# ASSESSMENT OF DISASTER PREPAREDNESS OF NGWATHE LOCAL MUNICIPALITY REGARDING FLOODS

**By**

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## DECLARATION

By submitting my thesis, I confirm that the work submitted for assessment for this work is my own unaided work except where I have explicitly indicated otherwise. I have followed the required convention in referencing the thoughts and ideas of others and I have not previously or in its entirety or in part submitted it for obtaining any qualification.

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MATS'ELISO LEMEKO DATE

# DEDICATION

This is dedicated to my father, Ntate Khotso, and mother, Mme ‘Matau Lemeko, who raised me in the love and light of education.

It is also dedicated to my late sister and brothers Moliehi and Maqheku Lemeko

***Death Be Not Proud! (Martin L. King)***

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# LIST OF ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| ADRC | Asian Disaster Reduction Centre |
| BCA | Benefit and Cost Analysis |
| CDC | Centre for Disease Control and Prevention |
| CFO | Chief Financial Officer |
| DMP's | Disaster Management Plans |
| FDDM | Fezile Dabi District Municipality |
| GIS | Geographical Information System |
| IDP | Integrated Development Plan |
| KPA | Key Performance Area |
| MDMF | Municipal Disaster Management Finance |
| MM | Municipal Manager |
| NDMC | National Disaster Management Centre |
| NLM | Ngwathe Local Municipality |
| PAR | Progression of Vulnerability Model |
| PDMC | Provincial Disaster Management Centre |
| PTSD | Post Traumatic Stress Disorder |
| SALGA | South African Local Government Association |
| SAPS/D | South African Police Service/ Department |
| RSA | Republic of South Africa |
| UN | United Nations |
| UNDP | United Nations Development Plan |
| UNISDR | United Nations International Strategic Disaster Risk |
| UNHC | United Nations Humanitarian Charter |
| WHO | World Health Organisation |

# DEFINITION OF TERMS

**Disaster**: is a serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources.

**Disaster Management:** is the systematic process of using administrative directives, organizations, and operational skills and capacities to implement strategies, policies and improved coping capacities in order to lessen the adverse impacts of hazards and the possibility of disaster.

**Flood**: is a cataclysmic event in many religious and mythological traditions in which, in a remote time in the past, the world is destroyed or cleansed by fire or flood, often inflicted as a result of divine moral anger at the wrongdoings of humankind.

**Mitigation**: is the lessening or limitation of the adverse impacts of hazards and related disasters.

**Municipality**: is a local government serving the community.

**Preparedness**: is the knowledge and capacities developed by governments, professional response and recovery organizations, communities and individuals to effectively anticipate, respond to, and recover from, the impacts of likely, imminent or current hazard events or conditions.

**Prevention**: is the outright avoidance of adverse impacts of hazards and related disasters.

**Public awareness:** is the extent of common knowledge about disaster risks, the factors that lead to disasters and the actions that can be taken individually and collectively to reduce exposure and vulnerability to hazards.

**Recovery**: is the restoration and improvement where appropriate, of facilities, livelihoods and living conditions of disaster-affected communities, including efforts to reduce disaster risk factors.

**Response**: is the provision of emergency services and public assistance during or immediately after a disaster in order to save lives, reduce health impacts, ensure public safety and meet the basic subsistence needs of the people affected.

**Resilience:** is the ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions.

# CHAPTER 1
# PROBLEM STATEMENT AND RESEARCH METHODS

## 1.1 BACKGROUND

The occurrence of disasters is increasing at an alarming rate and intensity so that efficient measures need to be in place to mitigate and prevent the impact thereof. South Africa as a developing country has it hard to deal with some of the impacts (damage) of disasters. Common disasters are floods, fire, drought, spillages and minor earthquakes. Flood disasters are a major global problem and many developing countries are affected by floods to some extent and find particularly difficult to protect their people against such disasters.

According to Napier and Robin (2000), floods cost communities in terms of lives lost, economic and environmental damages and human suffering. Therefore it necessitates the introduction of measures to reduce risk to an acceptable level. Negative impact is suffered due to measures that are not in place. One reason can be budgets that are insufficient to cater for those measures. Lack of measures means lack of preparedness; which will be researched in this study. Effective flood risk reduction measures require an understanding of the processes that cause floods, the magnitude, appropriate analytical methods and environmental assessment procedures and need to be implemented to reduce the risks (UNISDR 2002).

According to the Disaster Management Act (South Africa 2002), preparedness is the state of readiness which enables organs of state and other institutions involved in disaster management, the private sector, the communities and individuals to mobilise, to organise and provide relief measures to deal with an impending or current disaster or effects of the disaster. It is vital for the communities to understand the hazard so that they get prepared.

National Disaster Management Centre (NDMC) has declared Fezile Dabi as disastrous area early 2011. This is the result of heavy rainfall experienced within December 2010 and January 2011, and this negatively affected the municipality due to lack of capacity to deal with floods. According to the Disaster Management Act (South Africa 2002), disasters should have a dedicated account wherein money is allocated as emergency fund. The December 2010 - January 2011 floods

became an eye opener to NDMC that this act has not been adopted; therefore the mandate will be enforced to ensure the efficiency of the recovery phase.

It is clear that most local and some district municipalities in South Africa have not implemented the disaster management framework that assists in the execution of disaster projects and programmes within stipulated time frames as would be contained in the Integrated Development Plan (IDP). According to the Department of Provincial and Local Government (2000:17) the failure to implement affects service delivery as a whole.

## 1.2 SIGNIFICANCE OF THE STUDY

According to FEMA (2009), preparedness is a continuous cycle of planning, organizing, training, equipping, exercising, evaluation and improvement activities to ensure effective coordination and the enhancement of capabilities to prevent, protect against, respond to, recover from, and mitigate the effects of natural disasters, acts of terrorism, and other man-made disasters. Therefore the understanding of baseline conditions related to both implementation of the available programmes, and to the broader question of livelihood change in response to floods will be catered for within the study. Preparedness enhances the mitigation process that is very important in the disaster management cycle.

It is presumed that the results of this study will be useful to policy makers, disaster risk management stakeholders including nongovernmental organisations, civil society as well as academics in analyzing floods, and to plan for them. Informed decision-making (by both policy makers and the vulnerable communities) relies on the availability of information about the flood risk contexts such as this study seeks to bring to the fore.

## 1.3 DESCRIPTION OF THE AREA OF STUDY

Ngwathe Local Municipality (NLM) is the largest local municipality of Fezile Dabi District Municipality which is in the Northern part of the Free State Province. It is comprised of five towns, namely Parys, Vredefort, Heilbron, Koppies and Edenville as well as the rural areas as demarcated by the Demarcation Board of South Africa. It is further divided into 20 wards with 39 councillors. Approximately 43.5% of the population is unemployed and 65.6% of the people are living in poverty (community survey 2007). In terms of section 155 of the Constitution of the

South Africa, NLM has been classified as Category C Municipality and therefore has to perform its functions accordingly. NLM like some of the municipalities in similar positions is faced with a number of key challenges in all its towns; central to this situation, is the level of unemployment that consequently contributes significantly to high levels of poverty and low revenue base. According to Community survey (2007), Ngwathe Local Municipality capacitates 95,187 persons with 32 872 households. The population surpasses the job opportunities in this area, and people are forced to search for jobs outside the perimeters of NLM.

## 1.4 PROBLEM STATEMENT

Floods in Ngwathe pose a serious threat not only to the lives of the residents, but also to the environment and economy. The problem lies within the municipality's ability to deal with these floods. The inability of the municipality to implement preparedness and mitigation is disaster management's points of departure therefore they must seriously be taken into consideration. Incapacity to deal with floods ignores important components such as early warning and preparedness plans which should be in place. This has been reflected in the recent floods occurrence (December 2010-January 2011).

NLM relied on Fezile Dabi District Municipality and that was evident in the recent floods occurrence (Dec-January 2011). With the Disaster Management legislation and continuum (which consists of preparedness, mitigation, recovery phases), Ngwathe local municipality did not address issues of the recovery phase (response, rehabilitation and reconstruction) because there was no preparedness and mitigation plans. Preparedness and mitigation are vital stages in the Disaster Management Process because they take care of the other phases that follow. Good planning is characterized by good results while bad results emanates from bad planning.

Parys area in Ngwathe is an example of most unsafe conditions regarding disasters. Unsafe conditions refer to the various actual forms which a population's vulnerability presents spatially and in time, in conjunction with a hazard (Wisner, Blaike, Cannon & Davies 2005:55). In this community unsafe conditions include primarily the physical location; the Vaal River with its danger to the community that cannot afford safe buildings, the subsequent failure by government for appropriate land use planning, and the implementing and enforcing of building codes and by-laws respectively. In contrast, the city of Cape Town has plans in place in preparation to deal with winter floods that have taken place every year for the past three years.

The City of Cape Town's pro-active winter plan yields dividends with a steady decline in the number of structures being damaged due to flooding during the wet winter months (City Of Cape Town Government, 2011).

With the lack of expertise in disaster management amongst the authorities, Ngwathe suffers a backlog in terms of economy and community trust (Fezile Dabi District Spatial Development Framework 2011/12). Such a scenario causes a strain on the adjacent communities' resources leading to potential conflicts and migration. Against this the probability for human, economical and environmental losses are quite substantial in this area hence, the need for development and implementation of various proactive actions and policies on local level.

This study therefore aims to conduct the preparedness assessment in Ngwathe, which will then inform the authorities and key stakeholders of the need for planning and preparation for flood prevention, mitigation, response and recovery plans for floods so that threat to human life, property and the environment is minimized.

## 1.5 AIM OF THE STUDY

This study is aimed at assessing Ngwathe disaster preparedness in order to increasing the awareness of the nature and management of flood disasters, leading to better performance in flood disaster preparedness and response. Preparedness contributes to flood risk reduction through the measures that are taken in advance to warnings. This seeks to speak to the following research objectives:

- To assess NLM's preparedness for floods.
- To determine the capacity (coping mechanisms) of NLM towards floods (this includes people and resources/equipment).
- To establish the role that NLM can play in the flood risk reduction initiatives.
- To make a contribution to NLM in terms of flood disaster management information and/or knowledge.
- To propose a way forward in terms of the disaster management unit.

## 1.6 RESEARCH DESIGN (RESEARCH APPROACH AND METHODS)

Research methodology is the logical plan of processes to be conducted in a research. Lichtman (2006:219) defines methodology as the various techniques, methods and procedures used in conducting research. McNeill (1990:14) concurs that methodology is the theoretic study of the logical basis of research of collecting data, interpreting and analyzing the findings. Therefore research can be understood to mean the layout and detailing of the research processes. In that regard this thesis will highlight the sampling, data collection and analysis techniques to be used in the study.

The research design is the entire strategy one adopts when approaching the central research problem (McNeill 1990:14; Leedy & Ormond 2001:91). The design depicts the broad layout of the procedures to be followed by a research including the data collected and the data analyses conducted with a view of generating answers to a research question. Simply put, the design is the plan outlining the course of a research.

In this study a qualitative method will be employed and the main source of data will be the result of interviews with appropriate stakeholders. Qualitative research is that component of research with a starting point being the manner in which the insider regards social proceedings. Leedy & Ormond (2001:93) state that qualitative research serves to create profound elucidation and comprehension of human life, behaviour or experiences Description, understanding and interpretation are key traits of qualitative research and therefore become points of departure. This will apply in the interaction or interviewing of the Ngwathe disaster management authorities. Aim of using the interview (as a dimension of qualitative approach) is to provide the detailed information about the problem, meaning that the subject (interviewee) speaks for itself.

According to Cooper and Schinidler (2006:23) personal interviews carry the advantages of enabling the interviewer to notice particular reactions and thus eliminate confusion over the questions asked. An advantage of interview is that interviewer could pick up non-verbal data like dread or fear and flexibility among others. Personal interviews will be conducted where the researcher selects the conducive time and place to personally solicit information from the selected segments of the population preferably in their natural environment. A list of open and closed ended questions will be administered in order to probe the participants to bring out their opinions on the information sought and control the flow of the interview respectively

Qualitative research is the most appropriate method to acquire data and information from the authorities, as they are at the strategic positions to immediately take decisions through the suggestions and recommendations done during the interview. A list of open and closed ended questions will be administered through a questionnaire. This questionnaire will be developed in such a way that all appropriate data that is needed is captured. The objectives of the study will be addressed during the interview.

The data acquired will be evaluated in conjunction with all other information acquired via resources such as the internet, books and literature available which will be secondary sources of this research.

After collection of the raw data, it will be processed using quantitative methods. Conclusions will be drawn from the findings and appropriate recommendations will be put forward to the relevant authorities.

## 1.7 PRELIMINARY LITERATURE STUDY

Literature review about the national, provincial and municipal acts and Disaster Preparedness Framework should assist in the identification of the preparedness assessment to test the institutional readiness on flood disasters. This section seeks to provide a layout of the research and draws attention to the following questions;

- What is disaster?
- What is an emergency?
- What is disaster management?
- What is the current state of Ngwathe disaster management?
- What is disaster management continuum?
- What is disaster preparedness?
- What is a disaster preparedness framework?
- What is mitigation?
- What is flood mitigation?
- What is flood management?

- Disaster is a serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which

exceeds the ability of the affected community or society to cope using its own resources. (UNISDR 2009). Disasters are characterized by the scope of an emergency. An emergency becomes a disaster when it exceeds the capability of the local resources to manage it. Disasters often result in great damage, loss or destruction.

- Emergency is a deviation from planned or expected behaviour or a course of events that endangers or adversely affects people, property or the environment (Johnson 2000).

- Disaster Management is a systematic process of using administrative directives, organizations, and operational skills and capacities to implement strategies, policies and improved coping capacities in order to lessen the adverse impacts of the hazards and possibilities of disaster (UNISDR 2009). Disaster management refers to integrated multi-sectoral and multidisciplinary administrative, organisational and operational planning processes and capacities aimed at lessening the impacts of natural hazards and related environmental, technological and biological disasters (South Africa: 2002).

- According to Ngwathe IDP 2011/12, Ngwathe has only two officials for Disaster Management; the executive director and the director of Disaster Management. Ngwathe depends largely on the district disaster management (Fezile Dabi), which monitors the four local municipalities in preparing their respective disaster management plans and ensures submission thereof to the Provincial Disaster Management Centre. This dependency is very dangerous as some disasters need emergency responses, which means that Ngwathe will have to wait until the district comes to the rescue.

- The vision and mission of South African Disaster Management Act 57 of 2002 and Disaster Management Framework set out to promote an integrated and coordinated system of disaster management, with special emphasis on prevention and mitigation, by the national, provincial and municipal organs of state, statutory functionaries, other role players involved in disaster management and communities hence, the adoption of the disaster continuum. Disaster management continuum shows the inter-relationship between four phases of disaster management.

- The Disaster Management Continuum

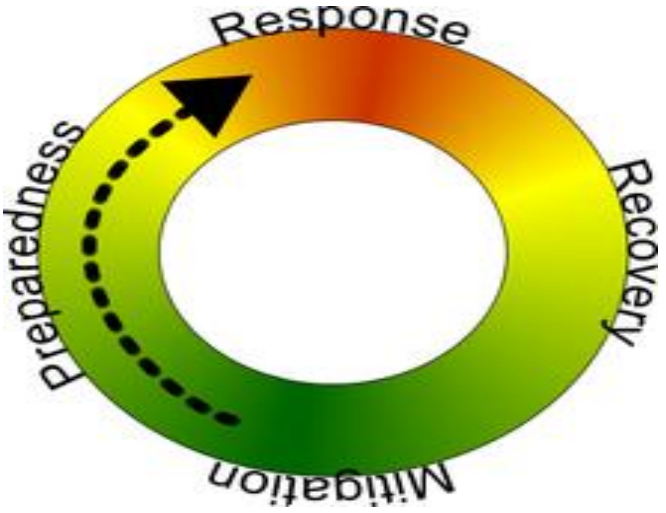


Figure 1.1: The Disaster Management Continuum (SOURCE: FEMA, 2006)

The continuum (Figure 1.1) acts as a checklist in the disaster management cycle in order to include all phases during the planning process. The framework dilates the phases into key performance areas (KPAs) and indicators. It also indicates the continuity of these four phases.

- According to the Disaster Management Act 57 of 2002, preparedness is the state of readiness, which enables organs of state and other institutions involved in disaster management, the private sector, the communities and individuals to mobilise, organise and provide relief measures to deal with an impending or current disaster or effects of the disaster. Its objective is to ensure that in times of disasters appropriate systems, procedures and resources are in place to assist those afflicted by the disaster and enable them to help themselves (UNDP 1992).

- Preparedness contributes to disaster risk reduction through the measures that are taken in advance to warning. It is therefore imperative to build the infrastructures such as roads and other useful facilities by using building designed codes, erosion control facilities through the activities and efforts of people involved in soil and farmland management, better land-use planning (ADRC 2003). Preparedness is getting ready to fight hazards before they occur. It is vital for the communities to understand the hazard so that they get prepared. In

some cases local communities may be unaware of weather events occurring upstream of their locations that might result in their destruction (UN 1998). Lindell, Prater and Perry (2006:26) depict preparedness as the tool to ensure effective coordination and enhancement of capacities to prevent, protect against, respond to, recover from and mitigate the effects of natural and man-made disasters.

- Coburn, Spene and Pomonius (1994:13) assert that mitigation and preparedness jet into a wide range of activities and protection measures that might be instigated, from the physical (like constructing stronger buildings) to the procedural (like standard techniques for in cooperating hazard assessment). In this regard, preparedness and mitigation are very pivotal in the disaster management process.

- Mitigation is the minimization of the disaster impact through risk reduction measures. It is the most cost-efficient method for reducing the effect of hazards although not always the most suitable. Mitigation includes providing regulations regarding evacuation, sanctions against those who refuse to obey the regulations (such as mandatory evacuations), and communication of risks to the public (Lindell, Prater & Perry 2006). According to UNISDR (2009), mitigation is the lessening or limitation of the adverse impacts of hazards and related disasters.

- FEMA (2009) states that flood mitigation involve the management of people, through measures such as evacuation. It involves managing the effects of flooding, such as redirecting flood run-off, rather than trying to prevent it altogether. The prevention of flooding can be studied on a number of levels, individual properties, small communities, towns or cities. According to Dales (2007) flood mitigation is a process of assessing risks from flooding, and then using the information to implement appropriate management measures.

- These measures might be the construction of flood defences, provision of flood warning systems, provision of washable and wetland systems or the development of policies, which reduce development in flood risk areas. This is the most effective way of reducing the risk of people and properties through the production of flood risks maps. FEMA (2009) adds that flood mitigation is the management of people, through measures such as evacuation and wet/dry properties.

- According to Dales (2007) flood management is a process of assessing risks from flooding and then using the information to implement appropriate management measures. These measures might be the construction of flood defences, provision of flood warning systems, provision of washable and wetland systems or the development of policies which reduce development in flood risk areas.

- The disaster preparedness framework illustrated by Kent (1994) outlines activities that are essential to the development of a preparedness strategy in the study.

## 1.8 SUMMARY

People's lives could be sustained effectively by ensuring safety, risk reduction, and attending to vulnerability aspects in each community. Government and the community has important role to play in terms of fighting disasters therefore involvement and commitment are vital. Policies, Disaster Management frameworks, IDP must be spread to each municipality and the monitoring of municipalities is recommended for sustainable livelihoods. This means that every facet of governance should and will need to focus its attention on the roll that Disaster Management plays within its particular daily activities. The business of disaster management therefore cuts through every fibre of governance and civil society, which includes local governance.

## 1.9 CHAPTER OUTLINE

The following is the chapter outlay of the study:

*Chapter 1:* contains an introduction to the investigation, problem statement, significance of the study, aim and objectives of the investigation and the description of research methods used in the investigation.
*Chapter 2*: contains the description of the study area relating to the topic.
*Chapter 3:* contains the theoretical study regarding floods, flood mitigation and the implementation of flood mitigation measures relating to the investigation.
*Chapter 4:* contains the results and analysis and the evaluation of the research findings (Disaster Preparedness in Ngwathe Local Municipality) as per the topic.
*Chapter 5:* contains the summary, conclusions and recommendations that will enhance preparedness in Ngwathe.

# CHAPTER 2

# DESCRIPTION OF THE STUDY AREA

## 2.1 INTRODUCTION

The purpose of Chapter 2 is to provide a description of the study area in an attempt to enhance disaster preparedness in Ngwathe local municipality. A municipality refers to a political subdivision that is established in terms of sections 151 and 152 of the Constitution of the Republic of South Africa of 1996 and has control of local affairs including the power to raise taxes. Fourie (2001: 22) adds that a municipality refers to a local institution comprising councillors, who function within a specific geographical area to provide services to their local community. A municipality is described through the following variables; geographically and physical land coverage, demarcations, features, demographically, socio-economically and political deviations. Environmental education must be fostered at every level by instilling an appreciation of the environment, and providing development alternatives less harmful to the environment as well as opportunities to participate in decisions regarding the environment.

## 2.2 NGWATHE LOCAL MUNICIPALITY

Ngwathe Local Municipality (NLM) is the largest local municipality of Fezile Dabi District Municipality which is in the Northern part of the Free State Province. It is comprised of five towns namely; Parys, Vredefort, Heilbron, Koppies and Edenville as well as the rural areas as demarcated by the Demarcation Board of South Africa. Fezile Dabi Municipality Spatial Development Framework (2011-2012) states that Ngwathe covers an area of 7,055 $km^2$ with 13.5 $km^2$ per population density and average household size is 2.9. Approximately 43.5% of the population is unemployed and 65.6% of the people are living in poverty (Community survey 2007). In terms of section 155 of the Constitution of the RSA, NLM has been classified as Category C Municipality and therefore performs its functions accordingly and also in terms of section 3 of the Local Government: Municipal Structures Act 1998 (Notice 6770 of 2000). NLM like some of the municipalities in similar positions are faced with a number of key challenges in all its towns, central to these are the rising level of unemployment that consequently contributes significantly to high levels of poverty and low revenue base. According to Community survey (2007), Ngwathe Local Municipality capacitates 95,187 persons with 32 872 households.

## 2.3 TOWNS IN NGWATHE LOCAL MUNICIPALITY

### *(a) Parys*

This town is located along the Vaal River inspired its founders to name it Parys, after the French city on the Seine River. The town was established in 1876 and has been growing from strength to strength since then especially since the discovery of The Vredefort Dome World Heritage Site. Demarcation is the act of creating a boundary around a place or thing. Microsoft Encarta Encyclopaedia (2008) adds that demarcation is the line that runs from north to south and west to east of the area of study. It is a medium-sized town situated 38Km to the west of Sasolburg and 60Km to the South of Gauteng province. It is situated on the border between the Free State and the North West Province formed by the Vaal River.

Owing to previous legislation the town consists of three sections: Parys, Tumahole and Schonenville. Parys is situated along the banks of the famous Vaal River and in close proximity of one of the longest National roads, the N1 with its toll gate, Vaal toll Plaza. The town was established in 1876 and has been growing from strength to strength since then especially since the discovery of The Vredefort Dome World Heritage Site. Parys is predominantly an agricultural area with following produce on offer; corn, tobacco, sorghum and livestock such as cattle, sheep etc. (Ngwathe IDP Final Review 2010-2011). Population is distributed as such; Parys town with around 10,950 residents, Tumahole with 61,160 residents and Schonkenville with 1,020 residents. The total population is 73,130. The growth rate of the population in Tumahole and Schonkenville is estimated at 5% and that of Parys at 0.5% per annum.

Parys has a strong commercial component and provide a wide range of services regarding health, education and professional services to the district. The contribution of these sectors is therefore substantial. The areas of Parys have unique nature and environmental assets like the Vaal River with several islands in the proximity of Parys and the Vredefort Dome that present exceptional tourism potential. Large areas of Parys are underlain with undifferentiated granite that is exploited directly to the north of Parys that further contribute to Parys being a prominent service and economic centre. Parys has a well-developed airfield that supports commercial and tourism development in the area.

According to Ngwathe IDP Final Review 2011-2012, Parys has a strong commercial component and provides a wide range of services regarding health, education and professional services to the district. The contribution of these sectors is therefore substantial. The areas of Parys have unique nature and environmental assets like the Vaal River with several islands in the proximity of Parys and the Vredefort Dome that present exceptional tourism potential. Large areas of Parys are underlain with undifferentiated granite that is exploited directly to the north of Parys that further contribute to Parys being a prominent service and economic centre. Parys has a well-developed airfield that supports commercial and tourism development in the area. Long-term economic prospects are:

- Various sectors in the Parys contribute to the GGP of the study area. This is primarily attributed to the Parys urban area, as a prominent services centre in the district.
- Parys has a strong commercial component and provides a wide range of services regarding health, education and professional services to the district. The contribution of these sectors is therefore substantial.

### *(b) Vredefort*

The town was established in 1876, it is situated south westerly of Parys and houses the famous Vredefort Dome World Heritage Site. It is an essentially small farming town with the following produce on offer: cattle, peanuts, sorghum, sunflower, and maize**.**

The most prominent economic sector in Vredefort is the agricultural sector. Commercial activities in town contribute minimally to the Gross Geographical Product (GGP) of the Municipality, especially when being compared to the contribution in the entire Fezile Dabi District Municipality. Because the agricultural sector is the most prominent economic sector, there are very limited work opportunities in town with the consequent high unemployment rate. This is aggravated by the population growth in specifically the Mokwallo residential area. However, the growing tourism potential of the town due to the world heritage site and its links to the Bothaville agricultural sector brings hope to the economic development of Vredefort.

### *(c) Heilbron*

Heilbron was founded in 1872. It is situated in the North Eastern part of the district as well as the Free State province as a whole, it is strategically placed as it is a window into the free State, the mountain Kingdom of Lesotho and Gauteng, it is a predominantly agricultural town with the following products: maize, wheat, cattle, dairy, sunflowers, sheep, sorghum, beef cattle farms.

Heilbron is predominantly an agricultural area although major manufacturing industries contribute largely to the Gross Geographic Product of the area. The agriculture and manufacturing industries have a direct influence on the per capita expenditure and employment opportunities of the urban area concerned. A vast range of products used to be manufactured by Clover S.A., Simba, Tudor, Peter's Knitwear and Microchem but the factories have since shut down, and resulting in huge impacts on the unemployment status of the people. These industries were significant employment sectors in the community. The study area is also in close proximity of the coal mining and coal-related industries of Sasolburg.

Furthermore, the town also links the Fezile Dabi district to the eastern Free State tourism hub and an international link to Lesotho as well as an alternative link to KwaZulu Natal. According to Ngwathe IDP of 2010/2011, Heilbron subsequently comprises a proper tarred runway to accommodate larger aircrafts. The airfield is a direct consequence of the area being a former "growth point" seeing industries such as Simba and Clover SA (national) established in the industrial area. The Heilbron case is an applicable example of the importance of air traffic facilities to enhance industrial development.

### *(d)Koppies*

Koppies town was established in 1924. The town Koppies is situated on the banks of the Renoster River; it is in a very close proximity of the N1 highway. It is also a major agricultural town area with products such as maize, wheat, sorghum, cattle, and beef cattle farming. Koppies town is located in an area of agricultural significance and mainly provides services in this regard to the surrounding rural areas. The three well-established and developed irrigation schemes subsequently enhance the agricultural character of the area and provide water resources to the De Beers mine development initiative. Koppies town is strategically located

between the larger centres of Kroonstad and Sasolburg, and the location mainly influences growth and development within the community.

These factors contribute to the relatively low level of economic activity in the area. The current bentonite exploitation near Koppies and the current initiative for coal mining in the vicinity of Koppies provide significant future growth potential. Koppies town is becoming well familiar for its tourist attractions. Specific reference is made to the R82 Battlefield Route that consists of several historical battlefields that are envisaged to be further developed as well as the Koppies Dam Nature Reserve. National annual angling competitions are held at the Koppies Dam.

Acoording to Ngwathe IDP 2011-2012, the agricultural sector of Koppies is also prominent in the area. The Koppies area is therefore a predominant agricultural area. The three well-established and developed irrigation schemes subsequently enhance the agricultural prominence of the area and provide water resources to the new De Beers mine development. The possible long term future mining opportunities of coal in the Koppies vicinity will significantly contribute to large scale economic growth and creation of employment opportunities. The existing mining activities of bentonite at Koppies are prominent in a local context that also has future economic growth potential.

***(e) Edenville***

It was established in 1912, is situated in between Heilbron, Kroonstad, Petrus Steyn, Lindley and Steynsrust. The R34 passes through Edenville. It too is agriculturally predominantly maize, wheat, sheep, cattle.

Edenville is located in an area of agricultural significance and mainly provides basic services in this regard to the surrounding rural areas. The main road linking Kroonstad and Heilbron, stretches adjacent to the area (Ngwathe IDP 2011-2012). The area is influenced to a great extent by Kroonstad as a large service centre in close proximity. The most prominent economic sectors contributing to the Gross Geographical Product of the town include the public sector, finance and real estate and transport. This is ascribed to the influence of Kroonstad, as a large service centre in the concerned town.

The large contribution by the public sector is attributed to the prominent function of several Government and Para-Statal institutions in Kroonstad. The prominence of these sectors is due to the large turnover in the real estate sector, specifically as a result of the above-mentioned. Future development of Edenville is not foreseen. Edenville will remain functioning as service town to the surrounding agricultural community. However, the existing wine route and agro-processing initiatives can boost the economic development of the area.

## 2.4 MUNICIPAL PROFILE

Municipal profile analyses and juxtaposes the area through four indices (population, health, educational and political analysis) that triggers the predictions of the risks (especially floods) reduction in this area. The following is the detail of each index found under this profile.

### *(a) Population*

It is the term referring to the total number of human inhabitants of a specified area, such as a city, country, or continent, at a given time. Microsoft Encarta (2008) states that population study as an academic discipline is known as demography. It is concerned with: the size, composition, and distribution of populations; their patterns of change over time through births, deaths, and migration; and the determinants and consequences of such changes. Population studies yield knowledge important for short- and long-term planning, particularly by governments, in fields such as health, education, housing, social security, employment, and environmental preservation. Such studies also provide the information needed to formulate government population policies, which seek among other things to modify demographic trends in order to achieve certain economic and social objectives. Demography is an interdisciplinary field involving mathematics and statistics, biology, medicine, sociology, economics, history, geography, and anthropology (Rowley 2008).

The total population of Ngwathe in 2007 was 133 000 with 34 000 households. This increased from the previous census (2001) which was 118 810 with 32 108 households. According to Community Survey (2007) the population has increased by 20% within seven years (2001-

2007). The significant, unplanned population has overloaded the infrastructure, such that the water pressures are low and sewers frequently block and overflow to the Vaal River.

The age and gender distribution reflects important information regarding the spatial needs of the population. It is reflecting the life stages and anticipated demand for specific needs which should spatially be provided within the local municipality.

**TABLE 2.1: GENDER DISTRIBUTION**

| GENDER | AVAILABILITY |
|---|---|
| MALE | 47.46% |
| FEMALE | 52.54% |

*Source: Demarcation Board 2006*

It is clear from Table 2.1that there are more women than men in Ngwathe, which could make it vulnerable to disasters like floods.

**TABLE 2.2: AGE DISTRIBUTION**

| AGE BREAKDOWN<br>Yrs | AVAILABILITY<br>% |
|---|---|
| 0-4 | 9.19 |
| **5-19** | **34.26** |
| 20-29 | 16.74 |
| 30-49 | 22.28 |
| 50-64 | 9.68 |
| 65 and Over | 6.84 |
| Age unknown | 1.01 |

*Source: Demarcation Board 2006*

Based on the age breakdown in Table 2.2, it is evident that the dominant population structure is "young" which is prevalent in the developing country. With the "young" age structure, the demand for basic needs; housing, social facilities and job creation increases.

### *(b) Education*

Wikipedia encyclopaedia (2011) asserts that education is any act or experience that has a formative effect on the mind, character, or physical ability of an individual. In its technical sense, education is the process by which society deliberately transmits its accumulated

knowledge, skills, and values from one generation to another. The legacy of apartheid in South Africa possibly manifests itself most clearly in education. Government spending on black education has increased significantly since the mid 1980s and especially since 1990 (Microsoft Encarta Encyclopaedia 2008). However, although education has been legally desegregated, in practice most black children are still restricted to ill-equipped schools.

In the early 1990s expenditure for white pupils was about four times higher than that for black pupils. The teacher-to-student ratio for blacks was 1:60 in urban areas and 1:90 in rural areas in the early 1990s. By comparison, the teacher-to-student ratio for whites averaged 1:30 or even lower. As a result of these conditions, only 41 per cent of all black students passed the secondary-school final qualification exam (a requirement for university entrance) in 1991. In the same year, 96 per cent of all white, 95 per cent of all Asian, and 83 per cent of all Coloured students passed the exam. Also, the black literacy rate is less than 50 per cent, while the white literacy rate is virtually 100 per cent. Overall literacy in 2005 was 87 per cent. In 2002–2003, 5.4 per cent of gross national product (GNP) was spent on education.

Today's government is tackling the education of the poorest children in society by introducing fee-free schools in the most deprived areas. All children attend school from age 7 (Grade 1) and matriculate at age 15 (or completion of Grade 9), before entering work or further education.

Though there are a number of primary, secondary and high schools in Ngwathe, lack of any FET and or Higher education institution remains the hindrance to tertiary education anywhere within the municipality; meaning that the students have to move out of the municipality once they have completed Grade 12 (matriculation). They rely on FET colleges (Flavius Mareka, two branches in Kroonstad and Sasol, Vaal University of Technology in Vanderbijlpark, North West University in Vanderbijlpark, Sebokeng and Potchefstroom. Communities raised them as there was a need, but they are however not well attended.

Despite this shortcoming the municipality is still able to assist learners with registration fee or bursaries to pursue their careers at various tertiary institutions. The following (Table 2.3) is the list of schools found in NLM as per the IDP 2011-2012.

**TABLE 2.3: NUMBER OD SCHOOLS IN NLM**

| TOWN | # OF SCHOOLS |
|---|---|
| **Heilbron** | 27 |
| **Parys** | 20 |
| **Koppies** | 17 |
| **Edenville** | 08 |
| **Vredefort** | 07 |

*Source: Demarcation Board 2006*

### *(c) Health analysis*

There are nine clinics, two hospitals and two community centres in Ngwathe. Whilst there is the construction of a community health centre that is in progress in Phiritona, mention should be made of the appalling conditions in Tumahole/ Parys clinics. They are experiencing high volumes on a daily basis resulting in some patients having to return home unattended. Edenville and Vredefort struggle to access the ambulance services timeously. However, the emergency call centre remains a challenge for all the areas. Rural health provision, similar to the national tendency, is still an issue of concern. Health services are not regularly provided within this region. This is a situation in Ngwathe therefore service delivery needs to be enhanced.

### *(d) Political analysis*

Van der Waldt (2007) asserts that each municipality has a council where decisions are made, and the municipal officials and staff who carry out the work of the municipality. Elected members have legislative powers to pass by-laws and approve policies for their area. Therefore Ngwathe Municipality has a governance system, which consists of different decision making levels. Councillors meet in various committees to develop proposals for the council. These levels are divided as follows in order to enable smooth administration of governance issues:

- The Municipal Council
- Mayor and Executive Council
- Portfolio Committee

➢ **Mayor and executive committee**

It is composed of the mayor, five councillors, the municipal manager and all the four section's 57 directors.

- **Portfolio committee**

The meetings of the governance structures are conducted in order to form synergy with public participation processes and administrative processes of council. Therefore the portfolio committees and the executive committee meet monthly and the general council meets once a quarter.

Strong political leadership for developmental local government should be emphasised in order to ensure ability of the municipality to make difficult policy decisions. White Paper (South Africa 1998:81) adds that if the leadership role is embarked on, the municipality will be able to work with the role players from all levels of society and to guide the actions of their administrations to promote the social and economic well-being of local communities. The importance of the delegation of executive powers is embraced in order to ensure efficiency and accountability.

## 2.5 MUNICIPAL STRUCTURE

### *(a)Organisational Structure*

Ngwathe Municipal Council developed and approved an organogram in 2004. The main objective was to establish a strong administrative support, to implement the integrated development plan, and for the smooth running of the day-to-day activities of council. Below the re-organized structure that enables Ngwathe Municipality to implement the IDP is discussed. The total staff complement of Ngwathe local Municipality is 719.

## 2.6 DISASTER MANAGEMENT PROFILE

The Disaster Management Act (South Africa 2002) provides clear guidelines to ensure the establishment of a national, provincial and local disaster management system. Section 28(1) determines that each province must establish a framework for disaster management ensuring an integrated and uniform approach to the process. The framework should, amongst others, ensure general representation of governmental, non-governmental and the private sector. It follows

naturally that the DMF of the District Municipality will have to be established in context with the Provincial Framework to ensure a uniform and integrated approach to disaster management. Chapter 5 of the Act deals, in great detail, with the establishment of a Municipal Disaster Management Framework (MDMF) and clearly states (Section 42) that a MDMF needs to be established for the District Municipality. The District Municipality needs to establish the MDMF for proper consultation with the various Local Municipalities (LMs).

The profile confines what the department or unit consists of. The disaster management of Ngwathe functions on fire and traffic line function which makes it very difficult to deal with floods and other disasters. It is evident that the profile is well presented in the IDP, but is not practically portrayed. It is important to note that NLM has two disaster officials within its ranks.

## 2.7 ECONOMIC PROFILE

The South African Census 0f 2006 Community profile, provides the economic profile of Ngwathe. Additional information on the economic profile has been incorporated into municipal functions. The municipal functions have presented economic analysis to reflect potential and constraints for their functional economic development. In the subsequent paragraphs, municipal functions *inter alia* housing, roads and storm water, electricity, transport; libraries, fresh produce market and health will be discussed with the economic implication attached to each.

Ngwathe municipal area is predominantly agricultural area. However, two of its towns, Parys and Heilbron are amongst the fastest growing towns in the province with Parys rapidly becoming a tourist attraction destination in the region, with various activities in place. It is the long-term intention of the municipality to exploit the economic spinoffs presented by this area. One key factor is the Vredefort Dome World Heritage Site. With regard to housing, Ngwathe is not an investment destination. As a result of this, it has 13 786 of unemployment and 22 446 of employed population. Lack of social amenities in township is a further result of the low investment appeal.

Furthermore, Ngwathe has been characterised by a culture of non-payment and general perception of degeneration of the town with a lack of economic activities, opportunities or planning (Ngwathe IDP 2010-2011).

It can be deduced that IDP has become a tool for integrated development to determine the economic implication of each municipal function. Also, strategies are required to relate the payment of services to IDP process to demystify the culture of non-payment as indicated above. Free basic services to the poor and encouragement of investment in township development remains a development drive. It can be deduced that improved road systems to ensure mobility and access to socio-economic development opportunities require consideration to attract investors and create jobs.

Transport operations and investment in the transport infrastructure have been influenced economically. Weakening economic circumstances of the urban population due to job losses in Ngwathe area have affected investment in the transport industry. Increasing private vehicle ownership, deteriorating public resources for investment and changing technological and operational requirements of modern business have affected investment in the transport infrastructure (Ngwathe IDP 2010-2011).

Health care in Ngwathe generally has economic implications based on the public sector financing, financial status of local government and high usage of Primary Health Care (PHC) services in the Tshwane area (Ngwathe IDP 2010-2011). The declining per capita allocation for health care and negative growth in national and provincial health budgets are a limitation. Consequently, the financial status of municipalities fails to meet Primary Health Care (PHC) demands. Ngwathe has estimated a lot of inhabitants who are not medically insured and therefore these residents depend on the usage of PHC services. The health care system experiences constraints, which include dependence for funding of the PHC, Ngwathe low budgetal locations, under-resourcing and a backlog in service delivery (Ngwathe IDP 2010-2011). Ngwathe should locate its PHC services within the provincial plan for funding. Health-related projects should also find mechanisms to manage PHC in a viable and sustainable manner.

## 2.8 ENVIRONMENTAL PROFILE

Environment is a thin layer of life and life-support called the biosphere, including the Earth's air, soil, water, and living organisms (Microsoft Encarta Encyclopaedia 2008). IDPs are required to consider issues related to the environment as they obtain within their municipal areas, Statutory

obligations contained in the National Environmental Management Act expects the municipality to be responsive to issues of nature that will help improve the quality of life**.** Ngwathe has major and minor environmental limitations. Minor environmental limitations are linked to specific operations of municipal functions. Major environmental limitations are *inter alia,* loss of environmental resources, urbanisation, insufficient security in open spaces, environmental apathy, the perception that open spaces spread crime and a lack of understanding that environmental resources contribute to the long term ecological sustainability of the municipality. Threats and problems of municipal function are identified through assessment. This will assist in listing problems, locating affected people, specification and identifying the cause of problems. Some Key Environmental Aspects include but are not limited to:

(a) Natural Water Resources and Water Quality
(b) Vredefort Dome World Heritage Site
(c) Land fill Sites
(d) Climate
(e) Mineral resources
(f) Air quality
(g) Land
(h) Endangered species
(i) Effluents control systems

***(a) Natural Water Resources and Water Quality***

Water used in Parys and Vredefort is directly from Vaal River treated through Ngwathe purification plant. Apparently the municipal treatment plants need maintenance which it does not get, therefore ends in agony. The water quality of Parys and Vredefort is hard and scale forming. This is due to the bad quality of the river. There are lots of algae and the water smells and tastes badly. The required treatment technology to address the above would be (1) the introduction of the Powdered Activated Carbon (PAC) dosed in a slurry form and that removes the colour, and (2) would be the introduction of the Dissolved Air Flotation (DAF), right after the sedimentation process just before the sand filtration, and that restores the taste currently missing. With the two processes being in place, the communities of these two towns would be able to drink the water without reserve.

The water treatment works for Parys, Vredefort and Koppies are operating at capacity and will not be able to meet the future water requirements for the area. There s a dire need to increase treatment capacity. Already the boreholes are experiencing shortage. Water used in Heilbron is brought from Rand water through a pipeline that runs from Sasol, while the water of Koppies is directly from Renoster River treated by Ngwathe's purification plant. Lastly, Edenville's water is drawn from the Boreholes which are currently running dry. The municipality is complementing this by transporting 90 000 of water from Heilbron on a daily basis including weekends and public holidays. This exercise is very costly but unavoidable.

### *(b) Climate*

Climate is the long-term effect of the Sun's radiation on the rotating Earth's varied surface and atmosphere. Thornthwaite (1948) defines climate as the weather averaged over a long period. The standard averaging period is 30 years, but other periods may be used depending on the purpose. It can be understood most easily in terms of annual or seasonal averages of temperature and precipitation (Microsoft Encarta Encyclopaedia 2008). Ngwathe IDP 2010-2011 depicts that climate change is a cross-cutting issue and also NLM is thus affected by the same.

Besides the effects of solar radiation and its variations, climate is also influenced by the complex structure and composition of the atmosphere, and by the ways in which it and the ocean transport heat. Climate encompasses the statistics of temperature, humidity, atmospheric pressure, wind, rainfall, atmospheric particle count and other meteorological elemental measurements in a given region over long periods (Wikipedia). Thus, for any given area on Earth, not only the latitude (the Sun's inclination) must be considered but also the elevation, terrain, distance from the ocean, relation to mountain systems and lakes, and other such influences, adds Microsoft Encarta Encyclopaedia (2008).

Climate has profound effects on vegetation and animal life, including humans. It plays statistically significant roles in many physiological processes, from conception and growth to health and disease. Humans, in turn, can affect climate by changing their environment, both through the alteration of the Earth's surface and the introduction of pollutants and chemicals such as carbon dioxide into the atmosphere. The following are responses to climate change:

- Improved disaster management support within the area

- Drought relief programmes
- Support the shift to green economy programmes in the country.
- It is moving away from programme that lead to destructive development like deforestation

***(c) Mineral Resources***

The following mineral resources are found within the municipal area:

- Sand deposits
- Bentonite
- Granite
- Coal deposits

***(d) Land Use Management***

Land-Use Management involves the control of floodplain development that has a notion to attract the attention of government agencies and the general public to control location of development. Ngwathe Local Municipality has endeavoured on a formal legislative process, in terms of the Free Sate Township Ordinance, in order to prepare an integrated land use management system. The Draft Ngwathe Town Planning Scheme is under way. There are challenges regarding land scarcity, particularly in Koppies and Heilbron. The Land Use Management will assist not in flood reduction but also the overall risks reduction within the area; increases public and institutional awareness of risks associated with flooding. This technique also tend to be less costly in capital expenditure but more so in terms of human commitment.

## 2.9 COMMUNITY AND STAKEHOLDER PROFILE

Butcher (1993:4) and Wilcox (1994:48) define community as the body of people having the common rights, privileges or interests or living in the same place under the same laws and regulations. Legislation requires that communities must be consulted annually during the IDP reviews, and be afforded the opportunity to make inputs according to the priorities in their respective wards; all the 19 wards were consulted and accordingly afforded such an opportunity. Prioritising the needs established development objectives that were laid into projects (Ngwathe IDP 2010-2011).

The prioritised issues have characterised the submissions of ward committee. The IDP identified housing, roads and storm water, social development, electricity, water and sanitation, safety and security, economic development, education and environment as municipal priorities. The IDP has detailed identified priorities in respect of wards, which indicate the presence of needs (Ngwathe IDP 2010-2011). The IDP has submitted ten priorities *inter alia* economic development, infrastructure services, safety services, primary health care, environment, city form appearance, communication, social development, accessibility and housing.

It can be deduced that IDP structures have identified municipal priorities from different material realities. It can also be deduced that the submissions of communities have superseded the submission of other IDP structures.

Intergovernmental relation (IGR) is about relations between different spheres of governments or between organs of state from different government about the conduct of their affairs (Ngwathe IDP: 2010-2011). The idea behind IGR is basically to indicate and promote synergy between the three spheres of government. Intergovernmental Relations Framework Act no 13 of 2005 came into effect with the intention of ensuring that all the spheres of government are able to provide sustainable services to our people. However, there are eminent tensions in the process. Lemon (in Parnell, *et al.* 2002:19) adds that the existence of tension between central and local tiers of government suggests that local government is more than simply an agent of the central state. The reason for this tension lies in the fact that the 'politics' of central and local government levels differs vastly. IGR promotes value chain. Some IGR practices by NLM are:

- Provincial Coordinating Forum
- District Coordinating forum
- Technical IGR
- District MM's forum
- District CFO's and technical forum
- IDP Rep forum
- Cordial relationship with other locals
- IDP Manager's forum
- Sec 4 meetings and shared services.

## 2.10 CONCLUSION

Thorough knowledge of Ngwathe is very vital and should be the point of departure for every potential investor and members of the public. Investors are captured by the insight portrait of the municipality in the IDP. This will assist in development of the municipality and the prevention of disasters that lead to sustainability. It will also enhance the external relations with other stakeholders especially private and NGOs when disaster strikes, Ngwathe will know who and where to go to. The linkages between development and disaster risk are not difficult to visualize. Any development activity has the potential to either increase or reduce disaster risk.

# CHAPTER 3
# THEORECTICAL STUDY

## 3.1 INTRODUCTION

By watching the daily news or reading a newspaper, we can conclude that disasters happen regularly. They can take many forms, ranging from natural disasters such as tornadoes and floods to man-made disasters such as workplace violence, hazmat including spillages. No matter what type, the results are usually the same: substantial loss of life, loss of income, assets, and productivity. Disaster is a serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources (ISDR 2009). It should be noted that disaster is hazards vulnerability (people and infrastructure). According to Microsoft Encarta Encyclopaedia (2008) flood is a cataclysmic event which destroys the world. Floods disasters have enormous consequences, socially and economically, and have long-term detrimental effects, especially on vulnerable societies and population groups. Kofi Annan, Former Secretary-General of United Nations (08 October 2003 at the International Day for Disaster Reduction);

> *Natural hazards are a part of life. But hazards only become disasters when people's lives and livelihoods are swept away…let us remind ourselves that we can and must reduce the impact of disasters by building sustainable communities that have long-term capacity to live with risk.*

In this chapter floods will be discussed in more detail. Part of the description will include the definition of floods, characteristics and the causes thereafter.

## 3.2 CAUSES OF FLOODS

The Department of Environment, Food and Rural Affairs, United Kingdom (2006) adds that periodic floods occur naturally on many rivers, forming an area known as the flood plain. These river floods often result from heavy rain, sometimes combined with melting snow, which causes the rivers to overflow their banks; a flood that rises and falls rapidly with little or no advance

warning is called a flash flood. Chow (1956) states that floods are high flow which overtax the natural channel provided for the run-off. Yevyvich (1992) adds that floods are extremely high flows or levels of rivers, whereby floodplains or terrains outside of the water confined major river channels. Jones (2002) argues that floods are also the maintainers of ecosystems and support life in the lakes, wetlands and enrich vast floodplains and play a role in the geomorphic evolutions of landscapes. However, this chapter focuses mostly on the negative impact of floods.

According to UNDP (1992:65) floods are the results of heavy rainfall. Rivers and streams that are functional to surrounding population may, however, be a hazard to them and also render these populations vulnerable to disaster by periodic flooding. When it rains or snows, some of the water is retained by the soil, some is absorbed by vegetation, some evaporates, and the remainder, which reaches river channels, is called run-off. Floods occur when soil and vegetation cannot absorb all the water; water then runs off the land in quantities that cannot be carried in river channels or retained in natural ponds and constructed reservoirs held behind dams. Throughout history people have been attracted to the fertile lands of the floodplains where their lives have been made easier by virtue of close proximity to sources of food and water, therefore would be flooded.

Microsoft Encarta Encyclopaedia (2008) states that about 30 per cent of all precipitation is run-off and this amount may be increased by melting snow masses. Periodic floods occur naturally on many rivers, forming an area known as the flood plain. These river floods often result from heavy rain, sometimes combined with melting snow, which causes the rivers to overflow their banks; a flood that rises and falls rapidly with little or no advance warning is called a flash flood. Birkman (2006) states that flash floods usually result from intense rainfall over a relatively small area. Reed (1992:66) adds that flash floods are floods which occur within six hours of the beginning of heavy rainfall, and are usually associated with cumulus clouds, severe thunderstorm, tropical cyclones or during the passage of a cold weather front. Coastal areas are occasionally flooded by unusually high tides induced by severe winds over ocean surfaces, or by tidal waves caused by undersea earthquakes.

UNISDR (2002) states that floods occur when peak discharge exceeds channel capacity. This is brought about by the failure of man-made structures, deforestation, urbanisation, overpopulation, which reduce infiltration, and by engineering works, such as land drainage and the straightening and the embankment of rivers. Floods involve both the extent and types of vulnerability generated

by people's situations within political and economic systems, and manner in which society deals with floods in terms of mitigation and preparedness (Varley 1994).

Vulnerability to flood disasters comes in various forms; through exposure to floods as a result of locating in flood-prone area; through occupying a dwelling that has little resistance to floods; through weakness that come with age, gender, health status, infirmity or quality of buildings; and through disadvantaged and lack of access to resources which can reduce floods. Parker (2000) adds that lack of protection from floods; inability to avoid, withstand or recover from floods; powerlessness through an inability to influence one's own safety level of protection or relief, are also contributory social factors.

Chapman (1999) depicts that flooding is a natural function of the river behaviour and floodplains. River behaviour is basically the depiction of the flood characteristics in it. Several authors jointly discuss the six measurable characteristics of floods as:

(a) Flood depth or stage is height of the flood which has a direct consequence for humans. Penning Rowsell and Chatterton (1977) illustrate that low velocity floodwaters of 1m (metre) or more are usually considered to be a great threat to humans.
(b) Flood discharge is a magnitude. Parker (2000) relates flood discharge to a stage- discharge rating curve that has been empirically through measurement using flow-metre.
(c) Flood duration is the length of time the floods takes place or erupts. It has effect on the flood damages.
(d) Flood frequency is a statistical measure of the probable occurrence of a flood of a given magnitude (Cordery & Pilgrim coded in Parker; 2000). This is commonly used in the design of structural flood protection projects.
(e) Flood extent is a measure important in modelling the flow and effects of floods. (Parker 2000). Parker adds that high quality flood extent and floodplain mapping is fundamental to many planned methods of reducing flood hazards. The larger the flood magnitude and the longer the flood return period, the greater is the flood extent or the geographical area covered by the floodwater.
(f) Flood damage is the impact or effect of floods on humans and the environment. It also associated with flood velocity. It is further dealt with in the following section.

## 3.3 EFFECTS/ IMPACTS OF FLOODS

Floods not only damage property and endanger the lives of humans and animals, but also affect the three major spheres; environmental, social and economical. The impacts cut across income groups, social classes, and the level of community development, from subsistence fishermen in the rural fishing communities to industries, businesses and tourists in urban populated centres, (ADPC, 2006). Flood disasters invariably have a range of adverse impacts directly or indirectly associated with extent and magnitude of floods. However, some of the impacts are seen in the long run. The incident of flood is related to people's differential capacity to cope, which in turn Hewitt (1997) sees it related to material wealth or poverty, ability to access information and access decision-makers.

### 3.3.1 Environmental sphere

Microsoft Encarta (2008) asserts that environment is the thin layer of life and life-supports called biosphere, including the Earth's air, soil, water, and living organisms (such as people, plants and animals). South African National Environment Management Act 107 of 1998 stipulates that environment as well as people should be protected from induced hazards and disasters. It further states that pollution and degradation of the environment should be avoided or minimized and remedied (South Africa 1998:12). Deforestation, land degradation and resource exhaustion processes contributed to disaster vulnerability (Wisner 2004).

Environment is an important input of human beings therefore managing and utilizing the environment in a way that continues to supply goods and services is required. Rapid run-off causes soil erosion as well as sediment deposition problems downstream. Spawning grounds for fish and other wildlife habitats are often destroyed. High-velocity currents as the result of floods increase damage; prolonged high floods delay traffic and interfere with drainage and economic use of land. Bridge abutments, bank lines, sewer outfalls, and other structures within flood ways are damaged, and navigation and hydroelectric powers are often impaired (Microsoft Encarta 2008).

The impact suffered by people, infrastructure and the atmosphere have great impact on the environment. Therefore the impact on the environment covers the nature, society and economy. Environment holistically include human elements (social), natural elements and bio-physical environment. Understanding the composition of environment in this regard will unfold the impact of floods on the environment as a whole.

### *(a) Pollution*

Microsoft Encarta Encyclopaedia (2008) asserts that pollution is the contamination of the environment by man-made substances or energy that has adverse effects on living or non-living matter. This contamination of air, water, or soil materials interferes with human health, the quality of life, or the natural functioning of ecosystems. Pollution can be categorized according to the medium in which it occurs: atmospheric pollution (air pollution), freshwater and sea pollution (water pollution), or land pollution (solid waste disposal). Running water in the rivers naturally pollutes the atmosphere, the land and the river itself during flood. River water evaporates with the chemicals in it, and those chemicals react with oxygen which is helpful to people; hence pollution. Water pollution arises from the discharge of industrial, agricultural, and human wastes into freshwaters, estuaries, and seas. This may result in the poisoning of aquatic organisms or the depletion of oxygen owing to excessive growth of micro-organisms, which makes less of the water habitable for fish (Thomas & Collins 2000).

The CDC Fact Sheets (2004-2005) states that flooding water impairs clean water sources with pollutants and devastates sanitary toilets. In addition, waste-water treatment plants, if flooded and malfunctioned, can be overloaded with polluted run-off waters and sewage beyond their disposal capacity, resulting into back-flows of raw sewage to homes and low lying grounds. Boucher (2002) adds that private wells can be also contaminated or damaged severely by flood-waters, while private sewage disposal systems become a cause of infection and illness when they are broken or overflowed.

Land drainage carries pollutants from point and diffuses sources. According to James (1994) point sources include direct discharges by the industry and residences into the rivers and canals. While diffuse sources are typically associated with agricultural activities and result in discharges of pesticides, nitrates, phosphates, solid wastes and organic matter being transported into the river system by surface and sub-surface run-off. The sediment loads (as a result of flood) increase as a consequence of agricultural activities, especially in the upper catchment. James (1994:121) identifies the behaviour of pollutants in the environment as follows:

(e) Direct toxic effects on organisms (effects of volatile components of oil on corals.)

(f) Sub lethal effects which increase stress (thermal discharges and heavy metal pollution).

(g) Accumulation in sediments (oil residues, heavy metals and organic micro-pollutants).

(h) Habitat modification and loss.

(i) Overloading of detritus food chains and subsequent reductions in oxygen levels.

(j) Stimulation of plant growth which, if extreme, causes nocturnal deoxygenation.

(k) Generation of unpleasant sights and smells.

***(b) Degradation***

Soil degradation is the decline in quality and quantity of soil. This may be brought about by various processes: erosion, contamination, drainage, acidification, and loss of soil structure, or a combination of these. Processes induced by human behaviour and activities (sometimes combined with natural hazards), that damage the natural resource base or adversely alter natural processes or ecosystems. Potential effects are varied and may contribute to an increase in vulnerability and the frequency and intensity of natural hazards (ISDR 2002).

Degradation of land is brought about by drainage resulting in soil-loss due to oxidation and wind erosion. Arbhabhirama (1987) adds that soil degradation problems cause soil compaction and soil erosion; and all these threaten to become prominent in the environment. Owing to rivers, the degradation becomes so massive that the soil is not cultivatable; if there are no trees and plants the water runs off very easily and quickly. Fertile top soil is washed away. People can no longer grow crops which are helpful to them. The erosions enlarge the size of the river and create more dongas.

### 3.3.2 Economical sphere

James David (1994) asserts that economics mainly focuses on the interplay of supply and demand, during any disaster (floods in this case). Needs for public water supply, food and shelter have always driven investments and planning but contribution of water scarcity in the overall financial

burden is hardly singled out. Supply security is however one of the main criteria of decision in any strategic water supply scheme.

Examples of economic impacts of floods:

- Direct flood damages
- Indirect flood damages
- Loss of jobs
- Decrease in agricultural production
- Loss of infrastructures- houses, bridges and properties.
- Deforestation

Direct flood damages are impacts that are mostly tangible and suffered during and immediately after disaster; example are loss of lives, infrastructural and property damages, loss of jobs. While indirect flood damages are those that are mostly intangible and are seen long after disaster happened; examples include, PTSD (Post Traumatic Stress Disease) and some related diseases, decrease in economy and GDP.

### *(i) Deforestation*

Deforestation is the large-scale removal of forest, prior to its replacement by other land uses for their own use. Most of the Black poor community depends on the trees for fuel so much that some people sell their trees for survival especially in winter. Cutting down of trees for income has an impact on the environment in the sense on disfiguration and bareness. Economic analysis is therefore being encouraged to help place economic values on damages to help these to be recognized more easily. David (1994;1) illustrates that economic approach in environment impact offers a logical means of integrating applied science and public decision making, of reducing conflict in environmental and natural resource management, and of reaching a balanced decisions on the development and environmental protection. It is through economy that we quantify the environmental impacts in monetary terms. The idea is to apply this method as early as possible so as to get the overall costs of the whole area and take decisions to sustainable development.

### *(ii) Finance*

Floods directly affect the physical environment but greatly affect the country's economy to reconstruct and recover what has been damaged. This leads to the loss of value and the decrease in competition of the South Africa Rand in the stock market. There is economic hindrance suffered each year due to floods impact. Floods stress people who have been affected in that they are unable to cope outside their family structure. Poor communities tend to suffer great loss due to lack of insurance cover, fewer financial reserves and less financial resilience to enable them to recover.

Indirect effects can be that businesses are disrupted due to flooding with the resulting loss of income, and jobs can be lost. Parker (1987) shows that the flood affecting section of business community in town is likely to generate financial losses among the flooded firms and financial gains among the non-flooded ones. This is because customers are likely to transfer their business to the non-flooded firm where there easy alternative outlets. Parker (2000) states that floods generate damage within a region which leads to commodity scarcity such that nationwide commodity prices rise. This leads to economic loss because producers of these commodities outside the flooded area may gain significantly as a result.

### *(iii) Decrease in Agricultural production*

Owing to loss of lives and property, the agriculture is greatly affected. There is the prominent decrease in labour which leads to more work. The machinery is also affected to some extent, due to loss of profits the farmers are left in despair.

### *(iv) Loss of infrastructure/ infrastructural damage*

Obviously there are quite prominent infrastructural damages including roads, bridges, houses private properties and work stations. Loss of these factors leads to stagnation of profits, work and desires.

### 3.3.3 Social sphere

It is important to consider the types of disaster that exist, their duration and whether a particular disaster is natural or man-made. Each of these impacts greatly influences the degree of stress and social impact that is felt by the community after experiencing a disaster event. Human and social impacts are worst felt locally. These are manifested in terms of displacement of people, death, occupation of school buildings as evacuation centres, increased exposure to disease and psychosocial illness. Detailed social impacts are discussed below;

***(i) Loss of lives***

According to Williamson (2009), the death rate is 90% from natural disasters in developing countries. Many people whose houses are by the river side or on the banks are washed away by those rivers. People drown during floods; however drowning is not only the source of death during floods. Death has a negative impact on the community and results in helplessness and no reason to live after losing the loved ones. People become widows, childless and also parentless due to death; therefore the family structure was broken. Family structure is very vital for the growth of children because it builds moral values and cultural practices transfer, from older generation to younger generation. Burton *et al.* (1993) illustrates that poorer nations bear the greatest effects of floods impacts due to comparatively low standards of living and low property values at risk.

- **Homelessness**

  One of the effects of floods is that it leaves people homeless. If one has no home, one becomes a wonderer in the streets and restless, which in turn affects the dignity of such a person. It is known that home is where the heart is, one without a home does not have a place for her or his heart. This means that the victim will move from place to place looking for a safer place to stay. His/her health is also at risk, due to the unhygienic toilet system, water and food that he/she eats.

- **Health**

  According to the Centre for Disease Control and Prevention (CDC 2005) mental health problems can result when social, political, natural and cultural environment are inter-

related and out of balance. In places where health care infrastructures are already poor, people simply cannot cope with the strain on resources that flood disaster creates. According to CDC (2005) damage to hospitals, health facilities and water sewage systems has a big impact on health. During most floods events, a lack of coordination between organizations rendered causes a setback and ineffectiveness, due to the local infrastructure especially roads. That is, there are no update reports about the current conditions of roads going to from the affected area.

Families suffer from depressions due to the trauma of seeing their loved ones die. This generates the deep grieve of their loved ones, which later causes Post Traumatic Stress Disorder (PTSD). This in the long run, will have a huge negative effect on behaviour and inter-relationships within the community. The emotional strain of the event on financial and social costs would appear to be a catalyst for these impacts (ARMCANZ 2000).

Floods have a tendency of contaminating all stretches of water found in that particular area; be it a river, community well or dam due waste material carried along. Some people may not even be aware of this contamination. World Health Organization (WHO (2005) notes that unclean drinking and washing water, bad sanitation, coupled with lack of adequate sewage treatment, can lead to disease outbreaks such as life-threatening cholera, typhoid and hepatitis. The water becomes the carrier of germs and cells that promote diseases which are dangerous to people, plants and animals. It increases the transmission of the communicable diseases.

Industrial buildings may get damaged and chemicals can flow from other buildings. Floods sweep away these chemicals to the river, open wells and ground water sources. Reed (1992: 69) states that the pathogenic organism from the human or animal remains may also contaminate water and cause diseases to hundreds of people.

*Diarrhoea* is frequent and abnormally watery bowel movements. It is often a temporary affliction caused by poisonous or indigestible substances in the intestines, by nervous shock, or tension. The disorder is of longer duration in such inflammatory diseases of the intestines as enteritis, colitis, cholera, typhoid fever, bacillary and amoebic dysentery, and intestinal-worm infestations. The loss of fluids in diarrhoea may cause dehydration and shock, and may be serious with infants (Detroit Health Department 2004). According to

the findings, many people can be affected by diarrhoea because of contaminated drinking water. It mostly affects children, women, the elderly and animals.

Microsoft Encarta Encyclopaedia (2008) depicts that *cholera*, is a severe infectious disease endemic to India and some other tropical countries and occasionally spreading to temperate climates. That is, the spread is faster in rainy regions that are not hygienically conscious. The symptoms of cholera and diarrhoea are characterised by the loss of water and salts in the stool. In severe cholera, the patient develops violent diarrhoea with characteristic "rice-water stools", vomiting, thirst, muscle cramps, and, sometimes, circulatory collapse (Thomas & Collins 2000). However, death can occur as quickly as a few hours after the onset of symptoms. The mortality rate is more than 50 per cent in untreated cases, but falls to less than one per cent with effective treatment.

*Typhoid Fever* is an acute infectious disease caused by the typhoid bacillus *Salmonella typhi*. The bacillus is transmitted by milk, water, or solid food contaminated by faeces of typhoid victims or of carriers, that is, healthy people who harbour typhoid bacilli without presenting symptoms (Wikipedia 2011). This is a typical result of the unhygienic toilet system; people don't have proper toilets but use buckets which they dish out into the river. Then the water becomes contaminated and can affect people using water from infected rivers.

*Hepatitis* was previously known as infectious hepatitis. Hepatitis A is caused mainly by poor sanitation and lack of hygiene. According to Drug Interferon Information (2006) hepatitis is transmitted by food or water contaminated by excreta; by other objects taken into the mouth from person to person, including by sexual contact; or by injection with improperly sterilized hypodermic needles or needles shared by intravenous (IV) drug users. Outbreaks often occur in army or refugee camps and in institutions where small children are crowded together. Shellfish and uncooked food carry risk of infection. This form of the disease has become more common as a result of increased travel to countries where hepatitis A is common and where clean water and proper sewage disposal are not available (Microsoft Encarta Encyclopaedia 2008).

- **Coping Capacity**

  UNISDR (2009) asserts that coping capacity is the ability of people, organizations and systems, using available skills and resources to face and manage adverse conditions, emergencies or disasters. It normally requires continuous awareness and betterment of resource management, but most especially during crises. Lack of resources and lack of information about floods lead to incapability of the community to deal with the floods. Unplanned settlement and overpopulation also hinder the capacity to cope.

- **Education**

  An old proverb tells us that education is the key to success. Hawkins, Delahunty and MCdonald (1998) explain education as a process of training people's minds and abilities so that they acquire knowledge and develop skills. Nonaka (2006) suggests that education enables the individual to gain access to knowledge, which is a precondition for coping, by anyone wishing to do so, with today's complex world. With the knowledge gained from education, health issues with be tackled in a better understanding. It prepares and sharpens the young people's careers for professional life in order to cope with today's technology.

  The classrooms may be flooded and this has impact on education of the students or scholars. The reconstruction of classes may take longer or not be repaired at all. In the meantime no accommodation for children is available. For some time or even permanently depending on the local government of that area, learners will not have chance to learn. This creates a gap that would assist that community in the long run.

- **Transportation**

  The delivery of aid can be compromised by lack of transportation during and after flood events due to collapsed infrastructure. Reduced transport capacity also hinders relief efforts from aid agencies. It has a social impact in terms of immediate and indirect impact of a natural disaster.

- **Political instability**

  Political instability can occur after a disaster. Political decisions which may be entirely unrelated to floods may lead to some persons or groups becoming more vulnerable to floods. Parker (2000) adds that those decisions may reduce the resources available to vulnerable

groups to cope or deprive them of those resources altogether. A cyclical relationship exist between political instability and natural disaster in that natural disaster can cause political instability, which in turn prevents adequate aid resources from through, which therefore maximizes the impact of disaster. For example Alexandra Township in Johannesburg suffered a lot because of two municipalities that were pointing fingers at each other. The battle was whether Alexandra fell within either Great Johannesburg Metropolitan or Eastern Metropolitan. In vulnerable areas service delivery is very poor, delayed and limited by poor infrastructure.

Political instability leads to law breakdown and lack of order. This results in high crime of other government services like electricity from illegal connections and the robbing of small businesses. People will not have proper services and will do whatever it takes for their survival. Ineffective response during floods cause that residents trust in authorities. Wisner (2004) adds that the majority of people are vulnerable because they are subordinated and unable to make choices that would provide even when they are aware of safer options.

- **Social Structure Breakdown**

Owing to death, many families are broken up. For example, if there is no father figure in the family, boys will not have manhood guidance and instructed regarding cultural practices done to them. They will lack someone to look up to and a mentor during their childhood. It moves to the community at large, and that community will be defined as the violent community with a lot of thieves and robbers. People become selfish individuals in their own community. They no longer care for one another and this kills the spirit of *Ubuntu.* This community will obviously be divided creating inharmonious relationships, which are in fact dangerous. A typical community should depend on one another and help one another.

While some displaced families who decide to send their children away to live with relatives or friends until the security situation in their area has improved, may unknowingly for lack of better options overlook the family social-fabric. Hence, the high rate of rampant prostitution reported among children from displaced families, probably because of economic hardships. Population has a negative social impact due to migration especially men. Men leave their wives and children to search for survival, but they might not be fortunate enough to succeed due to limited resources.

- **Conflicts**

  Conflicts can arise when there are limited resources for survival such as water, food and electricity. There is increased conflict and violent behaviour within families, between families and the community. The environment suffers while people fight because they break down or burn buildings at times. The emission of smoke from the burning buildings and/or tyres as the case might be pollutes the atmosphere.

- **Electricity power failure**

  Floods damage the electric infrastructure and this can lead to a secondary disaster. There will be massive damage caused by electric cut offs, meaning that people who are using electricity for cooking, store food in a refrigerator, keep dead bodies cool at the mortuaries will not have electricity. The environment becomes risky in terms of hygiene.

- **Security**

  Issues related to future security concerning the fear of future flooding and loss of security makes people feel their homes are no longer a safe refuge. Homes no longer have the same meaning for people as they did before the flooding. People will no longer trust the authorities judging from the recovery phase.

## 3.4 MITIGATION AND PREPAREDNESS

Disaster mitigation includes both disaster preparedness and prevention. These three processes ought to be considered before disaster in order to manage the situation. Mitigation is the collective term used to encompass all actions taken prior to the occurrence of a disaster (pre-disaster measures) including preparedness and long-term risk reduction measures (UNDP 1994).

Mitigation is furthermore the minimization of the disaster impact through risk reduction measures. It is the most cost-efficient method for reducing the affect of hazards although not always the most suitable. Mitigation includes providing regulations regarding evacuation, sanctions against those who refuse to obey the regulations (such as mandatory evacuations), and communication of risks to the public (Lindell, Prater & Perry 2006). According to UNISDR (2009) mitigation is the lessening or limitation of the adverse impacts of hazards and related disasters.

Preparedness consists of activities designed to minimize loss of life and damage, organize the temporary removal of people and property from a threatened location, and facilitate timely and effective rescue, relief and rehabilitation (UNDP 1994). Lindell, Prater and Perry (2006:26) depict preparedness as the tool to ensure effective coordination and enhancement of capacities to prevent, protect against, respond to, recover from and mitigate the effects of natural and man-made disasters. Prevention is the outright avoidance of adverse impacts of hazards and related disasters (UNISDR: 2009).

Coburn, Spene and Pomonius (1994:13) assert that mitigation and preparedness jets into a wide range of activities and protection measures that might be instigated, from the physical (like constructing stronger buildings) to the procedural (like standard techniques for in cooperating hazard assessment). In this regard, preparedness and mitigation are very pivotal in disaster management process.

Preparedness is getting ready to fight hazards before they occur. It is vital for the communities to understand the hazard so that they are prepared. In some cases local communities may be unaware of weather events occurring upstream of their locations that might result in their destruction (UN: 1998). The disaster preparedness framework illustrated by Kent (1994) outlines activities that are essential to the development of a preparedness strategy. This includes;

- Vulnerability assessment
- Planning
- Instructional framework
- Information systems
- Resource base
- Warning systems
- Response mechanisms
- Public education and training
- rehearsals

Vulnerability assessments are valuable tools for establishing an essential disaster management plan. Kent (1994) illustrates that vulnerability analysis is a continuing, dynamic process of people

and organizations assessing the hazards and risks they face and determining what they wish to do about them, if anything. It could be concluded the vulnerability assessment entails the means of structured data collection geared towards understanding the levels of potential threats, needs and immediately available resources. Assessment entails everything found within the affected area; infrastructure, vegetation, animals and people. On a technical level, vulnerability assessments serve as the starting point for determining the types of plans that should be developed as part of a national disaster preparedness strategy.

Planning is the theme of the whole disaster preparedness exercise. One objective is to have agreed-upon, implementable plans in place, for which commitment and resources are relatively assured. Kent (1994) adds that planning for readiness includes working out agreements between people or agencies as to who will provide services in an emergency to ensure an effective, coordinated response. Planning must be well coordinated with the inclusion of the national and local government, sector departments, private sectors, donors, UN agencies and NGOs in order for the plan to be implementable during and after flood disaster.

Instructional framework describes processes and mechanisms for establishment of cooperative arrangements with international role players. According to Disaster Management Regulations (2002) instructional framework addresses the application of the principle of cooperate governance for the purpose of disaster risk management. It also emphasises the involvement of all stakeholders to prevent the severity of the disaster impact.

Resource base entails the requirements to meet disaster needs, and those will depend upon the types of disasters the plan anticipates. Such needs should be made explicit, and should cover all aspects of disaster relief and recovery implementation. Specific arrangements should be established whereby each party with written agreements can secure goods and services as required. Kent (1994) illustrates that critical issues include special internal arrangements for the acquisition and dispersement of funds; policies and agreements for the use of other's equipment and services; and emergency funding strategies. The anticipated disaster relief and recovery needs should be made explicit and specific arrangements and written agreements should be established in order to assure the provision of goods and services as required.

Information system is the most appropriate means of gathering and disseminating early warning information and must therefore be carefully assessed and well defined within the disaster preparedness plan. It is imperative that early warning messages be understood by the people for whom they are issued.

Warning systems ensure the functioning of communications systems, such as telephones and telexes, and may not be available in times of a major disaster. Consider what type of communications equipment will be needed and be sustainable if power lines and receiving stations are destroyed. Kent (1994) highlights that preparedness plans should include provisions for access to alternative communication systems among police, military and government networks:

- **Flood Mitigation**

  FEMA (2009) states that flood mitigation involve the management of people, through measures such as evacuation. It involves managing the effects of flooding, such as redirecting flood run-off, rather than trying to prevent it altogether. The prevention of floods can be studied on a number of levels, individual properties, small communities, towns or cities. According to Dales (2007) flood mitigation is a process of assessing risks from flooding, and then using the information to implement appropriate management measures.

  These measures may be the construction of flood defences, provision of flood warning systems, provision of washable and wetland systems or the development of policies which reduces development in flood risk areas. This is the most effective way of reducing the risk of people and properties through the production of flood risks maps. FEMA (2009) adds that flood mitigation is the management of people, through measures such as evacuation and wet/dry properties.

- **Response**

  There are a vast number of responses that ought to be considered. Each response depends upon the nature of the threat. Once an effective disaster preparedness plan is in place, these response mechanisms should be familiar to potential beneficiaries or to those with the responsibilities of implementing such measures. Some of the broader categories of response for a variety of hazards include:

- evacuation procedures
- search and rescue
- security of affected areas
- assessment teams
- activating special installations (such as emergency hospital facilities)
- activating distribution systems
- preparing emergency reception centres and shelters
- Activating emergency programmes for airports, harbours and land transport.

Kent (1994) states that alerts must be issued 24 hours before the occurrence of disaster, advisories must be issued twelve hours in advance and a warning must be issued 60 minutes maximum or anytime before the disaster strikes.

Priority shall be disaster risk training, awareness and education**.** UNISDR (2009) states that public awareness is the extent of common knowledge about disaster risks, the factors that lead to disasters and the actions that can be taken individually and collectively to reduce exposure and vulnerability to hazards. There shall be training workshops conducted for community members. The training workshops shall entail knowledge and awareness about the major hazards which include floods. The community shall be trained about the interpretation of alerts, advisories and warnings which will differ based on the time.

Training workshop must be compulsory for every resident; members of the community and must be informed about the evacuation routes and the manner in which instructions should be followed once disseminated during disasters. Volunteers/interns will assist (especially elderly, disabled and younger children) and lead during evacuations to avoid major confusions and frustrations. Community members will be made aware during workshops about the communication tools that will be used before, during and after a disaster.

Rehearsals are the only way to keep plans fresh, especially during extended periods without disasters. Rehearsals must be conducted system-wide and taken seriously. System-wide means that all the components which would be involved in a real disaster situation, from central to local authorities, should be rehearsed. They provide opportunities to re-emphasize training programme

instructions, identify gaps that may exist in the disaster response plan, and inform on-going revisions of that plan.

## 3.5 IMPLEMENTATION OF MITIGATION MEASURES

The basic methods of flood control have been practised since ancient times (Kent 1994). These methods include reforestation and the construction of levees, dams, reservoirs, and flood-ways (artificial channels that divert floodwater). Long-term risk reduction measures are intended to minimize the adverse effects of a hazard by eliminating the vulnerabilities which hazards would otherwise expose. These measures directly reduce the potential impact of a hazard before it strikes. Disaster preparedness assumes that certain groups of people or property will nevertheless remain vulnerable, and that preparedness will have to address the consequences of a disaster's impact (Kent 1994).

In order to control floods, channel modification should involve increasing the channel cross-sectional area so that higher discharge will not increase the stage of the river. Straighter channels allow higher velocity flow and enable the stream to drain faster when discharge increases. Lining the channel with concrete provides a smoother surface over which the water can flow, thereby reducing friction and also increasing the velocity of the stream (Microsoft Encarta Encyclopaedia 2008). Channelization for flood control may reduce the incidence of flooding in the channelized area; it often results in more severe flooding both upstream and downstream from the channelized area.

Dams are used to hold water back so that discharge downstream can be regulated at the wanted rate. Human constructed dams have spillways that can be opened to reduce the level of water in the reservoir behind the dam. Construction of dams can reduce floods by controlling the rate of water flow if well constructed.

Drainage system is a removal of surface or subsurface water from a given area by natural or artificial means. This is commonly applied to the removal of excess water by canals, drains, ditches, culverts, and other structures designed to collect and transport water either by gravity or by pumping (Microsoft Encarta 2008). A drainage project may involve large-scale reclamation and protection of marshes, underwater lands or lands subject to frequent flooding. Such a project

usually involves a system of drainage ditches and dykes; often pumps are required to raise the water into the drainage network.

Levees are embankment along the course of a river. Natural levees are low banks that are produced by the river during floods when the overflowing of the river decreases the speed of the water and permits the deposit of silt (Microsoft Encarta 2008). Normally levees and dams are chosen floods mitigation measures, in order to minimise economical and environmental losses. These two are weighed based on the costs and benefits of the community that is helped against floods impact.

The situation of NLM is not good; no disaster management unit, no funds available for recovery and the damages were so extensive. The damages include; water treatment plant, houses, shacks, bridges and storm water channels.

## 3.6 CONCLUSION

It can be concluded that vulnerable people in our communities need effective disaster risk reduction planning to deal with any disaster. The focus and priority must be on preventing or mitigating disasters within the area, to reduce the disasters or eradicate them. Livelihoods that provide people with little more than basic needs are unlikely to enable the provision of self-protection, and any associated lack of social protection for such people will result in high levels of vulnerability.

It is, however, imperative to implement the necessary strategies to reduce disaster risk and to minimize the effects of a disaster. Attention must be paid to local people and engage in public awareness such as education campaigns, public consultation through relevant structures such as civic organizations, and through media coverage particularly topics that are related to hazards affecting the entire community. Public better awareness is also necessary so that the community is alerted of what is happening regarding a disaster risk reduction plan.

The municipalities should develop and implement policies to restrict development of house and other useful infrastructures on the flood plain area to reduce the flood risks. The community should be made aware of the legislations that need to be complied with; such information should be disseminated by that municipality in an attempt to reduce flood impact.

# CHAPTER 4
# RESULTS ANALYSIS

## 4.1 INTRODUCTION

The purpose of this chapter is to assess the ability of Ngwathe to deal with floods. This assessment exercise is undertaken by disaster management representatives of Ngwathe through interviews in order to get the municipal views on their preparedness. This only represents the municipal preparedness because it is the one that has to deal with floods in Ngwathe, and warn the community of those floods. It is aimed at enhancing the municipality's capacity to reduce flood risks that lead to disaster. It is also to help Ngwathe to regard disaster management as a cyclical process made of four vital phases that need to be fully done; preparedness, mitigation, response and recovery.

Ngwathe is the local municipality found in Fezile Dabi District therefore falls under its demarcation. National Disaster Management Centre (NDMC) has declared Fezile Dabi as disastrous area early 2011. This is the result of heavy rainfall experienced within December 2010 and January 2011, and this negatively affected the municipality due to lack of capacity to deal with floods. According to the Disaster Management Act (South Africa 2002), disasters should have a dedicated account wherein money is allocated as emergency funds.

The December 2010-January 2011 floods show that the municipality is not prepared for disasters; therefore more must be done to ensure that Ngwathe is a safer place It is clear that most municipalities in South Africa have not implemented the disaster management framework that assists in the execution of disaster projects and programmes within stipulated timeframes as would be contained in the integrated development plan (IDP). According to Department of Provincial and Local Government (2000:17) the failure to implement it, affects service delivery as a whole.

Floods in Ngwathe pose a serious threat not only to the livelihoods and the lives of the residents but also to the environment and economy. The problem lies within the municipality's ability to deal with these floods. The ability of the municipality to implement preparedness and mitigation is disaster management's point of departure therefore they must seriously take it into consideration.

## 4.2 METHODOLOGY

Qualitative research was the most appropriate method to acquire data and information from the authorities. Structured questions were compiled in a questionnaire to assess the preparedness of Ngwathe Local Municipality regarding floods. Two officials representing disaster management unit in Ngwathe were interviewed face to face. A list of open and closed ended questions were administered in order to probe the participants to bring out their opinions on the information sought, and control the flow of the interview respectively.

The process was as follows:

*Step 1:* Interviews were scheduled with the officials telegraphically, and the purpose of the interview was explained. Two of the interviewees were not a problem because they formed part of the steering committee at Fezile Dabi District, representing their municipality (Ngwathe).

*Step 2:* Questionaires were sent via e-mail and fax before the interviews were done.

*Step 3:* The interview took about 20-30 minutes each.

According to Cooper and Schinidler (2006) personal interviews carry the advantages of enabling the interviewer to notice particular reactions and thus eliminate confusion over the questions asked; the interviewer can also pick up non-verbal data like dread or fear and flexibility among others. The aim of the interviews is not to spot or pinpoint anybody, it is to be fair and open for the benefit of the organisation at large.

The officials were very much keen to respond as a way of enhancing the corrective in as far as disaster management was concerned, and also to put forward their concerns regarding service delivery. Their willingness and availability simplified the research process.

## 4.3 FLOODS DAMAGES IN NGWATHE LOCAL MUNICIPALITY

As stated earlier (previous chapters), Ngwathe has five towns. The conditions of this local municipality showed that the towns were ill prepared and did not have the necessary skills as far as floods were concerned. Data collected from disaster management officials assisted in understanding the factors that led to flood disaster unpreparedness. The analysis included

measuring the degree to which these factors could be anticipated to make a difference in the implementation of disaster management plan. Four out of those towns were badly affected, and below are the findings per town:

- **Parys**

  According to Fezile Dabi District Flood Report (2011) storm water channels were destroyed hence, the water flowed in the roads causing potholes and cracks on the surface. The water channels were blocked by the sediment from the runoff; water could no longer be channelled to the intended direction therefore failed their purpose.

  Two bridges were washed away; the golf course bridge and the bridge that divides Mandela and Mbeki sections in Tumahole Location was washed away. The bridge dividing the locationsvwas low and was inundated. While the golf course bridge could not survive due to the full capacity of the Vaal River. Houses (RDP) and shacks were flooded in those incidents and many people were left homeless. Houses by the riverside were flooded; however, the residents could recover themselves due to insurance covers. One person died as a result of the flood. The municipality undertook flood assessments that were submitted to the Fezile Dabi District Municipality. The assessments formed part of the district report sent to the Provincial and National Disaster Management Centre. The municipality was able to take care of the funeral costs of the deceased. At the moment, project planning has been done and the municipality is awaiting the funds from National Disaster Management. Fezile Dabi District Municipality distributed the blankets to the affected.

- **Edenville**

  There was a tornado followed by floods and subsequently houses were destroyed. Many people lost their houses, properties and livestock. The most affected area was the graveyards, according to Fezile Dabi District Municipality Report (2011). The municipality undertook flood assessments that were submitted to the Fezile Dabi District Municipality. The assessments formed part of the district report sent to the Provincial and National Disaster Management Centre. The project planning was done and the municipality was awaiting the funds from National Disaster Management. Fezile Dabi District Municipality distributed blankets to the affected people.

- **Heilbron**

The storm water channels were heavily blocked by debris floating down the river and hampering smooth flow of water, while Phiritona Bridge was flooded and water ran over the bridge. The houses and shacks were affected leaving people homeless (Fezile Dabi District Municipality Report: 2011). Informal settlements below flood line were also flooded. The municipality undertook flood assessments that were submitted to the Fezile Dabi District Municipality. The assessments formed part of the district report sent to the Provincial and National Disaster Management Centre. At the moment, project planning has been done and the municipality is awaiting the funds from National Disaster Management. Fezile Dabi District Municipality distributed the blankets to the affected and effected.

- **Koppies**

The water treatment plant was flooded such that the pump could not function at full capacity. The booster pump that supplies the water reservoir was also damaged and could not cope in filling up the reservoir. As a result, there was water shortage in this town. The houses next to the railway line were also flooded leaving the residents homeless (Fezile Dabi District Municipality Report 2011). The municipality undertook flood assessments that were submitted to the Fezile Dabi District Municipality.

The assessments formed part of the district report sent to the Provincial and National Disaster Management Centre. Project planning has been done and the municipality is awaiting the funds from National Disaster Management. Fezile Dabi District Municipality also distributed the blankets to the affected.. Through Fezile Dabi District Disaster Management Centre, the private sponsor for the treatment plant was found, and the plant was fixed to at least function. However, the plant was still not absolutely in good condition therefore phase two projects had been proposed.

Ngwathe hired one manager who has experience in emergency services, so the number of the interviewees was increased from two to three. Disaster management is a multidisciplinary discipline therefore involves traffic department. The head of traffic contributed to some extent to some of the questions in the interview though he was not fully interviewed.

## 4.4 PREPAREDNESS OF NGWATHE DISASTER MANAGEMENT UNIT

The discussion below is based on the responses of the interviews from Ngwathe Disaster management unit. Most of the responses were more or less the same (See Annexure A).

### 4.4.1 Planning

Section 23 of the Local Government: Municipal System Act (South Africa 2000), specifies that municipalities should undertake developmentally orientated planning to ensure that they achieve the objectives of local government, as stipulated in section 152 of the Constitution of the Republic of South Africa (South Africa 1996). This should offer effect to their developmental duties, as required by section 153, and would make a significant contribution to the realisation of fundamental rights contained in sections 24 to 29 of the Constitution of the Republic of South Africa (South Africa 1996). This demonstrates the principal relationship of the Local Government: Municipal System Act (South Africa 2000), and the Development Facilitation Act (South Africa 1995) with the Constitution of the Republic of South Africa (South Africa 1996).

Section 24 of the Local Government: Municipal Systems Act (South Africa 2000) makes provision for municipal planning in co-operative government. It stipulates that municipal planning should be aligned and complemented with the development plans and strategies of other organs of the state, such as the legislature and executive. Municipalities should give effect to the principle of co-operative governance to participate in national and provincial development programmes, as required by section 153 (b) of the Constitution of the Republic of South Africa (South Africa 1996). It can thus be concluded that a constitutional framework for co-operative governance has been established.

In terms of section 25 of the Local Government: Municipal Systems Act (South Africa 2000), municipalities should adopt a single, inclusive and strategic plan for the development of the municipality within its prescribed five-year term. The municipal plan must link, integrate and co-ordinate plans and proposals for the development of the municipality. The plan should align the resources and capacity of the municipality with the implementation of the plan, and form a policy framework and a general foundation on which to base the annual budget. It can be concluded that the strategic development of the municipality is dependent on alignment and linkage of planning and available resources.

Section 35 of the Local Government: Municipal Systems Act (South Africa 2000) presents a strategic planning instrument, which guides and informs all planning and development, and all decisions with regard to planning, management and development in a municipality. This implies that any form of planning in the municipality must take place within the framework of the IDP and should not be seen as separate from the IDP.

Disaster Management Framework (2005) states that all the resources should be in cooperated as part of the planning for an infrastructural development, for example assessing the likelihood of weather, flooding, subsidence and other threats damaging the structure, so that these can be factored into the construction specifications. This will enhance the sustainability of a development project or programme to support vulnerable households.

***(a) Preparedness plans of the municipality***

Preparedness contributes to disaster risk reduction through the measures that are taken in advance to warning. It is therefore imperative to build the infrastructures such as roads and other useful facilities through using building designed codes, erosion control facilities through the activities and efforts of people involved in soil and farmland management, better land-use planning (ADRC 2003). Preparedness is getting ready to fight hazards before they occur. It is vital for the communities to understand the hazard so that they are prepared. In some cases local communities may be unaware of weather events occurring upstream of their locations that might result in their destruction (UN 1998). Lindell, Prater and Perry (2006:26) depict preparedness as the tool to ensure effective coordination and enhancement of capacities to prevent, protect against, respond to, recover from and mitigate the effects of natural and man-made disasters.

Chapter 5 of the Disaster Management Act (South Africa 2002) deals, in great detail, with the establishment of a Municipal Disaster Management Framework (MDMF) and clearly states (Section 42) that a MDMF needs to be established for the District Municipality. The District Municipality needs to establish the MDMF for proper consultation with the various Local Municipalities (LMs). Ngwathe in this regard, uses FDDM disaster preparedness plan as one

of the local municipality. It is clear that Ngwathe is not prepared for any disaster; it needs external help from the district, province and national.

***(b) Emergency or contingency plans***

There are contingency plans in place which have been developed by Ngwathe itself. According to Ngwathe Traffic department, the disaster management contingency plans did not include the traffic department (one of the important stakeholder) as supposed to. During the recent floods, the disaster management unit struggled to demarcate the flooded area until the SAPS intervened. The traffic was then called later on; in a way disaster management's contingency was not effective. The main problem lies in the resources and information available, for the implementation of the plan; good planning informs easy implementation.

***(c) Strategies***

Section 26(a) of the Local Government: Municipal Systems Act (South Africa 2000) requires municipalities to determine a vision for the long-term development, development objectives for an elected term of office and to develop strategies which are aligned with national, or provincial sector plans and planning requirements. Strategies have been developed to address the priority issues within Ngwathe regarding flood. These strategies are built upon the indigenous knowledge from the community at large. These strategies, according to Ngwathe official, are short term because they only apply during floods.

### 4.4.2 Prevention measures

Places on the river banks of the Vaal River are occupied by the wealthy people whom the municipality find it hard to evacuate. It becomes the question of where to place those rich people as opposed to the appropriate and standard evacuation area. The crux of the matter is that the municipality has no preventative measures for floods alongside Vaal Riverside residential area.

Ngwate disaster management unit is now attempting to come up (it is ongoing negotiation) with some measures; there is the joint venture between the municipality and aquatic companies along the Vaal River. Their main purpose is to reduce the impact of floods damage and provide warnings to the community and riverside residents on time. There will be the well equipped

control which will be operated by the riverside and send SMS-notification warnings to the community. Mitigation may include implementing legislation that limits building in flood zones.

### 4.4.3 Organisational structure

The organisational structure of Ngwathe is there, though not functional. The structure is informed by the budget, hence it is not functional. There are only three officials; director, manager and deputy manager, who have experience in emergency services and fire fighting. In cases of disasters, staff from the fire department is utilised. This becomes a challenge especially because the staff is only trained in fire not floods, and they also use shift system of operation.

### 4.3.4 Budget

There is no specific budget for disaster management, but for the execution of disaster issues, the fire budget is used. This simply means that disaster management duties and activities are not met due to lack of funds. UNHCR (1992) and Disaster Management Act 57 of 2002 stresses the importance of having the emergency fund for disaster management due to the fact that disasters occur when least expected. Ngwathe, unfortunately depends on the National Disaster Management Centre (NDMC), which delays the whole process of recovery phase. It should be noted that, even now (October 2011), Ngwathe still awaits the NDMC for the recent floods (Dec-Jan 2011).

### 4.4.5 Awareness

Owing to lack of funds, awareness campaigns are done jointly with FDDM. They are not as effective as they could if they were planned by Ngwathe. One emphasis of a disaster preparedness plan should be to anticipate the requirements for a disaster relief operation and the most effective ways of meeting those requirements. The planning process would only be effective if those who were the ultimate beneficiaries knew what to do in times of disasters and knew what to expect. For this reason, an essential part of a disaster preparedness plan was the education and warning of those who might be threatened by any disaster.

Kent (1994) points out that although television, radio and the printed media will never replace the impact of direct instruction, sensitively designed and projected messages can provide a useful supplement to the overall process. Riley and Meadows (1997) further reflect that information flow becomes problematic in disasters therefore hinders the coordination of response.

### 4.4.6 History of flood

Parys in Ngwathe has the history of floods due to the Vaal River, but the municipality has limited capacity to deal with residents along the riverside. However, it is the private sector's initiative to do some preventative measures. In most instances, you can identify particular geographical areas or communities that are predictably under threat from flood hazard. These may include traditionally drought-prone areas or communities living in flood-prone areas. They can be squatter settlements in which housing structures are known to be vulnerable to floods.

### 4.4.7 Topography

According to Microsoft Encarta Encyclopaedia (2008) topography is cartography and surveying, layout of natural and artificial features on the surface of the Earth, and the science of their detailed, graphic representations on maps and charts. Parys's topography is a disadvantage due to the huge river that runs across. The Vaal River is a hazard because it sometimes overflows, damaging properties and taking lives of animals and nearby vegetation.

There are also informal settlements without good settlement planning. Many of houses/ shacks are built below the flood line because of a lack of knowledge. In places like these, the runoff can cause major problems due to lack of good infrastructure. The significant unplanned population has overloaded the infrastructure such that water pressures are low and sewers frequently blocked and overflowing. Maintenance of such systems is very difficult because the high densities and congested nature of the settlement makes access for maintenance very difficult or impossible.

### 4.4.8 Response

Response is the provision of emergency services and public assistance during or immediately after a disaster in order to save lives, reduce health impacts, ensure public safety and meet the basic subsistence needs of the people affected (UNISDR: 2008). Response is the post disaster phase that has to deal with victims and everything that has been affected during disaster. It also involves the resources like transport, food parcels, blankets, portable water, medical services and evacuation areas to mention a few.

According to Disaster Management Act 57 (South Africa 2002), response is defined as measures taken during or immediately after a disaster in order to bring relief to people and communities. On a personal level the response can take the shape either of a shelter in place or an evacuation. In a shelter-in-place scenario, a family would be prepared to fend for themselves in their home for many days without any form of outside support. In an evacuation, a family leaves the area by automobile or other mode of transport, taking with them the maximum amount of supplies they can carry, possibly including a tent for shelter. If mechanical transportation is not available, evacuation on foot would ideally include carrying at least three days of supplies and rain-tight bedding, a tarpaulin and a bedroll of blankets being the minimum.

From the interviews it was clear that the resources were not enough. There was lack of water and rescue equipment for response. There was only one boat which would not sustain the water pressure because it did not have an engine. Training was not efficient; only one official was trained in disaster management. Support from district was minimal due to lack of appropriate resources. That is, there was too much dependency on the District, Province and the National Disaster Management Centre.

### 4.4.9 Community involvement

Community refers to a group of people living within a specific geographical area where their needs are met through an interdependent relationship. Community implies that a group of individuals is an exclusive phenomenon given the heterogeneity of people's interests, needs and values (Friedman 1993). It includes fighting flood disaster by the community at large; Ngwathe community does understand floods, but the problem lies within visitors from all over South Africa. When Vaal River is full, visitors would come to Ngwathe to view, yet this poses a threat to the Ngwathe disaster management. Most of the times, the community becomes committed when it is affected, so their involvement is all about themselves not the neighbours. For example Mandela section does not help Schonkenville when it is flooded; however, these two locations are in Parys-Ngwathe.

## 4.5 NGWATHE LOCAL MUNICIPALITY AND CAUSES OF DISASTERS

The next section describes the root causes of disasters and Ngwathe's situation is evaluated against it.

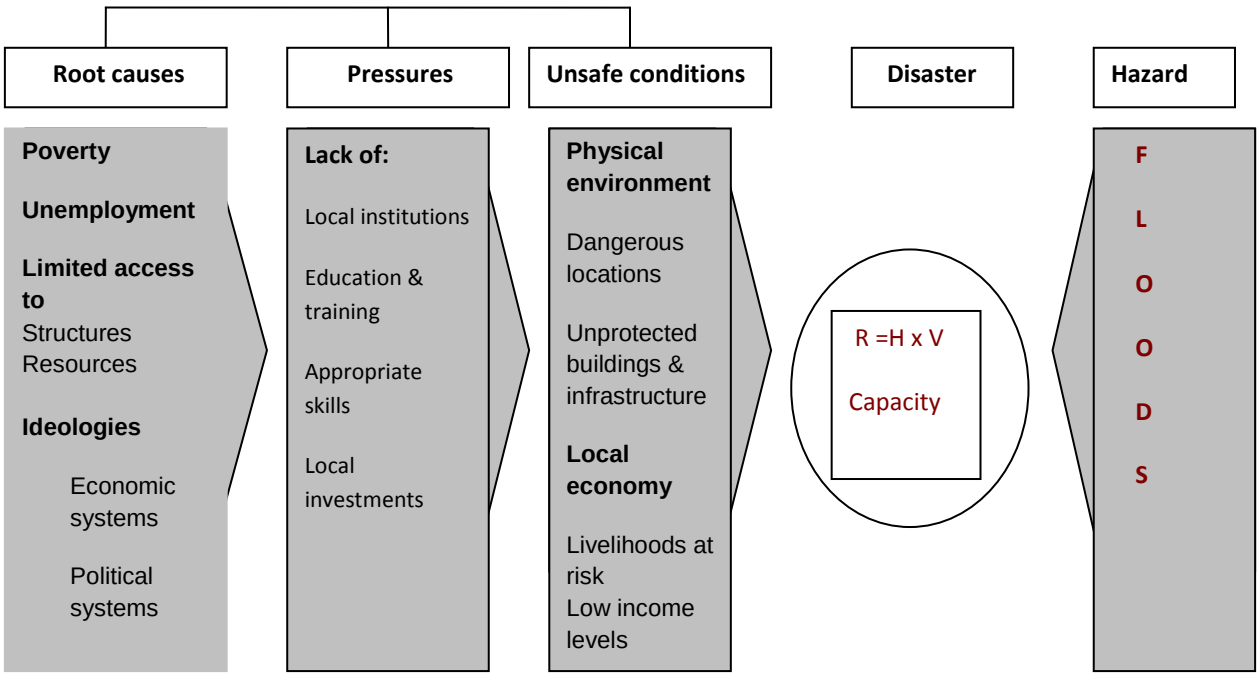


Figure 4.1: Pressure and Release Model: The Progression of Vulnerability (Wisner, *et al.* **2006).**

Figure 4.1 describes the relationship between the root causes, dynamic pressures, and unsafe conditions; and how these factors increase the impact of floods in Ngwathe. The employment of the Pressure and Release (PAR) progression of vulnerability model clearly gives a picture of the relationship between risk, vulnerability and hazards. It shows the root causes, pressures and unsafe conditions that lead to vulnerability of the environment and the people. Floods are the main hazards identified that are associated with risk and vulnerability of the community, so the model explains all the dynamics associated with floods including the causes and effects:

**a)** ***Root causes***

This is a deep-rooted set of factors within a society that together forms and maintains vulnerability (Van Niekerk 2002:75). Ngwathe local municipality area has a high rate of unemployment due to insufficient resources, lack of resources, river running through, poor infrastructure, unstable political systems and limited access to economic systems. Most of

the community members solely depend on the government grants and low paying temporary employment for their living which makes it difficult for this community to cope using their own resources since it is vulnerable to most of the disasters. The average level of education is low and it sometimes becomes difficult to communicate.

**b) *Dynamic pressures***

In this phase there is a translating process that channels the effects of a negative cause into unsafe conditions. This process may be due to lack of basic services or provision or it may result from a series of macro-forces (Van Niekerk 2005:75). Shortage or lack of local institutions means that there are no possibilities of institutionalizing flood prevention and mitigation in the area. Training facilities are highly desirable in this area to educate, transfer skills and knowledge and train community members. The absence or shortage of electricity within the informal settlements makes it very difficult since this community has to depend on firewood collected from the veld which has adverse effects on environmental degradation.

**c) *Unsafe conditions***

Unsafe condition is the vulnerable context where people and property are exposed to the risk of disaster. The fragile physical environment in Ngwathe informal settlements is one element that needs attention. The informal settlements are built in such a way that they are closely packed, mostly built with combustive material, and that becomes a high risk during floods. The building infrastructures are vulnerable to the floods in the area. No communication, infrastructures for disaster preparedness and early warnings, crowded families practices poor hygiene and sanitation that lead to epidemics. Epidemics are health hazards that are very disastrous because many people become sick, and some die. Absence of people leaves a great gap in the community, at work or any social groups.

## 4.6 RESEARCH FINDINGS

The purpose of this paragraph is to give a description of the respondents' answers to the preparedness of Ngwathe Local municipality as per 5-point Likertte Scale. Most of the answers were a bit similar. Scale 5= strongly agree 4= agree 3= mediocre 2= disagree 1= strongly disagree.

**TABLE 4.2: REPSONDENTS PREPAREDNESS ACCORDING TO THE LIKERTTE SCALE**

| ITEM | SCALED RESPONSE YES/NO/MAYBE | NUMBER AS PER LIKKERT SCALE |
|---|---|---|
| Are the disaster management plans in place? | NO | 2<br>Reason is that there are emergency plans |
| Are there any prevention measures? | NO | 1<br>No measures at all, but there is an ongoing decisions on prevention measures |
| Does your organisation have a functional DM structure? | NO | 1<br>Reason is lack of staff |
| Is there any DM budget according to your IDP? | NO | 1<br>Reason is that disaster management uses fire budget |
| Are there any awareness campaigns done by Ngwathe? | NO | 3<br>Reason is that it has joint ventures with FDDM. |
| Does Ngwathe has history of floods? | YES | 5<br>Almost every year along Vaal River |
| Does the topography disadvantage you? | YES | 4<br>Places along riverside and also the informal settlements due to their poor building system. |
| Are there any mitigation, response and prevention plans? | NO | 2<br>Private and district intervene |
| Do you have resources to deal with floods | NO | 1<br>Lack of staff and equipment |
| Do you have any external help? | YES | 4<br>Private companies along riverside |
| Is the community involved in flood reduction | YES | 3<br>The involvement is minimal, that is, they only act when they are affected. |
| Do have other stakeholder's involvement? | YES | 3<br>Not good enough due to lack of resources and action plan |

According to the results, there are disaster management plans in place however the emergency plan focuses only on fire as one of the disasters. The emergency plan excludes other disasters like floods among the few. The interviewees therefore rated the question very low according to Likertt Scale; meaning that they disagreed. Results also indicate that there are no preventative measures in as far as floods are concerned although there is an ongoing negotiation with external companies along the Vaal River. The interviewee strongly disagreed with the question and rated 1 (very low) as per Likertt Scale. Disaster management is not interpreted in Ngwathe's organisational structure

therefore there is no designated personnel and budget. Rating was very low meaning that the respondents strongly disagreed. The budget for the execution of disaster management activities does not exist and this has a great impact on the overall municipal budget due to the damages to be recovered. Rating was very low meaning the respondents strongly disagreed. Ngwathe does not have capacity to undertake disaster management awareness campaigns however join hands with Fezile Dabi District municipality to execute such activities. The rating was minimal because whenever Ngwathe gets chance, it uses that chance to do what it is supposed to do.

Ngwathe has history of floods due to topography and poor infrastructure. Ratings were very high meaning that the respondents strongly agreed. There are no mitigation and response plans and the rating was very low. According to Ngwathe, Head of Traffic Department, the absence of disaster management preparedness and mitigation plans made their work very difficult during disaster response because they did not know their role in that particular incident. Basically, lack of resources (staff, plans, and equipment) was the main reason for absence of plans, and therefore Ngwathe struggled to cope with floods. Rating was very low in this regard. There was no action plan that was inclusive of every relevant stakeholder's role and responsibility. The involvement of other stakeholders was very difficult and the rating was very low. The community's involvement was minimal meaning that the community helped to fight floods in whatever possible ways it could. The rating was mediocre meaning that the community still needs to be sensitised on flood disaster.

## 4.7 CONCLUSION

It can be concluded that the heart of this chapter lies within the incapacity of Ngwathe Local Municipality to deal with floods. The problems emanate from poor planning, lack of knowledge and skilled staff. It should be noted that disaster management is a cyclical process that includes four phases respectively; preparedness, mitigation, response and recovery. The failure of one phase leads to failure of other phases and malfunction of disaster unit as the whole. In conclusion, Ngwathe needs effective disaster risk reduction planning as it is the only hope to deal with any disaster. The focus and priority must be on preventing or mitigating disaster within the area, to reduce the disasters or eradicate them. It is, however, imperative to implement necessary strategies to reduce the disaster risk and to minimize the effects. It needs to pay attention to the local people and engage in public awareness such as education campaigns, public consultation through relevant

structures such as civic organizations, and through media coverage particularly topics that are related to hazards affecting the entire community. Public awareness is also necessary so that the community is alerted to what is happening regarding a disaster risk reduction plan.

# CHAPTER 5

# CONCLUSIONS, SUMMARY AND RECOMMENDATIONS

## 5.1 INTRODUCTION

This chapter serves as a synthesis of all chapters, that is; it provides the gist of each chapter in an attempt to capsulate the challenges encountered in NLM. Translating and transcribing mitigation measures into workable or implementable programmes to facilitate service delivery has been the challenge in most municipalities, unfortunately NLM is falls within the category. This chapter sets out to forward the workable measures that will address the problems. The intension is put forward various mitigation measures in order for NLM to weigh according their budget, in terms of risk reduction.

Each local authority is autonomous, that is, each has the right to place the function where it wishes. However, when one considers the importance of the function, who the Head of Disaster Management is and the vast scope that the function covers, then one has no other option but to place the function correctly within the office of the Chief Executive Officer. Any individual department within local government environment should have sole control over a function as important as Disaster Management. This has led, in the past to a local authority not truly considering the issue of sustainable development, but also being responsible, from time to time, for unnecessary expenses incurred.

## 5.2 CHAPTER SUMMARY

### (a) *Problem Statement & Research Methods*

**Chapter 1** illustrates that floods in Ngwathe pose a serious threat not only to the livelihoods and the lives of the residents, but also in the environment and economy of the region. The problem lies within the municipality's ability to deal with these floods and the effects thereof. The ability of the municipality to implement preparedness and mitigation for disaster management is very important and therefore it must be taken into consideration to be implemented. Preparedness and mitigation are marked as vital stages in the Disaster Management Process due to the fact that they take care of the other phases.

In order to assess Ngwathe's preparedness, individual interviews as an approach in qualitative method, were utilized. All three disaster management officials were interviewed as to determine the capacity of municipality and further detect the floods reduction gaps in the municipality.

**(b)** ***Description of the study area***

Chapter 2 outlines a description of the study area in an attempt to enhance disaster preparedness in Ngwathe local municipality. The area is analysed geographically (whereby the issue of size and demarcation are addressed), demographical (issues of age, gender, health and educational status), organisational structure and socio-economic status to deal and cope with floods.

Concept of poverty and underdevelopment seems to be very quintessential in this local municipality to cope with floods. The high and growing rate of unemployment reflects the increasing vulnerability within the municipality and places more burden on the same municipality. According to the collected data, most areas in Ngwathe live under the poverty line and most young people are not working due to lack of higher institution of learning, whereby the learners could sharpen their skills in any spectrum. Because of these extreme levels of unemployment, there is a slow economic growth that hinders the municipality to overcome challenges of flood disasters.

Underdeveloped infrastructures increased the vulnerability. There was a lack of town planning especially at the locations, and it remained an issue during floods; more houses were flooded as a result. On the other hand, the informal settlements added load to the municipality because their houses were not compliant with municipal standards. The significant, unplanned population overloaded the infrastructure so that water treatment plants exceeded their capacity so much so that the municipality could not cope.

The higher the population, the higher the demand for scarce resources like water and electricity which exceeded the system design capacity. That resulted in low pressures at peak times, water shortages and more flood damages. During heavy rains, the flow of water became difficult and overflowed the residential areas. Eventually, due to lack of storm water channels, the water would be everywhere resulting in floods.

Lastly, the issue of establishment of a disaster management unit within the municipality seemed to be a problem. In the majority of local authorities (including Ngwathe), government is still practising Disaster Management as it was before the adoption of the Disaster Management principles. In the local government environment, the function was seen to be a reactive one, which some officials perceived them to fall within the ambit of either the Emergency Services environment or even the Traffic environment. That was largely as a direct result of:

- A lack of training of the officials tasked with the function,
- A lack of understanding by senior officials on the roll of Disaster Management,
- A lack of understanding of the roll of Disaster Management by Councillors.

**(c) *Theoretical study of floods***

Chapter 3 provides details of the causes of floods in NLM, the constraints facing NLM's preparedness in floods, their impacts and the implementation of mitigation strategies. Knowledge gained from this chapter makes it possible to understand the importance of planning to make floodplains safer for the community living in it. The theory behind this chapter is to build resilience by flood adaptation and adjustment. This means ability to adapt successfully to floods, which involves being aware of both flood hazard, and the means by which such floods may be avoided and reduced. The efforts reducing the impacts of floods are called adjustments. The flood impacts do not only affect people, but cut across the three spheres of life, namely social, economical and environmental.

According to UNDP (1992:65) floods are results of heavy rainfall. Rivers and streams that are functional to surrounding population may, however, be a hazard to them and also render these populations vulnerable to disaster by periodic flooding. When it rains or snows, some of the water is retained by the soil, some is absorbed by vegetation, some evaporates, and the remainder, which reaches river channels, is called runoff.

Floods occur when soil and vegetation cannot absorb all the water; water then runs off the land in quantities that cannot be carried in river channels or retained in natural ponds and constructed reservoirs held behind dams. Throughout history people have been attracted to the

fertile lands of the floodplains where their lives have been made easier by virtue of close proximity to sources of food and water, therefore would be flooded.

Floods not only damage property and endanger the lives of humans and animals, but also affects the three major spheres; environmental, social and economical. The impacts cut across income groups, social classes, and the level of community development, from subsistence fishermen in the rural fishing communities to industries, businesses and tourists in urban populated centres (ADPC, 2006). Flood disasters invariably have a range of adverse impacts directly or indirectly associated with extent and magnitude of floods. However, some of the impacts are seen in the long run. The incident of flood is related to people's differential capacity to cope, which in turn Hewitt (1997) sees related to material wealth or poverty, ability to access information and access to decision-makers.

Environment is an important input of human beings. Therefore managing and utilizing the environment in a way that continues to supply goods and services is required. Rapid runoff causes soil erosion as well as sediment deposition problems downstream. The impact suffered by people, infrastructure and the atmosphere has great influence on the environment. The impact on the environment covers nature, society and the economy. Environment holistically include human elements (social), natural elements and the bio-physical environment. Understanding the composition of environment in this regard will unfold the impact of floods on the environment as a whole.

David (1994) asserts that economics mainly focuses on the interplay of supply and demand, during any disaster (floods in this case). Needs for public water supply, food and shelter have always driven investments and planning, but contribution of water scarcity to the overall financial burden is hardly singled out. Supply security is one of the main criteria of decision-making in any strategic water supply scheme.

Direct flood damages are impacts that are mostly tangible and suffered during and immediately after disaster; example are loss of lives, infrastructural and property damages, loss of jobs. Indirect flood damages are those that are mostly intangible and are seen long after the disaster has happened, for examples a decrease in the economy and GDP. Indirect effects can be that businesses are disrupted due to flooding and with the resulting loss of income and

jobs can be lost. Parker (1987) shows that the flood, affecting sections of the business community in town is likely to generate financial losses among the flooded firms and financial gains among the non-flooded ones. This is because customers are likely to transfer their business to the non-flooded firm where there are easy alternative outlets. Parker (2000) states that floods generate damage within a region which leads to commodity scarcity such that nationwide commodity prices rise.

It is important to consider the types of disaster that exist, their duration and whether a particular disaster is natural or man-made. Each of these impacts greatly influences the degree of stress and social impact that is felt by the community after experiencing a disaster event. Human and social impacts are worst felt locally. These are manifested in terms of displacement of people, death, occupation of school buildings as evacuation centres, increased exposure to disease and psychosocial illness.

Coburn, Spene and Pomonius (1994:13) assert that mitigation and preparedness jets into a wide range of activities and protection measures that might be instigated, from the physical (like constructing stronger buildings) to the procedural (like standard techniques for in cooperating hazard assessment). In this regard, preparedness and mitigation are very pivotal in disaster management process.

The basic methods of flood control have been practised since ancient times (Kent 1994). These methods include afforestation and the construction of levees, dams, reservoirs, and flood-ways (artificial channels that divert floodwater). Long-term risk reduction measures are intended to minimize the adverse effects of a hazard by eliminating the vulnerabilities which hazards would otherwise expose. These measures directly reduce the potential impact of a hazard before it strikes. Disaster preparedness assumes that certain groups of people or property will nevertheless remain vulnerable, and that preparedness will have to address the consequences of a disaster's impact (Kent 1994).

(d) **Results analysis**

Chapter 4 deals with a discussion regarding the problem stated in Chapter 1. The main purpose of this chapter is to assess the ability of Ngwathe municipality to deal with floods. This assessment exercise was done by interviewing disaster management representatives of Ngwathe in order to determine their preparedness. It was aimed at enhancing the

municipality's capacity to reduce flood risks that lead to disaster. Current perceptions that disasters happen because God is punishing His people due to their bad deeds, and that the world is coming to an end need to change. Disasters are not primarily rare occurrences managed by emergency rescue services. Rather, there needs to be a common awareness and shared responsibility for risk reduction in every aspect of our lives. This means that every facet of governance should and will need to focus its attention on the roll that Disaster Management plays within its particular daily activities.

According to the White Paper (South Africa 2005), there is a need for a paradigm shift in as far as disaster management is concerned. Disaster Management should no longer only be seen within the context of response to disaster, but the emphasis should be on prevention, mitigation, and development. The function thus causes a dilemma for local authorities, which White Paper attempts to resolve.

The legal framework of government indicates that municipalities cannot work in isolation. They need to follow the protocol; National, Provincial, District and Local. This can cause problems after floods, whereby the local municipality does assessment and sends it to district, then district verifies and sends it to province; province verifies and sends it to national. This is a very long process that in the long run turns the public against their local municipalities. The challenges leading to NLM's inability to cope include:

- Understaffing.
- Lack of flood fighting equipment.
- Lack of plans (preparedness, mitigation and response).
- Lack of knowledge.
- Existence of informal settlements.
- Underdeveloped infrastructure.

The current NLM disaster management status is three disaster management personnel against five towns which is insufficient for the local municipality. All the towns are not prepared. Floods are a problem in Parys, Heilbron and Koppies,with their rivers. However, the other towns are better off but it does not mean that they are prepared. The following is a short summary of each town;

- *Parys* is situated along the banks of the famous Vaal River and in close proximity of one of the longest National roads, the N1 with its toll gate, Vaal toll Plaza. Parys is predominantly an agricultural area with the following produce on offer; corn, tobacco, sorghum and livestock such as cattle, sheep, and etcetera (Ngwathe IDP 2010-2011). The town was established in 1876, and is situated south westerly of Parys and houses the famous Vredefort Dome World Heritage Site. It is an essentially small farming town with the following produce on offer: cattle, peanuts, sorghum, sunflower, and maize**.** The most prominent economic sector in Vredefort is the agricultural sector. Commercial activities in town contribute minimally to the Gross Geographical Product (GGP) of the Municipality, especially when being compared to the contribution in the entire Fezile Dabi District Municipality. Because the agricultural sector is the most prominent economic sector, there are very limited work opportunities in town with the consequent high unemployment rate.

- *Heilbron* was founded in 1872. It is situated in the North Eastern part of the district as well as the Free State province as a whole. It is strategically placed as it is a window into the Free State, the mountain Kingdom of Lesotho and Gauteng. It is a predominantly agricultural town with the following products: maize, wheat, cattle, dairy, sunflowers, sheep, sorghum, beef cattle farms. Heilbron has the Vaal Dam, which runs through and destroys the bridges. In a nutshell, it is vulnerable and there are no flood preparedness plans.

  Heilbron is predominantly an agricultural area although major manufacturing industries contribute largely to the Gross Geographic Product of the area. The agriculture and manufacturing industries have a direct influence on the per capita expenditure and employment opportunities of the urban area concerned. A vast range of products used to be manufactured by Clover S.A., Simba, Tudor, Peter's Knitwear and Microchem, but the factories have since shut down, resulting in huge impacts on the unemployment status of the people.

  - *Koppies Town* was established in 1924. The town, Koppies, is situated on the banks of the Renoster River; it is in very close proximity of the N1 highway. It is also a major agricultural town area with products such as maize, wheat, sorghum, cattle, and beef cattle farming. Koppies town is located in an area of agricultural significance and mainly provides services in this regard to the surrounding rural areas. The three well-established

and developed irrigation schemes subsequently enhance the agricultural character of the area, and provide water resources to the De Beers mine development initiative. Koppies town is strategically located between the larger centres of Kroonstad and Sasolburg, and the location mainly influences growth and development within the community.

- *Edenville* was established in 1912, is situated in between Heilbron, Kroonstad, Petrus Steyn, Lindely and Steynsrust and the R34 pass through Edenville. It too is agriculturally predominantly maize, wheat, sheep, cattle. There are no plans but at least Fezile Dabi District could respond to the Water Treatment plant destroyed by recent floods. Edenville is located in an area of agricultural significance and mainly provides basic services in this regard to the surrounding rural areas. The main road linking Kroonstad and Heilbron stretches adjacent to the area (Ngwathe IDP 2011-2012). The most prominent economic sectors contributing to the Gross Geographical Product of the town include the public sector, finance and real estate and transport. This is ascribed to the influence of Kroonstad, as a large service centre in the concerned town. It is not prepared for floods; however, it has an advantage of not being located next to the river.

## 5.3 RECOMMENDATIONS

Well-argued recommendations are suggested in accordance with the challenges that were encountered in Ngwathe Local Municipality;

### *(a) Improving community resilience*

Resilience is the ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions (UNISDR 2009). Parker (2000) adds that resilience is a measure of the capacity of an individual and/or their household to cope with the aftermath of floods impact, and reinstate their earning or livelihood pattern.

Resilience also addresses the issue of poverty reduction. Microsoft Encarta (2008) depicts that poverty is an economic condition in which people lack sufficient income to obtain certain minimal levels of health services, food, housing, clothing, and education generally recognized as necessary to ensure an adequate standard of living. What is considered adequate, however,

depends on the average standard of living in a particular society. A sort of income would take care of some of the needs at the minimal level, so volunteerism serves as poverty reduction strategy. This might include continued employment, press freedom, volunteerism, couching and training. This will result in community participation by previously disadvantaged groups because they would be able to build their own house when flooded. Disaster Management Act (South Africa 2002), states that the municipality must establish a unit of volunteers who will participate in disaster management in the particular municipality during disasters. The municipality must be able to identify needs and organise the hands-on training to volunteers. Unfortunately, NLM does not have volunteers due to budget constraints, although this compromises the service delivery. NLM must have its own volunteers who will be trained and registered so that it eases the work during disasters. Another reason for having trained and registered volunteers is to avoid havoc during disaster.

The municipality must pay attention to local people and engage in public awareness such as education campaigns about disasters, public consultation through relevant structures such as civic organisation, and through media coverage, particularly topics that are related to hazards affecting the entire community. (Bethke 1997) adds that public awareness is necessary for alerting the community of what happens with regard to disaster risk reduction plan.

Societal protection concerns the ability of social and political structures at the social and political levels above the individual or household, to provide protection from the hazards. This includes the local, district, provincial and national government, other relevant organisations and community-based initiatives. According to UNHCR (1992) people must not be subject to some cruelty, inhuman or degrading treatment. People must be free and feel safe in their community regardless of disasters.

Municipalities are required to ensure that there are mechanisms for constant community engagement in disaster management and its subsequent phases. Most importantly the mechanisms for the community require consideration for different situations. Community involvement should be enhanced through Advisory forums and any other public meetings wherein, the public is warned about certain disasters. This will give raise to indigenous knowledge that should be captured and saved by the municipal representatives. Varley (1994)

adds that indigenous adjustment strategies are vital, and should be adapted by the community before and during floods in order to mitigate the loss and to overcome the calamity.

While ward committees are recognised, there are other non-statutory community structures that can add notably as a vehicle to address community issues. Municipalities are required to structure links between non-statutory and statutory structures. Municipalities are also required to take an interest in the organisational development of existing structures while trying to address the institutional capacity of ward committees. Structured and unstructured techniques to exchange information and educate and build support of ward committees become vital.

The use of technology will also enhance resilience and assist in preparedness. The use of GIS, flood warning and prediction equipment, forecasting equipment and media (radio, newspapers, pamphlets, TV, etcetera) will help. White (1975) advocates the combination of technology and indigenous knowledge as the way forward. This will benefit NLM a lot because of the information gathered from the media added to the indigenous, will solve more problems. In short, community resilience through poverty reduction, creation of employment opportunities, volunteerism (as per the Disaster Management Act 57 of 2002), public awareness, societal protection, community involvement and the employment and/or use of technology will enhance NLM's ability to deal with floods. Therefore it is highly recommended as a point of departure to a way forward.

***(b) Reviewing of public policies***

Flood alleviation measures are sometimes viewed as public goods therefore Parker (2000) points out that the proper responsibility for provision lies with the public agencies through public policy. In those policies, the respective roles and policies of the individual and the state regarding response to floods must be defined according to different traditions and institutions. If those policies bring reduced flood damages, they must be adopted for the benefit of the community. The following are example of such policies:

(i) Public policies designed to improve quality of housing accommodation in a region can at the time improve the flood resistance of flood-prone property, even if this is not a prime objective.

(ii) Public policies designed to reduce social exclusion and provide enhanced educational opportunity for disadvantaged groups can also have a positive impact among those living in flood-prone areas.

(iii)Re-engineering a river channel in order to reduce flooding in a community.

In general, public policies aimed at enhancing sustainable development may also impact positively to enhance resilience to flooding. Therefore, NLM should review their policies to provide implementation ability. Disaster Management Act (South Africa 2002) states that, the rehabilitation should not be below standard but acceptable bearing in mind risk reduction. For example flooded shacks should be replaced with proper houses or RDPs to eliminate flood impacts.

People should be forbidden to settle in flood prone areas in order to reduce risks of being flooded. Law enforcement within the citizens will enhance this process of illuminating informal settlement. Through the review of such policies, for example- people must be removed if found in those designated areas.

People living by the riverside, especially the Vaal River should turn their homes into guest houses for tourism. Basically, guest houses are insured for any circumstance, and are not used every day. There will also be an increase in GDP on NLM. NLM is recommended to develop and implement policies to restrict development of houses and other infrastructures on the floodplains to reduce the hazards. The community members should be made aware of the legislation that needs to be compiled with, and such information should be disseminated by the municipality. Structures which are already located in the floodplains should be engineered to withstand flood forces and designed with elevated floors to reduce damage by floods.

### *(c) Prevention and Mitigation Measures*

Floods are increasing in frequency and severity therefore introduction of mitigation plans is key to reduce the damages that are suffered. It is very crucial to conduct Environmental Impact Analysis (EIA) prior to the development of the mitigation measure project, and it is the integral part of planning and development. EIA is important for assuring the development of the principles of sustainability, and can be achieved through evaluating the economic projects and detriments of developing oriented flood prevention and mitigation measures

(James 1994). Early warnings systems may not be very effective as flood is a rapid onset natural disaster therefore structural control mitigation measures are very important as to prevent and protect communities from flooding. An efficient and reliable mitigation measure can only be implemented after calculating or carrying out meticulous Benefit-Cost analysis and weighing the options. It is recommended that Ngwathe investigate what mitigation measures to implement to mitigate or prevent impacts of floods. Examples of these measures are:

- **Land-use Planning**

  The process undertaken by public authorities to identify, evaluate and decide on different options for the use of land, including consideration of long-term economic, social and environmental objectives and the implications for different communities and interest groups, and the subsequent formulation and promulgation of plans that describe the permitted or acceptable uses (UNISDR 2009). Parker (2000) deliberates that land-use is used as a flood mitigation measure and is pursued in two ways; comprehensive plans and stand-alone plans.

  Comprehensive land-use planning is a process in which planners and other local government professionals work with community members to produce the information, agreement, goals and policies to achieve sustainable urban development and redevelopment. Stand-alone, land-use planning process is done by local governments that have particularly severe flood problems and intensively focus on those floods without the community involvement (Parker 200).

- **Evacuation areas**

  The municipality should have plans for evacuation area during floods. Planned evacuation from floods and replacement with appropriate land use, better whole-catchment management, and improved early warning is highly recommended.

- **Dam Construction**

  A dam is barrier constructed across a stream or river to impound water to raise its level (Microsoft Encarta 2008). The most common reasons for building dams are to concentrate the natural fall of a river at a given site, thus making it possible to generate electricity; to direct water from rivers into canals and irrigation and water-supply systems; to increase

river depths for navigational purposes; to control water flow during times of flood and drought; and to create artificial lakes for recreational use. Many dams fulfil several of these functions. It is the option of a dam construction that will not only reduce risks, but also benefit the community. In economics, the Benefit-Cost Analysis (BCA) is the technique for evaluating the cost of dam construction as opposed to that of the levee. Through the BCA method, the future of the mitigation project is determined and compared to the cost of the project.

Owing to the presence of heavy flow rivers in Parys, Heilbron and Koppies towns, dams are highly recommended to reduce the flow speed. Dams with controlled spillways will reduce the flood peaks, decrease flood flow and lower the impact of damage (Alexandra 1993). This will also fight the issue of unemployment during the construction, and promote sustainability.

- **Levee construction**

  Levee is an embankment along the course of a river. Natural levees are low banks that are produced by the river during floods when the overflowing of the river decreases the speed of the water and permits the deposit of silt (Microsoft Encarta 2008). Artificial levees are considerably higher than natural ones and protect the surrounding countryside from floods.

### *(d) Capacity building*

The municipality must create the ability to cope with disasters by employing skilled personnel in disaster management, developing opportunity for research for more knowledge, and having a working/flexible structure. Through advisory forums, the municipality can define the interrelations with other stakeholders, defining their roles and responsibilities in the realm of disaster management. The disaster plans must be reviewed every year for continuity, attending to what was not done well. Workshops and conferences must be provided to the disaster officials to capacitate their knowledge in new found challenges and solutions. It will be easy to execute the disaster programmes once the officials are equipped with all the knowledge they need. Research is very vital for collection of indigenous knowledge that can be transcribed into books and journals, and be shared among the decision makers for the benefit of NLM. Therefore research is highly recommended.

Coping capacity leads to preparedness of the municipality. According to Disaster Management Act (South Africa 2002), preparedness contributes to disaster risk reduction through measures taken in advance to ensure effective response to the impact of hazards to enable organs of state and other institutions involved in disaster risk management:

- **Proposed structure**

  The profile confines what the department or unit consists of. The disaster management of NLM functions on fire and traffic line function which makes it very difficult to deal with floods and other disasters. There is organisational structure of Ngwathe, though not functional. The structure is informed by the budget, hence it is not functional. There are only three officials; director, manager and deputy manager, who have experience in emergency services and fire fighting. It is evident that the current profile does not address issues of disaster management therefore needs to be reviewed. NLM should consider employing at least five disaster management officers (representing five towns), one manager and one director. Volunteers will be utilised to supplement the officials during disaster management activities.

- **Roles and responsibilities**

  *Director*: s/he is the head of disaster management centre. The head of a municipal disaster management centre is responsible for the exercise by the centre. In accordance with the directions of the council, takes all decisions of the centre in the exercise of its powers and the performance of its duties, except decisions taken by another person in consequence of a delegation by the head of the centre. The head of a municipal disaster management centre performs the functions of office subject to section 44(3). He makes decisions in favour of the unit

  *Manager*: manages the unit. S/He ensures the staff establishment through staff attendance to disaster workshops and conferences and also availability of disaster equipment.

  *Disaster management officials*: these are at the operational level where the plans and programmes are executed. These people should be very skilled in disaster management because the unit depends on their doings. These officials should represent their own towns; they will work hand in hand with the volunteers.

*Volunteers* are deployed during disasters for assisting in evacuation, distribution of available recovery resources, data collection and impact assessments. These are not permanent posts.

- **Vegetation**

  NLM must work with botanists, agriculturists and communities to plant trees, shrubs, bushes and other plants that will reduce soil erosion. Plantation is vital to cut the speed of flood flow; hence flood impact reduction. This is highly recommended in NLM.

- **Disaster Management Plans**

  Section 23 of the Local Government: Municipal System Act (South Africa 2000), specifies that municipalities should undertake developmentally orientated planning to ensure that they achieve the objectives of local government, as stipulated in section 152 of the Constitution of the Republic of South Africa (South Africa 1996). Risk Reduction Plans are highly recommended in NLM; preparedness, mitigation, contingency, and strategies to use. Section 26(a) of the Local Government: Municipal Systems Act (South Africa 2000) requires municipalities to determine a vision for the long-term development, development objectives for an elected term of office and to develop strategies which are aligned with national or provincial sector plans and planning requirements.

- **Reversal of the PAR model (Progression of the Safety Model)**

  The aim of this model is to solve what was identified before (in Chapter 4); whereby the root causes, dynamic pressures and unsafe conditions were pointed out. The idea is to address all the issues for the benefit of instilling safety within the community in as far as disasters are concerned. This model ensures that there is no loss of life, fewer casualties, fewer property damages and food security in order to control the situation.

## 5.4 CONCLUSION

The problem statement depicted the incapacity of NLM to deal with floods. Being unprepared and understaffed is the centre piece of the whole problem. The study was aimed at assessing Ngwathe disaster preparedness in order to increasing the awareness of the nature and management of flood disasters, leading to better performance in flood disaster preparedness and response

Reliable and accurate knowledge of floods impacts is important because decision-makers allocate scarce resources to flood-related concerns on the basis of their interpretation of trends in and causes of the impacts and their expectations for the future. Pielke (1999) adds that the implementation of policies in response to floods is hampered by lack of specific knowledge of trends in flood impacts on society and more importantly, the causal factors which underlie those trends.

The time for action is now, and correcting the injustices of uninformed persons, bent on extending their own agendas, can only strengthen each Chief Executive Officer, Executive Mayor and Councillor's position. At this time when many local authorities and councillors are busy restructuring their local authority, it is appropriate timing that the restructuring takes cognisance of the wrongs of the past so that it may be corrected. No longer should any individual department within the local government environment have sole control over a function as important as Disaster Management. The Disaster Management Act (South Africa 2002) stipulates that preparedness enables organs of state and other institutions involved in disaster risk management, the private sector, communities and individuals to mobilise, organise, and provide relief measures to deal with impending or occurring disaster or the effects of a disaster.

This has led, in the past, to a local authority not truly considering the issue of sustainable development, but also being responsible, from time to time, for unnecessary expenses incurred. As highlighted earlier, each facet of a local authority's business contains aspects of Disaster Management. Disasters are not a daily occurrence, but sustainable development within the context of local government.

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## 5.6 ANNEXURE A


**INTERVIEW**

**INTRODUCTION**

I am Me Lemeko, student from the University of the Free State doing Masters in Disaster Risk Management. Currently, I am an intern in Fezile Dabi District Municipality in the Disaster Management Centre and undertaking the Research for the Masters. I would very much appreciate your help in this regard.

This study focuses on preparedness of floods in Ngwathe Local Municipality (NLM), awareness and capacity of municipality to deal with floods. The interview is done with disaster practitioners like the municipal manager, disaster director, and technical staff. The data collected will be kept strictly confidential and findings will be used for academic purposes only.

Regards

M. Lemeko (079880 3913)

Masters in Disaster Risk Management (DIMTEC)


**NAME: _____**

**POSITION: _____**

**GENDER: _____**

**YEARS OF EXPERIENCE: _____**

**EXPERTISE: _____**

**PREPAREDNESS**

(c) Do you have plans in place? For example, Preparedness, Emergency or Contingency plans and strategies for floods?

_____
_____
_____
_____
_____
_____
_____
_____
_____

(d) Do you have any prevention measures in place in terms of mitigating the floods?

_____
_____
_____
_____
_____

(e) Does your organizational structure provide for disaster management?

_____
_____
_____
_____

## LEGISLATION

(l) Does your IDP, Service Delivery and Budget implementation Plan cater for disaster management issues?

## AWARENESS

(j) Are there any awareness campaigns done? How effective are they, in terms of risk reduction?

(k) Does Ngwathe Local Municipality have the history of floods? What has the municipality done to instil awareness?

## GEOGRAPHICAL TOPOGRAPHY

- How does topography perpetuate the floods in NLM? Do you feel disadvantaged?

## PLANS

- Are there any mitigation, prevention and response plans to floods?

## RESPONSE

1 Do you have enough resources for rescue? For example, funds, equipment, support, and trained people for floods.

2 Do you have any intergovernmental relations (for example stakeholders, private sectors and businessmen)

_____
_____
_____
_____
_____

**INVOLVEMENT**

1. What is the community involvement; role played by the volunteers and the community during the floods?

_____
_____
_____
_____
_____
_____
_____

## 5.7 ANNEXURE B