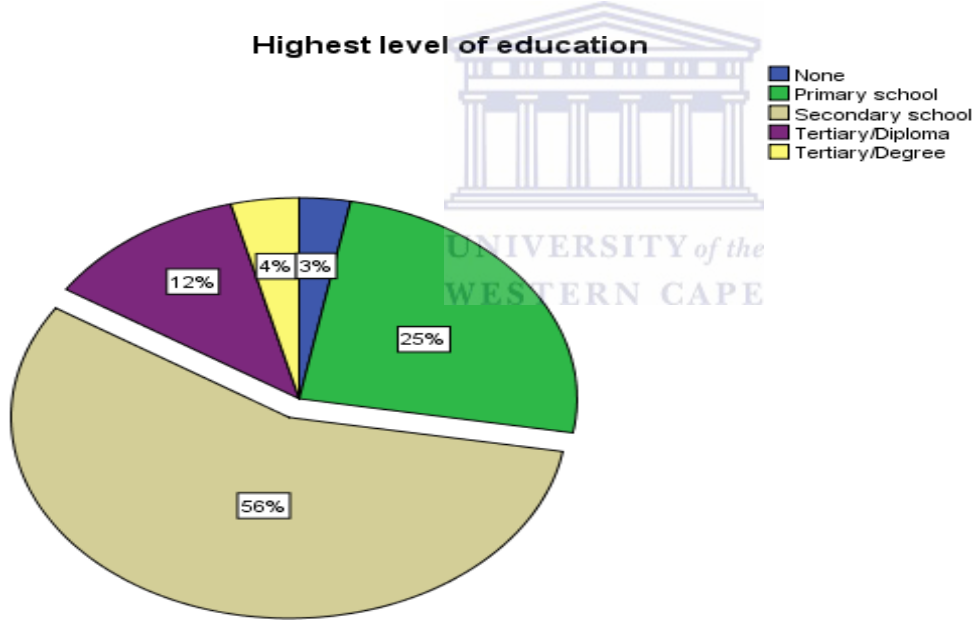



8(b) *Age*

Figure 8(Continued)




8(c) *Marital Status*




8(d) *Level of Education*

Source: Author's Compilation.

Out of the 102 heads of households interviewed, 49% were never married, 16% were married to more than one partner, 12% were separated, 15% were living together, 8% were divorced and 2% were widowed (8c). Regarding the highest level of education attained, 56% had completed secondary school, 25% had completed primary school, 12% had completed a tertiary diploma, 4% had completed a tertiary degree and just 3% had no educational training (8a). From a summation of those who completed secondary school (56%), tertiary diploma

(12%) and tertiary degree (4%), one could conclude that the sample population is relatively literate, since they made up 70% of the total sample. However, 28% could be considered semi-literate or illiterate since they had only completed primary school or had never been to school.

## *4.3 NATURE OF HOUSING*

In theory, the South African Constitution grants all of its citizens the right to adequate housing and basic services such as access to clean water, education and health services. But contrary to this, the government's effort in delivering housing subsidies to the urban poor has suffered a huge backlog of approximately 1.2 million houses; of which in 2006, 400,000 were in the Western Cape (City of Cape Town, 2006). There is no indication that this backlog has fallen. In addition, in 2006, there were still approximately 8.5 million people out of the population of 43 million, living in slum conditions in South Africa (UN-HABITAT, 2005a).

In effect, the housing backlog in Cape Town has become an issue of principal concern to the City planners since it has rendered the low income Capetonians highly vulnerable to the dynamic weather conditions of the city. More so, findings from a report published by the city of Cape Town's Information and Knowledge Management Department reveal that the number of informal settlements grew grown higher since the first count was made in 1993 from 50 to over 200 informal settlements in 2006 (City of Cape Town, 2006: 5). And, the number of informal dwellings also increased from 28,300 in 1993 to 98,031 in 2005 (City of Cape Town, 2006: 5). For clarity, the city of Cape Town defines an informal settlement as 'an unplanned settlement on land which has not been surveyed or proclaimed as residential, consisting mainly of informal dwellings (shacks)' where an informal dwelling is defined as 'a wooden or iron structure which does not meet basic standards of safety in building' (City of Cape Town, 2006: 3). As a result of the housing backlog, many low income Capetonians have resorted to the risky and insecure form of housing, erected in informal settlements and backyard dwellings which may be closer to better livelihood facilities and may have low or no rental rates and a minimum service charge.

Based on published reports from the Housing Department of the City of Cape Town, the Enkanini informal settlement in Khayelitsha is made up of more than 90% informal dwellings as a result of the massive housing backlog in Cape Town (City of Cape Town, 2006: 10). This section will therefore examine the nature of housing in the study area by monitoring if the houses conform to the City of Cape Town's disaster risk management

centre and fire & rescue service safety regulations. It will also evaluate the type of construction materials used in building these dwellings and whether they meet the basic standards of safety in buildings as recommended by the housing department.

### 4.3.1 CONFORMITY TO CITY OF CAPE TOWN'S REGULATIONS

As a measure to check the rate of flooding and fires in informal settlements, the City's Disaster Risk Management Centre and Fire & Rescue Services department came up with regulations to guide the inhabitants of susceptible informal settlements. The regulations give the informal dwellers some tips on how to protect themselves and their dwellings from fire and from floods during the summer and winter months respectively (See pamphlet in Appendix 6). It should be noted that the focus of the regulations is particularly for fires and floods because these are the two major weather-related episodes that are persistent in informal settlements all year round. The pamphlets emphasize the key points the informal settlement residents should adhere to, before building their dwellings. In other words, their dwellings should conform to these regulations for their safety to be guaranteed, or damage minimised.

Firstly, it points out the space required between houses. Here it states that the dwellings must be constructed at least 3 metres apart from each other, to prevent fires from quickly spreading with the aid of wind, which is a great agent of fire transfer in clustered settlements such as Enkanini. Another reason for the space is to reduce overcrowding in the settlement, allow proper ventilation around such dwellings and allow access for emergency services.

Secondly, there should be a defined plan of any house before construction. The regulation stresses that every dwelling needs a plan before construction begins and that the dwelling should have more than one way out in case of a fire or any eventual emergency that arises later-on. As another fire preventive measure, each household should keep a bucket of sand and a bucket of water ready, so as to put out all small fires before they spread and cause greater damage. The regulation emphasises more alertness on this point especially because most of the dwellings are prone to fires during the hot and dry summer months due to the nature of their proximity to one another and the nature of construction materials used.

As a check for flooding and protection against cold weather conditions during winter, the inhabitants are cautioned not to construct their dwellings in flood prone areas and storm water channels with poor drainage patterns. The classic example used is that of a detention

pond[27], which might look empty and dry during summer but becomes logged with water during winter or after a heavy storm, due to poor drainage. Residents are equally reminded that flooding in informal settlements is not only caused by heavy rainfall but also influenced by location and gradient of the settlement. If a dwelling is located in a wetland or in a low lying area, it will likely be inundated after a heavy storm since it acts as a basin and drains the surrounding land. This is applies to the informal settlements located in the Cape Flats, including this case study of Enkanini in Khayelitsha. Since a greater proportion of the Cape Flats is lies only about 10 metres above sea level, the water table remains close to the surface, which makes it easier for water to seep up into the floor of dwellings in this location after a heavy storm, mainly because the area is poorly drained. Some other informal settlements get exposed to flash floods or surface run-offs because they are located in detention ponds or close to other water sources and on steep slopes.

In all, the inhabitants of informal dwellings are advised to raise the floor of their dwellings above ground level, in order to prevent quick seepage and damp floors when it rains. They are equally advised to keep storm water drains clear from dirt in order to ease the flow of run-off after a heavy storm, in order to reduce the level of inundations in the settlement. More so, those living in slopes and the base of hills are urged to make furrows and gutters that will help to channel water away from their dwellings after any heavy storm.
The last, but not least of the regulatory measure that should be observed all year round is the emergency call for help, where they are counselled to call 107 from all Telkom pay phones or 021 480 7700 from all cell phones in case of extreme emergency, that is; when all their preventive measures have failed and they have ran out of options.

In the study survey, a question was asked on whether the houses of the informants conformed to the City of Cape Town's disaster risk management centre and fire & rescue service safety regulations. From the responses of both residents who knew about the regulations and those who did not know, 52% of the sample answered 'No' and 48% answered 'Yes'. The responses give an indication that a majority of the dwellings do not conform to the city's construction regulation. The question that followed, probed the respondents further who answered 'No', to give a reason why their dwellings did not conform to the city's regulation. Together with the researcher, their reasons for non-conformity to the city's regulations were categorized under respective regulations, just as prescribed by the city, in order to identify the reason with the highest frequency (See Table 1).

[27] A basin or reservoir where water is stored for regulating flooding. It has outlets to release the flow during flood events.

*Table 1: Reasons for Non-Conformity.*

| REGULATION | FREQUENCY |
|---|---|
| SPACE | 25 |
| DRAINAGE | 14 |
| LOCATION | 6 |
| PLAN | 4 |
| FIRE PREVENTIVE MEASURE | 2 |

Source: Author's Compilation.

## *Space*

From Table 1 above, the most recurrent reason for non-conformity was the space between dwellings. The city demands that the spaces between dwellings should be at least 3 metres apart in order to prevent fires from spreading quickly to other dwellings. When asked why their dwellings did not conform to the city's regulations, the inhabitants complained of inadequate building space. An anonymous head of household commented…

> *"we prefer to be clustered than to live far away in isolation from friends and other members of our families. Another reason is that the crime rate is high and we do not feel very safe when we are further apart".*

Another one added…

> *"the solidarity amongst us is a driving force to our survival and none of us really bother if their relative or family friend came from the Eastern Cape and wanted to add his shack just next to our existing dwelling".*



**Figure 9: A Clustered Settlement Pattern-Enkanini.**


(a)

(b)

Source: Author's Photograph (2011-10-19).

Figure (9a) above (Left), illustrates how clustered and dense the settlement pattern looks like. In the above Figure (9b) above (Right), you can actually see how narrow the spaces between the dwellings are. Most of them are less than one metre wide. This does not meet the city's regulation and therefore renders them vulnerable in an event of a fire outbreak.

### *Drainage and Location*

The drainage pattern and terrain in which the dwelling is located were the second and third most recurrent reason for non-conformity respectively. Some of the dwellings were located in flood-prone areas such as storm water channels, wetlands and detention ponds that eventually flooded after heavy storms. Anonymous inhabitants in these restricted locations gave reasons such as…

"*this is the only available space we can build our house*".

and they added that…

*" we have been evicted from our previous locations due to marginalisation, so where does the City want us to go?"*

Other locations such as detention ponds may look dry and alright during summer but when the winter rains come, these spaces get flooded within a short space of time due to their poor drainage pattern (See Figure 10).



**Figure 10: Dwellings located in poorly drained Flood Plain.**

(a) (b)

Source: Weathering the Storm, 2008.

The Figure (10a and 10b) above shows flooded informal dwellings after a severe storm. In such settlements, women, children, elderly and the chronically ill tend to suffer the worst effects of the flooding since they are highly dependent and less mobile than the men.

### *Plan*

The fourth reason for non-conformity was the absence of a plan for the dwelling. The plan emphasized the need for an alternative emergency exit in the dwelling other than the main door. At least two of such dwellings had only one door, with no window, which clearly validates how vulnerable they were, if encountered with a fire or any other emergency. Another dwelling had a very small window that could barely let in fresh air and light. Coupled to that, the position of the window was higher than that of an average window and it could not be easily accessed if the main door was affected in case of an emergency (See Figure (11).

**Figure 11: A small and high window, as an emergency exit.**



Source: Author's Photograph (2011-10-21).

Figure 11 above shows a small and high window that serves as the only emergency exit in this informal dwelling. When asked if the owner was aware of the risks involved in the case of a fire out break or any other emergency, the owner replied that if the window was bigger, it would attract thieves who might break in and steal valuables. But that if it was tiny, it discouraged anyone from even thinking of breaking in since they would know they can not take away any valuable asset like a television through such a small window.

### *Fire Prevention Plan*

Most of the dwellings had at least one bucket of water in the house, though they complained about keeping sand in the house, saying it occupied unnecessary space that could be used for storing other furniture. The fire prevention plan was observed to be the least of their worries and some of the residents added that sand was available everywhere in the settlement and that it is the least of their worries in the case of a fire outbreak.

### 4.3.2 CONSTRUCTION MATERIALS USED

An informal settlement is defined by Eighty20 consulting, as ‘an unplanned settlement on land which has not yet been surveyed or proclaimed as residential, consisting mainly of informal dwellings (shacks), while they define an informal dwelling as a makeshift structure, not erected according to approved architectural plans’ (Eighty20, 2011: 4). Simply put, the City of Cape Town defines an informal dwelling as ‘a wood and iron structure which does not meet basic standards of safety in building’ (City of Cape Town, 2006: 5).

Both of the above definitions of an informal dwelling cut across the nature of the construction materials used and the absence of safety standards, associated with the construction of informal dwellings. Therefore an inquiry into vulnerability to weather in an informal settlement such as Enkanini could not be complete without questions that considered the nature of the construction materials used in the dwellings. Before inquiring about the construction materials used, preliminary questions about the ownership status of the dwelling, the number of rooms in each dwelling and the duration of stay of each resident were asked in order to gain an understanding about the composition, content and nature of their housing.

From the analysed results, it was observed that out of the 102 heads of households that constituted the survey, 72% of them were owners of the dwellings they resided in; whereas 28% of them were paying rents and were not the dwelling owners. The number of rooms in each dwelling ranged from a minimum of 1 room, to a maximum of 6 rooms, with a mean of 3 rooms. Regarding the duration of their stay in Enkanini, there was a minimum of 1 year and a maximum of 21 years, with a mean of 6 years on a normal frequency distribution. Respondents were then asked the important question about the type of materials used in building their dwellings. The answers to this question were critical, since they had a direct link to the research question and the third research objective that emphasized the vulnerable nature of the dwellings in the case study during unusual weather episodes. Responses to inquiries into the type of construction materials used were a joint exercise by both the researcher and the respondents. To avoid errors, the researcher made an observation to ensure that the responses given actually matched with the type of construction material the dwellings were made-of. The compiled list of construction materials was later grouped and reduced by the researcher into categories as seen in Table 2 below.

*Table 2: Construction Material Used.*

| CONSTRUCTION MATERIAL USED | FREQUENCY |
|---|---|
| IRON SHEETS/ZINC | 61 |
| PLYWOOD/PLANK | 18 |
| CEILING/CARDBOARDS | 11 |
| ASBESTOS /POLES/ PLASTIC BAGS | 8 |
| BRICKS/STONES/BLOCKS | 4 |

Source: Author's Compilation.

Just as the City of Cape Town's definition pin-points wood and iron as the major components of informal dwellings, the category of construction materials with the highest frequency in the study was iron sheets and zinc. Some sixty-one (61) dwellings in the study fell in this category, constituting 60% of the dwellings in the study sample. The other category of construction materials that was also widely used in the settlement was plywood and plank. Eighteen (18) dwellings in the study sample fell in this category and it constituted 17% of the dwellings in the study sample. The third category of construction materials used was ceiling and cardboard. 11 dwellings from the sample were constructed from ceiling and cardboard, which made up 11% of households in the study sample. Asbestos, poles and plastic bags constituted the major construction materials used in eight (8) dwellings in the study sample and they made up 8% of households in the survey. The last category of construction materials used was bricks, stones and blocks. Only four (4) households fell within this category and they also constituted 4% of the study sample.

From Table 2 above, one can clearly see that most of the households were constructed from materials which do not meet the basic standards of safety in building, as defined by the City of Cape Town. Up to 96% of the households that made up the study survey were constructed from a makeshift structure of iron sheets, zinc, plywood, plank, ceiling, cardboard and plastic bags, without any architectural plans. The use of asbestos is also of concern especially as it has a negative impact on the health of the residents whose dwellings are poorly ventilated. Just 4% of the households were constructed with bricks, mortar, blocks and stones, which coincidentally had actual plans. This high percentage of housing that does not meet basic standards of safety in buildings illuminates the major reason for the high vulnerability to weather-related episodes encountered in Enkanini.

## *4.4 UNDERSTANDING VULNERABILITY TO VARIABLE WEATHER PATTERNS*

In order to understand how and why these informal settlement residents are vulnerable to the prevailing weather pattern in Cape Town, it is important to recall what vulnerability to variable weather is all about.

Bolin and Stanford (1998: 6), examined vulnerability by saying 'it concerns the complex of social, economic and political considerations in which people's everyday lives are embedded and that structure the choices and options they have in the face of environmental hazards.' They added that 'the most vulnerable people are typically those with the fewest choices, those whose lives are constrained, for example, by discrimination, political powerlessness, physical disability, lack of education and employment, illness, the absence of legal rights and other historically grounded practices of dominion and marginalisation' (Bolin and Stanford, 1998:9-10).

The above definition cuts across two key issues that play a major role in highlighting environmental vulnerability, which can be identified in the case study of Enkanini. The first is on the complex consideration of choices victims encounter during periods of environmental hazards or in our case, during episodes of undesired weather conditions. Whereas the second emphasizes the choices the vulnerable inhabitants make in order to remedy their situations. The definition also points out that in most instances their lives are constrained by marginalization and other historically grounded practices of dominion. This is classically the case with Khayelitsha where Enkanini is located, which was established by segregation laws during the apartheid regime, suffers a housing crisis, has been marginalized since its establishment, under-serviced and lacks a great deal of basic needs.

An understanding about the vulnerability of these informal settlement residents to the variable weather pattern in Cape Town leads to questions about why and how they become vulnerable. A recap from Table 2 above confirms that up to 98% of their dwellings do not conform to the city of Cape Town's Disaster Risk Management Centre and Fire & Rescue Safety Regulations and building standards. This in essence is primarily due to the nature of construction materials used in building their dwellings, followed by other reasons such as awareness of their potential vulnerability and their socio-economic status.

To get a clearer picture about the scenario, another question was asked of the 98 heads of household whose dwellings did not meet the city's standards, to answer if the construction

materials they used rendered them vulnerable to bad weather. Out of the 98 household heads, 72 answered 'Yes', to confirming that their dwellings exposed them to bad weather events due to the nature of the construction materials they used. They made up 80% of the residents whose dwellings did not conform to the City's regulations. Eighteen (18) household heads answered 'No', saying that their dwellings did not expose them to undesired weather events and they made up 20% of the households that do not conform to the City's regulations.

To understand how these residents are affected by the variable weather pattern in Cape Town, a significant question about the most vulnerable season, and its effect thereof to their livelihoods in Enkanini was asked. Out of the 90 residents who responded to the question, 46 said they were most vulnerable during winter and they made up 51% of respondents. Four (4) residents (5%) said they were most vulnerable during summer while 44 residents said they were vulnerable all year round (that is; during summer and during winter) and they made up 44% of respondents. Thereafter, a specific question about what weather element affected them the most was equally requested, to match it up with the seasons they were affected. The responses were noted and later categorised into three major weather elements, which were temperature, rainfall and wind. These three major weather elements and their accompanied effects were identified to be the most threatening in the Enkanini community. Therefore each element was examined to identify its season of occurrence, trend of change and its effect(s) to the livelihood of the informal settlement residents.



### 4.4.1 TEMPERATURE

Temperature refers to 'the degree of hotness or coldness of a body or environment that can be measured using a thermometer' (Miller, 1996: 129). It plays an integral role in determining key processes in life forms on earth and the level of comfort with the environment for human beings. Diurnal temperatures change daily and the average daily temperature during summer is higher than the average daily temperature during winter. The general trend of change in atmospheric or air temperature has been observed to be changing due to global warming.[28] The global temperature change has shown a clear warming of about $0.6^0$C over the last century (IPCC, 2001: 108), but this is made up of widely varying trends in different regions of the world. Recent climate projection models simulate all of Africa to be warming in this century and that the warming is likely to get higher than the global annual mean warming. These models have been consistent with the overall temperature trends observed over

[28]The observed and projected increases in the average temperature of Earth's atmosphere and oceans.

subtropical South Africa and they confirm that the warming is already occurring (Kruger & Shongwe, 2004: 1929-1930). The Conference of Parties (COP 17) website also reiterates that South Africa should be worried about the warming because 'its coastal regions will warm by around 1-2°C by about 2050 and around 3-4°C by about 2100 and its interior regions will warm by around 3-4°C by about 2050 and around 6-7°C by about 2100.'[29] Generally, the largest temperature increases are projected for autumn and winter, with the summer and spring changes being the smallest.

A future climate projection for the Western Cape in general and Cape Town in particular, suggests that Cape Town is likely to get warmer and drier than it currently is. Therefore to verify what reports say about the increasing trend of temperature change in Cape Town and in the case study in particular, climatic data about the mean monthly temperature of the case study was requested from the South African Weather Service (SAWS) (Figure 12 below). Temperature data for the past 50 years (1960-2010) was obtained and analysed, in order to identify any pattern of change that occurred.

The mean monthly temperatures were derived from the daily minimum and maximum surface air temperatures recorded from the station [00211879]-Cape Town DF MALAN-WK, measured at 8:00 SAST. This station collects data for Cape Town International Airport and its surroundings and the case study Enkanini-Khayelitsha, falls under this region. To identify the trend of change, the yearly average or annual mean was obtained by dividing the sum of the monthly means by the number of months for each year. The derived annual means from 1960-2010 were later plotted on a graph, to verify any trend of change (See Figures 12 and 13 below). For the monthly trends, a significant warming trend was identified in the summer months of December, January, February and March, which recorded the highest maximum temperatures, whereas the winter months of July, August and September recorded the lowest minimum temperatures. It was observed that the very warm days have become warmer and have occurred a lot more frequently in the last two decades, particularly in January, April and August. Data concerning the mean monthly temperatures were important in providing direction on obtaining the mean annual temperature.

[29]http://www.cop17-cmp7durban.com/en/south-africa-on-climate-change/effects-of-climate-change-on-south-africa.html, accessed 23 January, 2012.

## 4.4.1.1 MEAN MONTHLY AND ANNUAL TEMPERATURE

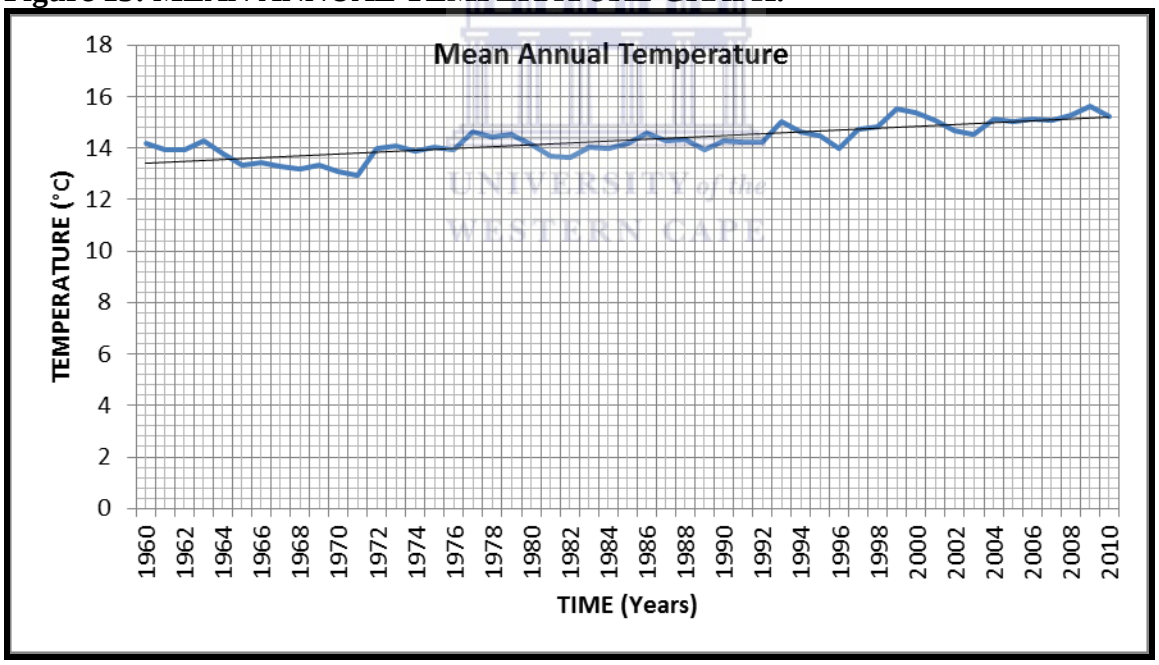
**Figure 12: Mean Monthly Temperature (°C).**
**Data for station [0021178 9] - CAPE TOWN D.F.MALAN - WK Measured at 08:00**

| Year | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | Annual Mean |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1960** | 19.5 | 18.4 | 15.7 | 12.4 | 11.3 | 10.5 | 7.1 | 8.9 | 12 | 15.3 | 18.9 | 20.1 | **14.2** |
| **1961** | 19.1 | 18.1 | 17 | 14 | 9.9 | 10 | 9.3 | 9.2 | 11.4 | 12.8 | 17.9 | 18.2 | **13.9** |
| **1962** | 18.9 | 18.2 | 15.9 | 13 | 10 | 11 | 8.8 | 8.9 | 11.9 | 14.4 | 16.7 | 19.7 | **13.9** |
| **1963** | 20.7 | 17.9 | 16.9 | 12.4 | 10.1 | 9.4 | 7.8 | 9.5 | 12.4 | 15.9 | 18.6 | 19.8 | **14.3** |
| **1964** | 20.1 | 18.1 | 17.2 | 12.8 | 10.9 | 8.1 | 8.9 | 8.5 | 10.3 | 14.5 | 16.7 | 19.1 | **13.8** |
| **1965** | 18.9 | 17.9 | 15.9 | 13.4 | 10.5 | 5.8 | 9.1 | 8.8 | 11.8 | 14.4 | 16.6 | 16.7 | **13.3** |
| **1966** | 18.9 | 16.4 | 15.1 | 13.7 | 10.1 | 8.8 | 8 | 8.8 | 10.8 | 14.7 | 17.3 | 18.7 | **13.4** |
| **1967** | 18 | 18.2 | 15.6 | 12.3 | 10.1 | 8.5 | 6.7 | 7.4 | 11.2 | 14.2 | 17.7 | 19.5 | **13.3** |
| **1968** | 18 | 16.8 | 16.3 | 13.5 | 11.6 | 8.3 | 7.5 | 7.3 | 10.3 | 13.1 | 17.4 | 18 | **13.2** |
| **1969** | 18.1 | 18.4 | 17.1 | 12.7 | 8.7 | 8.3 | 7.5 | 9.7 | 10 | 13.8 | 16.9 | 19 | **13.3** |
| **1970** | 19.5 | 17.6 | 16.1 | 13.5 | 10.7 | 8.4 | 6.8 | 8.5 | 9.6 | 14.4 | 15.5 | 16.3 | **13.0** |
| **1971** | 17.6 | 18 | 15.2 | 12.7 | 9 | 8.9 | 7.7 | 8.2 | 8.7 | 13.8 | 16.8 | 18.7 | **12.9** |
| **1972** | 19.5 | 18.4 | 16.5 | 12.5 | 11 | 9.4 | 8.4 | 8.4 | 11.3 | 15.3 | 18.7 | 18.2 | **13.9** |
| **1973** | 19 | 18.7 | 16.6 | 14.4 | 10.8 | 10 | 9.4 | 7.7 | 10.5 | 15 | 18 | 19.1 | **14.1** |
| **1974** | 19.8 | 18.8 | 16.1 | 13.8 | 10.9 | 10.5 | 7.8 | 8.6 | 10.3 | 13.5 | 17 | 19.4 | **13.8** |
| **1975** | 19.7 | 19.1 | 16.5 | 13.2 | 11.3 | 10 | 9 | 8.3 | 12.7 | 13.3 | 16.4 | 18.8 | **14.0** |
| **1976** | 19.5 | 18.3 | 16 | 13.9 | 12 | 11.4 | 9.2 | 8.8 | 11.3 | 14.5 | 14.8 | 17.5 | **13.9** |
| **1977** | 18.3 | 18.7 | 15.9 | 15.8 | 11 | 11.6 | 8.9 | 9.8 | 12.3 | 14.7 | 18.6 | 19.7 | **14.6** |
| **1978** | 20.4 | 18.8 | 17.3 | 13.9 | 11.5 | 9.6 | 9.9 | 10.2 | 10.5 | 13.7 | 18 | 19.3 | **14.4** |
| **1979** | 19.1 | 18.7 | 15.6 | 15.5 | 12.3 | 10.3 | 8.5 | 10.6 | 11.2 | 13.9 | 18.1 | 20.5 | **14.5** |
| **1980** | 20 | 17.8 | 16.8 | 14.3 | 10.4 | 10.2 | 8.9 | 9.9 | 11.7 | 14.7 | 16.4 | 18.7 | **14.1** |
| **1981** | 18.6 | 18.6 | 16.5 | 13.9 | 11.1 | 7.9 | 8.2 | 8.5 | 10.7 | 14.5 | 16.5 | 19.1 | **13.6** |
| **1982** | 18.6 | 17 | 15.9 | 13.5 | 11.1 | 8.3 | 8.4 | 8.6 | 12.4 | 15.3 | 16.8 | 17.7 | **13.6** |
| **1983** | 18.9 | 17 | 15.7 | 14.4 | 11 | 10.6 | 9 | 8.4 | 11.4 | 15 | 17.6 | 19.2 | **14.1** |
| **1984** | 19 | 18.8 | 16.1 | 12.9 | 10.7 | 9.6 | 8.9 | 9 | 12 | 14.5 | 18.1 | 18.1 | **13.9** |
| **1985** | 19.4 | 18.8 | 15.9 | 13.5 | 11.2 | 10.2 | 7.8 | 9.5 | 11.3 | 15.1 | 18.8 | 18.7 | **14.2** |
| **1986** | 19.5 | 18 | 15.6 | 14.2 | 11.9 | 9.9 | 9.3 | 11.1 | 12.7 | 14.6 | 17.7 | 20.2 | **14.5** |
| **1987** | 19.4 | 18.6 | 17.5 | 13.6 | 13.1 | 9.1 | 8.9 | 9.3 | 12.1 | 14.8 | 16.7 | 18.5 | **14.3** |
| **1988** | 19.3 | 19.7 | 17 | 14 | 12.2 | 7.9 | 9.2 | 10.2 | 11.3 | 14.1 | 17.9 | 19.4 | **14.4** |
| **1989** | 20 | 18.4 | 16.7 | 13.7 | 10.1 | 9.3 | 7.7 | 9.3 | 11 | 13.8 | 18.3 | 19 | **13.9** |
| **1990** | 19.8 | 19.2 | 16.4 | 14.4 | 11.4 | 9.2 | 9.4 | 9.2 | 11.5 | 15 | 16.7 | 19.1 | **14.3** |
| **1991** | 19 | 17.6 | 17.4 | 14.9 | 12.3 | 8.9 | 9.2 | 7.8 | 11.8 | 15.6 | 17.1 | 18.9 | **14.2** |
| **1992** | 19.9 | 19.2 | 17.3 | 12.7 | 10.9 | 9.2 | 9.1 | 8.2 | 11.6 | 15 | 17.6 | 19.8 | **14.2** |
| **1993** | 20.6 | 18.4 | 18.2 | 14 | 12.3 | 9.9 | 11 | 10 | 12.5 | 15.6 | 18.5 | 19.4 | **15.1** |
| **1994** | 19.6 | 19.2 | 18 | 15.1 | 10.7 | 9.7 | 8.3 | 8.9 | 12.6 | 15.7 | 18 | 19.9 | **14.6** |
| **1995** | 19.6 | 19.8 | 17.6 | 12.8 | 12.1 | 9.5 | 8.2 | 9.4 | 12.4 | 14.4 | 18.1 | 19.8 | **14.4** |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1996** | 20.6 | 19 | 16 | 14.5 | 10.9 | 10 | 7.2 | 8.6 | 11.5 | 14.6 | 15.6 | 19 | **13.9** |
| **1997** | 19.9 | 19.1 | 16.9 | 13.4 | 10.7 | 9.2 | 9 | 11.2 | 13.7 | 17.1 | 17.6 | 19.1 | **14.7** |
| **1998** | 19.7 | 21 | 17.6 | 15.2 | 11.8 | 10.1 | 8.9 | 9.6 | 11.6 | 15.3 | 17.5 | 19.8 | **14.8** |
| **1999** | 20.3 | 19.8 | 18.1 | 14.4 | 12.7 | 11 | 9.8 | 11 | 11.7 | 17.2 | 18.2 | 22 | **15.5** |
| **2000** | 20.4 | 20.2 | 18.2 | 14.1 | 12.4 | 10.9 | 10.1 | 12.2 | 12.2 | 15.7 | 18.6 | 19.3 | **15.4** |
| **2001** | 19.4 | 19.3 | 16.4 | 14.1 | 12.3 | 10.5 | 10.3 | 11 | 12.7 | 16.4 | 18.4 | 20 | **15.1** |
| **2002** | 19.2 | 19.7 | 17.7 | 14.5 | 11.6 | 9.2 | 8.8 | 9.4 | 13.8 | 15 | 17 | 20.4 | **14.7** |
| **2003** | 20.2 | 19.9 | 18.2 | 15.4 | 12.3 | 7.8 | 9.1 | 8.3 | 12.2 | 15.9 | 16 | 18.9 | **14.5** |
| **2004** | 20.7 | 20 | 16.5 | 14.3 | 12.6 | 10 | 7.6 | 10.7 | 12.7 | 15.7 | 19.3 | 21.2 | **15.1** |
| **2005** | 21 | 19.8 | 17.8 | 14.1 | 12.2 | 9.4 | 10.5 | 9.5 | 12.7 | 15.1 | 18.4 | 19.7 | **15.2** |
| **2006** | 20.8 | 19.7 | 17.2 | 14.7 | 10.9 | 10 | 10.5 | 10.3 | 13.5 | 15.8 | 18.6 | 19.6 | **15.1** |
| **2007** | 21 | 19.7 | 17.7 | 15 | 11.7 | 10.1 | 9.4 | 9.8 | 12.5 | 16.5 | 17 | 20.5 | **15.1** |
| **2008** | 20.4 | 19.6 | 17.9 | 14.7 | 14.6 | 11.7 | 9.5 | 9.8 | 10.7 | 15.6 | 18.1 | 20.5 | **15.3** |
| **2009** | 20.1 | 20.2 | 18.6 | 15.6 | 12.7 | 11.6 | 10.8 | 11.1 | 12.7 | 16.3 | 18.3 | 19.5 | **15.6** |
| **2010** | 20.5 | 20.4 | 18.9 | 14.8 | 12.3 | 10 | 9 | 9.6 | 12.8 | 15.9 | 17.9 | 20.7 | **15.2** |

Source: Author's compilation from the SAWS repository for station [0021178 9].

**Figure 13: MEAN ANNUAL TEMPERATURE GRAPH.**




Source: Author's compilation.

The mean annual air temperature over the same region shows a significant warming trend. From the graph above (Figure 13), the best-fit line has a gentle inclination from left to right and it indicates a slow but steady increase in mean annual temperatures for the past five decades observed.

Since the observed results from the plotted mean annual air temperature graph confirms global climate projection models, it supports the simulations that the annual air temperature in Cape Town is slowly warming up as well. Now, after confirming that the obtained results fit the global literature of international model simulations about the warming climate, particular note should be taken concerning its myriad impact in poor and vulnerable communities. Therefore addressing vulnerability to climate change in the Cape Town should comprise identifying hazards that could affect the livelihoods of inhabitants in communities such as Enkanini. It should also strongly consider deteriorating health due to air pollution, heat stress and the possibility of increased flooding in such vulnerable settlements.

The effects of air temperature to the residents on Enkanini were identified to be all year round i.e. most of the inhabitants said they were affected both in summer and winter. Their responses about the effect of temperature on their livelihood were grouped into categories as seen on the vulnerability chart below (Table 3).

### 4.4.1.2 TEMPERATURE VULNERABILITY CHART



The temperature vulnerability chart below is a summary of the complaints from the residents about how temperature affects their livelihoods. It should be noted that their vulnerability to this weather element is all year round unlike for rainfall which only affects them during the rainy winter season. There effects were categorised under three broad themes; extreme heat and high temperature during the summer months (December, January, February, March), extreme cold and low temperatures during the winter months (May, June, July, August, September) and fire incidences (November, December, January, February, March).

*Table 3: Temperature Vulnerability Chart.*

| WEATHER ELEMENT | SEASON OF VULNERABILITY | EFFECT ON RESIDENTS |
|---|---|---|
| **Temperature** | All Year Round | *Extreme Heat & high temperatures during Summer:<br>- makes houses very hot and uncomfortable (heat stress).<br>- leaves residents with serious Migraine headaches<br>-gives rashes, burns and makes their skin darker.<br>-difficult to move around during the day. |

| | | |
|---|---|---|
| | | -fire destroys property (including ID's) and leaves people unemployed.<br>-sickness from dust particles (dehydration + flu).<br><br>*Extreme Cold & low temperatures during Winter:<br>-makes it hard to wake up early and go to work.<br>-low working hours due to lateness to work and absenteeism.<br>-work short hours due to early night fall.<br>-low savings, due to the high cost of keeping warm.<br>-less mobile, often sick and more expenditure.<br>-kids are always sick.<br>-struggle to get warm water since there are no geysers and there's no electricity sometimes.<br><br>*Fire destroys lives and property during the dry hot summer and from the use of paraffin heaters during winter. |

Source: Author's compilation.



Some of the effects during the hot summer months include heat stress from high daily temperatures. Considering the nature of their dwellings, high temperatures make sitting inside the house very uncomfortable. This usually leaves them with serious migraine headaches, heat rashes and burns. Some residents even get dehydrated and seriously sick when it gets really hot because they have no fans or air conditioners to cool off with.

During this same period of high temperatures, the environment is conducive for fires which often ravage their personal belongings and even some of their dwellings. The incidence of shack fires in Enkanini has increased and Holloway (2005: 17) confirms that more than 41,000 informal homes were destroyed by fire between 1990 and 2004 in the Western Cape.

On the other hand, during the cold winter months, the situation even gets worse for these residents. There is first a constant battle to keep warm, since their dwellings are not properly constructed and lack the adequate insulation checks. Therefore it gets difficult to wake up early to bathe and go to work on time. Most of the residents said their working hours

are always low during winter because of lateness and absenteeism from work. They also spend a lot of the little money they have in hospitals, since their kids are always sick. Or it is spent trying to keep warm.

The effects of this weather element cannot be over emphasized but it generally has a great deal of negative consequences to these residents. This often leaves them pondering why they have been abandoned by the city and government departments in-charge of their welfare.

### 4.4.2 RAINFALL

Rainfall is defined by Miller (1996) as 'a form of liquid precipitation that occurs as a result of the condensation of atmospheric water vapour into drops of water, heavy enough to fall on the earth's surface' (Miller, 1996: 117). It is measured using a rain gauge (calibrated in mm) and its amounts can also be estimated by weather radars. Other forms of precipitation include snow, hail, sleet, drizzle, frost, fog and dew. Rainfall is the primary source of fresh water in most regions of the world and it provides suitable conditions for diverse ecosystems and farming. Too much rainfall results in floods and inundations which negatively affect people and the environment but too little or no rainfall leads to drought, which is detrimental to most life forms supported on earth.

Generally, rainfall patterns vary with seasons and geographical locations on the globe with decreasing intensities away from the equator. But due to global warming, the global distribution pattern of rainfall is slowly being affected, causing delays in some parts of the globe and early arrival in others. For instance, wetter conditions due to rainfall have been experienced lately across eastern North America and drier conditions in the tropics (Woodworth, 2011: 609). In South Africa as well, the distribution of mean annual rainfall has been decreasing un-uniformly as you move westwards from the escarpments across the interior plateau. According to Kruger and Shongwe (2004: 1932), about 35% of South Africa receives less than 300mm of rainfall per annum as a result of the increased presence of the sub-tropical high pressure cells which inhibit rainfall generation because of a predominantly subsiding air. More so, Coupled ocean-atmosphere Global Circulation Models (CGCMs) projected for South Africa as described in the Fourth Assessment Report (AR4) of the Inter-governmental Panel on Climate Change (IPCC) indicate that rainfall amounts are likely to decrease over the winter rainfall region of South Africa and the western margins of Southern Africa (IPCC, 2007: 874). In Cape Town, the forecasts project a drier summer rainfall region in spring and autumn as well as drier conditions during winter as a result of frequent

formation of mid-level high pressure systems that prevail in the area (Kruger and Shongwe 2004: 1936). To fully comprehend and verify the above projections about the rainfall pattern in Cape Town, the mean monthly rainfall data for Cape Town over a 50 year period (1960-2010) was requested from the South African Weather Service (SAWS), for analysis. Just like the temperature data, the rainfall data was requested for station [00211879]. This station (Cape Town D F Malan), records data for the Cape Town International Airport & its surroundings and the study area falls within this region.

For the mean monthly trends, a minor shift in the rainfall totals was identified for late May, which recorded higher than usual rainfall amounts, whereas the trend for July and August were not as high as they were five decades ago. It was observed that the rainfall events had become fewer, but heavier in the last two decades, particularly in June and July (Figure 14 below). Data concerning the mean monthly rainfall was important in providing direction on obtaining the mean annual rainfall. To verify the projected shift in the trend of rainfall over Cape Town, the mean annual rainfall (from 1960-2010) was plotted on a graph. It was obtained by dividing the sum of the monthly means by the number of months for each year as seen in Figure 14 below.

### 4.4.2.1 MEAN MONTHLY AND ANNUAL RAINFALL



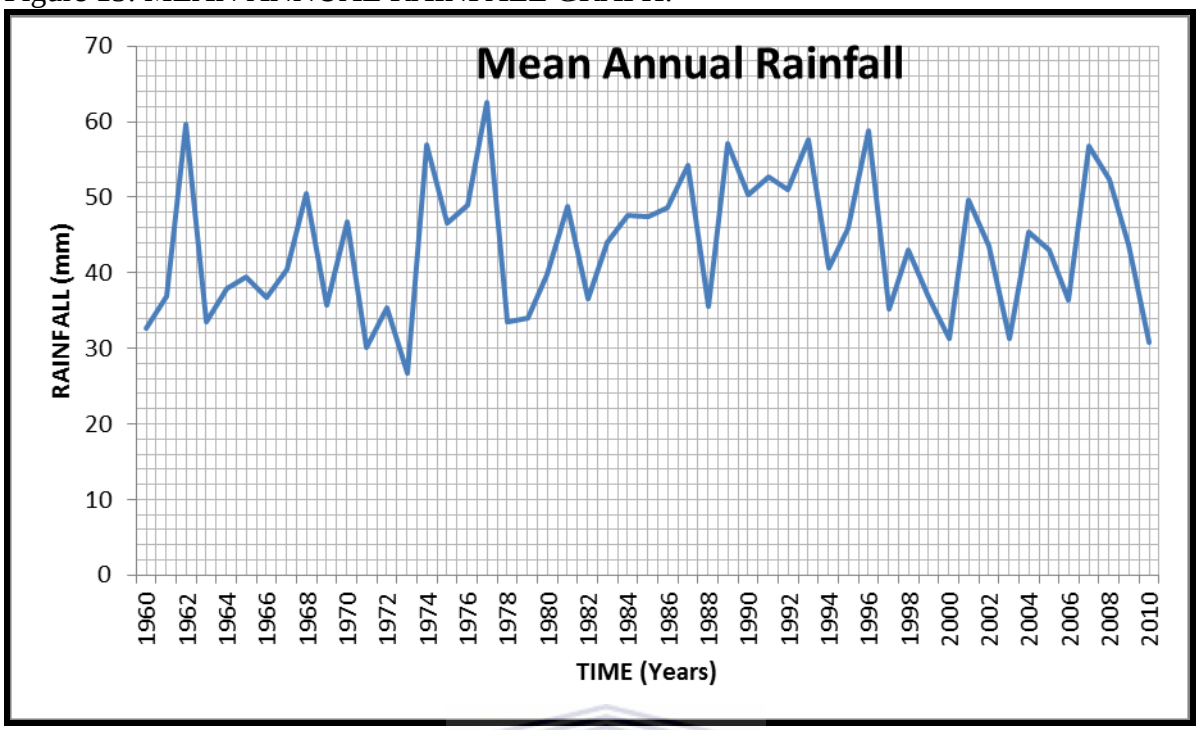
**Figure 14: Mean Monthly Rainfall (mm).**
**Data for station [0021178 9] - CAPE TOWN D.F.MALAN - WK Measured at 08:00**

| Year | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | ANNUAL MEAN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1960** | 7.2 | 7.2 | 21 | 43.5 | 59.8 | 152.3 | 36.7 | 21.5 | 18.8 | 8.2 | 0.3 | 16.2 | **32.7** |
| **1961** | 25.9 | 14.6 | 13.7 | 6 | 28.6 | 93.7 | 44.5 | 73 | 83.8 | 21.5 | 0 | | **36.8** |
| **1962** | 5.2 | 39.6 | 39.9 | 76 | 18 | 225.2 | 64.6 | 88.6 | 28.3 | 106.9 | 20.1 | 4 | **59.7** |
| **1963** | 7.1 | 1.7 | 3.9 | 6.2 | 21.4 | 68.4 | 122.2 | 87.3 | 23.6 | 11 | 37.2 | 12.9 | **33.6** |
| **1964** | 2.7 | 48.8 | 1.5 | 16.5 | 42.5 | 101.4 | 64.3 | 83.6 | 33.2 | 33.6 | 20.5 | 6.4 | **37.9** |
| **1965** | 16.4 | 25.5 | 36.6 | 56.9 | 83.5 | 51.6 | 41 | 69.9 | 19.5 | 32.6 | 11.2 | 28.4 | **39.4** |
| **1966** | 1.8 | 6.5 | 35.9 | 13.7 | 40 | 58.3 | 93.4 | 92.2 | 50.9 | 22.5 | 8.7 | 16.2 | **36.7** |
| **1967** | 18.3 | 0.2 | 5.6 | 66.9 | 40.2 | 130.4 | 61.8 | 42.2 | 27.4 | 50.5 | 35.4 | 6.7 | **40.5** |
| **1968** | 16.6 | 10.9 | 0.6 | 43.6 | 105.3 | 116.2 | 113.6 | 77.7 | 22.2 | 80 | 1.9 | 17.1 | **50.5** |
| **1969** | 31.6 | 10.7 | 19.2 | 51.5 | 16.5 | 78.5 | 42.8 | 62.4 | 56.3 | 52.5 | 2.9 | 3.7 | **35.7** |
| **1970** | 6.2 | 13.4 | 2.7 | 6 | 84.3 | 109.1 | 110.9 | 81.8 | 47 | 48.7 | 17.5 | 34 | **46.8** |
| **1971** | 9.1 | 0.9 | 10.2 | 18 | 47.4 | 57.9 | 60.3 | 85.8 | 29.6 | 23.4 | 3.4 | 15.5 | **30.1** |
| **1972** | 25.2 | 7.6 | 17.4 | 46.1 | 76.7 | 68.5 | 38.5 | 55.5 | 34.9 | 18.4 | 0.1 | 35.2 | **35.3** |
| **1973** | 1.8 | 3.6 | 17.2 | 8.9 | 39 | 33.1 | 81.7 | 46.5 | 50.4 | 10.7 | 5.7 | 22.4 | **26.7** |
| **1974** | 8.9 | 4.6 | 7.2 | 4.6 | 126.4 | 130 | 82.8 | 214.8 | 38.3 | 40.1 | 19.2 | 5.7 | **56.9** |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1975** | 20.2 | 0.9 | 10.5 | 45.9 | 143.7 | 51.1 | 155.5 | 61.4 | 9.3 | 33.9 | 25 | 1.8 | **46.6** |
| **1976** | 0 | 4.9 | 18 | 40.4 | 48.4 | 184.6 | 61.6 | 74.2 | 47.3 | 5.4 | 56.7 | 45.9 | **48.9** |
| **1977** | 14.4 | 53.2 | 13.7 | 78.3 | 130.6 | 166.4 | 108.9 | 125.4 | 28 | 11 | 14.4 | 6.9 | **62.6** |
| **1978** | 12.9 | 27.2 | 27 | 59.7 | 40.8 | 22.9 | 18 | 82.3 | 63 | 23.1 | 6.9 | 18.4 | **33.5** |
| **1979** | 17.9 | 36 | 6.6 | 9.2 | 63.1 | 76.4 | 45.9 | 40.3 | 27.4 | 80.8 | 2.1 | 2.4 | **34.1** |
| **1980** | 12.7 | 15.9 | 0.6 | 52.3 | 113.4 | 75.9 | 29.6 | 39.6 | 23.7 | 21.2 | 62.7 | 29 | **39.7** |
| **1981** | 58.9 | 0.3 | 41.3 | 52.5 | 13.8 | 58.3 | 168.6 | 66.8 | 87.8 | 9.7 | 14.7 | 12.5 | **48.8** |
| **1982** | 21.3 | 6 | 12.2 | 44.7 | 42.4 | 65.6 | 58.3 | 91.2 | 12.7 | 29 | 27.7 | 27.8 | **36.5** |
| **1983** | 10.7 | 48.8 | 38.6 | 7.8 | 95.9 | 165.9 | 59.4 | 34.9 | 43.6 | 11.5 | 3.5 | 7.5 | **44.1** |
| **1984** | 14 | 5.5 | 31.9 | 22.4 | 133.3 | 45.5 | 48.3 | 30.7 | 86.9 | 80 | 2.2 | 70.5 | **47.6** |
| **1985** | 25.4 | 14.2 | 72.5 | 49.6 | 44.6 | 110.3 | 132.3 | 69.2 | 33.1 | 5.7 | 2.9 | 9.4 | **47.4** |
| **1986** | 11.4 | 7.9 | 37.5 | 31.6 | 52.7 | 130.2 | 100.8 | 116.1 | 29.9 | 37.5 | 20.5 | 8.3 | **48.7** |
| **1987** | 14.6 | 18.3 | 14.2 | 36.7 | 121.1 | 114 | 139.4 | 103.3 | 41.7 | 12.6 | 10 | 25.4 | **54.3** |
| **1988** | 0.7 | 0 | 33.4 | 40.8 | 60.5 | 46.3 | 95.5 | 77.2 | 40.7 | 20.9 | 1.9 | 7.7 | **35.5** |
| **1989** | 4.7 | 19.9 | 57.7 | 65.9 | 89.6 | 56.2 | 120.6 | 99.1 | 91 | 47.7 | 29.5 | 3 | **57.1** |
| **1990** | 14 | 31.2 | 0.7 | 142.1 | 69.2 | 110.1 | 124.3 | 43.8 | 27.5 | 3.5 | 18.2 | 18.8 | **50.3** |
| **1991** | 5.8 | 10.9 | 10.6 | 25.4 | 89.9 | 151.4 | 167.6 | 31.1 | 72.5 | 48.3 | 11.2 | 7.5 | **52.7** |
| **1992** | 1.4 | 29.5 | 13 | 85.8 | 51.2 | 145.1 | 91.7 | 43.3 | 62.3 | 77.1 | 10.7 | 1.8 | **51.1** |
| **1993** | 4.7 | 38 | 3.8 | 178.9 | 136.9 | 78.5 | 142.5 | 63.2 | 9.1 | 3.8 | 2.3 | 29.4 | **57.6** |
| **1994** | 14.6 | 0.7 | 3.6 | 35 | 39.5 | 229.4 | 68.9 | 30.9 | 39.5 | 14.1 | 7.9 | 3.4 | **40.6** |
| **1995** | 9.9 | 1 | 5.8 | 17.9 | 68 | 109.8 | 96.7 | 75.1 | 19.7 | 88.9 | 23.1 | 34.5 | **45.8** |
| **1996** | 2.2 | 34.7 | 26.5 | 33 | 55.3 | 131.4 | 85 | 106.5 | 100.4 | 69.2 | 34 | 28.3 | **58.8** |
| **1997** | 9.6 | 2 | 1.9 | 40.5 | 74.4 | 105.6 | 14.9 | 81.7 | 8.3 | 24.6 | 47.8 | 11.5 | **35.2** |
| **1998** | 9.7 | 0.3 | 14.1 | 35.4 | 120.2 | 52.8 | 99.7 | 46 | 30.9 | 15 | 47.1 | 45.4 | **43.1** |
| **1999** | 1.2 | 0.9 | 0.4 | 57.2 | 34.8 | 83.3 | 40.7 | 105.2 | 98.2 | 1.4 | 15.6 | 2.6 | **36.8** |
| **2000** | 16.1 | 0 | 12.9 | 13.8 | 62.3 | 92.6 | 46.3 | 46.2 | 66.6 | 6.6 | 6.8 | 5.9 | **31.3** |
| **2001** | 8.3 | 4.7 | 2.5 | 39.4 | 80.6 | 62.3 | 207.8 | 97.3 | 47 | 26.3 | 12.7 | 6.4 | **49.6** |
| **2002** | 60.9 | 14.9 | 9.3 | 28 | 71.9 | 76.4 | 98.2 | 65.7 | 26.1 | 32.5 | 22 | 15.9 | **43.5** |
| **2003** | 2.4 | 8.4 | 47.6 | 11.9 | 37.1 | 25 | 33.4 | 100.3 | 63.9 | 19.2 | 5.8 | 21.1 | **31.3** |
| **2004** | 5.8 | 0.2 | 9.2 | 63.1 | 3.8 | 91.1 | 64.7 | 169.7 | 25.1 | 98.9 | 3.4 | 9.2 | **45.3** |
| **2005** | 24.5 | 2 | 8.7 | 95.3 | 77.7 | 90.2 | 64.6 | 89.6 | 29.7 | 13.5 | 20.1 | 1.2 | **43.1** |
| **2006** | 0 | 13 | 4.7 | 30.1 | 121.8 | 34 | 71.4 | 56.2 | 20 | 37.2 | 37.7 | 10 | **36.3** |
| **2007** | 0.5 | 27.3 | 18.6 | 65.6 | 96 | 123.4 | 151.5 | 101.5 | 18.2 | 18.7 | 40.8 | 18.5 | **56.7** |
| **2008** | 6.8 | 13.9 | 5.2 | 15.2 | 51.4 | 63.2 | 182.4 | 79.6 | 137.8 | 12.4 | 53.1 | 7.8 | **52.4** |
| **2009** | 1.4 | 3.6 | 0.6 | 24 | 64.4 | 108.4 | 88.4 | 52 | 60.2 | 31.6 | 86.2 | 4.4 | **43.7** |
| **2010** | 3.4 | 7.9 | 6.4 | 12 | 95.4 | 70.2 | 40.3 | 32.2 | 24.4 | 31 | 27.8 | 18 | **30.7** |

Source: Author's compilation from the SAWS repository for station [0021178 9].

Figure 15: MEAN ANNUAL RAINFALL GRAPH.




Source: Author's compilation



The trend of the curve Figure 15 above depicts a fluctuating pattern of rainfall over Cape Town. The highest annual mean rainfall of about 62mm was recorded in 1977 whereas the lowest annual mean rainfall of about 26mm was recorded in 1973. The observed rainfall pattern has been steadily decreasing since 1996, though there was an increase in 2007 but it continued decreasing since then.

It should be noted that rainfall is a very difficult weather parameter to analyse for trends, due to a high degree of inter-annual variability, and single extreme events can readily skew a simple analysis and hence lead to a misleading conclusion. Therefore after a careful plot of the curve above, the annual rainfall pattern derived was compared to that of the entire City of Cape Town to identify if it fell in line with the projected scenarios for Cape Town. The compared results matched, which confirms that the effects of climate change are evident, and will definitely affect the inhabitants of Cape Town as they continue to experience drier conditions and a shift in the rainfall pattern. It should also be noted that though a shift in the rainfall pattern has been identified, the intensity of rainfall has not changed much. The resulting effects of heavy rains still constitute a major challenge especially in informal settlements located on the Cape Flats. Here, the residents are predominantly vulnerable to floods and cold weather conditions during winter, mainly due to the nature of their dwellings.

The effects of rainfall in Enkanini were identified to be prevalent mostly during winter and have been categorised as seen on the rainfall vulnerability chart in Table 4 below.

#### 4.4.2.2 RAINFALL VULNERABILITY CHART

The rainfall vulnerability chart below shows a thematic summary of the challenges posed by rainfall to the residents of Enkanini-Khayelitsha in Cape Town. Unlike temperature vulnerability which was all year round, rainfall vulnerability occurred only during the rainy winter months of May, June, July, August and September. The effects resulted primarily from heavy rainfall and violent storms which most at times made the streets inaccessible due to floods and inundations.

*Table 4: Rainfall vulnerability chart.*

| WEATHER ELEMENT | SEASON OF VULNERABILITY | EFFECT ON RESIDENTS |
|---|---|---|
| **Rainfall** | Winter | *Heavy Rainfall:<br>-makes streets inaccessible due to floods and inundations<br>-render residents sick because they get wet quite often and also contract respiratory illnesses from being cooped up in damp cold dwellings.<br>-leaves residents with little clean clothes to wear since it's impossible to hang out washing.<br>-makes residents go late to work since they can't afford boots and raincoats.<br>-makes houses uncomfortable due to leaky roofs, wet floors and damp walls.<br>-affects businesses (low sales) and spoil perishable foodstuff.<br>-spoil household items including clothes, furniture and food.<br>-gets residents worried because their home get flooded.<br>-makes it difficult to leave home when it starts raining (no umbrellas, raincoat or boots). |

Source: Author's compilation.

In ‘leafy’ parts of Enkanini, the storm drains get blocked by leaves particularly in autumn, which cause mass flooding of the settlement when rain arrives later in winter. Stagnant pools that emanate from the floods leave the kids sick since they like playing in these pools of water. The residents also complained they got wet and often missed work after every torrential rain storm. Another key complaint was their inability to hang out washing when it rained and so they end up using dirty clothes often. There is also the problem of leaky roofs, wet floors and damp walls which is the most serious, since it ends up making them sick. Residents with Spaza shops complained how it affected their sales and spoils their perishable foodstuff and that their furniture and clothes also get cold and spoilt during the wet winter months. The effects of winter rainfall is perhaps the most serious in informal settlements and especially in Enkanini where according to analysis, up to 98% of the houses do not conform to the City of Cape Town’s Disaster Risk Management Centre and Fire & Rescue Safety building regulations.

### 4.4.3 WIND



Wind is generally described as air in motion, involving a large scale flow of gases. Winds are often referred to, according to their strength and the direction from which they blow. Short bursts of winds with high speeds are termed gusts whereas strong winds with intermediate durations (around one minute) are termed squalls. Winds with long durations have various names associated with their average strength. They include; breeze, gale, storm, hurricane and typhoons. Wind is that one weather element that connects all life on earth and plays a vital role in the planet’s atmospheric circulation system. According to Miller (1996: 128) ‘without wind, most of the earth would be uninhabitable; for instance all of the tropics would be unbearably hot and most of the northern and southern hemispheres would freeze.’ Unlike temperature and rainfall, the global circulation pattern of wind has not registered any significant change. This is mainly because the differential heating between the equator and the poles and the rotation of the planet (Coriolis Effect) remain the two major large scale causes of atmospheric air/wind circulation.

Ponte and Riera identified that ‘the wind climate in South Africa appears to show similarities with that of southern South America,’ in their report on wind velocity during thunder storms (Ponte and Riera, 2007:292). South Africa is divided into wind climatic zones which indicate the sources of annual maximum wind gusts. Over the eastern and southern interiors of South Africa, annual maximum wind gusts are usually caused by thunder storm

gust fronts during summer while in the western and southern interiors; extra-tropical cyclones play the most dominant role in the wind pattern. According to Kruger et al., (2010:1), the four major sources of strong winds over South Africa are from; 'the ridging of the quasi-stationary Atlantic and Indian Ocean high pressure systems of the subcontinent, surface troughs to the west in the interior with strong ridging from the east, conveyance from the interior towards isolated low pressure systems and deep surface troughs on the west coast.'

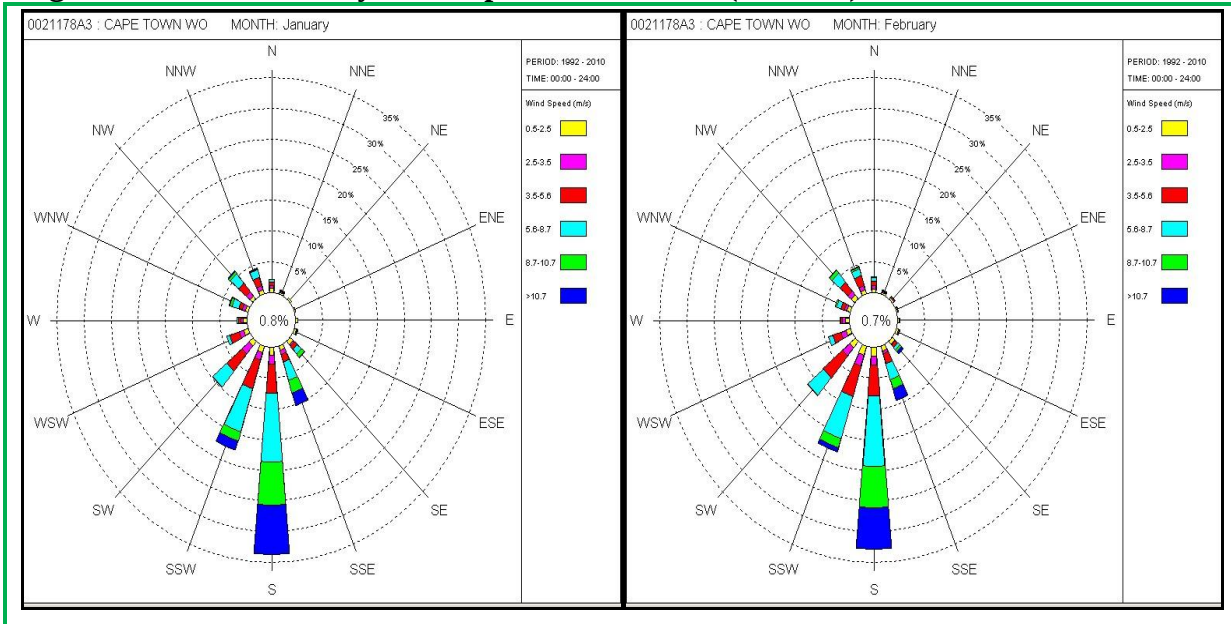
Just like temperature, the effect of wind on the residents of Enkanini is all year round. The winds with the most devastating effects are gale[30] force winds and the berg[31] winds that are also prevalent over Cape Town. These winds and gusts are usually caused by strong cold fronts, moving mostly over the southern belt of Cape Town and also by the ridging of the high pressure systems behind the fronts.

In a like manner as with temperature and rainfall, the data for wind speed and direction in for the case study was equally requested from the South African Weather Service (SAWS). Only this time, the data for an 18 year period was provided since it was the only available data for that station. It was represented in Wind Roses,[32] which summarised the occurrence of wind in the case study, showing their strength, direction and frequency as seen in Figure 16 below.



### 4.4.3.1 AVERAGE MONTHLY AND ANNUAL WINDSPEED

**Figure 16: Mean Monthly Wind Speed & Direction (Jan-Dec).**




[30] A gale is a very strong wind measuring between17.5–24.2 m/s

[31] Hot dry winds blowing off the interior plateau of South Africa, roughly at right angles to the coast.

[32] A wind Rose is a class of diagrams designed to display the distribution of wind direction experienced at a given location over a period of time.

Figure 16(Continued).

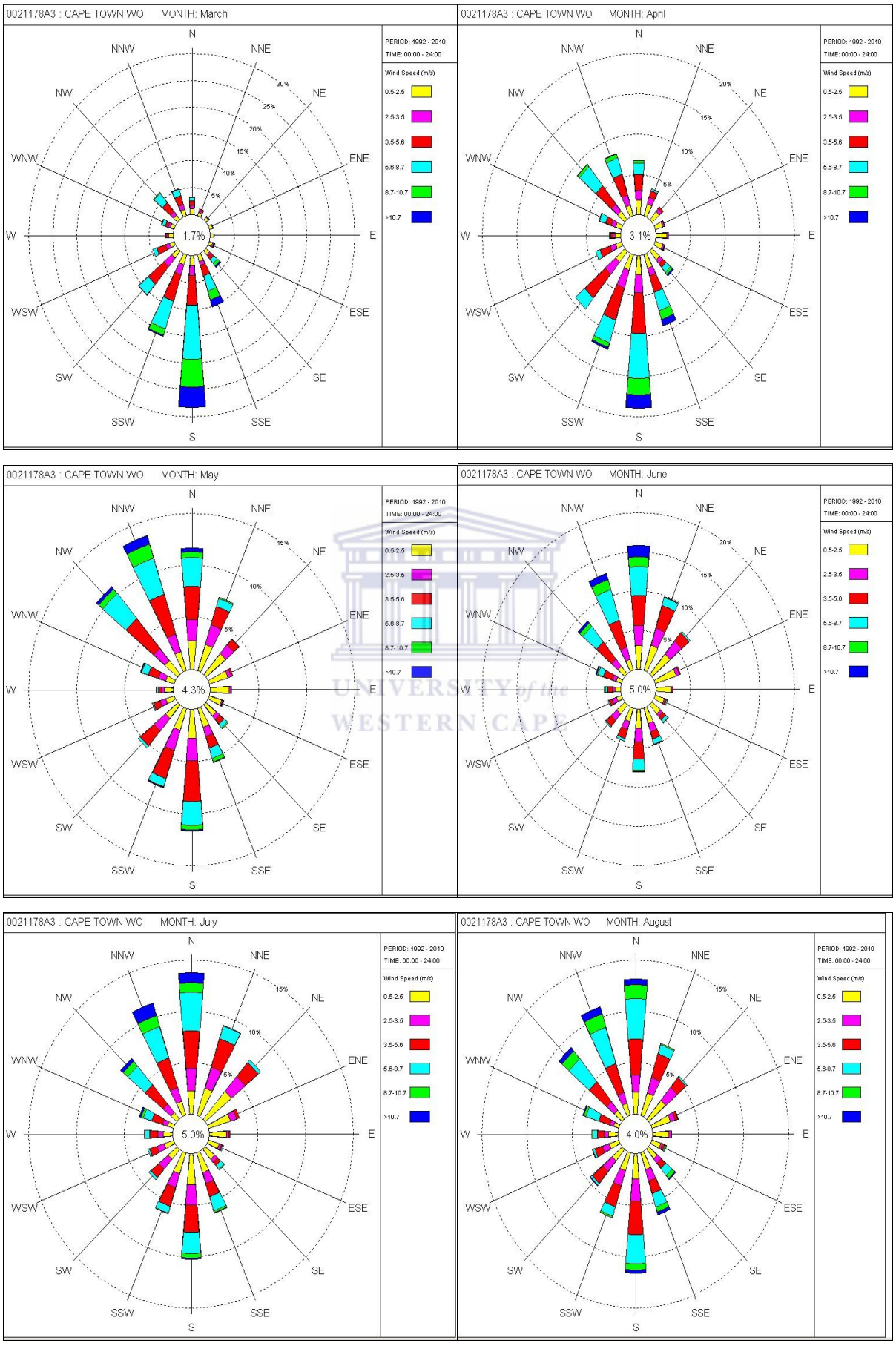
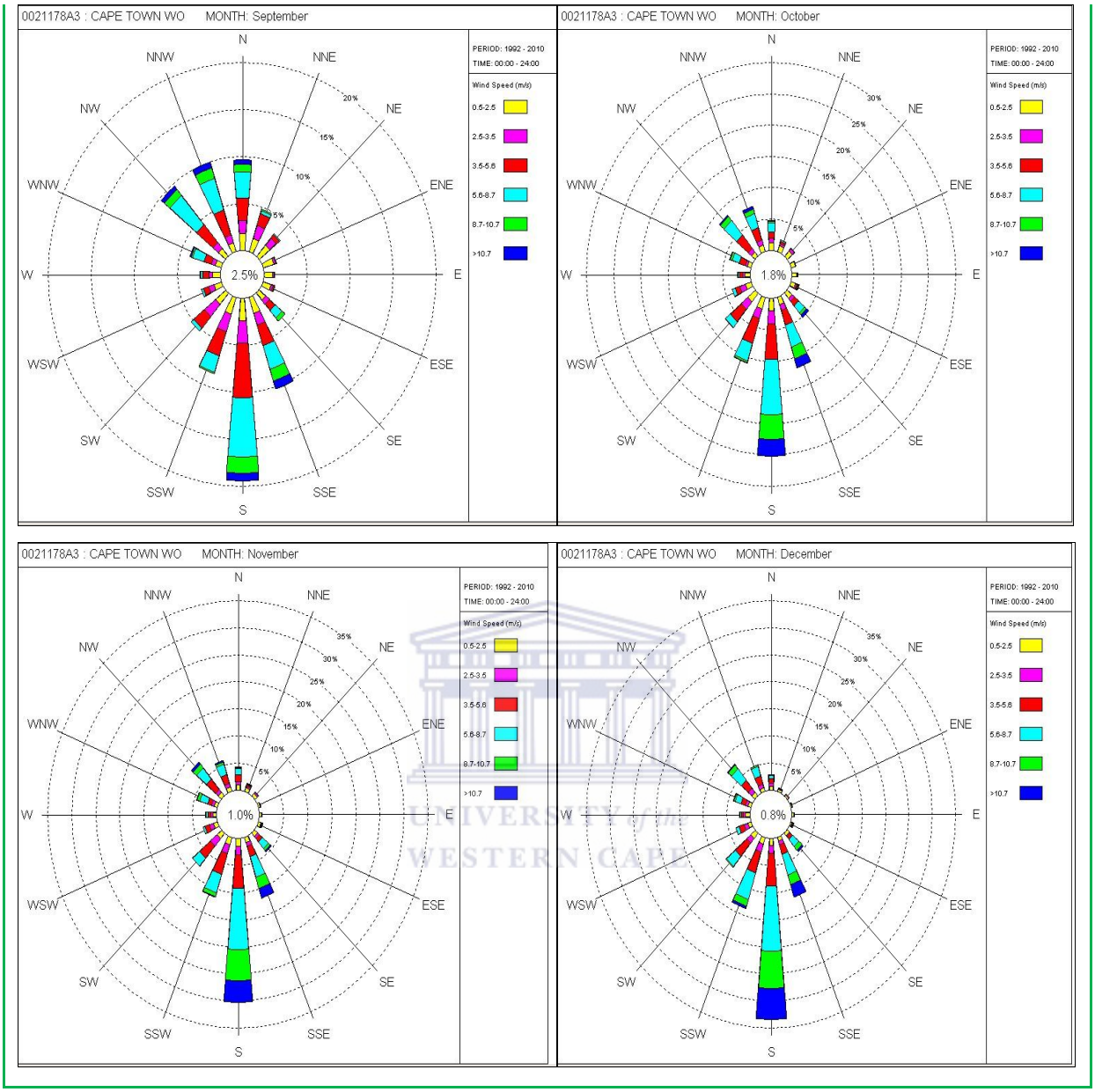


Figure 16(Continued).



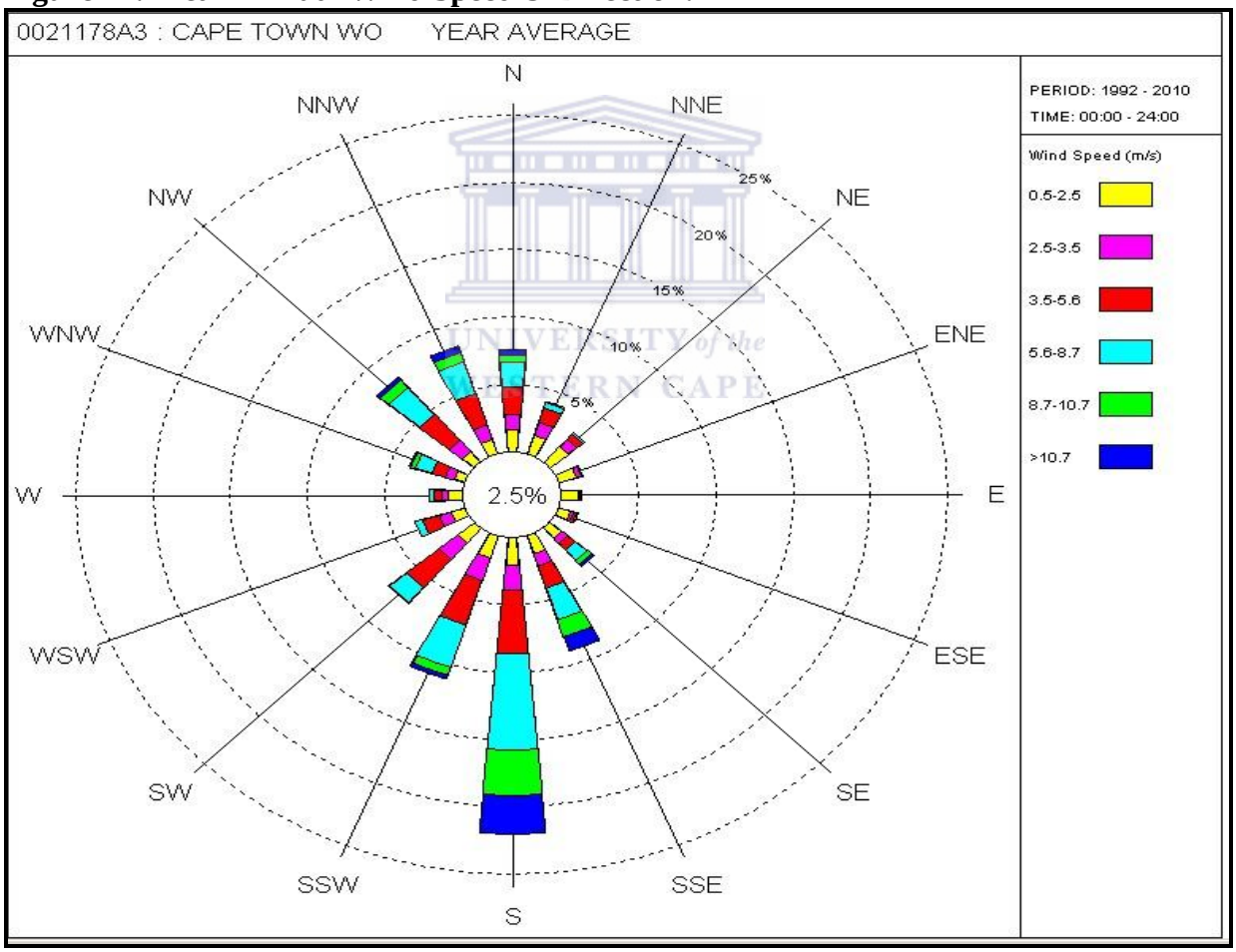

Source: South Africa Weather Service (SAWS).

From Figure 16 above, an analysis of the monthly wind speed and direction in the case study shows that the months of November, December, January and February were the months with the highest wind speeds of over 10.7m/s. The prevailing winds were predominantly the southerlies, with frequent turbulent conditions. The majority of the wind blew over 70% of the time, especially the southerly (S), south southwesterly (SSW), south westerly (SW) and the south southeasterly (SSE). These winds when combined with cold temperatures tend to be very destructive as they transform to gale force winds which bring floods in especially low lying settlements around Cape Town (e.g., Cape Flats Floods; 1994 and 2001). In summer,

they also combine with the high temperatures to exacerbate fire events especially in informal settlements (e.g., Joe Slovo informal settlement fires; 2000, 2004 & 2005). Strong winds therefore pose a grim threat to a majority of the informal settlements on the Cape Flats all year round (e.g., Manenberg wind storms; 1999 and 2000). The months with the lowest wind activities are July and August, with calm northerly (N) winds of about 8m/s. Most of the wind blows about 30% of the time, primarily from the northerly direction and less than 10% of the time from the southerly (S) direction, with less than 5% calm conditions.

To verify the overall wind pattern in Enkanini, the mean annual wind rose for the case study will be analysed to identify the wind trend. It was a cumulative annual mean over an 18 years period (1960-2010) as seen in Figure 17 below.

**Figure 17: Mean Annual Wind Speed & Direction.**




Source: South African Weather Service (SAWS).

From Figure 17 above, the mean annual wind speed and direction indicates the prevalent wind conditions in the case study. From the wind rose, a majority of the wind around Enkanini-Khayelitsha were the southerlies (S). They prevailed more than 60% of the time,

with wind speeds greater than 10.7m/s. The south southwesterly (SSW), south southeasterly (SSE) and the south westerly (SW) also prevailed, though less than 10% of the time. There was likewise an average of 2.5% calm conditions in the entire duration.

Since these winds prevail all through the year, it implies that the residents of Enkanini are also affected all year round. This is primarily because their dwellings are located in high risk areas such as detention ponds and flood plains, which are easily prone to disasters. The combined effect of strong winds and heavy rains can easily lead to flash flooding of their dwellings. Furthermore, strong winds sometimes blow away roofs of unstable dwellings or the entire dwelling (figure 6a), thereby rendering the residents vulnerable to its effects. The effects of wind on the residents of Enkanini were grouped into categories as seen on the wind vulnerability chart on Table 5 below.

### 4.4.3.2 WIND VULNERABILITY

Table 5 below shows the effect of wind on the residents of Enkanini as was provided during data collection. Just like temperature, the effects of wind vulnerability were identified as being encountered all year round though it had peak seasons in the summer months of November, December, January and February.



*Table 5: Wind vulnerability chart.*

| WEATHER ELEMENT | SEASON OF VULNERABILITY | EFFECT ON RESIDENTS |
|---|---|---|
| **Wind** | All Year Round | *Violent Wind Activity:<br>-hot, dry and windy conditions.<br>-blows sand particles into houses and makes them hard to stay clean.<br>-brings uncomfortable hot gusting gale force winds.<br>-brings dust, dirt and other debris into houses.<br>-an agent in spreading shack fires quickly.<br>-blows dirt into eyes, food and makes residents sick.<br>-blows water into houses during winter. |

Source: Author's compilation.

The major complaint of respondents was the effect of hot, dry and windy conditions that blow sand particles into their houses, making it very uncomfortable and and hard to stay inside

during the day. They also complained that during such hot and dry conditions, any shack fires that occur could easily spread to nearby dwellings because of the strong winds and proximity of the shacks to one another. During the wet and cold winter months, the wind also aggravates the intensity of the prevailing weather, for instance blowing cold air and water into their dwellings. All the above variable weather patterns; including temperature, rainfall and wind, have negative effects on the residents of Enkanini. The effects come as challenges on a day to day basis as will be explored in the following section.

## *4.5 CHALLENGES ENCOUNTERED DUE TO VARIABLE WEATHER*

The effects of the aforementioned weather elements (temperature, rainfall & wind) on the inhabitants of Enkanini cannot be over emphasized. This is because from a cross-examination of the elements above, they have been identified to pose a major threat to the residents of Enkanini all year round. From recorded encounters, their living conditions seems to revolve around an endless cycle of challenges all through the year, posed by weather; which they identify as the most challenging, though it comprises an important component of the climatic system. The challenges lie in their vulnerability to these weather elements particularly due to the nature of their construction materials and most especially because of their socio-economic status.



When asked if the weather affected their daily activities, 83 residents, out of the 100 residents that responded to the question answered 'Yes'; that weather affected their daily activities. Overall, they comprised of 83% of those who answered the question. The remaining 17 residents responded 'No'; that weather did not affect their daily activities and they constituted 17% of these respondents. From the above responses, it implies that variable weather activity affects the livelihood of about 83% of the residents while the livelihood of the remaining 17% is less affected.

### 4.5.1 THE RAINY DAYS

This section seeks to explore the most challenging season in the informal settlement. A majority of the respondents in Enkanini describe it as a *"nightmare".* This component is also important because it sheds light on the research question and particularly the second research objective which seeks to examine in detail the challenges encountered with respect to weather threats in the most vulnerable season.

Due to the nature of the observed effect weather has on these residents; a specific question was designed to help the researcher identify the season they faced the most challenges and also to know how vulnerable they were, to the effects of the prevailing weather in that season. In effect, the outcome helped the researcher gain a good understanding about their most challenging season and also to propose suggestions to ameliorate their dilemma to the relevant authorities concerned with addressing such issues.

From their responses, 84 residents who constituted 82% of the overall sample highlighted that their most challenging season was winter while 14 residents who constituted 14% of the total study sample responded that their most challenging season was summer. In line with the obtained responses above about the most challenging season, this study can therefore ascertain that winter is the most challenging season in Enkanini since up to 82% of its residents identified it as the season where all things go wrong in their dwelling and the most challenging to adapt to. As result, the detailed challenges encountered during winter and summer will be examined in the following section in order to understand what the residents go through seasonally. One ward councillor describes it as…

*'an endless cycle of challenges year in, year out'*

and added that…

*'this vicious cycle of challenges could only stop when the relevant city authorities intervene timeously.'*

(Interview with ward councillor of ward 95 Enkanini, 08-10-2011).



#### 4.5.1.1 CHALLENGES DURING WINTER

Winter was identified to be the most challenging season in Enkanini and up to 82% of the respondents complained about its negative effects on their livelihoods. The overall challenges encountered during winter were summarized and categorised into themes as seen in Table 6 below. The observations in each theme highlighted the number of respondents that fell within that category.

*Table 6: Challenges Encountered During Winter.*

| SEASON | CHALLENGES ENCOUNTERED | OBSERVATIONS |
|---|---|---|
| WINTER | -Illness due to cold from excessive rainfall (asthma). | **8** |
| | -Immense battle to keep warm, no money to buy blankets. | **51** |
| | -Flooded and dirty streets. | **4** |
| | -Blown away roofs by strong winds. | **13** |
| | -Inability to do and hang out washing | **10** |
| | -Messy toilets during floods; especially the Mshengu toilets (blue container toilets). | **9** |
| | -Mould spoils food & furniture due to cold from leaky roofs, wet floors and walls after rains. | **7** |
| | | **n=102** |

Source: Author's compilation.

NB: *A majority of the respondents stated that they all knew it was appropriate to buy blankets, duvets, beanies, scarf, gloves, jerseys, umbrellas and to dress warmly during winter but their financial situation was the major predicament with regard this challenge.*



From Table 6 above, the challenge with the highest observation is the 'immense battle to keep warm,' with 51 respondents falling in that category. This is primarily because a majority of the inhabitant's dwellings are constructed from iron sheets and zinc, which allows cold to get into the dwellings easily. Coupled with their low socio-economic status, most of the residents barely have incomes to survive, so they find it extremely difficult to buy blankets, heaters and jerseys to gear-up during winter.

The next most common observation was 'blown away roofs by strong winds,' with 13 respondents falling in the category. This happens because the prevailing winds in the settlement are mostly the southerlies (S), which prevail over 60% of the time. Figure 17 above shows mean annual wind speed and direction. During winter, these winds combine with cold fronts to form very strong gale force winds (greater than 10m/s) which often blow-off roofs of unstable dwellings in the settlement. The inability to hang out washing follows next, which results from excessive rain and cold weather conditions and the absence of

sunlight during the peak of winter. After periods of intense rainfall, toilets also overflow and result in unhygienic conditions. This is also a serious challenge because excessive rainfall floods the toilets and human waste contaminates standing and drinking water around their dwellings. This is particularly bad because children often get sick with gastro-intestinal illnesses when they come in contact with such dirty and contaminated water. The Mshengu toilets (blue container toilets) are particularly described by the residents to be very uncomfortable. They are far from their dwellings, which makes them wet every time they use them during rainy conditions.

Furthermore, some shacks with leaky roofs experience damage to their furniture and beds because their walls and floors are constantly wet. Such cold and damp conditions provoke asthmatic conditions in the elderly and others. Their foodstuff, groceries and clothes also get mould due to the damp conditions of their dwellings during winter.

In all, the winter season is considered the most challenging because of the numerous effects of rainfall, cold, wind and floods to these informal inhabitants who have the least resources to cope with such precarious challenges posed by the weather in Cape Town.

#### 4.5.1.2 CHALLENGES DURING SUMMER



Because a majority of the residents identified winter to be the most challenging season, it would seem convincing that summer will be the time to worry less. This is not the case in Enkanini as was revealed from the responses given by the residents to the researcher, concerning their challenges during summer. Just as was analysed during winter, their comments were summarized and categorised into themes as seen in Table 7 below. The observation in each theme highlights the frequency of responses that fall within that category.

*Table 7: Challenges Encountered During Summer.*

| SEASON | CHALLENGES ENCOUNTERED | OBSERVATIONS |
|---|---|---|
| SUMMER | -Hot sandy and dusty wind blasts into dwellings that also contaminates food. | **19** |
| | -Excessive heat makes dwelling very uncomfortable. | **41** |
| | -Skin burns, dehydration and migraine headache resulting from heat waves. | **18** |
| | -Dwelling fires destroy valuable properties and ID | **9** |
| | -Migraine headaches heat rashes and dust. | **11** |
| | -Better/Okay. | **4** |
| | | **n=102** |

Source: Author's compilation.



From Table 7 above, the challenge with the highest frequency is 'excessive heat makes dwelling uncomfortable,' with 41 observations. This can be related to a similar challenge during winter, which is the 'immense battle to keep warm.' A reason for the discomfort due to excessive heat is primarily because the majority of the dwellings are constructed with iron sheets, zinc, plywood and ceiling boards. These construction materials allow the transfer of heat into the dwellings without any reservation, making them adopt any prevailing environmental weather condition. For example if it is hot outside, it will be hot inside and if it is cold outside, it will be cold inside as well. Again, it should be noted that this challenge is largely related to their socio-economic status which puts them in a position where they cannot afford better housing or insulation.

Another challenge encountered during summer is the constant blast of hot sandy and dusty winds into the dwellings, which often contaminate drinking water and foodstuffs of the residents. They add that this experience as very uncomfortable and it makes them sick as well. Other severe challenges include associated health threats such as skin burns, migraine headaches, heat rashes and dehydration, resulting from heat waves. There are also shack fires that result from paraffin stoves and candles that are usually left unattended. These fires easily spread to neighbouring dwellings with the help of piles of flammable household waste and litter that act as fire bridges between dwellings with the aid of prevailing winds. This

eventually leads to loss of dwellings and valuable property such as ID books which further renders them poor and unemployed. These fires can also occur in winter where they often use paraffin stoves to keep warm.

Comparing the challenges of both seasons, a handful of residents revealed that they preferred summer to winter and that summer is generally better and okay than winter. It was generally observed that the construction materials of their dwellings and their socio-economic status, played a major role in determining the challenges they encountered thereby affecting their adaptation to weather. Therefore if these issues are addressed appropriately, it will go a long way in bridging these challenges in the respective seasons or as need be.

### 4.5.2 EMERGENCY ASSISTANCE

After understanding the degree of the challenges that these residents encounter during respective seasons, it would be appropriate to find out whether they also receive any form of assistance from emergency services. The City of Cape Town's disaster risk management centre and fire & rescue service safety departments provide emergency services to communities that are affected by any disaster within Cape Town. As noted above, the city provides toll free numbers for reporting emergencies.

When asked if the inhabitants of Enkanini receive any emergency services during unusual weather events, 88 residents responded 'No'; that emergency services do not assist them during unusual weather events and they constituted 85% of the entire sample. 16 residents confirmed that they received help from emergency services during unusual weather and they constituted 15% of the total study sample.

This percentage of negative responses raised 'eye brows' and prompted the researcher to probe further in order to understand why this is the case. Also, because of the high level of vulnerability in this informal settlement, it would only be fair for the emergency response services to be ever ready, but this did not seem to be the case. Therefore further questions were asked to investigate if the inhabitants perhaps knew the emergency numbers to call, and the proximity of Telkom pay phones to their dwellings. The following section explores the general knowledge of the residents, concerning their knowledge about emergency assistance in the settlement.

### 4.5.2.1 GENERAL KNOWLEDGE

As a result of the responses given by the residents of Enkanini when asked if they received any help from emergency services during unusual weather events, the researcher opted to probe further and inquire about their general knowledge and understanding about emergency response. The residents were shown a pamphlet from the Disaster Risk Management Centre (DRMC) and asked if they knew the emergency number to call when faced with any weather-related disaster.[33] This time around, 84 residents responded 'No'; that they had never seen the pamphlet before and had never come across such a number. They constituted 82% of the study sample and this indicates that it is likely that the majority the majority of the inhabitants of Enkanini are totally unaware of such emergency services. Although 18 residents confirmed that they knew the emergency number, they constituted only 18% of the study sample which is relatively insignificant, compared to the vast majority that did not know the emergency number.

Similarly, respondents were asked if they knew the emergency number to call when faced with a fire or flood danger. Some 69 residents replied they did not know the number while 33 residents confirmed they knew the number. The 69 residents that did not know the number constituted 68% of the study sample whereas the 33 residents that confirmed they knew the number constituted 32% of the study sample.



From the above analysis, it was clearly evident that a majority of the residents did not know the emergency number to call when faced with either a weather-related, flood or fire danger. This is particularly disturbing to know because the reverse ought to be true in such a disaster-prone settlement. Most of the residents testified that they survived barely from assistance from their neighbours and that the solidarity amongst them is what keeps them going from one season to another. Therefore the City of Cape Town's Disaster Risk Management Centre (DRMC) still has a lot to do, in sensitising these residents about their emergency services, toll free numbers and life safety regulations.

### 4.5.2.2 EARLY WARNING SYSTEMS

An Early Warning System (EWS) is defined by the United Nations-International Strategy for Disaster Reduction (UN-ISDR) as 'the provision of timely and effective information, through identified institutions, that allows for individuals exposed to a hazard to take action to avoid

[33] Interviewees were provided with pamphlets that educated them how to prevent fires and floods, including a toll free number they can call during an emergency.

or reduce their risk and prepare for effective response' (ISDR, 2004: 47). To be effective and complete, an early warning system needs to comprise four interacting elements namely; risk knowledge, monitoring & warning service, dissemination & communication, and response capability. In Enkanini, only the first element is properly assimilated by the inhabitants, since they have well been made aware of how vulnerable their settlement is to weather-related phenomena. An examination of their awareness related to general knowledge about emergency assistance as examined earlier indicated that a vast majority of the inhabitants were not aware of any emergency services they could call on in times of crises.

Respondents were then asked if there are any early warning systems to alert them in an event of unusual weather. Their responses were similar to the previous patterns but only this time, it was extremely skewed. Out of the 102 residents that answered the question, a hundred (100) said that there were no warning systems in place and only two (2) residents indicated that there were warning systems, making the ratio 98% to 2% in this response category.

From the above responses, it can be identified that the last three elements that comprise an early warning system (i.e. monitoring & warning service, dissemination & communication, and response capability) are not effectively implemented in Enkanini. This therefore leaves them at a very great disadvantage and renders them highly vulnerable to the effects of any extreme weather.



#### 4.5.2.3 SELF HELP MOVEMENTS

A careful examination of the challenges encountered in the Enkanini informal settlement highlights that the vulnerability of the residents is primarily related to the nature of their dwellings. Their geographical location (Cape Flats), coupled with the nature of construction materials (zinc, ply wood, iron sheets & ceiling boards) used in building their dwellings exposes the inhabitants to the effects of the prevailing weather. At this juncture, it is imperative to remember that these residents moved to this location by force (i.e. against the will of settlement authorities of the City of Cape Town) and they currently occupy land that was not earmarked for residential purposes. As already indicated, the word Enkanini in IsiXhosa means 'staying here by force' and this depicts how the residents have been moving to the area, to occupy the settlement. Therefore they face threats of eviction, demolition and confiscation of buildings on a regular basis by the city authorities. It is on this front that the

self-help movements in the community set in, to protect victims against further evictions by the city officials.

When asked if there is any self-help movement in the community, 74 residents answered 'Yes' and 28 residents answered 'No'. The proportion that answered 'Yes' constituted 74% of the sampled population while the respondents that answered 'No' constituted 26% of the sample population. This implied that a majority of the residents were aware of these movements in their community. From an interview with the former ward councilor of Zwézwé, some of the self-help movements active in Enkanini include; South African National Civic Organisation (SANCO), AbalaleBasemjondolo (ABM), the Poor People's Alliance (PPA) and the Khayelitsha Development Program (KDP). They all work in the interests of the residents and often capitalize on the Prevention of Illegal Eviction (PIE) Act of 1998. The PIE Act N$^{o}$ 19 of 1998 clearly states 'No one may be evicted from their building, or structure, or have their home demolished without any order of court, made after considering all the relevant circumstances.' According to the ward councilor, 'the Act iterates that a building or structure includes any hut, shack, tent, or similar structure or any other form of temporary or permanent dwelling or shelter,' and that 'the dwellings should not be destroyed without any alternative plan for the residents' (interview with the former ward councillor of Zwézwé, September 17$^{th}$, 2011). Therefore self-help movements play a major role in ensuring the existence of these dwellings and they often decry the lack of basic sanitation and medical services in these settlements. They constantly remind city officials through protests, that they also have the rights to access every service that other city dwellers enjoy, although their focus is on the promises of the government to provide them with better housing and improved support infrastructure.

Despite the above enormous challenges encountered throughout the year in Enkanini, these informal settlement residents are in a constant battle with the variable weather pattern in Cape Town and its effect on their everyday lives. Their adaptation strategies that have been presented in this section show innovation, as they endeavour to transform some of these occurrences into opportunities.

## *4.6 ADAPTATION TO VARIABLE WEATHER*

The variable trend of weather-related episodes that these residents encounter from season to season comes with enormous challenges. Coupled with their socio-economic status, adequate adaptation to such variable weather occurrences is difficult and often impossible. This is

primarily due to economic constraints and inadequate infrastructural support to enable them fully adapt to the vicissitudes of the prevailing weather conditions in the settlement. This section will examine their adaptation status, explore their level of weather forecast understanding and cross-examine the seasonal techniques they employ, to enhance their survival in the settlement.

### 4.6.1 ADAPTATION STATUS

In order to fully comprehend the level of adaptation to the variable weather pattern in Enkanini, the residents were asked how they adapted to any weather-related episode they ever encountered. On an adaptation scale of 1 to 5, with1 representing 'Not Very Well' and 5 representing 'Very Well', they were asked to indicate a category which represented their encounter. The results of their responses can be seen in Table 8 below, which shows that 49 of the residents (58.3%) who answered the question fell under the category of 'Not Very Well'. Twenty-seven 27 residents (32.1%) of the study sample ticked 'Not Well,' which implied that they did not adapt well to the weather episodes they encountered. Only five (5) residents ticked 'Well' and one (1) resident ticked 'Very Well.' This signifies the proportion of residents who adapt well and very well to the prevailing weather episodes in this settlement and together, they constitute 6% and 1% respectively of those who answered the question in the entire study sample.



*Table 8: Level of adaptation to the variable weather pattern.*

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Not Very Well | 49 | 48.0 | 58.3 | 58.3 |
| | Not Well | 27 | 26.5 | 32.1 | 90.5 |
| | Don`t Know | 2 | 2.0 | 2.4 | 92.9 |
| | Well | 5 | 4.9 | 6.0 | 98.8 |
| | Very Well | 1 | 1.0 | 1.2 | 100.0 |
| | Total | 84 | 82.4 | 100.0 | |
| Missing | System | 18 | 17.6 | | |
| Total | | 102 | 100.0 | | |

Source: Author's compilation.

Combining the proportion of residents that ticked 'Not Very Well' (58.3%) and those that ticked 'Not Well' (32.1%), it gives us 90% of those that answered the question that do not

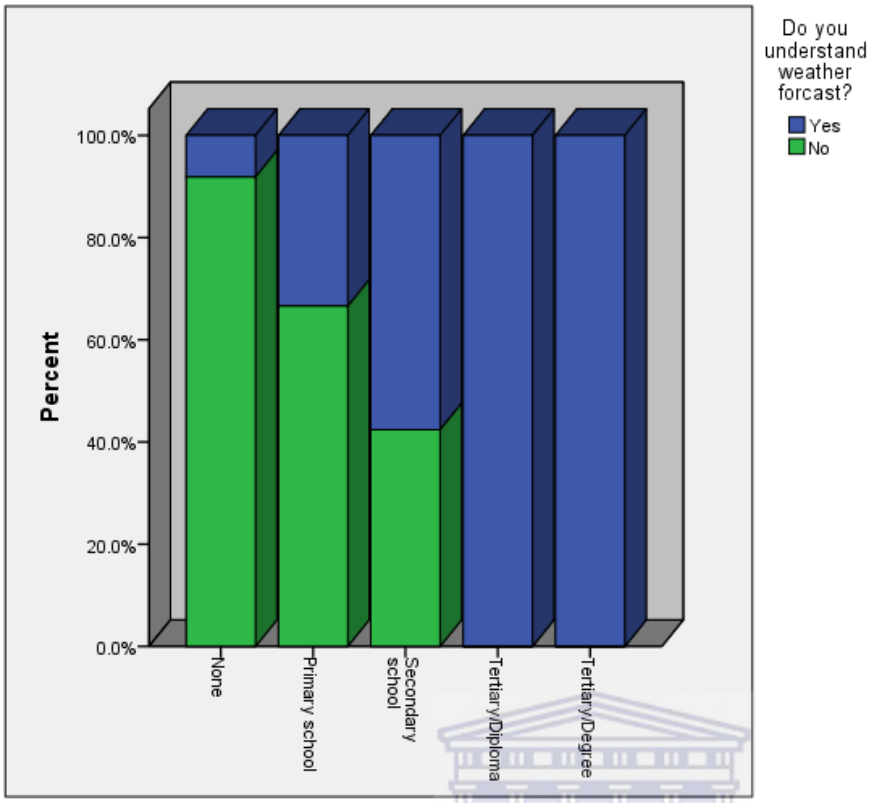
adequately adapt to the weather pattern of Enkanini. In the same vein, the residents that adapt 'Well' (6.0%) and those that adapt 'Very Well' (1.2%) together comprise 7.2% of the entire sample. Whereas the remaining 2.4% of the residents 'Don't Know' how well they adapt to any weather-related episodes. From the above percentages, it becomes very clear that a majority, if not all the residents do not adequately adapt to the prevailing weather conditions in the settlement.

### 4.6.2 MEDIA FORECAST & UNDERSTANDING

The inadequate adaptation status of the residents observed above, and the aims of the study prompted the researcher to ask the residents if seasonal weather patterns affected their daily activities. Out of the 102 residents that answered this question, 85 (85%) of the total sample confirmed that the prevailing weather episodes of the settlement affected their daily activities. The remaining 17 respondents (15%) of the sample indicated that their daily activities were not affected by the prevailing weather in the settlement.

With the weather episodes affecting up to 85% of the respondents, the residents were then asked about their awareness about weather forecasts over the radio, television and the internet, emphasizing if they understood the weather forecasts and how it helped them adapt to the weather. Out of the 102 residents that answered this question, 34 of them confirmed that they understood the forecast whereas the remaining 67 residents indicated that they do not understand the forecasts. They comprised 33% and 67% respectively of the entire population sample of the question. These results indicate that one of their major setbacks to adaptation could be as a result of their inability to fully process weather forecasts and take appropriate action to adapt. To test this hypothesis, their level of education attained was cross-tabulated with weather forecast understanding as seen in Figure 18 below.

**Figure 18: Level of education attained and weather forecast understanding.**




Source: Author's compilation.



From Figure 18 above, it could be identified that the level of weather forecast understanding decreases left wards as one moves from 'Tertiary Degree' to 'None'. It could also be identified that a greater proportion of residents with 'no education' and those who had only completed 'Primary school' education do not understand the forecast, while up to 44% of the residents with 'Secondary school' education do not understand the forecast as well.

Referring to the demographic characteristics of sample (Figure 18 above), it is worthy to remember that the study sample comprised residents with secondary education (56%), primary education (25%) and no education (3%). This therefore confirms why up to 67% of the study sample does not understand forecasts and only 33% does.

### 4.6.3 SEASONAL TECHNIQUES EMPLOYED

Despite the high percentage of respondents who said they did not adapt very well (90.4%), and who said the prevailing weather affected their daily activities (85%) and their inability to understand weather forecast (67%), these vulnerable informal settlement residents continue to use their ingenuity in devising adaptive and survival strategies that enable them to cope in respective seasons. Open ended questions were asked for the residents to pin point some of

the vital techniques they adopted in order to enhance their seasonal adaptation. The responses were later summarized and grouped into seasonal themes, and then sub-categorised, beginning with those with the highest frequency as seen on Table 9 below.

*Table 9: Survival schemes adopted to enhance adaptation.*

| SEASON | TECHNIQUE EMPLOYED |
|---|---|
| WINTER | *Look out for days with extreme rains and strong winds.<br>*Dig trenches and open up culverts at the beginning of winter.<br>*Raise floor levels with sand bags and the dwelling on stilts.<br>*Use metal sheets or sand barriers to divert and hold back water.<br>*Build retaining walls to prevent water from flowing inside dwelling.<br>*Close holes in roof with melted plastic bags or cardboard and put down buckets for leaks.<br>*Make fire in drums (Jerry Bliks) and paraffin stoves in the house to keep warm.<br>*Hang washing around drum fire (Jerry Blik) inside the house at night.<br>*Use newspapers to soak floor water and raise bed on bricks or tin containers to prevent it from getting wet.<br>*Put valuable items on bed as it rains or when water seeps up from the ground.<br>*If severely affected, stay with friends and family who are not affected by floods.<br>*Build away from the road, detention ponds and other water bodies. |
| SUMMER | *Look out for fires during extreme hot days, heat waves and strong winds.<br>*Support dwelling from strong winds with ropes and place heavy rocks or bricks on roof.<br>*Open doors & windows all day long and sleep on the floor since its cool.<br>*Wear less and lighter clothing and go to the beach if too hot.<br>*Bury bottles with water in the ground at night to cool by morning since fridges are scarce.<br>*Apply calcium carbonate on face and arms to reduce sunburn.<br>*Place candle sticks and paraffin stoves away from kids to prevent home fires.<br>*When it's hot, it's hot! Very hard to cope but what can we do! |

Source: Author's compilation.

From the majority of their responses, they indicated that winter is the most challenging season and some of the techniques they devised include digging and opening up culverts before the rains come. When the rain finally comes, they raise their floor levels with sand bags and put their dwellings on stilts to prevent their floors from getting wet. They also use sand barriers and metal sheets to divert and hold back water from getting into their dwellings. Some residents melt plastic bags to close holes in their roofs and use buckets or other containers to collect leaking water. When it gets extremely cold, they make fire in drums (Jerry Bliks) and paraffin stoves in the house to keep warm. They also hang washing around the fire at night due to the absence of washing machines and tumble driers. Some of the residents use newspapers to soak floor water and raise their bed on bricks or tin containers to prevent it from getting wet. In extreme cases, valuable items are placed on the bed when water seeps from the ground and the affected residents usually ask to stay with relatives or friends until the inundation subsides.

During summer, the residents particularly look out for shack fires, heat waves and strong winds. Most of their dwellings are supported from strong winds by ropes and the roofs held down with heavy rocks or bricks. Due to the hot nature of most summer days, they open up their doors and windows all day long and sometimes sleep on the floor since it feels refreshing and cool. When it gets extremely hot, they go to the beach and apply calcium carbonate to their faces and arms to reduce sun burns. As a fire preventive measure, candles are placed on candle sticks and together with stoves, are kept out of reach of children. Matches, lighters and other fire-starting devices are like-wise hidden in higher cupboards where kids cannot reach.

A great deal still needs to be done in improving the level of seasonal adaptation to weather in Enkanini. This is because from the obtained results, up to 90.2% of the residents do not adequately adapt to weather, 85% of the residents confirm that weather affects their daily activities and 67% confirm that they do not understand weather forecasts. Therefore, in order to ensure adequate adaptation, these issues have to be effectively addressed by the relevant city and state departments.

## *4.7 HEALTH, ECONOMIC STATUS AND QUALITY OF LIFE*

Coping with the variable weather pattern in Enkanini requires an understanding of its vulnerable weather, the challenges encountered due to seasonal variation in the weather pattern and the adaptation techniques employed when faced with an unusual weather episode.

But due to the socio-economic status of its residents, their ability to cope with such a variable weather has almost reached its full capacity. In fact, some residents are already close to the brink of their limits to cope with this variable weather pattern, thereby jeopardising their very existence in the settlement. This section will examine the state of their health, their economic status and the quality of life they live, in relation to the seasonal variability of the weather in Enkanini.

### 4.7.1 HEALTH

A major outcome of the challenges to weather variability encountered by the residents of Enkanini was recorded to be ill-health. The state of their health generally becomes critical as they battle with the seasonal challenges of the weather and its accompanied effects. This section will explore the seasonal challenges they encounter, regarding the state of their health, the number of visits they make to the clinics/hospitals, the common illnesses contracted and likewise explore the alternative sources of consultations they make use of.

#### 4.7.1.1 SEASONAL CHALLENGES ENCOUNTERED



As mentioned above, there is a constant struggle with weather-related challenges during respective seasons. Although their most challenging season is winter as seen from the analysis above, the overall effect of their vulnerability is felt in both winter and summer. When asked if the most challenging weather-related episode they encountered had any effect on their health, the following information in Table 10 below was obtained.

*Table 10: Effect of a weather-related episode on your health?*

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Yes | 76 | 80.9 | 80.9 | 80.9 |
| | No | 18 | 19.1 | 19.1 | 100.0 |
| | Total | 94 | 100.0 | 100.0 | |

Source: Author's compilation.

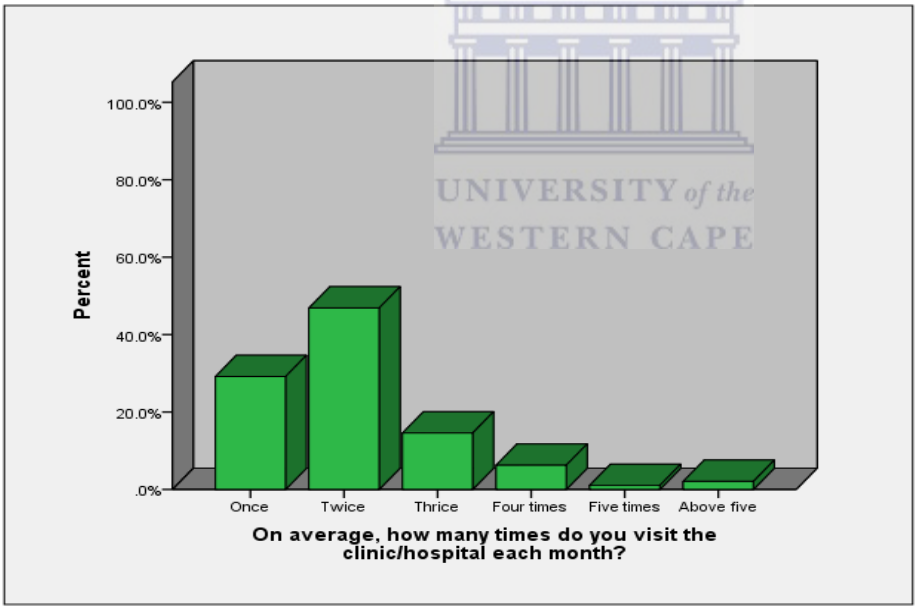
From Table 10 above, out of the 94 residents that responded to the question, 76 of them confirmed that their encounter with a weather-related phenomenon had an effect on their health and they constituted 80.9% of the sample surveyed. The remaining 18 residents

responded that their encounter with a weather-related episode did not have any effect on their health 19.1% of the overall sample surveyed. The obtained results clearly highlight that the health of a majority of the residents is affected by the prevailing weather in the settlement, since approximately 81% of the respondents answered 'Yes' to the question.

### 4.7.1.2 MONTHLY VISITS TO THE CLINIC/HOSPITAL

Because a considerably high proportion of the residents' health (81%) is affected by the prevailing weather encounters in this settlement, it was imperative, to investigate the frequency of their visits to clinics and hospitals[34] around the settlement in order to measure the severity of such an effect. Hence, the residents were asked to indicate the average number of times they visited the clinic/hospital per month. The plotted results can be seen on the bar chart (Figure 19) below.

**Figure 19: Bar Chart showing Monthly visits to the Clinic/Hospital.**




Source: Author's compilation.

Based on the data that was used to plot the bar chart above, out of the 96 respondents that answered the question, 45 of them visited the clinic/hospital at least twice a month, making them 46.9% of the total study sample. Some 28 out of the 96 respondents (29%) of the study sample confirmed that they visited the clinic/hospital only once a month. Meanwhile 14

[34]It should be noted that Khayelitsha does not yet have a hospital with complete healthcare infrastructure for the estimated two million residents, although one is now being built.

respondents (14%) of the study sample indicated that they visited the clinic/hospital at least three times per month. Furthermore, six (6) respondents said that they visited the clinic/hospital at least four times a month, while two (2) respondents indicated that they visited the clinic/hospital more than five times each month and one (1) respondent said that they visited the clinic/hospital five times each month.

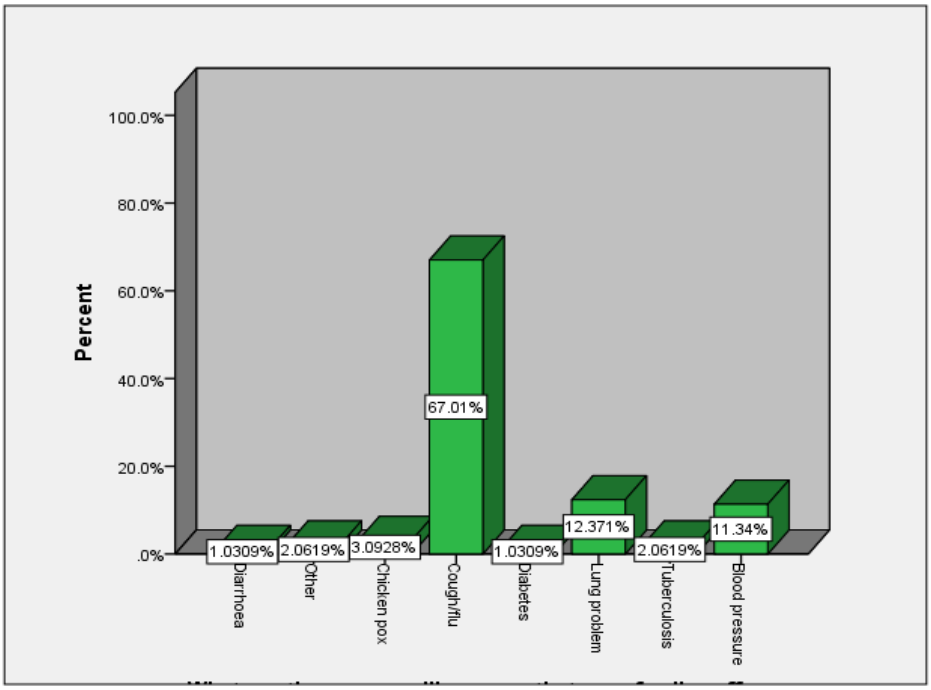
Overall, approximately 72% of the residents visited the clinic/hospitals more than once a month. This could be an indication of their inadequate adaptation to the prevailing weather in the settlement. To ascertain the cause of their regular clinic/hospital visits, they were later on asked to identify the illnesses they frequently suffered from, as shall be examined in the following section.

### 4.7.1.3 COMMON ILLNESSES CONTRACTED

Due to the cumulatively high proportion of more than one clinic/hospital visit per month (72%) in the settlement, the residents were asked to identify the common illnesses that their families suffered from. This was important in order for the researcher to identify whether the illnesses they suffered from were as a result of their inadequate adaptation to the seasonal variation in the weather. The bar chart below highlights the common illnesses they suffer from in relation to the percentage of the sample.



**Figure 20: Bar Chart showing Common illnesses suffered from.**




Source: Author's compilation.

The data that was used to plot the bar chart (Figure 20) above, showed that 65 respondents commonly suffered from cough/flu and they constituted approximately 67% of the entire sample that answered the question. In addition, 12 respondents (12.4%) of the study sample indicated that they commonly suffered from lung problems. Moreover, 11 respondents (11.3%) of the study sample indicated that they commonly suffered from blood pressure problems. Some other common illnesses indicated included; chicken pox, tuberculosis, diabetes and diarrhoea representing 3, 2, 1 and 1 respondents respectively.

From the chart above, it can be identified that a majority of the common illnesses the residents suffer from, are weather-related or linked to their inadequate adaptation to the seasonal variation in the weather of the settlement. Most of them attributed the cough and flu to the dusty, windy and wet conditions that prevail in both winter and summer. Some of them added that the inadequate ventilation in their dwellings, coupled with asbestos contamination from their roofs, was the cause of their lung and tuberculosis problem.

#### 4.7.1.4 ALTERNATIVE SOURCE OF MEDICAL CARE

Despite the presence of a primary health care centre around the settlement, some of the residents believe they can only be treated by naturopathic and traditional healers. They claim that hospitals and clinics are expensive and too far from their dwellings so they prefer to consult the traditional healers who are often nearby. To examine the validity of this assertion, the residents were asked if they made use of the services of traditional healers and the results can be seen on Table 11 below.



*Table 11: Do you make use of the service of traditional healers?*

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Yes | 28 | 29.2 | 29.2 | 29.2 |
| | No | 68 | 70.8 | 70.8 | 100.0 |
| | Total | 96 | 100.0 | 100.0 | |

Source: Author's compilation.

Out of the 96 residents who answered the question, 28 confirmed that they made use of the services of traditional healers while 68 indicated that they do not make use of the services of traditional healers. They constituted 29.2% and 70.8% of the surveyed sample respectively. The obtained results elucidate that only arelatively small proportion of the residents make use

of the services of traditional healers while a greater proportion of them actually go to hospitals and clinics.

### 4.7.2 ECONOMIC STATUS

Residents encounter challenges especially in relation to coping with seasonal weather variability. Their vulnerability to weather becomes of less priority as the fight for adequate housing, a stable employment and a balanced diet dominates their thoughts on a daily basis. In essence, most families worry a lot more about where their next meal will come from, than they worry about the adaptation and challenges they encounter in relation to weather variability. As a result, the economic status of a household to a great extent determines the level of its adaptation to the prevailing weather. Therefore this section will examine the employment status of the residents, their household capacities, and their average monthly income and expenditure. An examination of the above pointers will shed more light on the understanding of the challenges the residents encounter with respect to their vulnerability to the weather in Enkanini.

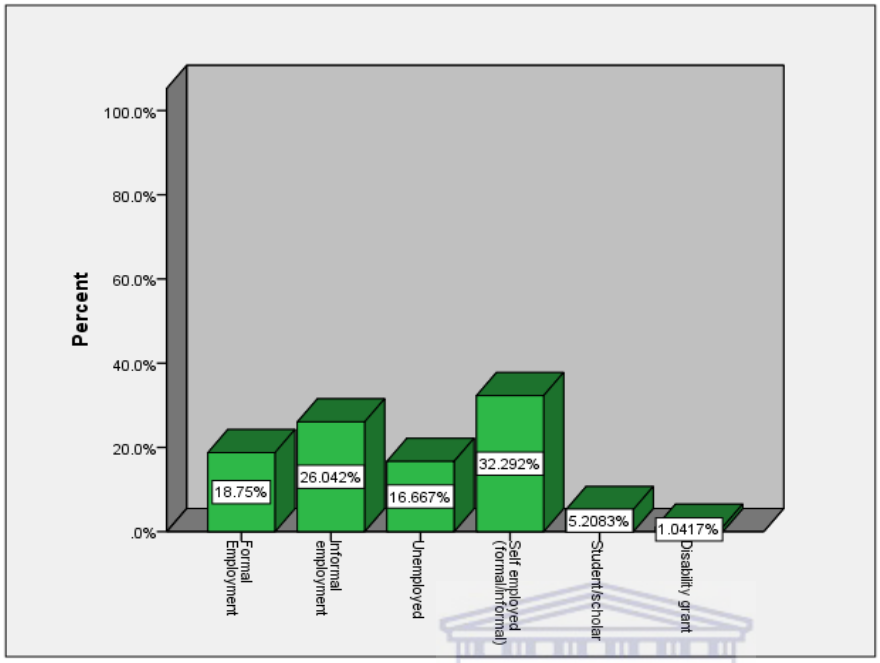
#### 4.7.2.1 EMPLOYMENT STATUS



As a means of securing the necessities of life, most of the residents take any kind of job that comes their way. Coupled to the fact that most of them are unskilled, they regularly get employed in the informal service sector. The women are often employed as domestic workers, cleaners and assistant sales persons in retail outlets. The largest cohort are self-employed and they sell meat, chicken, fruits and vegetables on the street as a form of subsistence, in order to take care of their families. From their responses, the men are either hired temporally or employed in building & construction sites while others get hired as taxi drivers. Those that are self-employed often sell in their Spaza shops or Taverns (Shebeens), which are often located in their houses. It should be noted that a majority of the residents are informally employed and there is no guarantee they can keep their jobs over long periods. Therefore variable and challenging weather only makes things worse for them since they often lack the financial resources to enable them cope with the challenges of the accompanied seasonal variation in the weather. The financial power of any household plays a major role in determining its functionality and survival approaches. Therefore a household with an employed head will inevitably adapt better to seasonal variations than a household with an

unemployed head. The employment status of the residents obtained can be seen in Figure 17 below.

**Figure 21: Employment status.**




Source: Author's compilation.



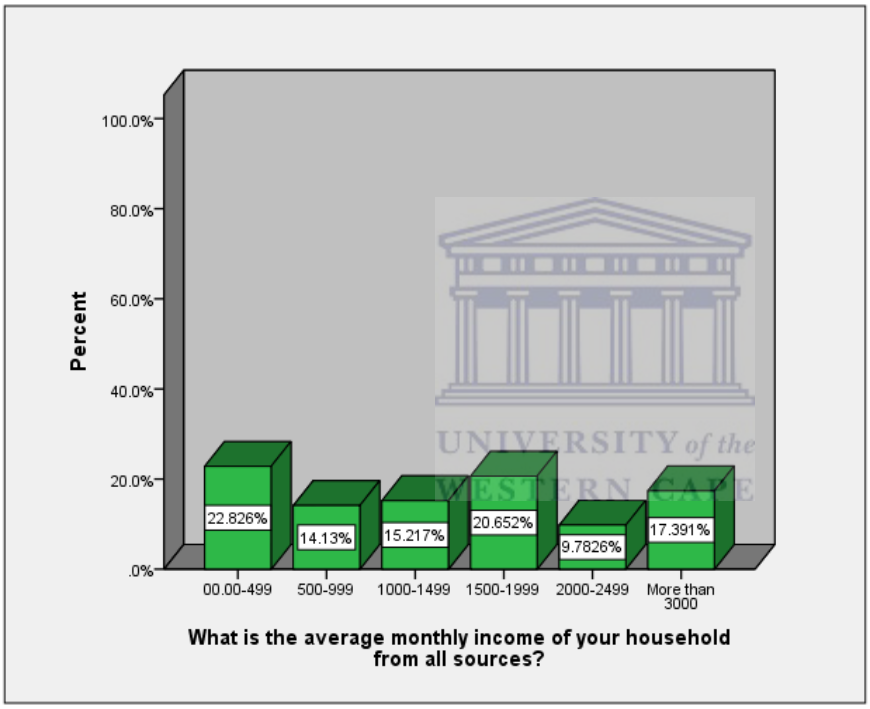
Although some of the respondents indicated that they were uncomfortable with the question, the response was relatively remarkable and 96 respondents answered the question. Based on the data that was used to plot the bar chart above, 31 of the respondents were self-employed in the formal and informal sectors. Some 25 had informal employment while 18 were formally employed. In addition, 16 of the respondents were unemployed whereas five (5) of them were students or scholars with no jobs. Only one (1) respondent was receiving a disability grant. Overall, the respondents with formal employment constituted approximately 19% of the surveyed sample, while those with informal employment constituted 63.3% of the entire sample. The unemployed respondents made up 16.7% of the study sample while 1% constituted the person receiving the disability grant.

Together, the percentage of respondents with informal employment (63.3%) plus the percentage of the unemployed (16.7%) gives 80%. Thus, the majority of the sample was made up of residents who were informally employed or unemployed. This as well could be a major reason for their inability to adequately adapt with the seasonal variability of the weather in Enkanini as incomes are likely to be low.

### 4.7.2.2 AVERAGE MONTHLY INCOME

The income of any household is the major determinant of its sustenance, viability and survival. It is from the household's income that a budget is designated, based on the respective needs of every member of the household. As a result, this becomes an essential proxy in determining the sustainability and survival of any household. Therefore the greater the average monthly income of any household, the better its adaptation whilst the lesser the average monthly income, the less likely its adaptation. The household heads were asked to identify their average monthly income from all sources as shown in Figure 22 below.

**Figure 22: Average monthly household income from all sources.**




Source: Author's compilation.

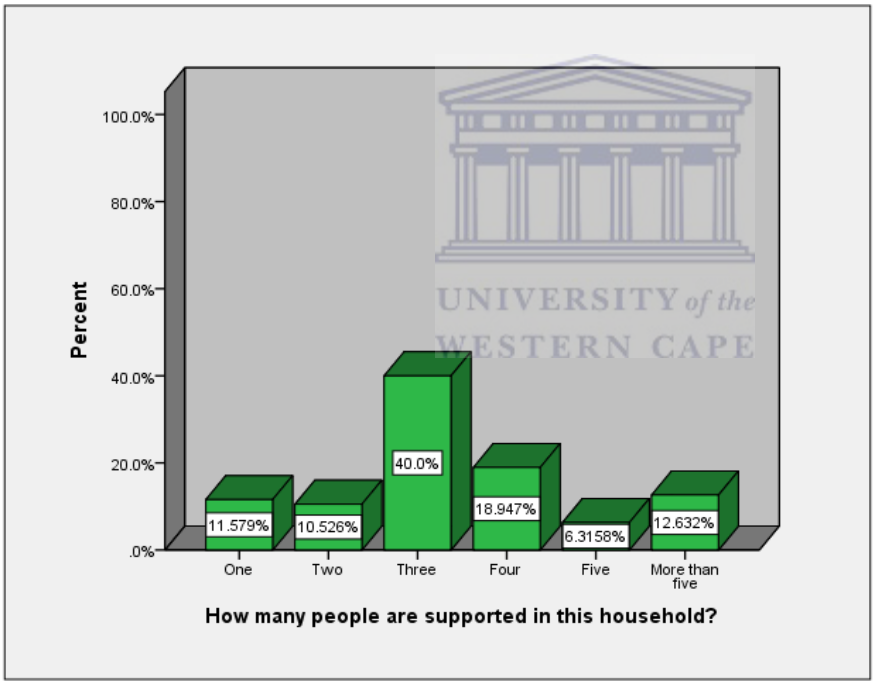
This was also a sensitive question and some of the respondents were hesitant to disclose their average monthly incomes. This reduced the number of respondents that participated in the question to 92, out of 102. Based on the data that was used to plot the bar chart, 16 residents indicated that their average monthly income was more than R3000 and they made up 17.4% of the surveyed sample. The remaining 82.6% of the residents earned less than R3000, with approximately 23% earning less than R500 per month. This clearly demonstrates the high proportion of residents living with limited options, considering their low incomes. Since the nexus between income and survival plays a great role in enhancing the challenges

encountered during unusual weather episodes, this average income scenario sheds more light as to why adaptation to prevailing weather is relatively inadequate in this settlement.

### 4.7.2.3 HOUSEHOLD CAPACITY

The number of people in any household, coupled with their employment status also plays a paramount role in determining their level of adaptation and exposure to seasonal variation in the weather pattern of any settlement. For instance, the cost of adaptation in a household with one person will be less than that for a household with more than one person. A question was designed to document the number of people each household supported and the results were plotted in Figure 23 below.

**Figure 23: Number of people supported in a household.**




Source: Author's compilation.

Based on the concrete data that was used to plot the bar chart (Figure 23) above, thirty-eight (38) households that answered the question supported three people and they made up 40% of the surveyed sample. Eighteen (18) households (19%) supported four, while twelve (12) households (13%) supported more than five people. Eleven (11) households (12%) had only one person in them. Lastly, ten (10) households (11%) supported two people while the remaining six (6) households (6%) supported 5 people.

Mindful of the fact that a majority of the dwellings are made up of less than three bedrooms, it can be deduced that approximately 77.8% of the dwellings support more than two persons and only approximately 22.2% of the dwellings support less than two persons. In effect, coupled with their high percentage of informal employment and unemployment (80%) as was shown above, it is even more difficult for them to adequately adapt to the dynamic weather pattern in the settlement due to their dire need to address other pressing social demands.

### 4.7.2.4 AVERAGE MONTHLY EXPENDITURE

With their average household incomes obtained, each household was later asked how much they spent per month on rent/bills, health, education, food/nutrition, transportation, recreation/leisure and on weather related occurrences. The obtained figures were computed and used to determine their mean monthly expenditures as seen on the Table 12 below.



*Table 12: Mean Monthly Expenditure.*

| | | | Statistic | Std. Error |
|---|---|---|---|---|
| On average, how much do you spend per month on the following? | Mean | | 1713.27 | 135.532 |
| | 95% Confidence Interval for Mean | Lower Bound | 1441.55 | |
| | | Upper Bound | 1985.00 | |
| | 5% Trimmed Mean | | 1657.53 | |
| | Median | | 1450.00 | |
| | Variance | | 1010294.498 | |
| | Std. Deviation | | 1005.134 | |
| | Minimum | | 0 | |
| | Maximum | | 4300 | |
| | Range | | 4300 | |
| | Interquartile Range | | 1150 | |
| | Skewness | | .902 | .322 |
| | Kurtosis | | .366 | .634 |

a. Unless otherwise noted, bootstrap results are based on 1000 bootstrap samples

Source: Author's compilation.

Results from Table 12 above showed that the minimum monthly expenditure was R0, which indicated that every resident spent an amount each month. On the other hand, the maximum monthly expenditure was R4,300, with a standard deviation of 1005.134. The average monthly expenditure of R1,713.27 depicts the expenditure of the residents, relative to their monthly incomes in a combination of the categories above.

## 4.7.3 QUALITY OF LIFE

Just like health and economic status, the quality of life of the residents of Enkanini is equally important in understanding their adaptation to the challenges of variable weather in the settlement. The quality of life includes their internal living space, recreational facilities, livelihood & security, and emergency & safety responses (SOS) in the settlement. All these pointers will be cross examined in the following sections in order to get a clear picture regarding these aspects of quality of life in the settlement.

### 4.7.3.1 INTERNAL LIVING SPACE

This embodies the entire interior of the dwelling, including its size. Some of the dwellings are noted to be very small and inadequately ventilated, often covered with patchy roofs that let in rain water during the rainy season and sunlight during summer. In that regard, the residents were asked if they found their internal living spaces satisfactory in terms of weather-related threats. The obtained results can be seen in the Table 13 below.

*Table 13: Do you find your internal living space satisfactory in terms of weather-related threats?*

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Yes | 38 | 39.6 | 39.6 | 39.6 |
| | No | 58 | 60.4 | 60.4 | 100.0 |
| | Total | 96 | 100.0 | 100.0 | |

Source: Author's compilation.

Out of the 96 residents that answered the question, 38 (39.6%) of them confirmed that they found their internal living spaces satisfactory in terms of weather-related threats. The remaining 58 (60.4%) residents indicated that they did not find their internal living spaces satisfactory in terms of weather threats. This primarily because a majority of their dwellings are constructed with iron sheets, zinc, plywood, plank and ceiling boards which cannot fully protect them during periods of unusual weather.

### 4.7.3.2 RECREATIONAL FACILITIES

The need to do something for recreation is an essential element of human biology and psychology. Recreational facilities are often equipped with activities for amusement, pleasure or enjoyment and are generally considered to be fun. Leisure and recreation forms part of a healthy lifestyle in every community and facilities should be part of any community irrespective of its location. The residents of Enkanini, were asked if there are any recreational facilities in their community.

Out of the 95 respondents that answered the question, 31(32.6%) of them confirmed that there were recreational facilities in the settlement. The remaining 64 (67.4%) respondents of the study sample indicated that there were no recreationaal facilities in the settlement. Figure 24(a) shows children playing in a Retention Pond which is the only

**Figure 24: Recreational facilities in Enkanini.**


(a)

(b)

Source: Author's Photograph (2011-02-21).

playground they have. Adults spend more time in Shebeens and a common indoor activity that helps them relax is Pool, as seen in Figure 24(b).

One of the respondents who said that there were no recreational facilities in the settlement added that 'there are no public spaces where our kids can play' and that 'kids and the youths cannot play in school playgrouds because they are often locked after school hours,' 'so our kids resort to playing on the road, which is dangerous' (Interview with anonymous resident, 18th October, 2011). Another one also pointed out that 'the closest public recreational facility is the Khayelitsha sports complex located in Site B which is too far for us and our kids' ( Interview with informant, 20th October, 2011). Despite the lack of

facilities, they indicated that recreational facilities are good because they help keep their youths away from crime activities and also promote talents, and that the government should constuct more playgrounds as a matter of urgency.

#### 4.7.3.3 LIVELIHOOD

The livelihood and security of residents, which is largely based on the degree of protection against danger, damage, loss and crime in the settlement, is mainly in the hands of the South African Police Service (SAPS) officials. 'Due to the nature of the settlement's location, the response time of the Police has been noted to take longer than stipulated.' (comment from a street committee member, 8th October, 2011). With this situation in hand, ward councillors have set up street security committees that attend to any security issues before the police arrive.

#### 4.7.3.4 SECURITY

The residents were asked if they feel safe and secure in and around the community of Enkanini. Out of the 95 residents that answered the question, 38 confirmed that they felt safe and secure in the community and they constituted 40% of the sampled population. The remaining 57 residents (60%) of the sampled population indicated that they did not feel safe and secure in the community. Overall, a majority of the residents had issues about the safety and security of the settlement and in their view, concluded it was not secure. In terms of human security and their vulnerability to weather patterns, as well as their precarious employment and financial situations, it introduces another level of insecurity in their lives. More so, the lack of knowledge about who to call in case of an emergency also increased their level of insecurity in the settlement.

#### 4.7.3.5 EMERGENCY AND SAFETY RESPONSES (SOS)

Emergency and safety responses largely determine the degree of safety and security in the settlement both from a human and a natural perspective. Since the majority of the residents in Enkanini (60%) indicated that they did not feel safe and secure, another question was asked about their awareness on emergency procedures and numbers to call. Just as was the case during the inquiry about safety, they were shown a pamphlet and asked if they can

identify with the emergency procedures and the number to call when faced with any weather-related disaster. The results can be seen on the Table 14 below.

*Table 14: Do you know the emergency numbers to call when faced with any weather- related disaster?*

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Yes | 18 | 18 | 18 | 18.9 |
| | No | 84 | 82 | 82. | 100.0 |
| | Total | 102 | 100.0 | 100.0 | |

Source: Author's compilation.

From Table 14 above, out of the 102 residents that responded to the question, 18 identified with the emergency procedures and the number to call in an event of a weather-related danger and they constituted 18% of the study sample. The remaining 84 did not identify with the emergency procedure and number to call, when faced with any weather-related disaster and they constituted 82% of the entire study sample.

The respondents were later asked who came to their rescue, as a safety response when they encountered any weather-related disaster. Their responses can be summarised that 'the Fire & Rescue Services and the Disaster Risk Management Centre's response teams always arrived late' (interview with a fire committee member, 17th October, 2011). This fire committee member added that the solidarity amongst the residents themselves is a major binding force and that relatives and neighbours rapidly intervene in any disaster even before the City officials arrive. He also mentioned that the ward councillor or a street committee member is the one who calls the Fire & Rescue Services or Disaster Risk Management officials in an event of any disaster. Lastly, he testified that most of them had never seen the pamphlets anywhere around the settlement and that the City of Cape Town should not wait until a weather disaster happens before it assists them but it should try and salvage them from their poor living conditions before it gets too late.



## *4.8 SUMMARY OF FINDINGS*

Based on the analysed data, a plethora of findings emerged from the results. Some confirming existing concepts and a new, bringing to light, the actual scenarios encountered such as the rudimentary survival techniques adopted by the informal settlement residents in a bid to survive, which all adds to the bliss of the ethnographic inquiry procedures adopted for this

research. Out of the myriad of analysed results, some of the main findings cut across such concepts as poverty & nature of housing, global warming & climate change, adaptation and vulnerability; as have been summarised below.

First and very crucial is the result of the housing backlog in Cape Town. Empirical evidence confirm that the South African constitution grants all of its citizens the right to adequate housing and basic services. But ironically, the government's efforts have fallen short in delivering housing subsidies and adequate housing especially to the urban poor. The study found that the housing backlog in the Western Cape is approximately 400,000, with most of the urban poor, living in slum conditions. As a means to survive, most of the low income residents have resorted to the risky and insecure form of housing erected in informal settlements with low rental rates and a minimum service charge. In Enkanini particularly, the analysed results showed that 90% of the dwellings emerged as a result of the housing backlog and shortage of affordable housing in Cape Town. More than 52% of the dwellings surveyed did not conform to the city of Cape Town's Disaster Risk Management Centre and Fire & Rescue regulations since a majority of them used iron sheets and zinc as major construction materials.

Global warming and climate change have been grouped together for the sake of this summary though they were analysed separately. The concepts are of paramount importance because research findings from the Intergovernmental Panel for Climate Change (IPCC) confirmed the earth's warming of about 0.6$^{o}$C over the past century (IPCC, 2007: 872). These projections have been consistent with the overall projections for Cape Town which suggests that it is likely to get warmer and drier than it currently is. More so, analysed results of findings from temperature and rainfall data over Cape Town for the past fifty years (1960-2010), confirmed that the very warm days have become warmer and occurred a lot more frequently in the last two decades, particularly in January, April and August. Results from the rainfall data also found a minor shift for late May, which recorded rainfall amounts that were higher than usual whereas the rainfall totals in July and August were not as high as they were, five decades ago. Findings from the analysed results of these two weather elements confirmed the effects of global warming and climate change over Cape Town, in conjunction with the projections over subtropical South Africa as highlighted by Kruger and Shongwe, 2004.

Challenges, adaptation and vulnerability were all intrinsically related to the economic status of the residents. Findings from the analysed results showed that 82% of the surveyed residents confirmed that their most challenging season was winter, with their most

challenging encounter being the immense battle to keep warm. Results from their opinions regarding emergency assistance during a weather-related flood or fire incident indicated that 82% of the residents did not know the emergency number to call. This emerged as a major setback to their challenge and it was particularly disturbing because the reverse ought to be the case in such a disaster-prone settlement.

With regards to adaptation, more than 80% of the respondents stated that they knew it was appropriate to keep warm during winter and to avoid extreme hot conditions during summer but they lacked the financial capacity to carry them through, during such tough times. In essence, they were more concerned about getting out of the poverty cycle that has trapped and prevented them from adequately adapting to the variable weather pattern of Enkanini.

Their vulnerability also has grave effects on their health and quality of life which was found to be mainly as a result of their economic status. Results confirmed that approximately 81% of the residents complained about the effect of the variable weather on their health. Adding to that, 72% of the residents indicated that they visited the hospital more than twice each month and 67% of them suffered from coughs and flu which resulted from their vulnerability to the prevailing weather conditions.

Regarding their quality of life, 60.4% were dissatisfied with their internal living spaces, complaining that they were too small. About 67.5% of the residents also added that there were no recreational facilities for leisure in the settlement. About 61% of all the residents stated that they preferred living in the community and they termed it a ‘mixed blessing’, due to the solidarity of their relatives and neighbours. As a general remark, a majority of them recommended that the City of Cape Town or the government should provide them with jobs in order to reduce the crime in the settlement whilst making plans to relocate them to areas with better housing and adequate service delivery, since they have been waiting for too long.

# CHAPTER V

# CONCLUSION AND RECOMMENDATIONS

## *5.1 INTRODUCTION*

This study was instigated by the desire to investigate the challenges encountered by informal settlement residents with respect to weather vulnerability by understanding the coping mechanisms and adaptive strategies they improvised during unusual weather episodes. It particularly focussed on three prevailing weather elements and the nature of housing in the case study (Enkanini). The weather elements included temperature, rainfall and wind which had been identified to be the elements with the most severe repercussions to the livelihood of the inhabitants of the Enkanini informal settlement in Khayelitsha, Cape Town. The nature of their housing was also assessed based on the City's regulations and the construction materials used, as stipulated by the City of Cape Town.

Field observation and inquiry by the researcher brought to light the fact that the vulnerability of the residents to weather was largely as a result of the nature of their housing. Findings from the analysed results revealed that most of the dwellings did not conform to the City of Cape Town's building regulations and a majority of the construction materials used was mainly iron sheets and zinc.

The study employed both a qualitative and a quantitative research design and ethnography was the principal methodology used for inquiry whereas the case study design was the supplementary method applied in collecting the qualitative and the quantitative data. There was also an extensive review of literature on informal housing, weather variability & adaptation, global warming & coping mechanisms, climate change and vulnerability, all in perspective to survival in urban poor communities around the world. The main findings brought to light a clearer scenario regarding the nature of housing in Enkanini which indicated that up to 52% of the dwellings did not conform to the City of Cape Town's Disaster Risk Management Centre and Fire & Rescue Services regulations. The reasons for non-conformity, beginning with the most recurrent included; 'spaces between the dwellings,' 'drainage pattern of the settlement,' 'location of dwelling relative to detention ponds' and 'ignorance of fire preventive measures' as seen on Table 1 above. There were also the

construction materials used, which indicated that up to 60% of the dwellings were made from iron sheets and zinc, which rendered the residents more vulnerable to the prevailing weather elements particularly during winter. A summary of the salient points that emanated from the results will be discussed in the following section.

The Risk-Hazard (RH) and the Pressure and Release (PAR) models used in the theoretical assessment greatly assisted with clarity to the dynamics of vulnerability's double structure and shaping its analysis. It also helped the study not to only focus on social vulnerability aspects but also highlighted that recovery and mitigation should target both the physical hazard and the socio-economic and political circumstances of a community, if any change is needed. Overall, the Pressure and Release Model was found to be of relevance to this study. Its analysis could help in shedding light especially in addressing environmental conditions that deteriorate with the increasing frequency of weather-related episodes in Enkanini.



## *5.2 CONCLUSIONS*

Based on the research inquiry and from analysed results, conclusions were drawn from the four fundamental themes that were identified throughout these procedures. They include the trend of weather elements that were analysed, the nature of housing, seasonal challenges encountered and the adaptation strategies employed by the informal settlement residents of Enkanini. A conclusive summary of the respective themes will be discussed in the following sections.

### 5.2.1 WEATHER ELEMENTS

Grounded on climate projections and simulation models, an extensive cross examination of climate change and weather patterns in the literature review section above indicated that global climate change is now undisputed. As has been mentioned in the previous chapter, the key weather elements that were analysed in this study included temperature, rainfall and wind. They were identified based on the negative effects they have to the livelihood of the residents in Enkanini and the following findings were recorded:

The overall observed temperature trends over subtropical South Africa were found to follow the trend of the simulated models for Africa. The models projected that the warming

of Africa is likely to get higher than the global annual mean warming of 0.6 $^{0}$C. It also added that the coastal regions of South Africa will warm by around 1-2 $^{o}$C by the year 2050 and 3-4 $^{o}$C by the year 2100 (Kruger and Shongwe, 2004; Kruger et al., 2010).

Since Cape Town falls within the coastal regions of South Africa, a fifty (50) years temperature data (1960-2010) for the case study was plotted to examine the trend. Graphical observations from the plotted data indicated a slow but steady increase in the mean annual temperature over the past five decades. The observed increasing pattern corresponds with the simulated models thereby confirming that Cape Town is getting warmer than it used to be in the past. Furthermore, an observation of individual monthly trends also indicated that the very warm days have become warmer and have occurred a lot frequently in the last two decades, particularly in January, April and August. Therefore, with these projections falling in place, attention should particularly be paid in vulnerable communities such as Enkanini, which have been identified by experts to be the most vulnerable and the ones who will suffer the most, to the effects of an increasing temperature.

Similarly, the global distribution pattern of rainfall is slowly being affected due to global warming as it causes delays in some parts of the globe and an early arrival in others. The distribution of mean annual rainfall in South Africa was identified to be un-uniformly decreasing westwards to the interior plateau. Moreover, recent reports reveal that about 35% of South Africa receives less than 300mm of rainfall per annum due to an increase in the predominant subsiding air masses over the region. Worst still, the fourth assessment report of the Intergovernmental Panel on Climate Change indicated that the rainfall amounts are likely to decrease over the winter rainfall region with a drier summer rainfall region in the Western margin of South Africa. In line with the predicted scenario, the analysed rainfall totals have been observed to be decreasing steadily since 1996, though there was an increase in 2007 but it has continued to decrease steadily till date. Since rainfall is such a difficult weather parameter to analyse for trends due to a high degree of inter-annual variability, a single extreme event can result to a misleading conclusion. Therefore note should be taken that though a shift in the rainfall pattern has been identified, the intensity of rainfall has not changed much. Consequently, the effect of rainfall in Enkanini is often devastating because of its elevation (height above sea level). Since the settlement is located approximately 10m above sea level, any form of rainfall eventually leads to flooding, because the water table is relatively close to the ground surface.

As observed from the analysis section above, the winds have not registered any significant change, unlike temperature and rainfall. This is explained by the differential

heating between the equator and the poles (Coriolis Effect) and the rotation of the earth. In the Western and Southern interiors of South Africa, extra-tropical cyclones play a dominant role in the wind pattern all year round. The predominant winds that were identified in Enkanini are the Southerlies, which prevail more than 60% of the time, with speeds greater than 10.7m/s. The combined effect of these very strong Berg and Gale force winds sometimes combine with heavy rains and often lead to flash flooding in the settlement. During the hot summer months, the wind acts as a transfer agent in spreading shack fires as well. Occasionally, strong and violent wind activity blow roofs of unstable dwellings away, rendering them more vulnerable to health crises and other environmental problems.

### 5.2.2 NATURE OF HOUSING

It was identified that due to the soaring rate of the housing backlog in Cape Town of over 400,000 houses, the number of informal settlements increased as well to over 98,031; as per the 2005 informal settlement count indicated in the literature review (City of Cape Town, 2006). Since most of these informal settlements are located on land that has not yet been surveyed or proclaimed as residential, the city council designed some regulations that the dwellings must conform to, in order to help protect the residents during cases of unusual weather episodes. The city emphasized on 'conformity to the regulations' and 'construction material used' as the bases they must adhere to, before building the dwellings.



As detailed in the analysis section above, the regulations that were set for conformity include space between the dwellings, the drainage pattern of the surrounding area, its location relative to detention ponds, a plan for the dwelling and lastly a fire preventive measure in the house hold. Ironically, up to 52% of the dwellings did not conform to these housing regulations since the shacks are erected without any of these considerations in mind.

Likewise, the predominant construction material used in Enkanini was iron sheets/zinc, followed by plywood, ceiling boards and plastic bags. Up to 96% of dwellings in the settlement were made of these construction materials. Very few dwellings used bricks, stones and blocks for their construction and they constituted just 4% of the dwellings in the entire Enkanini. Again, the residents use the very basic construction materials they can afford since they claim they have very low incomes and less privileged.

Despite efforts by the Disaster Risk Management Centre and the Fire & Rescue Services departments of the City of Cape Town to bridge the gap between nature of housing

and weather-related vulnerability, it seems their effort is wasted since a large majority of these dwellings do not conform to their standards and are mostly constructed with rudimentary materials. This dire situation with such an endless recurrence highlights the need for an office that will flexibly reconcile the city requirements with the actual ground scenarios.

On the contrary, this study also reveals the discrepancy between the city projects and the actual dissemination of information. For instance, most of the residents denied they never access to the pamphlets of the winter readiness program or the pamphlet on tips about protecting their dwellings from fires. So it is on the researcher's opinion that specific task teams should be trained and sent to these informal settlements to adequately disseminate the vital information at the beginning every new season.

### 5.2.3 CHALLENGES ENCOUNTERED

The effects of a changing climate bring enormous challenges to our planet. Individuals that are severely affected are people with the least resource to cope with its effects. This phrase is particularly true in Enkanini which is an informal settlement occupied mostly by the low income residents of Cape Town. The analysed results show that these residents are faced with challenges all through the year although the winter season was highlighted by 82% of the surveyed sample to be the most challenging season. The challenge with the most frequent observation is the 'immense battle to keep warm' during winter. Most of the residents added that they knew it was appropriate to dress warmly during winter and to stay indoors during heavy thunder storms but they lacked the financial capacity to do so and that there were no support systems in place for them to rely on.

On the other hand, during summer the challenge they encounter the most is dealing with the heat, dehydration and shack fires that often end up ravaging multiple dwellings. Again, they complained of improper systems in place to deal with such challenges. For instance, one resident complained that most often, before the fire engine arrives, it is too late and the fires are usually put out by street committee members who volunteer to do it. Again, the Disaster Risk Management Centre and Fire & Rescue Services should re-evaluate their rescue and intervention procedures and come up with new strategies and projects that entail community engagement or train personnel from such communities to be able to intervene during such crises before they arrive. It also highlights the need for an office in informal

settlements which will flexibly and timeously address such needs without compromising their welfare.

### 5.2.4 ADAPTATION TECHNIQUES & COPING MECHANISMS

Due to the enormous challenges encountered by the residents of Enkanini, most of them have devised adaptation techniques to help them moderate the impacts of such threatening seasonal weather episodes that prevail in the settlement in order to cope with its consequences. It was however identified that their adaptation capabilities had a direct relation to their socio-economic status. Findings from responses about their adaptation status reveal that 90.4% of the sampled population 'do not adapt very well' and only 7.2% 'adapt well' whilst 2.4% 'don't know' their adaptation status. With such a feedback, it was realised that the acquisition of adequate adaptation to such a variable weather pattern is farfetched. As identified in the study, a possible reason for such a gap was the absence of an adequate infrastructural support system to enable informal settlement residents fully adapt to the vicissitudes of the prevailing weather in this settlement.

Notwithstanding, some of the adaptation techniques improvised during winter include: raising floor levels with sand bags, raising furniture on bricks, digging trenches to divert rain water, building retention walls around houses, making fires in drums inside the house and hanging washed clothes around them. During summer their improvised techniques include: supporting roof from wind with bricks and ropes and opening doors/windows all day long, for fresh air. It should be noted that most of them are already close to the limits of their coping capacities and key efforts aimed at addressing these burning issues needs to take immediate effect in order to enhance their survival. Therefore, the relevant government departments should step in and complement the adaptation techniques adopted by these informal settlement residents. For instance creating employment opportunities or re-locating them to proper housing communities with adequate services to enhance their survival. Furthermore, the city council should adopt practical solutions such as cleaning of gutters at the beginning of every winter season and also assist in clearing existing culverts that get clogged with domestic waste all year round.

Cape Town's weather is changing and the most severely affected Capetonians are those living in informal settlements, particularly those located on the Cape Flats such as Enkanini. The average temperatures are slowly increasing; the rainfall totals are slowly decreasing although the wind pattern has not recorded any significant change. Most of the

dwellings in the case study do not conform to the city's housing regulations and their predominant construction material is iron sheet and zinc.

Therefore if change is expected in Enkanini, the issue that will need prioritisation has to be capacity building, where the local authorities will fully understand the mechanisms to utilise. For instance, access to quality housing and basic services should not be perceived as a privilege that benefits just few people but the rightful expectation of all South African citizens. The following suggestions that were highlighted during the 'Housing Local Government Conference' of 2003 should be enforced since they have not been implemented since then:

- '…Corrugated iron houses and wooden shacks should all be eradicated and the department of housing must start focusing on People Houses Processes (PHP's), in order for the community to take ownership of its own housing projects.
- The development and communication of policy should be improved and strengthened.
- The housing department should have regular updates on policy and workshops to discuss changes in policy to ensure that the local government in Khayelitsha fully understands them.'[35]

Worthy of note is that the eighteenth anniversary of freedom is still perceived as meaningless to most of the informal settlement residents in Enkanini. But if the housing problem is adequately addressed, it will improve their dispositions and boost their esteem. By design, it might moderate the challenges they encounter with regards to weather vulnerability and render them less susceptible to the effects of the prevailing weather, thereby reducing their vulnerability and ensuring a better adaptation in the community.

In all, the results reflected a disconnection between conformity of dwellings, the City's Disaster Risk Management Centre and Fire & Rescue safety regulations and suitable implementation measures, which are the core components that should underpin effective coping & adaptation strategies in Enkanini.

## *5.3 RECOMMENDATIONS FOR FURTHER RESEARCH*

This section highlights prospective research areas that arose in the course of the research inquiry, from consultations with experts and other spheres which were primarily considered to be beyond the scope of this study. Firstly, the researcher is of the opinion that a similar study which samples several other informal settlements in Cape Town be investigated at a

[35] City of Cape Town, 2011 as cited in the Western Cape Housing in Local government Conference 2010.

doctoral level before adequate conclusions could be made about the vulnerability of informal settlement residents to weather in Cape Town. This is because it is assumed that residents devise particular coping mechanisms and adaptation strategies since they experience objectively similar challenges to weather vulnerability. At a national level, such a study could include the Soweto in Johannesburg, Khayelitsha in Cape Town and Mdantsane in East London and the results could then be triangulated to identify particular trends which could help the Department of Environmental Affairs and the Department of Housing in policy formulation and decision making.

Furthermore, since over 81% of the residents' health is being affected by the prevailing weather in Enkanini, the researcher thinks there is also a need for another research study titled 'Health Challenges and Vulnerability to Weather in an Informal Settlement: a case study of Enkanini in Cape Town' in order to properly comprehend the health dilemma of the residents.

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## *APPENDIX 1: UWC Thesis registration and ethics clearance form.*

SR1

# UNIVERSITY *of the* WESTERN CAPE

**DEPARTMENT OF RESEARCH DEVELOPMENT**

**UWC RESEARCH PROJECT REGISTRATION AND ETHICS CLEARANCE APPLICATION FORM**

This application will be considered by UWC Faculty Board Research and Ethics Committees, then by the UWC Senate Research Committee, which may also consult outsiders on ethics questions, or consult the UWC ethics subcommittees, before registration of the project and clearance of the ethics. No project should proceed before project registration and ethical clearance has been granted.

| **A. PARTICULARS OF INDIVIDUAL APPLICANT** | | |
|---|---|---|
| NAME: Agbor Tabi Kris | TITLE: Mr. | |
| DEPARTMENT: Geography & Environmental Studies. | FACULTY: ARTS | |
| FIELD OF STUDY: Environmental Studies. | | |
| ARE YOU: | | |
| A member of UWC academic staff? | Yes ☐ | No **N** |
| A member of UWC support staff? | Yes ☐ | No **N** |
| A registered UWC student? | Yes **Y** | No ☐ |
| From outside UWC, wishing to research at or with UWC? | Yes ☐ | No **N** |

| **B. PARTICULARS OF PROJECT** |
|---|
| PROJECT NUMBER: TO BE ALLOCATED BY SENATE RESEARCH COMMITTEE: |
| EXPECTED COMPLETION DATE: **November, 2012** |
| PROJECT TITLE: Coping with Weather in Cape Town: Use, Adaptation & Challenges in an Informal Settlement. |
| THREE KEY WORDS DESCRIBING PROJECT: **Vulnerability, Weather, Poverty.** |
| PURPOSE OF THE PROJECT: |
| M-DEGREE: **MA** (YES) D-DEGREE: |
| POST GRADUATE RESEARCH: |

## C. PARTICULARS REGARDING PARTICULAR RESEARCHERS

FAMILY NAME: **AGBOR** INITIALS: **K.** TITLE: **Mr.**

PRINCIPAL RESEARCHER: **Kris AGBOR**

OTHER RESEARCH PROJECT LEADERS:

OTHER CO-RESEARCHERS:

THESIS: STUDENT RESEARCHER: **Kris Agbor**

THESIS: SUPERVISOR: Prof. Sally Peberdy
Mandy Carolissen

## C. GENERAL INFORMATION

STUDY LEAVE TO BE TAKEN DURING PROJECT (days): **N/A**

IS IT INTENDED THAT THE OUTCOME WILL BE SUBMITTED FOR PEER REVIEWED PUBLICATION?
**(YES)** Y☐ NO ☐



COMMENTS: DEPARTMENTAL CHAIRPERSON:

SIGNATURE OF THESIS STUDENT RESEARCHER – WHERE APPROPRIATE:

DATE

SIGNATURE OF THESIS SUPERVISOR – WHERE APPROPRIATE:

DATE

SIGNATURE OF PRINCIPAL RESEARCHER – WHERE APROPRIATE:

DATE:

SIGNATURE OF DEPARTMENTAL CHAIRPERSON:

DATE: **2011-07-13**

NOTE: THESE SIGNATURES IMPLY AN UNDERTAKING *BY THE RESEARCHERS*, TO CONDUCT THE RESEARCH ETHICALLY, AND AN UNDERTAKING BY THE THESIS SUPERVISOR (WHERE APPROPRIATE), AND THE DEPARTMENTAL CHAIRPERSON, TO MAINTAIN A RESPONSIBLE OVERSIGHT OVER THE ETHICAL CONDUCT OF THE RESEARCH.

## E. DESCRIPTION OF PROJECT AND RESEARCH ETHICS STATEMENT

**ABSTRACT**

The concern that weather variability due to climate change has raised nowadays puts every society or community on the alert. This is arguably the most persistent threat to global stability in vulnerable communities in recent times. City dwellers are at this time experiencing increased variable weather conditions such as frequent flooding, heat episodes and drought with increased wind and storm activities. Unfortunately, the aftermath of these weather irregularities are felt most severely by vulnerable urban poor residents.

This focus of this study is on the residents of Makhaza, an informal settlement in the greater Khayelitsha Township of Cape Town, South Africa. It will investigate the challenges they encounter with respect to weather, seeking to understand their adaptive strategies. Emphasis will also be laid on the vulnerable nature of their shelters (shacks) and their ingenuity on coping with a variable weather pattern during respective seasons.

Findings of the study will be of importance in proposing practical solutions to relevant city departments, on what could be done to improve their livelihoods for a successful adaptation to variable weather in future.

Both primary and secondary sources of data will be consulted. The methods of collecting primary data include; field notes during participant observation, semi-structured interviews, open/close-ended questionnaires and photographs. Secondary data will be collected from relevant text books, journal articles, government publications, documentaries and relevant websites in relation to the topic. Climatic/weather data for Cape Town will also be consulted from the South African Weather Service (SAWS) database.

**KEY WORDS**

**Vulnerability, Adaptation, Poverty, Weather Variability, Informal Housing, Survival, Ingenuity, Resilience, Climate Change, Global Warming.**

**ETHICS STATEMENT**

A paramount ethical consideration to any kind of research that involves people is consent. Permission to conduct interviews, administer questionnaires and collect photographs will be sought from the informants/respondents selected for the study. They will be requested to complete consent forms prior to any interview or questionnaire completion. Participation in the proposed research will be voluntary and the informants/respondents will be made aware of their option to withdraw from the study at any stage of interviews or questionnaire response. Confidentiality and anonymity of informants/respondents will also be highly maintained. In all, the entire research will be conducted with integrity, legitimacy and high standards of scholarly conduct will be adhered to, all through the research process.

## *APPENDIX 2: Consent Form.*


**UNIVERSITY OF THE WESTERN CAPE**

DEPARTMENT OF GEOGRAPHY & ENVIRONMENTAL STUDIES

Private Bag X17, Belville, 7535
South Africa
Tel: +27 (0) 21 959 2160
Fax: +27 (0) 21 959 3422
Website: www.uwc.ac.za /arts/geography


**CONSENT FORM**

Title of Research Project: Coping with Weather in Cape Town: Use, Adaptation & Challenges in an Informal Settlement.

The study has been described to me in a language that I understand and I freely and voluntarily agree to participate. My questions about the study have been answered. I understand that my identity will not be disclosed and that I may withdraw from the study without giving a reason at any time and this will not negatively affect me in any way.

Participant's Name/Code:.....

Participant's signature.....

Witness's signature.....

Date.....



Should you have any questions regarding this study or wish to report any problems you have experienced related to the study, please contact the study coordinator:


Study Coordinator's Name: Mandy Carolissen

Co-Supervisor: Prof Sally Peberdy

University of the Western Cape

Private Bag X17, Bellville 7535

Telephone: (021) 959 3597
Fax: (021) 959 3422

Email: mcarolissen@uwc.ac.za; speberdy@uwc.ac.za

## *APPENDIX 3: Respondents Information Sheet.*


**UNIVERSITY OF THE WESTERN CAPE**

DEPARTMENT OF GEOGRAPHY & ENVIRONMENTAL STUDIES

Private Bag X17, Belville, 7535
South Africa
Tel: +27 (0) 21 959 2160
Fax: +27 (0) 21 959 3422
Email: speberdy@uwc.ac.za
Website: www.uwc.ac.za /arts/geography


### INFORMATION SHEET

Title of Research Project: Coping with Weather in Cape Town: Use, Adaptation & Challenges in an Informal Settlement.

The following interview forms part of a research conducted by M.A student, **Kris AGBOR (2968674)** in the Department of Geography & Environmental Studies at the University of the Western Cape. The case study for this research is Makhaza, an informal settlement in the greater Khayelitsha Township of Cape Town. It will investigate the challenges the residents encounter with respect to weather, seeking to understand their adaptive strategies. Emphasis will also be laid on the vulnerable nature of their dwellings and their ingenuity on coping with a variable weather pattern in respective seasons.

Recommendations will be proposed based on the research findings and practical solutions will be suggested to the relevant City & Government Departments, on what could be done to improve their livelihoods for a successful adaptation to variable weather in future.

However, there is no guarantee that this research will improve upon the livelihood of these informal residents. Such a transformation usually requires inputs and efforts from both the government departments concerned and the residents as an integrated approach for reducing their seasonal vulnerability to weather.



Participant's Name / Code:.....

Participant's signature.....

Witness's signature.....

Date.....

Should you have any questions regarding this study or wish to report any problems you have experienced related to the study, please contact the Research Coordinator:


Professor Sally Peberdy

Department of Geography & Environmental Studies

University of the Western Cape

Private Bag X17

Cape Town 7535

Tel: +27-21-959-2626; Cell: +27-82-406-1911

Email: speberdy@uwc.ac.za

## *APPENDIX 4: Interview Confirmation Form.*

**UNIVERSITY OF THE WESTERN CAPE**

DEPARTMENT OF GEOGRAPHY & ENVIRONMENTAL STUDIES

INTERVIEW CONFIRMATION

**Title of Research Project:** Coping with Weather in Cape Town: Use, Adaptation & Challenges in an Informal Settlement.

**Name of Researcher:** Kris AGBOR.

| | Please Tick to Confirm |
|---|---|
| I confirm that I have read and understood the Information Sheet dated:..... | |
| I have had the opportunity to consider the information, ask questions and have my questions answered satisfactorily. | Yes / No |
| I understand that my participation is voluntary and that I am free to withdraw from the interview at any time, without giving any reason. | Yes / No |
| I also understand that I do not have to answer every question. | Yes / No |
| I agree to take part in the above research. | Yes / No |

Participant's Name/Code:_____ Date:_____

Sign_____

Researcher:_____ Date:_____

Sign:_____

## *APPENDIX 5: Interview Questions.*

| THEMES | **Guideline Interview Questions To Ward Councillors & Key Informants In Makhaza-Khayelitsha, Cape Town-South Africa.** |
|---|---|
| INTRODUCTION | *What is your position in this community?<br>*For how long have you been working in this position?<br>*What is your job description? |
| INFORMAL HOUSING & THE ADAPTATION DILEMMA DURING WEATHER RELATED EVENTS | *How do new settlers obtain permission to occupy spaces in this community?<br>*Do they buy ready-made houses or they build the houses themselves?<br>*Which of these forms is safe or recommended by the Western Cape's Housing Department (WCHD)?<br>*Can you describe the construction materials used in building the houses?<br>*Does this conform to recommended housing standards? Motivate..<br>*Who is to blame in an event where the hoses are destroyed during bad weather episodes?<br>*Does a household's structure determine its level of adaptation? Motivate..<br>*Does every household in the community adapt evenly to weather? Motivate...<br>*From your judgement (as a WC) would you say that there is a positive transformation in this community compared to previous years?<br>*Would you like to see more transformation occur?<br>* What changes would you like to see, regarding the nature of the housing? |
| DETAILED CHALLENGES ENCOUNTERED IN RESPECTIVE SEASONS & ADAPTIVE STRATEGIES IMPROVISED | * How would you describe the weather conditions in this community during winter & Summer?<br>*List some of the major challenges encountered during Winter and Summer.<br>*Describe how a typical winter/summer day feels like, in Makhaza.<br>*In your opinion which is the most challenging season in this community?<br>*What adaptive strategies do the inhabitants devise during the following weather-related episodes :<br>Floods, Extreme Cold, Fires, Heat, Strong Winds.<br>*What level of infrastructural damage does these weather episodes cause on Houses, Storm Drains, Roads, Toilets, Taps and waste Collection Bins?<br>*Which season poses grater health threats to the inhabitants, and why?<br>*What are some of the challenges in the community that you think are unknown to the relevant City and Government Departments? |
| RESILIENCE, USE & COPING MECHANISMS DURING VARIABLE WEATHER PATTERNS. | *Why do people still inhabit this community in spite its vulnerable nature?<br>*Where do the majority of the new inhabitants come from?<br>*What is being done to check the influx of new inhabitants in the community? |

(1)

*How well are the inhabitants of this community aware of their vulnerability, and what systems are in place, to remedy weather related disasters?

*Are there any benefits of the weather to this community?

*How is weather a resource or an obstacle to the livelihood of the inhabitants?

*Why are the residents adamant (recundant) to move despite an understanding of their vulnerability?

*What is the relevant City Department (WCHD, DMUCCF) doing to improve the situation

*In your opinion, what is the Government failing to address in this community?

*What approach would you suggest, to tackle such a problem?

*Are there any Self Help Movements in this community?

*How do they intervene during weather-related emergencies?

*What actions do they take to reduce the risks of seasonal catastrophes in the community?

*Does everyone in the community know the emergency number to call in case of a disaster?

# Protect yourself from fire

THIS CITY WORKS FOR YOU


Build homes at least three metres apart to prevent fires from spreading.

Every home needs more than one way out in case of fire.

Keep matches, lighters, paraffin and poisons safe and far away from young children. Use a child safety cap on paraffin bottles.

Many children get badly burnt each year. Take extra care to keep young children safe.

Keep stoves on a flat surface – away from drafts and things that can burn.

Fires and cooking stoves should never be left unattended.

Put out all candles and lamps before you go to sleep or leave your home. Smoking in bed is dangerous.

## Plan ahead ...

Keep a bucket of water and a bucket of sand ready.
Try to put out small fires before they spread.
But don't put yourself in danger.

Use sand for paraffin fires.

Use water for wood, paper and material fires.

## Gas and electricity



Turn off the electricity before putting out an electric fire.
Act fast. First turn off the gas. Then use a lid or damp cloth to put out the flames.
If you can't turn off the gas, get out and stay out.

## Calling for help

Know and show the emergency number and teach children how to dial 107 in emergencies.


When you phone, give the full address and a landmark (shop or school) close to the fire so the firefighters can find you quickly.

## If a fire breaks out ...


Warn people inside the building to get out.

Crawl low under smoke to escape the fire.

Help people to get out.
Then stay out.


Call emergency services on 107 and get help fast! The sooner you phone, the sooner help will arrive.

Keep roads clear so the fire engines can get to the fire quickly.

Keep fire hydrants clear so that firefighters can get water to put out the fire.

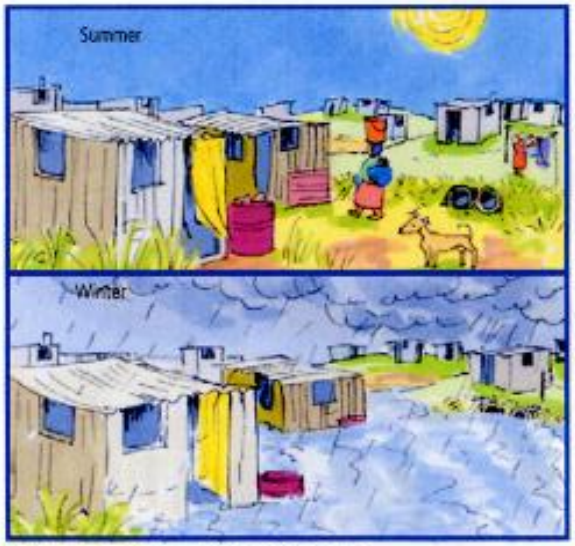
**For all emergencies**
**☎ 107**
From cellphones (021) 480 7700

City of Cape Town : Fire and Emergency Services : Fire and Life Safety
phone: (021) 403 3184 firesafety@capetown.gov.za

# Protect yourself from floods

## Plan ahead

Cape Town has a wet and cold winter season. Areas that are dry in summer can become flooded in winter.

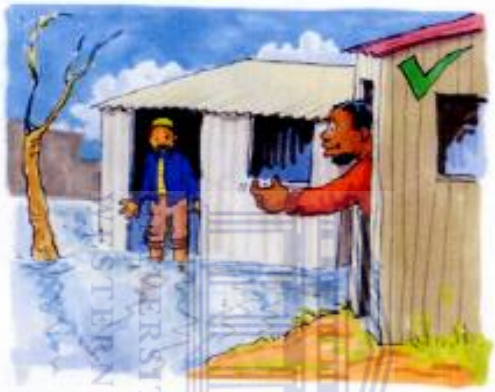



Build on higher ground — building on flood plains and in stormwater dams is dangerous.

Warn other people not to build in areas that are prone to flooding.

## If your home gets flooded ...

You do not have to stay in a community hall to qualify for help. You can stay with friends and family. If you have nowhere to stay, you may be housed in a community hall. If you do have to leave home, make sure your valuables are safe.



Help friends and family – provide them with shelter if your site is not flooded.

**To report flooding**
**(021) 424 7715**

For all emergencies
**☎ 107**
From cellphones (021) 480 7700

City of Cape Town : Disaster Management
phone: (021) 590 1961 www.capetown.gov.za

## Protect your health

Flood water is dirty and it can make your family sick.

Tell children not to play in flood water.
Beware of sharp objects in the water.
Wash your hands with soap and clean water before working with food.

## Protect your home

Raise your floor above ground level.
Make furrows to channel water around your site and keep stormwater drains clear.

## *APPENDIX 7: Questionnaire.*

# UNIVERSITY OF THE WESTERN CAPE

DEPARTMENT OF GEOGRAPHY & ENVIRONMENTAL STUDIES

**REGISTRATION NUMBER** | | | |

This questionnaire has been developed to collect data on seasonal *vulnerability to weather* in the informal settlement of *Makhaza*-Khayelitsha in Cape Town. All the information obtained will be treated with the necessary confidentiality and academic integrity. No names will be mentioned in the final report.

**1. PERSONAL DETAILS**

1.1 Gender

| Male | Female |
|---|---|

1.2 Age

| | | | |
|---|---|---|---|
| 21-25 | 26-30 | 31-35 | 36-40 |
| 41-45 | 46-50 | 51-55 | 56-60 |
| 60+ | | | |

1.3 Current Marital Status

| | | |
|---|---|---|
| Never Married | Married/More than one Wife | Divorced |
| Widowed | Living Together | Separated |

1.4 What is your level of education attained?

| None | Completed Primary School | Completed Secondary School | Completed Tertiary Diploma | Completed Tertiary Degree |
|---|---|---|---|---|

**2. NATURE OF HOUSING**

2.1 For how long have you been living here?

2.2 Are you the owner of the house you live in or you pay rent ?

| Owner | Pay Rent |
|---|---|

2.3 How many rooms do you have in your house?

2.4 Does your house conform to the CCT Disaster Management/Fire & Life Safety Regulations?

| Yes | No |
|---|---|

(SHOW PICTURES)

2.5 If NO, Why not?

_____

2.6 What type of material is your house constructed with?

_____

2.7 Does the nature of your construction material expose you to bad weather events?

| Yes | No |
|---|---|

a) If YES, during which season?_____

b) How?_____

2.8 What survival strategy do you device in order to adapt during such weather-related events?

List_____

1

## 3. VULNERABILITY, ADAPTATION & COPING MECHANISMS

3.0 How well do you understand your vulnerability to weather? (SHOW PICTURES)

| Not Very Well | Not Well | Don't Know | Well | Very Well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

3.1 Does the weather affect your daily activities? | Yes | No |

3.2 If YES, state how it affects your daily activities;

a) During Winter_____

b) During Summer_____

3.3 Have you ever been affected by severe weather conditions? | Yes | No |

3.4 If YES, which of the following weather-related episode affected you?

| FLOOD | FIRE | EXTREME SUNSHINE & HEAT, | EXTREME RAINFALL & COLD, | STRONG WINDS | DROUGHT | Other (Please Specify) |
|---|---|---|---|---|---|---|
| | | | | | | |

3.5 How did it affect you?

_____

3.6 How well did you adapt to it?

| Not Very Well | Not Well | Don't Know | Well | Very Well |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

3.7 What techniques do you use to enhance adaptation;

a) During Winter?_____

b) During Summer?_____

3.8 From which of the following Information Media do you get your local weather forecast?

| Radio | News Paper | Television | Internet | Other (Please Specify) |
|---|---|---|---|---|
| | | | | |

3.9 Do you understand the forecasts? | Yes | No |

3.01 If YES, how does it help you adapt;

a) During Winter?_____

b) During Summer?_____

## 4. CHALLENGES TO WEATHER VARIABILITY

4.0 a) Which is the most challenging season for you? | Winter | Summer |

b) WHY?_____

4.1 What is your most challenging encounter;

a) During Winter_____

b) During Summer_____

4.2 What is the outcome of such challenges?_____

4.3 Does it have any effect on your health? | Yes | No |

4.4 If yes, what kind?_____

4.5 Are there any emergency services that assist you during unusual weather events? | Yes | No |

If yes, list some_____

4.6 Do you know the emergency numbers to call when faced with any weather-related disaster? | Yes | No |

(SHOW PICTURE) after response.

4.7 Is there any Self Help Movement (SHM) in your community? | Yes | No |

a) If YES, What's its name?_____

b) How does it help?_____

4.8 Are there any warning systems to alert you in an event of unusual weather?

**5. QUALITY OF LIFE**

5.1 Do you find your internal living space satisfactory in terms of weather threats? If NO, Why not? | Yes | No |

5.2 Is there any recreational facility around your community? | Yes | No |

5.3 If YES, indicate the type of facility._____

5.4 Do you find the recreational facility;

| | | |
|---|---|---|
| Suiting Your Needs | Not Suiting Your Needs | Costly |
| Too Distant | Problematic to the Community | Unsecured |

5.5 Do you enjoy living in your community? | Yes | No |

Motivate_____

5.6 Do you feel safe and secure in this neighbourhood? | Yes | No |

Motivate._____

5.7 How is order and discipline maintained in the community?

_____

5.8 Who comes to your rescue when you need protection from fire, flood etc?_____

_____

5.9 Do you know the emergency safety numbers to call when in fire or flood danger? | Yes | No |

**6. ECONOMIC STATUS**

6.1 Please indicate your employment status below.

| | | | |
|---|---|---|---|
| Formal Employment | Informal Employment | Unemployed | Self Employed (Formal/Informal) |
| Student/Scholar | Disability Grant | Pensioner | Other (Please Specify) |

6.2 How many people are supported in this household?

| | | | | | |
|---|---|---|---|---|---|
| One | Two | Three | Four | Five | More than Five |

6.3 What is the average monthly income of your household from all sources?

| | | |
|---|---|---|
| R00.00 - 499.00 | R 500 – 999.00 | R 1000.00 – 1499.00 |
| R1500 – 1999.00 | R2000.00 – 2499.00 | > R3 000 |

6.4 Over the past year, how often, if ever, have you or your family gone without_____? (Please Tick)

| | | | | |
|---|---|---|---|---|
| a) Enough food to eat? | Never | Just Once or Twice | Many Times | Always |
| b) Enough clean water for home use? | Never | Just Once or Twice | Many Times | Always |
| c) Medicines or Medical treatment? | Never | Just Once or Twice | Many Times | Always |
| d) Enough fuel to cook your food? | Never | Just Once or Twice | Many Times | Always |
| e) A cash income? | Never | Just Once or Twice | Many Times | Always |
| f) School expenses for you children (fees, uniforms, books)? | Never | Just Once or Twice | Many Times | Always |

6.5 On average, how much do you spend per month on the following:

| Item | Average Amount/Month |
|---|---|
| Rents and Bills | |
| Health | |
| Education | |
| Food/Nutrition | |
| Transportation | |
| Recreation/Leisure | |

**7. HEALTH**

7.1 On average, how many times do you visit the clinic/ hospital each month?

| | | | | | |
|---|---|---|---|---|---|
| Once | Twice | Thrice | Four Times | Five Times | Five Times + |



7.2 What are the common illnesses that your family suffers from?

| | | | | |
|---|---|---|---|---|
| Diarrhoea | Chicken Pox | Mumps | Measles | Coughs/Flu |
| Diabetes | Lung Problem | Tuberculosis | Blood Pressure | Other (Please Specify) |

7.3 Do you make use of the service of traditional healers?

| | |
|---|---|
| Yes | No |

7.4 Motivate_____

7.5 Is there anything else you would like to say about living in Makhaza and managing the weather?_____

_____

_____.

**THANK YOU VERY MUCH FOR YOUR CO-OPERATION— *HAVE A NICE DAY***

UNIVERSITY of the
WESTERN CAPE