BITOU MUNICIPALITY'S DISASTER RISK ASSESSMENT

SUMMARISED REPORT

ABOUT THIS SUMMARIZED REPORT

This is Bitou Municipality's first Disaster Risk Assessment in summarized report format. This report summarizes a large amount of data, according to a predetermined set of indicators, to deliver a concise report.

This summarized report was produced by LUTICENTO PTY and was compiled with due care and attention. It was supported by the Western Cape Disaster Management Centre and this work has been undertaken in accordance with Western Cape Disaster Management's standardized methodology for conducting Disaster Risk Assessments. Although all efforts are made to identify all relevant hazards in the Bitou Local Municipality during the assessment, the nature of risks are such that it is possible that features of hazards, vulnerability and capacity could be overlooked during the study.

This report contains the views of a wide range of stakeholders engaged as part of the risk assessment process. This is research work, and as such there is always potential for uncertainties in what has been presented. While every effort has been made to ensure that the material in the report is accurate, the contributors provide no warranty, guarantee or representation that the material is accurate, complete, up-to-date, non-infringing or fit for a particular purpose. The use of this material is at the risk of the user. LUTICENTO PTY disclaims any liability for any loss, oversights, damage, cost or expense incurred as a result thereof or from any person acting in reliance upon the contents of this report. Furthermore, any opinions or findings stated in this report are based on circumstances and facts as they existed at the time LUTICENTO PTY conducted the work.

Any changes in such circumstances and facts, upon which this summarized report is based, may adversely affect the opinions or findings contained in this report. This summarized report is not intended to replace the formal and comprehensive Disaster Risk Assessment Report.

ACKNOWLEDGEMENTS

LUTICENTO PTY would like to acknowledge the collaboration with the Western Cape Disaster Management Centre. We are grateful to the stakeholders from the Bitou Municipality, private sector and other partner organisations who have contributed to the development of the summarized and the formal report.

THE FUTURE OF THIS SUMMARIZED REPORT

This summarized report aims to give governmental stakeholders and interested parties an overview of the methodology applied to conduct the Disaster Risk Assessment; to indicate the risk rating for each hazard; to highlight the areas, communities or households exposed to each hazard; and to indicate Disaster Risk Reduction plans for each hazard. The timeframe and budget for each disaster risk reduction plan has been left out and should be agreed upon and completed by the BLM.

It is strongly recommended to continually and annually review the risk profile to provide an ongoing analysis of trends within the municipality, and an indication of the success or failures of Disaster Risk Reduction (DRR) efforts to assist decision makers to make more informed decisions for sustainable development. These changes to the risk profile should be reflected in both the summarized and formal reports

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AFIS	Advanced Fire Information System
AQMP	Air Quality Management Plan
BLM	Bitou Local Municipality
BGCMA	Breede-Gouritz Catchment Management Agency
ARC	Agricultural Research Council
CA	Conservation Agriculture
CBRA	Community Based Risk Assessment
CBO	Community-Based Organization
CCA	Climate Change Adaptation
CDW	Community Development Worker
CGS	Council for Geosciences
CSAG	Climate Systems Analysis Group
CSIR	Council for Scientific and Industrial Research
CZMU	Coastal Zone Management Units
DAFF	Department of Agriculture, Forestry and Fisheries
DEADP	Department of Environmental Affairs & Development Planning
DEDAT	Department of Economic Development and Tourism
DHS	Department of Human Settlement
DMAA	District Management Amendment Act
DMAF	Disaster Management Advisory Forum
DM	District Municipality
DMC	Disaster Management Centre
DMP	Disaster Management Plan
DoA	Department of Agriculture
DoE	Department of Education
DoH	Department of Health
DoSD	Department of Social Development
DRA	Disaster Risk Assessment
DRR	Disaster Risk Reduction
DSO	Dam Safety Office
DWAS	Department of Water Affairs and Sanitation
DWS	Department of Water and Sanitation
EMS	Emergency Medical Services
EPWP	Expanded Public Works Programme
EWS	Early Warning System
FBO	Faith-Based Organizations

FPA	Fire Protection Association
GG	Greenhouse Gases
GIS	Geographic Information System
GRDM	Garden Route District Municipality
GRDDMC	Garden Route District Disaster Management Centre
HVC	Hazard Vulnerability Capacity
IAP	Invasive Alien Plants
IBBA	Important Bird and Biodiversity Areas
ICM	Integrated Coastal Management
IDP	Integrated Development Plan
ITP	Integrated Transport Plan
MAMSL	Meter Above Mean Sea Level
MIG	Municipal Infrastructure Grant
MoU	Memorandum of Understanding
MRCC	Maritime Rescue Coordination Centre
MTO	
NDMC	National Disaster Management Centre
NDPW	National Department of Public Works
NEMA	National Environmental Management Act
NEMBA	National Environmental Management Biodiversity Act 10 of 2004
NICD	National Institute for Communicable Diseases
NGO	Non-Governmental Organization
NPO	Non-Profit Organization
NSRI	National Sea Rescue Institute
PAWS	Plett Animal Welfare Services
PGWC	Provincial Government of the Western Cape
PMF	Predation Management Forum
RDP	Reconstruction and Development Programme
SALGA	South African Local Government Association
SAMSA	South African Maritime Safety Authority
SANBI	South African National Biodiversity Institute
SANS	South African National Standard
SANParks	South African National Parks
SAPS	South African Police Service

SASSA	South Africa Social Security Agency
SAWS	South African Weather Service
SCFPA	Southern Cape Fire Protection Association
SPCA	Society for the Prevention of Cruelty to Animals
WCDMC	Western Cape Disaster Management Centre
WfW	Working for Water
WMA	Water Management Area
WoF	Working on Fire
WUA	Water User Association
WWF	World Wildlife Fund
WWTW	Waste Water Treatment Works

EXECUTIVE SUMMARY

INTRODUCTION

Over the past decades, we have witnessed a steady increase in the number of disasters. The Western Cape Provincial Disaster Management Centre (WCDMC) in collaboration with the Garden Route District Municipality (GRDM) supported the Bitou Municipality in the compilation of a current Disaster Risk Assessment (DRA) in 2014. The Garden Route District and Bitou Municipality has been exposed to many major incidents and disaster in recent years and high levels of vulnerability exist that may lead to unacceptable deaths, injuries, damage, socio-economic loss, and the disruption of the normal functioning of communities. Due to the importance of having a current and accurate risk profile, Western Cape Disaster Management (WCDM) has committed itself to assist Local Municipalities (LMs) in updating their DRAs. This study was undertaken with the aim of providing disaster risk management and role-players with a user-friendly "living" document to assist them in legislating Disaster Risk Reduction (DRR) by focusing on pertinent risks affecting the Bitou Municipality.

PURPOSE

This summarized report was compiled with the aim of providing disaster risk management and role-players with a user-friendly summary to assist them in legislating Disaster Risk Reduction (DRR) by focusing on pertinent risks, high risk areas and implementing agents of DRR in the Bitou Municipality.

APPROACH

The Disaster Management Act, 2002 (Act No. 57 of 2002), as amended by the Disaster Management Amendment Act of 2016, and National Disaster Management Framework assigns responsibility for hazard monitoring and risk mapping to all spheres of government and all relevant organs of state. The Act recognizes the wide-ranging opportunities in South Africa to avoid and reduce disaster losses through the concerted energies and efforts of all spheres of government, civil society and the private sector. However, it also acknowledges the crucial need for uniformity in the approach taken by such a diversity of role players and partners.

There are four hazard categories applied in this report: Natural, Anthropogenic, Technological and Environmental. For a concise overview of each hazard category see the table on page 4.

The Hazard, Vulnerability, Capacity (HVC) Assessment was applied as a diagnostic tool to identify and understand specific risks and their underlying causes. It is the local government that is the first responder, and the one responsible for community development and sustainable Disaster Risk Reduction (DRR).

The HVC assessment tool assists advocacy for local level DRR and the empowerment of local governments and relevant stakeholders to actively collaborate and contribute to solving global issues while providing a space for stakeholders to work together.

By using GIS, each identified hazard was quantified and captured separately. Spatial overlays strengthen the risk profile in providing reasons why particular communities, areas or infrastructure may be affected differently. To view the community based and scientific spatial maps please refer to the formal DRA report.

USERS OF THIS SUMMARIZED REPORT

The Act requires local municipalities to take the necessary remedial steps to prevent and/or mitigate the occurrence or re- occurrence of disasters in its area of jurisdiction. Therefore, this report is primarily meant for the government sector, for all the disaster risk management practitioners and decision makers in the Bitou Municipality, as they are responsible for managing disaster risks and reducing losses during disaster incidents.

DRR should be targeted interventions implemented through multi-disciplinary action in order to be comprehensive and sustainable. In addition to this report's purpose in catalysing new disaster risk reduction

projects, the second user category of this report is local role-players such as regional departments, private citizens', conservation authorities and landowners. They can use this summarized report to update their projects by monitoring whether they are sustainable and climate resilient, as well as identifying where their projects may already be responding to disaster risks.
The WCDMC developed a provincial standard for conducting comprehensive disaster risk assessments, including guidelines for the application of a uniform disaster risk assessment methodology and approach, as well as the standardisation of reporting formats for disaster risk assessments.

RATIONALE: A TWO STEP PROCESS

Firstly, the scientific-based research method comprised desktop research, reviewing and analysing relevant and existing studies, and consultation with relevant stakeholders and hazard specialists. This first phase provided a lens for the second phase.

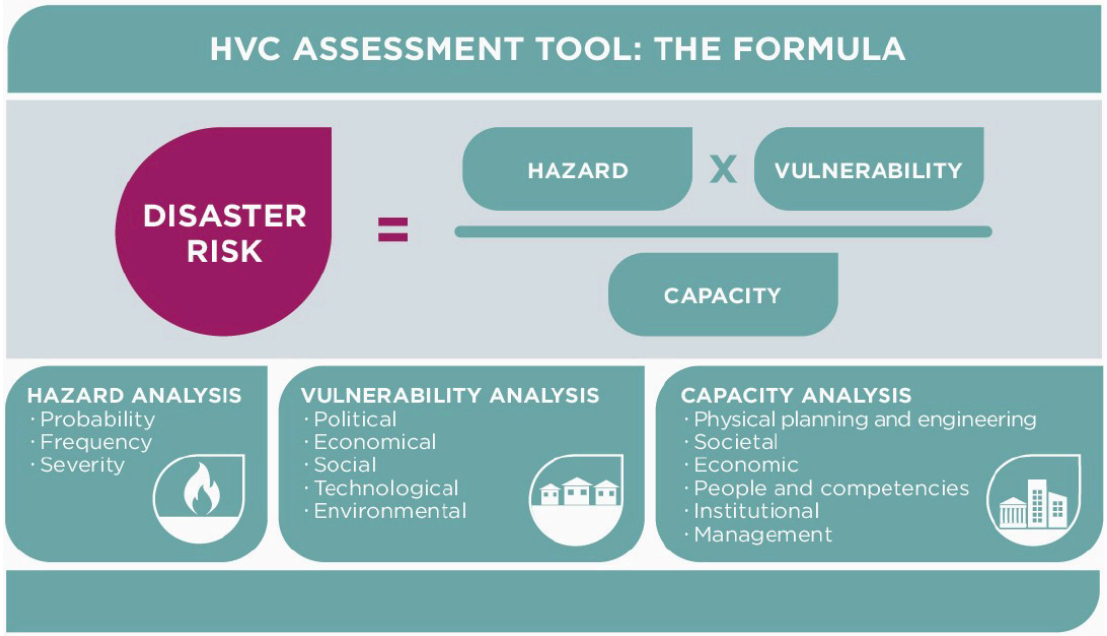
Secondly, the community-based research method was facilitated in the form of one comprehensive focus-group workshop as a structured process of quantifying the relevant risks in the municipal area. The last phase involved the preparation of the DRA report and the actual spatial maps. The data sets collected from these two methods was integrated to consolidate the results.

PROCESS: HVC ASSESSMENT

Hazards in themselves do not constitute disasters. Put simply disaster risk is the function of the combination of three elements namely vulnerability, coping capacity and hazard. The relationship of these

elements can be expressed as a simple formula that is not mathematical in nature - the Hazard, Vulnerability, Capacity (HVC) assessment (see the figure below).

This formula was applied to determine disaster risk by assessing potential impact of a hazard on a community, as a means of quantifying the root causes of vulnerability and identifying the available capacity to cope.



This interaction also forms the basis for disaster risk reduction planning. The aim of disaster risk reduction planning will be to facilitate one, two or all three of the following:

- Reduce the hazard level, by changing either the magnitude of the hazard, or the probability of the hazard occurring;
- Decrease the vulnerability of the receiving entity by changing the physical, social, economic or environmental characteristics of the receiving entity; and
- Increase the capacity of the affected community, society or organization by increasing the physical, institutional, social or economic means as well as skilled personnel or collective attributes such as leadership and management.

HAZARDS A potentially damaging physical event, phenomenon or human activity, which may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation.		
NATURAL HAZARDS These are natural processes or phenomena occurring in the biosphere that may constitute a damaging event. Natural Hazards are typically classified into:		
Geological Hazards Geological hazards include internal earth processes, such as earthquakes and related geophysical processes such as mass movements, landslides, rockslides, surface collapses, debris or mud flows.	Earthquake-related Cosmic-related Rock falls	Seismic hazard Tsunami
Coastal or Marine	Slope instability-related Coastal zone process-related	Sea level rise Storm surge Coastal erosion Severe weather Strong wind
Hydro-Meteorological Hazards: Natural processes or phenomena of atmospheric, hydrological or oceanographic nature.	Atmosphere-related Water-related	Drought Floods
Biological Hazards: Processes of organic origin or those conveyed by biological vectors, including exposure to pathogenic micro-organisms, toxins and bioactive substances.	Disease Epidemics Wildfire risk	Animal diseases Human diseases Alien Invasive Species Wildfire
TECHNOLOGICAL HAZARDS Technological hazards are defined as danger originating from technological or industrial accidents, dangerous procedures or certain human activities, which may cause the loss of life or injury, property damage, social and economic degradation.	Transport Incidents Urban and/or Industrial incidents Critical infrastructure disruption National Key Points Socio-economic disruption	Infrastructure disruption: Electricity, Sewage and Drainage, Water Supply. Dam failure Aircraft incidents Road incidents Structural fires Marine pollution Civil Unrest Air pollution
ENVIRONMENTAL HAZARDS These are 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).		Endemism: Loss of Biodiversity

The probable risk analysis framework in its pure form is nonetheless important. Its conceptual simplicity aids understanding, by making assumptions explicit, and because it is solid theoretical foundations and vast empirical evidence which examines its application in specific cases, makes it an important point of comparison for formal evaluations of the effectiveness of efforts to manage disaster risk.

Key variables quantified in the HVC assessment are summarized in the image above. For more detailed steps in the application of the HVC Assessment please refer to the formal DRA report.

RISK ASSESSMENT: 4 X 4 MATRIX

The assessment of the likelihood of occurrence of a specific risk evaluates the probability of a specific risk occurring. In this DRA report a basic 4 x 4 risk matrix was used for undertaking the rating and classification of identified hazard events, the existing vulnerabilities and capacity available to mitigate or respond to the hazard. The HVC Assessment tool finally allocates a relative risk priority to each hazard.

The final disaster risk is assessed and classified into one of four categories:

DISASTER RISK PROFILE		
Rating	**Total**	**Description**
Low	≤ 3.5	Low risk indicating a prepared community, but on-going preparedness is still required.
Medium	3.6 - 4	Very little risk for a largely prepared community. This combination equates to a tolerable moderate risk and preparedness plans for these risks must be prepared.
High	4.1 – 9.9	The risks to which these communities are exposed are potentially destructive, but the community is modestly prepared for the hazard event occurrence. This combination equates to a high risk and a combination of risk reduction interventions and preparedness plans must be initiated for these risks.
Extreme	≥ 10	Potentially destructive risk with a high probability of occurrence with a high level of unpreparedness. This combination equates to an intolerably high risk and may be a disaster in the making. For these very high risks urgent risk reduction interventions are required.

EXECUTIVE SUMMARY

The Bitou Municipality is the eastern-most coastal Municipality within the Western Cape Province (WCP). The Bloukrans River which constitutes the LM's eastern boundary is also the boundary between the WCP and Eastern Cape Province (ECP). The Bitou Municipality borders onto the Knysna Municipality (Garden Route DM) to the west, the George Municipality (Garden Route DM) to the north, the Kou-Kamma Municipality (ECP) to the east, and the Indian Ocean to the south. It is the smallest municipality of the seven that make up the district, accounting for only 4% of its geographical area.

The Bitou Municipality area is relatively small, namely 992 km^2 with an estimated population 59 157 in 2016 and estimated to increase to 67 376 in 2030. The northern portion of the Municipality is mountainous (Tsitsikamma range) and the settlement pattern is concentrated along the coast and on the coastal plain. Due to the mountainous terrain and other factors, only a small percentage of the area is considered suitable for intensive agriculture. Consequently, the agricultural sector does not constitute the backbone of the local economy. Instead nature and coastal-based tourism is the key driver of the Bitou economy. Bitou Municipality **has one of the largest percentages of formally protected land** of any municipality in South Africa. This land is incorporated in the Garden Route National Park and comprises mountains, inland plateaus, a coastal corridor and a marine reserve.

Bitou settlements include Plettenberg Bay, Nature's Valley, Kranshoek, Covie, Harkerville, Keurbooms, Kurland, Wittedrift, Qolweni, Bossiesgif, New Horizons and Kwa-Nokothula. Plettenberg Bay is the only large town in the Municipality with settlements such as Qolweni, Bossiesgif, New Horizons and Kwa-Nokothula being essentially Apartheid era satellite suburbs of Plettenberg Bay.

The vast bulk of the Municipality's population lives in Plettenberg Bay and these surrounding townships. Plettenberg Bay is as the main service centre in the Municipality, providing higher order medical, educational, commercial and administrative services. Kurland, Kranshoek and Nature's Valley are regarded as secondary settlements and the balance as small rural villages. All of them are reliant on Plettenberg Bay or other nearby large towns such as Knysna and George for major services.

Wards	Sub-Paces
1	Covie, Natures Valley, Kurland, Crags and Keurbooms
2	Plett South, Plett North and Bossiesgif
3	Qolweni and Pine Trees
4	New Horizon
5	Phases 1 & 2 Kwa-Nokuthula
6	Phases 3 and 4 Kwa-Nokuthula
7	Kranshoek, Harkeville, Green Valley, Wittedrift and uplands

The portion of the N2 through Bitou forms part of the internationally renowned Garden Route, with Plettenberg Bay – marketed by Plett Tourism as the "jewel of the Garden Route "- an established key attraction.

The Bitou Municipality is located in one of the most beautiful natural areas in the country. This makes the municipal area attractive to live and work. This has a direct impact on the natural environment with natural resources depleted to make room for growth and development. The Bitou Municipality contains the large Keurbooms River Estuary located to the east of the town of Plettenberg Bay. It is separated from the sea by a coastal barrier, which has a tidal inlet linking it to the sea. It is an important nursery area for fish, is home to the Knysna Seahorse, and is ranked number 16 in South Africa in terms of conservation importance. The Bitou Estuary, which feeds into the Keurbooms, has a unique mixture of plant and animal species, and no alien fish species

The impact of climate change can impact on the low-lying urban and coastal environment within the municipalities. It also results in changing

rainfall patterns and temperature extremes. The municipality should therefore actively be prepared for the consequences of changing rainfall patterns, demand management and the improvement of resource efficiency.

The prevention and response to pollution, air quality, conserving biodiversity, waste reduction and recycling will also be intensified over the next 5 years in order to improve the sustainability of the environment.

The N2 freeway is the spine of the road network in the Municipality traversing it in the south and east. In addition to serving the local population, it also plays an important role as an inter-provincial link between the Western and the Eastern Cape. Access is provided to Lang Kloof and the surrounding farming community by means of the MR390 and 395. These roads are carrying low volumes of traffic – 500-100 vehicles/day. The primary public transport route in Plettenberg Bay is Marine Drive. Marine Drive is supported by other routes in the form of the MR382, MR383 and the MR384. The routes only experience traffic congestion during the high peak tourist season.

The bulk of people moving to the Bitou area are from the Eastern Cape. 28.9% of residents are born in the Eastern Cape making the Eastern Cape the biggest contributor to the current migration patterns. Most of the people moving to the Bitou Area are low skilled individuals who are searching for employment opportunities. Some of the individuals also find themselves staying longer or permanently after the termination of their seasonal contract. The seasonal nature of Bitou 's economy is the causality of seasonal migration.

One observable effect of migration is the growing number of informal dwellings in the Crags and Qolweni areas. The municipality's efforts to control informal settlements have resulted in the increase of back yarder settlements.

The Bitou economy has grown faster than that of the Garden Route District. However, this is not reflected in the reduction of unemployment (jobless growth). The municipality is largely dependent on the tourism sector for growth and the development of the local economy.

Indigent households in the Bitou Municipal are has increased from 3, 843 to 4, 434 from 2015 to 2016. This trend is in line with the increase of unemployment and lower economic growth. If this trend continues, it could impact on the financial sustainability of the municipality and its ability to maintain the provision of services.

The typical challenges on the socio-economic front, relating to informal/poorer areas of Bitou Municipality, are:

- Large concentrations of poor households in both urban and rural locations;
- High levels of unemployment;
- Poorly performing residential property markets;
- Slower household income growth;
- Limited income retention;
- Undiversified and marginal local economies;
- Limited private sector investment; and
- Considerable fiscal burden.
- The need for additional housing opportunities;
- The need for additional infrastructure services and bulk infrastructure (also to cater for seasonality);
- Increasing backlogs of infrastructure maintenance;
- Encroachment and illegal dwellings;
- More Illegal electrical connections;
- Increased unemployment;
- Increased health hazards; and
- Increases in crime.
- Increase civil unrest risk.

The Bitou municipality is challenged to achieve sustainable development and a financially sustainable municipality in order to meet the needs of the rapidly growing population. Located in a water scarce region and extreme weather events, the Municipality should be able to be resilient against shocks or stresses facing the municipality.

DISASTER MANAGEMENT IN BITOU Municipality

Bitou Municipality does not have its own municipal DMC office. It is heavily dependent on the Garden Route DMC which is situated in George Municipality (95KM from Plettenberg Bay). This DMC was established as a result of government's commitment to provide a comprehensive safety service to the community of the district. DMCs provide the physical

environment where all disaster management activities can be managed in a coordinated and integrated approach. This DMC provides a 24-hour call taking and dispatch facility. An organisational facility is also available that is used as a Joint Operation Centre (JOC) during disasters and it hosts a venue for planning sessions outside disaster periods. A tactical facility is available as well as offices for various emergency services.

In terms of the Disaster Management Act of 2002 (as amended) section 51, each District and metropolitan may establish a Disaster Management Advisory Forum (DMAF). The Garden Route Disaster Management Centre has an active Advisory forum on which the Bitou Municipality participates. The Bitou Municipality is not required by the Act to have its own DMAF.

The Disaster Management Amendment Act 16 of 2015 includes the strengthening of reporting on implementation of policy and legislation relating to disaster risk reduction and management of allocated funding to municipal and provincial intergovernmental forums established in terms of the Intergovernmental Relations Act of 2005; expanding the contents of Disaster Management Plans (DMPs) to include conducting DRAs for functional areas, mapping of risk, areas and communities vulnerable to disasters; to provide measures to reduce the risk of disaster through adaptation to climate change and developing of early warning mechanisms.

Pertinent to the BLM is where section 43 of the principal Disaster Management Act is amended by the addition of the following subsections: (3) A local municipality must establish capacity for the development and co-ordination of a Disaster Management Plan and the implementation of a disaster management function for the municipality which forms part of the disaster management plan as approved by the relevant municipal disaster management centre.

The Key Outcomes of a Disaster Management Plan (DMP) is as follows:

- Integration of Disaster Risk Management into the strategic and operational planning and Project implementation of all line functions and role players within the municipality;
- Resilient communities; and
- An integrated, fast and efficient response to emergencies and disasters by all role players. Please refer to Addenda 6 for a list of legislative documents that are relevant to Disaster Risk Management in South Africa and within the BLM.

The municipality had a disaster plan, which was deemed as level 2, after the risk and vulnerability assessments were conducted. In order to ensure standard plans, the province submitted request for Municipalities to compile such of the template guidelines. The Act and amendments also emphasis the local municipality to ensure capacity in the disaster management section and its continuum. arrangements for managing disaster risk and for preparing for- and responding to disasters within the Bitou Municipality. It also provides officials, and other role players, with an effective guide as to what their roles and responsibilities are in the event of a disaster and also focuses on prevention of disasters and minimising the impact of hazards which cannot be avoided.

In Section 26(g) of the Local Government: Municipal Systems Act of 2000 (No 32 of 2000), it is a requirement that the IDPs of all municipalities should have a relevant DMP and DRA as core components of such IDP's.

COMMUNITY-BASED DISASTER RISK ASSESSMENT

As previously stated, the purpose of a Community Based Disaster Risk Assessment (CBRA) is to consult the community on their perceptions, experiences and concerns regarding disaster risk in the area they reside. A community is seen as a group that may share one or more things in common such as living in the same environment, similar disaster risk exposure, or having been affected by a disaster. Common problems, concerns and hopes regarding disaster risks may also be shared.

However, people living in a community, for example men, women and children, have different vulnerabilities and capacities. Some may be more vulnerable or more capable than others. The level of education and perceptions of the community members that take part in such

an assessment will have a big influence on the outcomes of the CBRA.

A benefit of CBRA is the fact that it strongly supports indigenous knowledge. "Indigenous knowledge may be defined as knowledge that has been created and developed over a period of time. Indigenous knowledge represents generations of creative thoughts and actions within a particular community in an eco-system generated to keep abreast of ever-changing agro-ecological and socio-economic environment." During this process, indigenous knowledge was thus also gathered. Ground truthing of other available information, both documented and undocumented historic events can also be done through this process.

A community-based workshop was held in Piesang Valley at the Community Hall on 25 October 2018.

ATTENDANCE OF ROLE-PLAYERS

Functional ward committees have been established in all seven wards of the Bitou Municipal Area. These ward committees comprise geographical as well as sector representatives in communities and are regarded as the statutory consultative forums in the public participation process of the IDP. The ward committees also play a pivotal role in the above-mentioned community-based planning processes and allow all stakeholders to take ownership and drive the developmental agenda in the areas in which they live and work. The ward councillor is automatically the chairperson of the ward committee and quarterly meetings keep the community informed of all municipal related matters. It is also incumbent on ward committee members to regularly interact with their constituencies and ensure maximum participation in all planning processes of Bitou Municipality. A formal agenda is followed and inputs from committees are referred to the Section 80 Committees and then on to the Mayoral Committee. The Ward Committees have an opportunity to consider items on the formal Council agenda which have a direct bearing on their specific areas. Bitou LM's Community-Based component is drawn from a combination of Ward Issues submitted during the Public Process of the IDP as well as input given during the workshop held In Piesang Valley during November 2018.

KEY-FINDINGS AND CONCLUSION

TOP RISKS FOR MUNICIPALITY:

Top 10 risks (in no particular order) for Bitou Municipality are (see full risk matrix):

- Wildfires
- Alien Invasive Species (Vegetative)
- Hazmat Incidents: Roads
- Civil Unrest
- Road Incidents
- Storm Surge/ Coastal Flooding
- Floods (Stormwater/Riverine)
- Urban Fires (Informal)
- Coastal Erosion
- Disruption: Waste Removal/Management
- Critical Infrastructure: Sanitation

WILDFIRES

POST-FIRE SITUATION

Invasive Alien Vegetation: The area has become **infested with alien vegetation** which not only will **lower species diversity** but also continue to make the area unstable because the natural vegetation is better at ensuring **landslides don't develop**. The changing of the vegetation from indigenous to alien would also negatively affect the fauna which depends on the vegetation for survival. There's also currently a problem with regards to landowner compliance to the removal of regrown alien invasive species. A lack of compliance is extended to land owned by Parastatals (Telkom/Eskom), MTO Cape, SANRAL. Coupled with this is a lack of enforcement on DAFF's side exacerbated by levels of apathy generated from a lack of awareness.

Flooding, landslides and debris flows: Flooding is worse in areas that have seen forest fires in recent years. Under normal conditions, dense forests and undergrowth trap moisture and rain. When terrain (especially slopes) is denuded of vegetation as a result of a fire, the risk of flooding increases dramatically. The fire also makes the ground almost hydrophobic (or

water repelling), and these effects can last 10 to 15 years. When large quantities of rain fall, the water runs off the ground as it would off a sheet of metal. The hilly topography in certain areas and worsens the flooding, channelling it into valleys. The burn scars from these fires are also at increased risk of debris flows and mudslides for the same reason: water quickly runs off, and there are fewer plants to hold rocks and soil in place. The water carries soil and rocks and dead trees, and can cause a lot of destruction. The likelihood of the burn scar being unstable for a long time will lead to the increased threat of landslides which will have an impact on the river in terms of sediment deposition and impact on the species which depend on the mud flats which in turn may affect fishermen who use the mud flats to collect bait as well as the fish which feed off the mud flats.

Threats to eco-tourism: Bitou is known for its green "face" or environment and with persistent drought and the threat of future low rainfall, the area will stay brown or white depending on the current colour of the soil which will affect the overall greenness of Bitou. The danger is that the burn scar does not get enough rainfall to allow the vegetation to come back which leads to wind and water erosion which could destabilise the top soil. Once this happens it is very difficult to get topsoil back onto the slopes and in practice what happens is that the burn scar remains without vegetation covering it which leads to an altered landscape. If large rainfall events take place this would probably lead to a lot of slumping and some landslides which could take all the topsoil away which could become a massive problem. Similarly, this can lead to sediment deposition and impact on the species which depend on the mud flats which in turn may affect fishermen who use the mud flats to collect bait as well as the fish which feed off the mud flats. Fishing and the use of the lagoon can be affected. Currently the biggest problem is the man power needed to cover all the burn scars with stabilising structures and ensure that alien vegetation clearing takes place.

Poor land use decisions and land invasion: There is a risk that landowners and developers will seek and take advantage of the fire disaster and the climate of economic urgency and fiscal pressure to obtain land use approvals in affected areas which may adversely impact on the functioning of the natural systems.

Garden Route Fires Of 2017/2018 and Lesson Learnt:

In June 2017 South Africa, and the world, watched in horror as a wildfire swept through the Garden Route destroying over 500 homesteads, farmland and timber plantations. The shear destruction left in the path of the blaze amounted to 22,000 hectares burnt, 7 lives lost and communities traumatized. The fire, like so many international wildfires that occurred in 2017, was the perfect inferno, the result of specific conditions. The consequence of global warming, five factors combined to fuel the Garden Route June 2017 fires, making them near impossible to control. There were five core conditions that made this fire so unique, namely:

- The regional drought conditions;
- The fuel load in the environment and suburbs;
- Topography of the area;
- Hot ambient air conditions;
- The speed of the wind;

Almost 18 months later, in October 2018, again the Garden Route is burning. This time the fire path is different, raging along the spine and slopes of the Outeniqua Mountain range and continuing along the Tsitsikamma mountain range.

A fire warning of hot dry and mild Bergwind conditions was issued for the week of 22nd October 2018. A Bergwind is a common weather condition in the Southern Cape which produces warm to hot air temperatures (30°C to 38°C) with extremely low Relative Humidity (6% to 15%)[121]. A consequence of a Bergwind is that vegetation and organic material dries out quickly, increasing its combustibility and making it ideal fuel for a wildfire. Under these conditions any spark or flame can set off a wildfire. And it did. The fire started near Herold, a small farming community at the top of the Montegu Pass north of George. Initially it burnt south to south east for the first day. Then the wind swirled and calmed down and the fire set course along the Outeniqua Mountains. The range is aligned along an east west axis and the fire set off in both directions, though predominantly to the east to start. Unlike the 2017 fire where high wind

speeds hampered firefighting efforts, in this fire the steep terrain and limited road access compromised firefighting efforts. Ironically, on calm days the plumes of smoke remained above the fire making it impossible to use aerial support as visual reference of the fire was impeded by the dense smoke plumes. Luckily in the fire did not spread into Bitou Municipal territory but it could've under the right conditions.

FYNBOS FUSE

Fire has a double impact on fynbos – it plays a role in germination and it also acts as a mineralizing agent. Some fynbos species die during fire and regenerate from seed stored in the canopy e.g. Serotinous Proteaceae more commonly known as Protea. Other species build up seed stores in the soil, such as Minetes spelendidus. The seed can be stored in shallow soil or it can be stored deep in the soil. Germination of the seed is stimulated directly through heat or smoke, or indirectly through changed environmental conditions. Other species can re-establish by sprouting from a woody root-stock after fire, stimulating new growth to occur.

It was determined in early October by a specialist that parts of the Outeniqua Mountains haven't burnt for three decades. Having not burnt for close to 3 decades in some areas, the Fynbos was in dire need of a fire to sanitize and invigorate large tracts along the Outeniqua Mountains. In the first 10 days close to 100,000-ha have burnt, more than 4 times the 22,000-ha burnt in June 2017.

FIRE FREQUENCY

There is controversy over the burn interval for Fynbos, but it seems that there is no prescribed interval. Intervals of five years favour the proliferation of pioneer, primary and some secondary succession species while longer durations will favour the proliferation of secondary and climax Fynbos species. The total suppression of fire will favour the advance of Afro-Montane forest into Fynbos. The October 2018 fire was destined to happen, and with the build-up of combustible fuel for close to 3 decades, became a beast difficult to control. There are areas in certain regions of Bitou Municipality that have created conducive environments for runaway fires to occur (under the right conditions) in the future.

South:

- Kranshoek;
- Fisanthoek (should a fire occur under the right conditions (wind) it would move over the mountain);
- Northern part of Harkerville;
- Kwanokuthula; and
- New Horizon (especially areas which are lacking fire breaks).

North:

- West of Keurbooms along R340 towards Uniondale (should a fire occur within the region then it will put a large area at risk which includes a game farm);
- Uplands.

East:

- The whole area from Covie to the Tollgates between Bitou Municipality and the Eastern Cape;
- Keurbooms – Southern Area (due to a lack of private landowner compliance to invasive vegetation clearing and fire breaks);
- Northern Part of Crags/Redford Road (due to dense vegetation and a lack of private landowner compliance);
- Kurland area (area near sawmill, R102 all the way down to Nature's Valley);
- Area between N2, Groot River Pass and Mountains to a lack of access – along R102.

DEFENDABLE ZONES FOR THE FUTURE

Timber plantations of exotic pine and eucalyptus need to be secured between corridors of Afro-Montane forest to mitigate wildfires burning across blocks. Planning against wildfires in the future needs to be a fine balance between defending farms, plantations and homesteads and urban centres and maintaining the vigour of the Fynbos. It is imperative that a 30-year spatial plan is compiled to defend against fires. Both the 2017 and 2018 fires demonstrated that the Afro-montane forest, except under extreme fire conditions, acts as a natural fire break. Corridors of Afro-Montane forest need to be maintained, and in areas between plantations, need to be propagated to mitigate fires spreading between blocks of pine plantations. Buffer zones between Fynbos and urban centres need to have regular managed burns with a high frequency program. These buffer zones should

be at least 500m wide. Rural and agricultural properties need to maintain defendable zones of a minimum of 250m to protect structures, assets, infrastructure and valuable crops and livestock.

Controlled Fynbos burns in rotation blocks need to implemented to reduce the future occurrence of extensive wildfires. If integrated in a coordinated manner future wildfire can be limited to the Fynbos without risking the wellbeing of agricultural, plantations and urban centres, all the while maintaining the combined health of the Fynbos and the safety of Garden Route residents.

STRUCTURAL FIRES

Hazards at **household and familial level** include the **layout and overcrowding** in the home, **use of high-risk equipment** and family or other constraints to the care and support of children[41]. A critical issue within informal settlements is the density of the settlement i.e. the higher the density of the settlements and poorer the quality of building materials (higher flammable degree) the greater the risk. The influx of people from other areas (urbanisation) increases the risk of structural fires as these people usually settle themselves as **backyard dwellers**. The **close location of structures** in backyards increases the risk that the resulting fire can spread rapidly from one dwelling to another Therefore, there is often the destruction of more than one home because of fires rapidly spreading between homes. Many **low-income families use paraffin** (also known as kerosene) as their main fuel source due to its lower cost and ease of accessibility.

ALIEN INVASIVE SPECIES (VEGETATIVE)

Invasive species will also become an ever-increasing hazard to manage and monitor due to its linkage to indigenous domination, increase in fire risks, impacts on water resources in the catchment areas etc. Alien infestation by species such as Rooikrans (Acacia cyclops), Port Jackson (Acacia Saligna), Black Wattle (Acacia mearnsii), Blackwood (A. melanoxylon), Pine (Pinus Pinaster), Silky Hakea (Hakea Sericea) and Eucalyptus spp. is rife throughout the area. Pines and Hakea have invaded the slopes of the mountains and it appears as if little is being done to contain this invasion. A noticeable feature of the mountains is the stubble of dead pines along the crests of the ridges, these killed by the frequent wildfires in the area. Alien vegetation dominates most of the riparian vegetation flanking rivers and streams in the area, mostly Black Wattle and to a lesser extent Blackwood, pines, and eucalyptus. Fynbos areas are invaded by Hakea, Blackwood, Pines and to a lesser extent Rooikrans. The latter dominates the vegetation along the coastal plain, especially along the seafront dunes, with Port Jackson common in some areas.

Alien Invasive Species biomass collects and causes localized flooding which washes away bridges. This has occurred in Nature's valley and some of the rural roads. Without these roads, access is often an issue. High-risk areas include Nature's Valley, Groot River, and the Whole Uniondale road to Prince Alfred's pass (R40). One of the major contributors to this problem is inappropriate disposal of cleared IAP biomass. This creates a flood and fire hazard in the municipality

The problem that many experts have alluded to is the hefty price tag associated with the removal of invasive alien species. This can be an expensive exercise but invasive species become incrementally costlier to remove as they grow. These costs will grow as existing infestations spread, and a new invasive species establish. It is imperative that this problem is effectively addressed. The effective management of invasive alien plants requires the integration of a range of strategies, including prevention, mechanical, chemical and biological control, and ecosystem restoration. Indications are that the current emphasis on mechanical and chemical control will not overcome the problem, which is large and growing

Invasive alien plants make the fire control problem worse, and they aggravate the effects of what would otherwise be an ecologically beneficial process. Because invasive alien plants are spread by fires, fire also increases their impacts on water resources, rangeland productivity, and biodiversity in fire-prone fynbos, grasslands, and savannas. As a result, they can introduce fires into areas where fires

did not occur historically, and by increasing the mass of plant material in fire-prone ecosystems, they can make fires more intense. It is thus important to increase attempts to remove invasive alien plants from fire-prone/ecosystems, as well as to prevent their introduction and spread in areas that are currently not invaded.

Invasion of many ecosystems by fire-adapted alien trees and shrubs is an enormous threat to the conservation of these ecosystems. An example is provided by invasive Australian wattles that produce an abundance of seeds that accumulate in the soil. These seeds are stimulated to germinate en masse by fires in fynbos, grassland, and savannas, which means that burning can dramatically increase the number of plants. Felling followed by burning can be used to deplete soil-stored seed banks but is not effective over large areas because repeated and intensive follow-up weeding of new seedlings is needed.

TRANSPORT OF HAZARDOUS MATERIALS (HAZMAT)/ROAD ACCIDENTS

The N2 freeway is the spine of the road network in the Municipality traversing it in the south and east. In addition to serving the local population, it also plays an important role as an inter-provincial link between the Western and the Eastern Cape. Any severe accident on the transport route will be seriously problematic for the Municipality due to the over-reliance on the N2 for access between wards and neighbouring regions. When driving into Plettenberg Bay from Knysna, residential properties along both sides of the N2 corridor are evident.

Vehicles transporting hazardous materials such as radioactive, inflammable, explosive and toxic liquids and gases through Bitou are putting the town at risk by ignoring vital regulations governing the transport of dangerous goods. The N2 runs through the middle of Plettenberg Bay as it connecting corridor to the Eastern Cape, as well as other nearby Garden Route towns. The areas include residential as well as business areas flanking the highway on both sides. A major concern that was highlighted was regarding the transport of specifically fluoric acid between the Eastern Cape and PetroSA (situated in Mosselbay). This hazardous material poses a severe risk to the immediate public and environ. It was mentioned during an interview that at a recent roadblock in Plettenberg Bay (during the weekend of PlettRage - a popular matric festival), at least 19 hazardous materials were flagged of which 3 was of immediate danger to the public. Considering the close vicinity of developments as well as important areas of biodiversity couple with a lack of capacity, potential HAZMAT incidences poses a big risk for the Municipality. The problem is exacerbated by a response delay on Garden Route District's end merely associated with distance. George Municipality is roughly 100KM away from Plettenberg Bay and under the right circumstances, this can be problematic especially if an incidence, such as fluoric acid, poses an immediate danger to the public and environment.

With regards to road accidents the most severe accidents within Bitou Municipality occurs along the **N2**. The accident black spots are as follows[131]:

- Section **between Garden of Garden Route and the Garage** (Sasol in Harkerville);
- Area **between Airport Turnoff and Kwanokuthula;**
- **N2 Section by Keurbooms;**
- The **bends by The Crags;**
- **Toll gates** (there was boom collision in the past).

The road section within the Municipality with the highest number of accidents is Main Street in Plettenberg Bay with 254 accidents over this period, resulting in 36.3 accidents per annum on average. Marine Drive in Plettenberg Bay follows this with 200 accidents over this period, resulting in 28.6 accidents per annum. The roundabout at the N2/ Marine Way/ Theron Street in Plettenberg Bay has also been identified as a road safety hazardous location. A total of 135 accidents were recorded for the period 2005 – 2012, i.e. 20 accidents per annum[2]. With regards to the safety of pedestrians and public transport passengers, of great concern was the crossing of the N2 especially between Kwanokuthula and New Horizons. A need for a footbridge or a roundabout was identified. Potential pedestrian crossing locations where identified where pedestrian tend to cross roads. All residential

and public areas along the N2 corridor is changing in character which will come with its future risks.

DROUGHT/WATER SUPPLY

The Western Cape Province was declared a national drought area, during the month of May 2017 and subsequently, the Bitou Municipal Council declared that Bitou is a local disaster due to the severe drought conditions.

Following the declaration by the municipality, requests were submitted to both National and Provincial Government for the funding of identified drought disaster relief projects. Bitou Municipality received funding from the National Disaster Management Centre to the tune of R10,92 million and a further R1.8 million from Western Cape Provincial Government. Bitou relies on water from various water sources namely; the Desalination Plant, surface and groundwater sources. The Keurbooms, Bitou, Wit and Groot rivers are the main contributors. Water from the rivers are being channelled to the Plettenberg Bay and Kurland water purification works. Water not accommodated in the current purification cycle is channelled to offshore storage at the Roodefontein dam. In order to supplement the water demand, drought mitigation measures were put into place. Groundwater augmentation was explored and found to be a solution that can provide immediate relief to the drought situation faced by Bitou. Ten boreholes were drilled. The two funding streams received was utilized to equip all ten (10) exploration boreholes with electricity supply, permanent pumps, and pipelines in order to extract water and channel to the relevant purification plant. Boreholes are situated as follows: Forest View 2, Kwanokuthula 2, George Fault East 4 and Kurland 2. Currently, these production boreholes supplement **the aggregated water supply for the Greater Bitou Municipal area, taking the water supply capacity of the municipality from 22Ml/day to 27Ml/day.**

The water supply currently is stabilized. Although water supply is currently not a pressing issue, the demand for water will always be on an increase due to ever-increasing growing population associated with in-migration, a growing indigent population and general development in Plettenberg Bay. With, the majority of water supply coming from the Keurbooms River for the large Bitou municipal area, reliance on surface water from rainfall was highlighted. Many people wrongly believe that Roodefontein is the source of water, but it is in fact only an off-channel storage dam for water extracted from Keurbooms River - except for a small amount coming from the dam's own limited catchment area. With population growth in mind (due to migration amongst other things) coupled with weather variability associated with climate change, water supply versus water demand must remain a priority for the Municipality to address future possible challenges as far as possible.

Wadrift Dam, which is to be an off-channel storage dam for Keurbooms River water in the Uplands area above Wittedrift, continues to be plagued by various problems. **This dam is crucial for Bitou's long-term water supply and will be filled from Keurbooms River in times of high flow.** Under dry conditions, like that being experienced now, filling the dam could take several years. Currently, the deadline for completion of Wadrift Dam is 2022.

CLIMATE CHANGE

Climate Change is increasingly elevated as a boiling point and big focus on the global agenda. The reason for this is that the world is rapidly experiencing the effect of this phenomenon on fundamental socio-economic indicators such as water, sanitation, food security, health, energy, industrial developments and human settlements. Bitou Municipality is no exception and it presents serious threats to the future of the town and its environs because of the sensitivity of the estuary to rising sea levels and the risk to development in low-lying areas. Furthermore, changing rainfall patterns and extreme weather events have already had an impact on the municipal area in the past. There is a general consensus that the increased frequency of extreme weather events over the past couple of years has been marked in practice it can increase the odds of a thunderstorm of great magnitude. Where it might take place every 100 years in a natural climate, it might increase to once every 30 years because of climate change.

Strong damaging winds often occur along coastal regions, but also often occur during thunderstorm activity. These winds are sudden and can cause much damage.

Bitou Municipality has recently recovered from one of the worst droughts on record requiring emergency augmentation and restriction measures to secure a supply of water for the ever-growing population. Bitou Municipality is also no stranger to flooding with the most notable flood events occurring in 2007 and 2012 respectively. Flooding occurs when water overflows its normal channels such as streams and storm water drains. It can occur with prolonged period of rain, with continuous heavy falls or in the form of flash floods which are usually associated with severe thunderstorms. Heavy rain may also result in river flooding causing damage downstream to areas that may receive no rainfall at all during the flooding event. Floods have caused major damage to property and infrastructure and put lives at risk, and had a significant effect on financial and insurance arrangements of the affected households.

The surrounding areas have also suffered major fires under hot and dry conditions. These issues not only affect the human population, but the indigenous flora and the fauna are particularly susceptible to lasting changes in climate conditions. Over the long term this will lead to major loss of biodiversity. In Bitou Municipality some mitigation measures against the repercussions of climate change are already in place, ranging from restrictions to develop in areas at risk of flooding, and desalination equipment to secure a fresh water supply.

Climate change response is both about reducing vulnerability to climate change and developing adaptive capacity to cope with what can't be avoided. Climate risk is relatively high in the Garden Route District as the Western Cape has always been prone to drought situations. Regions with Mediterranean climates are considered to be most vulnerable to climate change due to their strong seasonality of precipitation, high irrigation water demand, and dense and growing populations. Climate related disasters have substantial financial implications, and climate change in general could have far reaching long term economic consequences for the viability of the region.

80% of disasters are the result of extreme meteorological events, all of which are becoming more frequent and intense as the climate changes, with the effects of the rest exacerbated as these changes accelerate. Climate-related impacts such as drought, flooding, thunderstorms, strong wind, fires and extreme heat are not new to the Garden Route District but they are likely to be exacerbated, as well as increasing in frequency and severity. Importantly, long term incremental changes and shifts in trends in climatic variables will impact on the thresholds of tolerance of infrastructure and critical services provided by government. The Garden Route District therefore needs early warning systems to identify and respond to adverse climatic conditions in order to minimise the impact on its socio-economic conditions.

The impacts associated with certain hazards are increasing in severity because of changing societal vulnerabilities. South Africa experiences a wide variety of natural and human-induced hazards, however, the three that occur most frequently – floods, droughts and fires – are all associated with water, its excess or its lack. Infrastructure, basic resources (water, food and energy) and livelihoods will all be impacted on and these impacts will affect all sectors and stakeholders, with a particular impact on the poor and vulnerable sectors of our community.

Climate change intensifies the underlying risk drivers of disasters, for example the interaction between disaster risk and poverty. Certain factors compound the vulnerability of particular groups in South Africa – their ability to anticipate, cope with, resist and recover from a natural threat. This in turn increases the risk of a natural hazard occurring - culminating in physical, financial and social losses. On the one hand, it magnifies weather-related and climatic hazards, while on the other it decreases the resilience of many poor households and communities, impeding their ability to absorb the impacts of disaster losses. This loss of resilience results from, among other things, reduced agricultural productivity, increases in disease vectors, and water shortages. The intensification of these drivers will magnify even further the uneven distribution of disaster risk between rich and poor countries and between the rich and

poor within countries as well. Climate change will thus turbo-charge the disaster risk-poverty interconnection, drastically increasing the impacts of disasters on the poor. The question of identifying those most vulnerable or most at risk, and finding appropriate frameworks to understand vulnerability, is a dynamic process and is often better articulated at a local scale. The Garden Route District has been identified as particularly vulnerable to climate change because of its coastal location and tidal influence of rising sea temperatures on the weather patterns.

While the National Disaster Management Forum stresses the need for continual monitoring and improving capacity to predict, mitigate and respond to natural disasters, it does not engage with the added level of uncertainty brought on by climate change. In South Africa and the Western Cape there are a number of initiatives and resources available to manage the risk of climate change, these include: The National Climate Change Response Policy; the Western Cape's Climate Change Strategy and Action Plan; and the Western Cape Sustainable Energy Plan Development Facilitation Unit (DFU) of PGWC. There is a district climate change plan, the Garden Route Climate Change Response Framework (2017). This GRDM's Climate Change Response Framework (CCRF) is meant to give a strategic overview of climate change responses that is relevant for the Garden Route region. The Bitou Municipality is advised to have its own Climate Change Plan and adopt the framework within their council chambers for implementation.

SEA-LEVEL RISE AND STORM SURGES

Umvoto PTY conducted a study regarding sea-level rise for the Garden Route District in 2013. The majority of the Garden Route DM CZMUs are at a moderate to high risk from extreme coastal events such as large storm surges and tsunamis.

The regions at most risk include the Plettenberg Bay to Nature's Valley area, while the CZMUs with a **high-risk ranking are Plettenberg Bay, Keurbooms-Bitou, Keurboomstrand and Nature's Valley**. The areas of moderate to high risk reflect exposed low gradient headland-adjacent or inlet/pocket bay beaches, in association with areas of high population and extensive development close to the shoreline. Despite a 6.5 mamsl swash run-up being likely due to the Robberg Peninsula focusing wave energy, Plettenberg Bay southwards of Beacon Island remains unaffected due to the current protection offered by a thin portion of undeveloped foredune (10-20 m high, 40-60 m wide).

In contrast, the beach area between Beacon Island and Lookout rocks will be highly eroded during a large storm event, with coastal developments also being vulnerable to damage due to development on and the removal of the foredune. The Piesang River estuary and floodplain are vulnerable to flooding and inundation, especially the caravan park, adjacent farmlands and part of the golf course along the river.

The Tides, Gansevlei, Bitou, Keurbooms and Diep River floodplains, suburbs of Anath and Matjiesfontein, and Stanley Island are all vulnerable to flooding and inundation below 2.5 mamsl (which has been breached in the past). Large swells and an associated 4.5 - 6.5 mamsl swash run-up may erode the entire estuary mouth bar and Lookout Beach, which has occurred in the past. A relatively undeveloped 10-20 m high foredune north-eastwards of the estuary is present, although coastal development at Keurboomsstrand has resulted in some areas been vulnerable to large swash run-ups and dune erosion and undercutting.

Landward migration of the shoreline by ~ 5-20 m is possible, dependant on the dune gradient. This may affect coastal developments where the foredune has already been removed or degraded e.g. between Beacon Island and Lookout Rocks.

Landward migration of the shoreline by 20-30 m likely, causing dune migration and the possible movement of dunes into the first line of coastal developments at Nature's Valley.

STORMWATER INFRASTRUCTURE

The capacity of the current stormwater assets in certain areas within the Municipality is insufficient to carry the amount of runoff water. Most of the roads were built without the proper storm water and kerbing to channel the runoff water. The design of channels, especially crossing roads should be redesigned properly with storm water pipes underneath the roads. Due to climate change, the area is experiencing more severe runoff where the current infrastructure is unable to cope. The other challenge is the storm water intrusion into the sewer system and floods certain pump stations. Area effected by underground water need to be connect to existing storm water through installing subsoil drains channels etc. to reduce damage to road surfaces. The enhancement/upgrading of the stormwater in all areas, more especially the previously disadvantaged areas. The existing storm water infrastructure in all areas needs to be upgraded, and in some areas it also needs to be redirected to proper catchments. The Kwanokuthula and New Horizon Storm water infrastructure also needs to be extended as the current one is not coping during heavy rains/storms. There are areas in Kwa-Nokuthula and New Horizon that are built in flood zones, those nodes need to be identified and be catered with proper infrastructure.

CRITICAL INFRASTRUCTURE: WASTE MANAGEMENT/REMOVAL

The municipality is no longer doing landfilling; the municipal landfill site has exhausted its life span. The municipality has constructed a waste transfer station where waste is sorted, compacted and transported. Waste is transported to the landfill site of PetroSA in Mosselbay at a hefty cost1. The municipality procured two trucks that run every day from Plettenberg Bay to Mosselbay. The challenge associated with this arrangement is:

- The increasing cost of land filling;
- The increase in operational coast e.g. fuel and vehicle maintenance costs; and
- The effect on the road surface over time.

The Municipality is currently sitting with the following issues:

- The cost for providing transferring waste to Mosselbay is then pushed onto the consumer who already has a heavy tax burden. Inflation in rendering waste removal services in Bitou has gone way above the norm and the general inflation announced by statistics South Africa. If no sustainable solution is devised, waste removal will be very high and might result in a non-payment of services and increase illegal dumping174.
- Illegal dumping is a serious problem amongst the communities. People are dumping on all open spaces that they see and some instances people transport waste from affluent areas to dump illegally in some areas. Communities have been complaining about a lack of facilities for green and building waste. The municipality must expeditiously construct the waste drop-off facilities1.
- The problem is further exacerbated by the ageing of fleet to transport waste is currently an issue within the Municipality. There is a general concern with regards to lack of capacity especially during season peak.
- There' also a lack of recycling within the Municipality.
- Another challenge is extending waste removal services to the rural areas. The rapidly growing quantities of garbage in communities pose threats to human health and the environment133. Poverty perpetuates the problem as poor households cannot afford toilet paper and then make use of other materials (e.g. newspaper) that block the system
- Bitou Municipality faces a number of challenges with regards to the delivering of an effective and sustainable waste management service, including insufficient budgets, skilled capacity and a lack of appropriate equipment.

CIVIL UNREST

Plettenberg Bay has been plagued by riots, mostly over housing, last year by various communities - some of which brought the coastal holiday town to a near standstill when residents gathered on the N2 blocking the road for traffic. During February 2019, Motorists have yet again been warned to **avoid the N2 between Shell Ultra City and Airport Road** following reports of protesters pelting passing vehicles with stones and setting objects alight along the national

road. A **large crowd marched from Kwanokuthula** to the municipal officers to voice their concerns over issues with electricity. Residents indicated that they, among other things, wanted their electricity directly from Eskom as the municipality used the prepaid system to recover rates and taxes. This has led to residents receiving less electricity units than they pay for. A plan has since been put in place to address the housing shortage, but after a housing committee meeting during February 2019 residents voiced their unhappiness with the process so far. This spilled over into another wave of protesting on Tuesday evening, which included the burning of tyres and stoning of passing vehicles on the **N2 near the Plett footbridge.** Several Qolweni residents protested over housing issues during February as well. This included stone throwing and burning tyres.

Sprawling low-density settlements are undermining the sustainability of the district, undermining equitable provision of public services, threatening public health and safety, eroding the natural environment and increasing socio-economic fragmentation dominant models of infrastructure provision, coupled with public and private housing development patterns are driving sprawling, low density, and peripheral developments in the Garden Route District. This pattern in turn creates demand for new schools, public facilities, roads and services, putting pressure on already overburdened infrastructure maintenance funds of both local and provincial government.

Poverty-related challenges include unemployment, HIV/AIDS, a high rate of illiteracy and food security. Frustrations amassed concerning growing interest rates, recent electricity black-outs, growing oil and food prices, worsening unemployment, increasing complaints (and protests) about poor service delivery and crime. The dissatisfaction in the past was wrongfully targeted at foreigners.

Currently Bitou Municipality's Socio-Economic climate is characterised by the following factors which contributes to the overall risk of civil unrest:

- High level of households falling within the low-income bracket (63.6%) with overall unemployment standing at 28%. The problem is coupled with a high cost of living, inequality and general problems with social grants.
- Increase in Indigent in-migration and rapid population growth which furthers puts a strain on the Municipality's ability to render services. This is further pressured with limited availability of suitable land for development;
- Indigent figures stood at 4434 in 2016. This trend is in line with the increase in unemployment and lower economic growth. If this trend continues, it could impact on the financial sustainability of the municipality and its ability to maintain the provision of services. There is a huge influx of people of the Eastern Cape in hopes of creating a livelihood.
- The relatively high rate of unemployment especially amongst the youth (38%) coupled with a high cost of living. In addition, the growth of unemployed youth is on the rise. The is one of the underlying factors that contribute towards crime, substance abuse, and gangsterism;
- Poor services delivery to informal areas (due to various factors) with the inability to maintain current service levels in the future;
- Unfulfilled community expectations;
- Population growth and demographic influx;
- Being primarily tourism-based the Municipality suffers from economic instability with low economic growth and a lack of incentives to attract investment due to its seasonality. This problem is further exacerbated with a high-level of the unskilled labor market. The slow growth in the local economy has resulted in increased unemployment and decreased job creation as well as a decline in revenue;
- Conflict over housing ownership and occupancy;
- Cultural misunderstanding and distrust;
- Illegal land grabs that end up with eviction notices. In some instances, delayed evictions can lead to further problems;
- Unfair labor practices;
- Political instability;
- The relatively high crime rate in the poorer areas;
- Divided local communities where competition for scarce resources leads to disputes amongst different groupings;
- The absence of institutions effectively integrating the individual into the social decision-making process;

- The inability of politicians and communities to recognize and communicate early warning signs;
- Limited availability of suitable land for development;
- Lack of fully integrated planning and spatial alignment;
- The slow pace of land reform.
- The remote location of rural communities and settlements makes the cost for basic services and infrastructure non-feasible (forestry villages);
- Limited economic opportunities for rural communities;
- Limited access to government services;
- High cost and in-effective public transport systems for rural communities.

EMERGED VULNERABLE HUMAN SETTLEMENTS

PINETREE

Pinetree is a medium density settlement located on land owned by the municipality with no zoning, however a portion of the land is to be used by a school. The settlement experiences locational hazards since it is located in a flood-prone area, close to a garbage dump, on sinking soil, on a slope and under power lines. A portion of the settlement has been categorised for in situ upgrading and urgent relocation for the portion located under power lines. The effects of other hazards such as flooding can be solved by providing an adequate formal storm water drainage system and hardening surfaces, in order to mitigate the effects of sinking soil. Man-made hazards such as inadequate sanitation, inadequate waste management, a poor street network and water logging drainage can be addressed by incrementally upgrading the settlement. The settlement is well-located in relation to a clinic and educational amenities. However, socioeconomic and community facilities are absent. The community needs to organise itself with the help of the municipality to lead development initiatives. The municipality must use the EPWP to employ locals in cleaning up the settlement so that the community takes ownership of its infrastructure. The community has made reference to a time when they assisted the municipality with building the infrastructure for toilets. This same rationale must be applied to implementing community priorities.

TAMBO TRANSIT CAMP

Tambo Transit Camp is a **very high-density settlement** located inside **the urban edge** and on land that is zoned as public open space. The community was relocated from their previous settlement in Kranshoek because there was a fire disaster. Community members originally thought their relocation would be temporary, but they have remained in Tambo Transit Camp ever since. The settlement experiences natural hazards of **sinking soil, flooding, rock falls, locational hazards of being situated on a slope greater than 18** as well as being situated under power lines. These hazards can be improved through the incremental formalisation of the settlement. As such, the settlement is considered ideal for in-situ upgrading. The settlement has adequate access to water and sanitation services. A maintenance plan must be developed and include a protocol for reporting broken infrastructure. The community has identified priorities such as access to employment opportunities. The municipality should make use of local labour by developing a maintenance plan and appointing EPWP workers. The community leadership structure should meet with the municipality to begin implementing priorities. The settlement is well located and enjoys access to a clinic, socioeconomic amenities and educational facilities. The **community experiences a range of social problems linked to drug and alcohol-related violence, petty crime and gangsterism**. There is no police station located inside the settlement. The municipality should provide a mobile police station and fix street lights as a form of passive surveillance to improve the community's safety. The municipality should also facilitate social programmes from various state departments and social organisations to raise awareness around drug and alcohol use and abuse.

INDUSTRIA

Industria is **a very low-density settlement located on municipally owned land** and on an electrical servitude. The community experiences a **range of locational hazards and risks such as being located in a flood-prone area, close to a garbage dump, next to a road, on a slope**

greater than 18 and under power lines. The community has settled here for the past 20 years. Hazards and risks can be mitigated by formalising the settlement through upgrading road infrastructure and drainage channels. The community has adequate access to basic services. The settlement needs an infrastructure maintenance plan facilitated and funded by the municipality. Basic service shortfalls should be prioritised in order to address the living conditions on the ground. Health and educational amenities are not located far from the settlement but it **takes time for community members to walk** to them and as such, the municipality should ensure accessible transport for the community. The settlement is suitable for in situ upgrading. The electrical servitude should be addressed by reblocking the settlement. Given that **alcohol and drug-related violence is common in the settlement,** the community would like the municipality to facilitate active law enforcement in the area.

Kurland is a **very high-density settlement located on land** that is zoned as mixed use, of which 80% is owned by the municipality and 20% is privately owned. The settlement is situated on an electrical servitude and the community experiences numerous **hazards and risks such as a high incidence of fire, some floods, inadequate sanitation and sinking soil.** All these factors point to relocation, however the municipal pipeline indicates that this community will not receive housing within the next 3 years. Therefore, the settlement should be upgraded in situ and formalised in order to reduce the risks associated with living in this location. The settlement is well-located with regards to socio-economic amenities, education and healthcare facilities and employment opportunities. Most of the hazards can be alleviated by improving service delivery and maintenance as well as implementing clear strategies to reduce hazards such as fires and flooding. The municipality must attempt to expropriate the portion of the settlement that is located on private land. The municipality should also attempt to spatially organise the settlement in order to minimise the effects of the electrical servitude. The municipality must carry out the upgrading process in an environmentally sensitive manner as 61% the land falls into a critical biodiversity area.

The settlement has no leadership structure, and never meets with the municipality. De facto leaders generally cooperate but cannot reach agreements. The municipality must facilitate a working relationship with the community and help set up a leadership structure.

The settlement is situated in an area that experiences numerous locational hazards including a high **incidence of fires and flooding, proximity to a garbage dump, body of water, inadequate sanitation, high density, a poor street network, water logging and drainage problems.** These hazards and risks can be mitigated through the process of in situ upgrading and formalisation. The provision of additional legal electrical connections and settlement reblocking will help reduce fires. The installation of concrete storm water channels can alleviate flooding and drainage issues. The provision of a municipal skip will help combat litter and dumping. Due to the presence of drug related crime, the community has requested additional police assistance

WITTEDRIFT

Wittedrift is a very low-density settlement situated on municipally-owned land that is zoned as public open space. It is a peri-urban settlement located in a hamlet, distanced from any larger town in a critical biodiversity area. **The settlement faces the hazards of flooding, strong winds, water logging, and being located on a slope.** The community requires additional sanitation and electrical service provision to ensure that their basic service delivery needs are met. The community does not want to be relocated because residents enjoy the safety of the settlement. However, there are a number of housing projects in the pipeline, which the community would be eligible for. **These are in a location outside of a critical biodiversity area** which would provide better access to educational, health and socio-economic amenities and importantly, access to employment. It is particularly important to increase access to employment opportunities because the settlement reports a 100% unemployment rate. Therefore, until the settlement can be relocated, this analysis suggests in situ upgrading so that the community

can receive necessary basic services and live unrestricted by natural and man-made risks.

The settlement experiences f**looding and strong winds and is affected by risks including inadequate sanitation, inadequate waste management, drainage and water logging problems, and sinking soil**. These hazards can be mitigated by formalising the settlement, which includes installing concrete storm water channels, providing 1 toilet, efficiently managing waste and treating areas which contain unstable or sinking soil. The presence of a slope will make the provision of bulk infrastructure more expensive, but it should not be a determining factor for in situ upgrading in this settlement.

WITTEDRIFT/GREEN VALLEY 66

Green Valley is a very low density settlement situated on an electrical servitude and in a critical biodiversity area. The land is owned by the municipality and is zoned as public open space. The area is prone to flooding. The community has been selected for relocation to a housing project, where residents will be provided with top structures. However, project construction is only scheduled to begin after June 2019. Therefore, the municipality should embark on an in situ upgrading project so that the settlement can access a basic level of service delivery, ensuring the community's wellbeing and dignity. The municipality needs to alleviate the sanitation shortfalls, move water infrastructure closer to the settlement, provide access to educational and health facilities, install concrete storm water channels, provide 35 prepaid electrical connections, and establish a working relationship with the community. The municipality must ensure that the community understands when they should expect to receive housing and what level of in situ upgrading they can expect. The municipality also needs to facilitate skills training, EPWP programmes and entrepreneurship as the community reports a 100% unemployment rate.

The settlement suffers from various locational hazards as well as **natural and man-made risks such as flooding, sinking soil, inadequate sanitation, a poor street network, water logging and drainage issues**. The access road is in bad condition and currently there are pipes and community dug channels to assist with drainage. While the community waits to be relocated to a housing project, the municipality can alleviate these hazards and risks through the process of in situ upgrading. The municipality should install concrete storm water drainage channels, which would help alleviate the drainage issues of water logging and flooding. The access road must be repaired. The provision of additional toilets should alleviate the sanitation shortfall that is currently experienced.

FOREST VIEW

Forest View is a very low-density settlement located on municipally-owned land that is zoned for agricultural use. The municipality has plans to relocate the community to a housing project in the nearby settlement of Kranshoek, but in the meantime the municipality needs to ensure the provision of basic services and maintain a level of wellbeing. The municipality should provide flush toilets in the community and install concrete storm water channels to limit erosion in this environmentally sensitive area. The municipality must engage with the community leadership committee. In doing so, the municipality must be clear and transparent about the process of relocation and the level of targeted in situ upgrading that the municipality is capable of providing in the meantime. The settlement experiences a low level of locational risks and faces no natural or man-made hazards. It is located on a slope, which makes bulk infrastructure provision more expensive, but this is not a major hindrance for targeted in situ upgrading.

SOME OTHER KEY-FINDINGS

- Bitou Municipality has one of the largest percentages of formally protected land of any municipality in South Africa. This land is incorporated in the Garden Route National Park and comprises mountains, inland plateaus, a coastal corridor and a marine reserve;
- Key priority coastal and marine areas or special habitats that fall within the Bitou Municipality: The area from Noetsie to Toegroeiberg, east of Kranshoek (Knysna and Bitou Municipalities); The marine extension of the Piesangs River Mouth at

Plettenberg Bay (Bitou Municipality); The marine extension of the mouth of the Keurbooms Estuary (Bitou Municipality); The area extending from east of Keurboomstrand to the western boundary of the Tsitsikamma National Park (Bitou Municipality).

- The Bitou Municipality contains the large Keurbooms River Estuary located to the east of the town of Plettenberg Bay. It is separated from the sea by a coastal barrier, which has a tidal inlet linking it to the sea. It is an important nursery area for fish, is home to the Knysna Seahorse, and is ranked number 16 in South Africa in terms of conservation importance.
- The Bitou Estuary, which feeds into the Keurbooms, has a unique mixture of plant and animal species, and no alien fish species. This system supports several important fish species. The river and estuary are also home to several red data bird species.
- Bitou/Keurbooms estuary is a highly sensitive environment and its ecological health is essential to the economy of this mainly tourist town as a recreational resource and for its natural beauty;
- The only Endangered river identified by SANBI is the upper reaches of the Keurbooms where it flows through the farms before entering the Keurbooms River Nature Reserve at which point its conservation status improves to Vulnerable. This status is enjoyed by all of the other major rivers in the municipality.
- Endangered vegetation is competing with cultivated land and urban development. This competition is particularly evident in the built footprint of Plettenberg Bay as well as the Wittedrift Valley, which means that development needs to be sensitive to this;
- Informal settlements tend to be densely populated. These communities are generally considered vulnerable specifically to malnutrition and outbreaks of diseases such as typhoid, HIV/Aids and TB due to their rural profile. In addition, these liminal spaces often lack readily available water and sanitation facilities, which significantly exacerbates the spread of disease by increasing their vulnerabilities. In addition, burning coal in the winter as a source of heat creates smokes, which combined with cold and wet conditions, increase the risk of upper-respiratory-tract infections. Also, most informal settlements have inadequate facilities for the proper disposal of faeces which increases the risk of soil contamination in and around areas adjacent to dwellings and especially where children play. People also can get infected by swimming in sewerage- contaminated water;
- Stormwater and sewer spillage erosion has undermined the existing main outfall pipeline from Kwanokuthula to Gansevlei WWTW and it is at risk. Installation of the upgraded main outfall sewer is required as the existing system is overloaded and is required to accommodate already approved and planned low cost housing schemes in Kwa-Nokuthula and New Horizons. Aventura pump station is currently posing some challenges with reported spillages into the Keurbooms Estuary. Upgrades to the pump station are critical as it is currently monitored by DEA&DP. There is currently only one pump working at Kranshoek Pump station and sewage spillages still occur. The standby generator has been linked to activate on power failure. The provision of upgraded bulk sewer and upgrade of the Wittedrift pump station is at this stage crucial for any developments to continue in Green Valley.
- With regards to the Plettenberg Airport. the major requirement by the CAA to maintain a CAT 4 grading is the permanent presence of a fire fighting unit/station at the airport. This requirement is at present being addressed by the development of a satellite fire station at the airport which would serve both the on-field requirements as well as catering for the surrounding community.
- The N2 freeway is the spine of the road network in the Municipality traversing it in the south and east. In addition to serving the local population, it also plays an important role as an inter-provincial link between the Western and the Eastern Cape. The character of the N2 freeway is changing due to the various development taking place between Knysna and Plettenberg Bay as more direct access is required to properties

along its length. Most severe accidents within Bitou Municipality occurs along the N2. The accident black spots are as follows: Section between Garden of Garden Route and the Garage (Sasol in Harkerville); Area between Airport Turnoff and Kwanokuthula; N2 Section by Keurbooms; The bends by The Crags; Toll gates (there was boom collision in the past);

- Illegal dumping is a serious problem amongst the communities, especially rural areas but this problem has extended throughout the Municipality. People are dumping on all open spaces that they see and some instances people transport waste from affluent areas to dump illegally in some areas. Especially amongst the poorer areas especially Green Valley, Bossiegif, Qolweni, Kranshoek.
- Bossiesgif / New Horizons are the most vulnerable communities: Focused strategies are required to address service delivery and development needs in this area. This area is comparatively very highly endowed with working age males with relatively low levels of education and low levels of formal dwellings.
- Population densities are highest in Bossiesgif and in Kwa-Nokuthula. Human settlement place-making responses are required to ensure quality living environments and inclusive and integrated development.
- The communities reported various social issues such as drug and alcohol related crime, gangsterism, domestic violence, rape and house break-ins. According to community reports, unemployment is a strong causal factor in many of these crimes. The municipality must ensure that communities are adequately policed, that police and communities work closely together to mitigate crime and that the police always responds to calls for help and carries out its investigation procedures fully. Basic service delivery and improved employment opportunities will increase the wellbeing of communities and can help to reduce crime. Community leaders must arrange neighbourhood watches as well as oust criminals instead of shielding them.
- The communities have a variety of dominant occupations like farm work, domestic labour and construction. Unemployment is a major restricting factor. The municipality must consistently attempt to increase access to employment opportunities by implementing skills upgrading and vocational training projects. The potential exists for occupations (such as farm labour) to be seasonal. This can leave households in a vulnerable position. The municipality must take note of these dynamics and lend assistance where it can. Extending the EPWP and CWP programs into these communities is a good way to stimulate employment.
- Specific strategies are required to address issues involving the youth, female-headed households have increased and an integrated response to education strategies needs specific attention.
- The biggest growth occurs in the areas comprising Plettenberg Bay, Kwa-Nokuthula and Kranshoek (the latter is experiencing the fastest growth of all settlements in Bitou). Specific attention needs to be paid to urban efficiencies and the provision of facilities and amenities in an integrated manner. The SDF and IDP strategies need to provide clear guidance for public investment in this regard in these areas.

CLIMATE CHANGE VS RISK REDUCTION

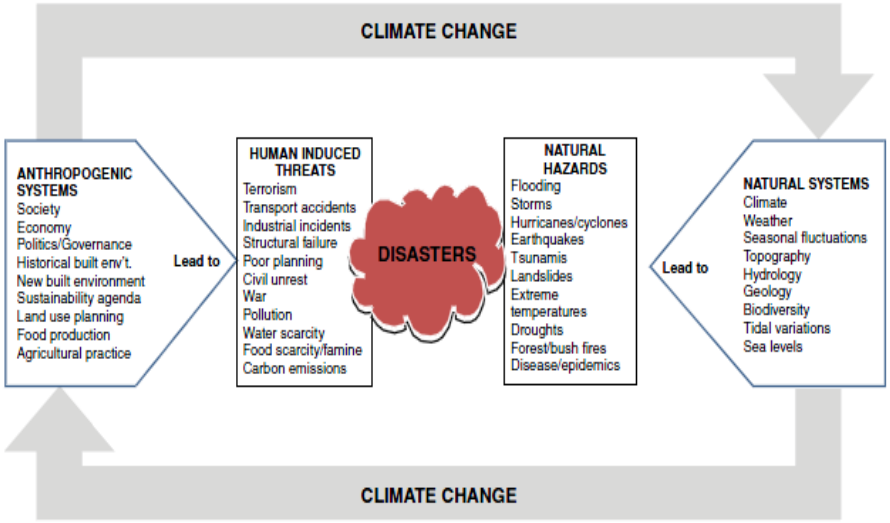
Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA) represent policy goals, one concerned with an ongoing problem (disasters) and the other with an emerging issue (climate change). While these concerns have different origins, they overlap a great deal through the common factor of weather and climate and the similar tools used to monitor, analyse and address adverse consequences. The figure below highlights the areas of overlap between disaster risk and climate change. The risk of climate-related impacts results from the interaction of climate-related hazards (including hazardous events and trends) with the vulnerability and exposure of human and natural systems. Changes in both the climate system (left of the figure) and socio-economic processes, including adaptation and mitigation (right of the figure) are drivers of hazards, exposure, and vulnerability.

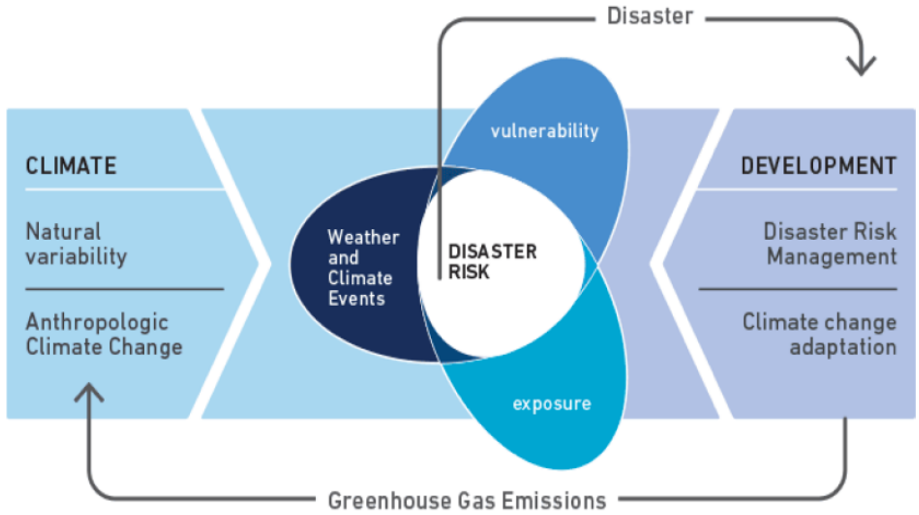
Globally in 2015/2016, three significant international treaties came into effect. These treaties to which South Africa has committed itself as a nation, place a significant focus on DRR and climate change.

They are:

- The Sendai Framework for Disaster Risk Reduction 2015-2030, which replaces the Hyogo Framework. The Sendai Framework has strong cross linkages between climate change adaptation and resilience, and disaster risk.
- The Sustainable Development Goals 2015-2025 (SDGs, which include 17 goals) which replace the Millennium Development Goals. Among the SDGs, the responsibility for the climate goal (#13) is given to the UNFCCC.
- The UNFCCC Conference of Parties (COP) 21 Agreement ("Paris Agreement"). The key commitment by all nations relates to keeping the increase in the global average temperature well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels.

Nationally, one of the most significant recent developments in South Africa has been the promulgation of the Disaster Management Amendment Act No.16 of 2015. This Amendment Act refers to climate change and





the responsibility of national, provincial and local government to "provide measures and indicate how it will invest in disaster risk reduction and climate change adaptation, including ecosystem and community-based adaptation approaches; develop early warning mechanisms and procedures for risks identified in its functional area; and regularly review and update its plan". This new legislation is important in terms of supporting adaptation through the requirement for providing measures and investment in ecosystem and community-based adaptation for DRR.

Responding to climate-related risks involves decision-making in a changing world, with continuing uncertainty about the magnitude and timing of climate change impacts and with limits to the effectiveness of adaptation. It makes sense, therefore, to consider them and implement them in a systematic and integrated manner. For example, risk assessments, flood management systems and building code enforcement contribute to both DRR and CCA policy goals. At the same time there are areas of non-overlap, such as in earthquake risk engineering for DRR and agricultural or trade policy initiatives for adaptation. There are also linkages with other policies, most notably poverty eradication and planning for sustainable development, and education and science.

The impacts of climate change will play out at a local level – floods, droughts, changes in rainfall patterns and temperature will all have serious implications for local communities and local municipalities such as Bitou Municipality. Municipalities will be the first point of impact and response to natural disasters and the economic and social impact of these (as well as slow-onset disasters such as long-term changes in temperature or rainfall). In terms of mitigation response, municipalities should implement responses to reduce their own GHG emissions, but they also have a major role to play as an enabler of mitigation responses in the private sector. Through municipal by-laws and guidelines to enable Small-Scale Embedded Generation (SSEG), Municipalities can assist the residential sector and industry to lower its carbon footprint. Municipalities can also play a major role in investigating and encouraging the development of renewable energy opportunities, which contributes to reducing the carbon footprint of the national electricity grid.

In the DRA comprehensive report climate change is analysed as a single hazard. The latter also evaluates how climate change affects both the frequency and magnitude of a hazard, as well as the vulnerability of specific communities in terms of health conditions, economic viability and social stability.

RISK REDUCTION

Disasters can be reduced by decreasing the exposure to hazards, lessening vulnerability of people and property, the sensible management of land and the environment, and by improving preparedness and early warning for adverse events. Disaster risk reduction includes disciplines like disaster management, hazard mitigation and emergency preparedness, but DRR is also considered an integral part of sustainable development. DRR sets out to bridge the gap between development and livelihood security, as development can only be sustained if there is a clear understanding of and response to the negative impact of disasters. DRR interventions seek to assist in the development of this understanding, to support livelihoods and to protect assets. As an increasing number of people are being affected by natural hazards, there has been a growing recognition by governments and organizations that building resilience and reducing disaster risk should be central to their everyday activities.

No community can ever be completely safe from hazards and threats, and different layers of resilience are needed to deal with different kinds and severities of risk, shock, stress or environmental change. It may be helpful to think of a disaster resilient or disaster-resistant community as the safest possible community that can be created in a natural hazard context, minimizing its vulnerability by maximizing the application of DRR measures.

Resilient communities commonly share a number of characteristics:

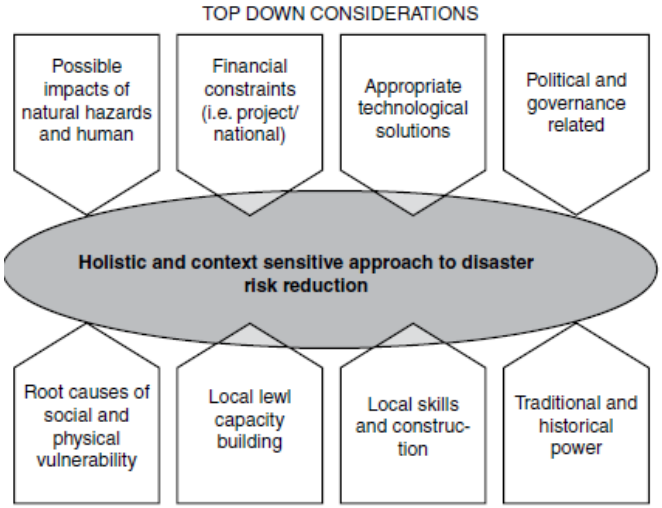
- *Knowledge and well-being*: the community has the ability to assess, manage and monitor its risks and learn new skills as well as build on past experiences

- *Governance and organization*: the community has the capacity to identify problems, establish priorities and act accordingly.
- *Connection with external stakeholders*: the community has an established relationship with external actors who provide a wider supportive environment, and supply goods and services when needed.
- *Operation and maintenance of infrastructure and services*: the community has strong housing, transport, electrify, water and sanitation systems. It has the ability to maintain, repair and renovate them.
- *Economic well-being*: the community has a diverse range of employment opportunities, income and financial services. It is flexible, resourceful and has the capacity to accept uncertainty and respond (proactively) to change by ensuring business continuity.
- *Sustainability*: the community recognizes the value of natural assets and has the ability to protect, enhance and maintain them.

As discussed in this report, there is an increasing threat to the built environment from a variety of different hazards and threats, some of which are well-known but hard to mitigate, and others that can be emergent and thus less predictable. Due to changes in the climate, a large number of hazards and threats are likely to become more frequent and significant in the near future; it is thus critical for those involved in planning, design, construction and operation of the built environment to take serious consideration of these hazards and threats as a core part of their professional activities. The decisions taken now will determine the burden that future generations inherit with regards to their resilience to a range of hazards; so efficient planning, design and construction today should lessen the need for expensive retrofitting measures in the future. It is vital that Bitou Local Municipality includes policies and regulations in the IDP to reduce vulnerabilities and increase opportunities of adaption. A deliberate focus on resilience building to recurrent weather shocks is fully consistent with both the National Development Plan and the Sendai Framework on Disaster Risk Reduction and Agenda 2030 for Sustainable Development.

Key ideas to take in regarding DRR:

- DRR should be a holistic multi-hazard/threat and multi-stakeholder approach should be mainstreamed into development project in order to increase the resilience of the built environment;
- DRR measures should be considered and where relevant implemented at the earliest appropriate stage of the design and planning process rather than added onto a project as an after-thought;
- It is important to build back better, especially when opportunities arise in the aftermath of a disaster;
- Professional institutions can play a very positive role in educating students and members about their roles in disaster risk reduction.



INDIGENOUS KNOWLEDGE

Even before high technology based early warning systems, or standard operating procedures for response have been introduced, many local communities worldwide have prepared, operated, acted and responded to natural hazards using indigenous methods (many of which are primarily oral) passed on from one generation to the next. Thus, it is important to understand, acknowledge and respect indigenous knowledge as a valuable source of information and as a key contributor to reducing risk in many parts of the world.

Indigenous knowledge refers to the methods and practices developed by a group of people from an advanced understanding of the local environment, which has formed over many generations of habitation. This knowledge

contains several other important characteristics which distinguish it from other types of knowledge, including originating within the community, maintaining a non-formal means of dissemination, collectively owned, developed over several generations and subject to adaptation, and imbedded in a community's way of life as a means of survival.

This knowledge can, for instance, be used to identify early signs of unusual weather patterns or animal behavior, longer-term impacts on the natural environment as well as insights into emergency evacuation plans and local coping mechanisms. The relationship between indigenous knowledge and disasters has garnered more interest in recent years. Discussions around indigenous knowledge highlight its potential to improve disaster risk reduction policies through integration into disaster education and early warning systems.

Four primary arguments have been made for the value of indigenous knowledge:

- various specific indigenous practices and strategies embedded in the knowledge can be transferred and adapted to other communities in similar situations;
- an incorporation of indigenous knowledge in existing practices and policies encourages the participation of the affected community and empowers its members to take the leading role in all disaster risk reduction activities;
- the information contained in indigenous knowledge can help improve project implementation by providing valuable information about the local context; the informal means by which indigenous knowledge is disseminated provides a successful model for other education on disaster risk reduction.

MULTI-STAKEHOLDER PARTICIPATION

No single agency or actor can deal with DRR issues alone. Effective DRR relies on the efforts of many different stakeholders. The only way disaster risk reduction can truly be approached holistically is to pull-in multi-disciplinary and various stakeholders from society. Since disasters are heavily felt on a local level it is of vital importance that both communities and local authorities be empowered to manage and reduce disaster risk by having access to the necessary information, resources and the authority to implement actions. It's important to promote a culture of participatory planning and implementation of DRR initiatives as well as sustaining such initiatives through on-going effort.

The occurrences or threat of disaster creates opportunities to facilitate better cooperation or relations amongst stakeholders through fostering linkages which otherwise might not have existed. The cooperative spirit generated from common efforts to deal with disasters – through either perceived necessity or choice from the humanitarian imperative – possible overrides pre-existing prejudices, breaking down barriers which then may never be rebuilt. A recommendation worth considering is to establish disaster management steering committees for each ward cluster within the municipality. Utilizing a bottom-up approach, such committees will serve as active channels towards the different parts of the municipality as needs and risk profiles are dynamic and ever-changing on a local level. When successful, this builds on various sectors and civil society partnerships and cooperation in support of grassroot initiatives to dramatically reduce the costs of risk reduction, ensuring local acceptance and enabling local empowerment. Should the municipality decide to implement a ward-based DRR process, it's recommended that the following actions be implements:

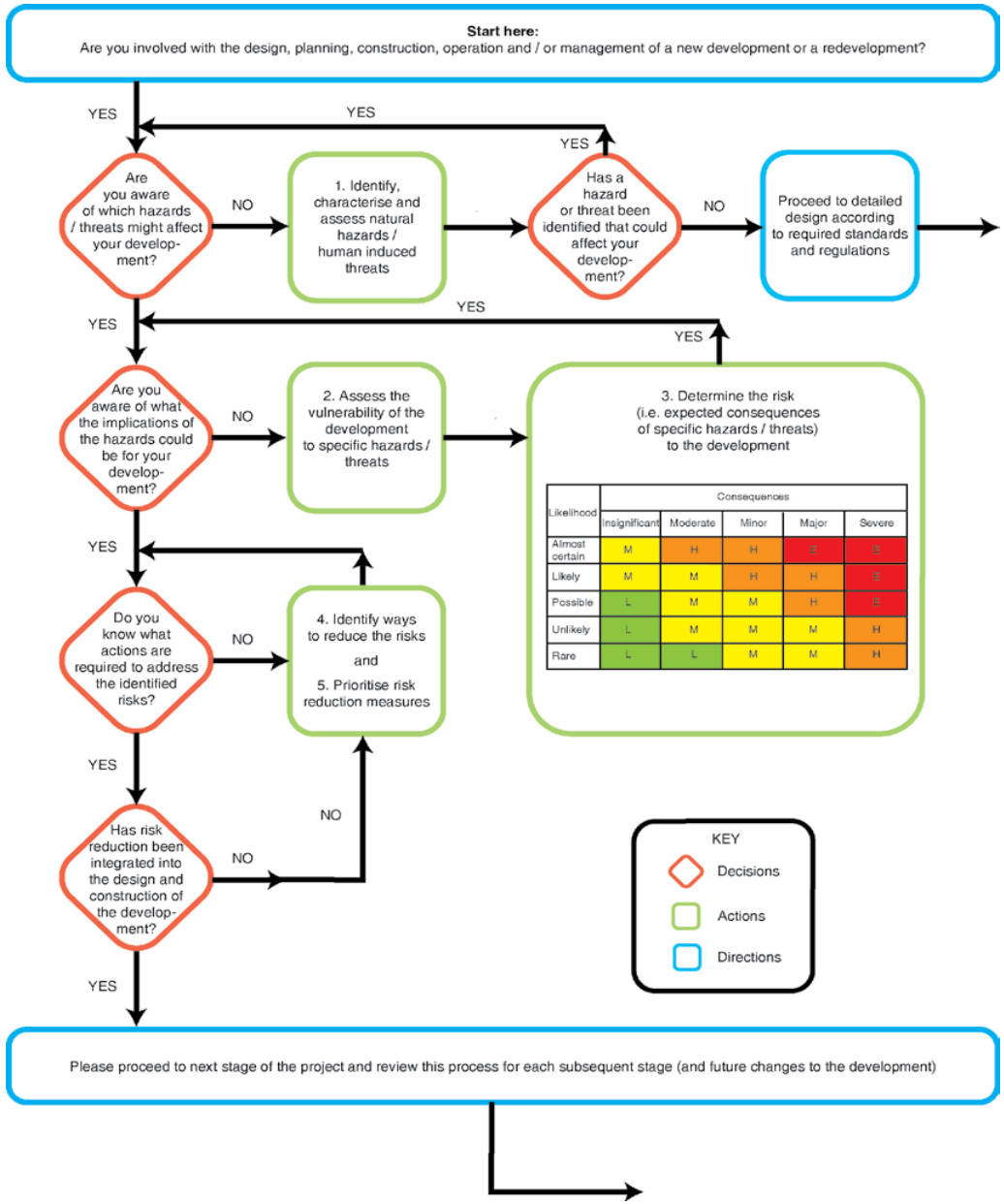
- Existing information regarding disaster risks and imminent threats should be communicated and verified per ward with the support of the various ward councilors; and
- After verification, it should be converted - with the assistance of area representatives and other stakeholders – into area-based DRR strategies. In this regard, is it recommended that the Garden Route DMAF together with Ward Committees play a leading role in the community-based DRR planning and implementation processes.

FINANCIAL CONSTRAINTS

Disaster management within Bitou Local Municipality still remains an unfunded mandate. Although the Protection Services Department of the municipality is assigned with the disaster management functions to direct and facilitate the disaster management process, it cannot perform the whole spectrum of disaster risk management activities on its own. Without adequate finances there is no way to fund the provision of skilled and trained staff, capacity building program, resources, volunteers, risk reduction projects, adequate emergency relief supplies, post-disaster recovery and rehabilitation activities necessary for ensuring that DRM is implemented to the levels recommended in the national legislation.

There is generally within the Bitou Local Municipality insufficient manpower (operational budget constraints) to mobilize additional personnel resources. A disaster situation becomes even more of a challenge to manage when existing staff are already over-utilized.

In order to implement the DRR projects it is recommended that the appointed lead for Disaster Management drive the process and that budgetary implication be determined to perform this function. This individual should champion the various DRR projects by determining priorities and by engaging with the community, leading departments and the Bitou Local Municipality IDP office. This champion can improve awareness



and seek active media coverage for the Bitou Local Municipality by targeting local ward councillors, IDP representative forums, and other community structures. This project leader should be capacitated with budget and power to ensure implementation and ongoing review and revision. Furthermore, the above-mentioned process must be monitored by the Garden Route Disaster Management's Advisory Forum on a quarterly process.

The ultimate goal is to implement the type of thinking illustrated in the figure below in all sectoral departments (from urban planning, engineering, environmental management, social development etc.) associated with disaster risks. The will ensure that DRR is at the forefront of all developmental planning.

DRR IN THE IDP

Section 26(g) of the Municipal Systems Act (No. 32 of 2000) requires that Disaster Management Plans (DMPs) are incorporated into Integrated Development Plans (IDPs) in the municipal sphere. An IDP is a locally produced and nationally-informed five-year strategic plan that guides local priorities and operational activities through decisions regarding planning, management and development. The IDP also serves as a platform to elevate local disaster management priorities to a higher level of cooperation for the effective use of scarce resources. The Garden Route Disaster Management Centre is the primary functional unit for disaster risk management in the district and it provides direction for the implementation of disaster risk management policy and legislation. At the local level, Bitou Municipality deals with the impacts of disasters, including those likely to become more frequent with climate change, such as rainfall, sea storm surges, increased wind speeds, drought and flood event.

This document could additionally support the Garden Route Local Municipality for the inclusion of relevant data in their IDP and aligning DRR in their IDP. All departments and role players submitting input content of the current and future IDP of the Bitou Local Municipality are implored to consider the inclusion and integration of disaster risk management into their strategies, operational planning and project implementation.

Disaster risk concerns should be integrated into the municipal budget in order to ensure that levels of public expenditure on DRR is sufficient and that there are adequate funding arrangements to manage residual risk. Annual reviews of the IDP should reflect on the progress made on institutional arrangements, risk assessment updates, risk reduction objectives and projects, as well as any changes made to the disaster management preparedness, response and contingency plans. In addition, it should include a review of progress on the policy amendments and project implementation of the SDF, according to the priority listings and expenditures programmes of the various sector departments' budgets.

The predominant goal is to ensure developmental risk reduction, by having planned development linked with risk reduction initiatives and risk information, i.e. considering the prevailing risks (risk assessment) for sustainable development (resilient municipal assets and communities). It is also to ensure that operational risk reduction objectives are developed and/or updated. Project plans and contingency plans for identified risks should also be updated in the DM Plan (e.g. flood preparedness & mitigation; summer readiness - fire & life safety education/awareness).

The objective of this DRA is to assist the Bitou Local Municipality in acquiring credible data to inform planning, budgeting and the accompanied prioritization with respect to policy options. In keeping with international best practice, the DRA report makes recommendations for DRR plans that should be implemented to mitigate potential loss of life and property. This DRA report should inform and be adopted by the Bitou Municipality council, wards and IDP so that the end results of this alignment would be the strengthening of a policy-led response that is aligned with an updated disaster risk profile.

ANNUAL DRA REVIEW

Disaster risks are dynamic and ever-changing. Therefore, it is imported that the DRA Report is monitored – both internally and externally – on

an annual basis to validate and update the relevancy of associated risks. In addition, the inclusion of new risks that may arise as well. DRR should be mainstreamed in all development planning and it's imperative that greater accountability be associated with disaster-related losses within the Municipality. The point is to eventually create a self-sustaining platform of understanding where local disaster management role-players and other interested parties can maintain their own municipality's DRA.

DISASTER RISK REDUCTION PLANS

A focused and comprehensive Disaster Risk Assessment aims to identify and analyse potential hazards and/or threats, assess the conditions of vulnerability, determine the level of risk for different situations and conditions and helps to set priorities for action. Furthermore, it raises the public's awareness of hazards, vulnerabilities and capacities and the risk taken by society.

Many disaster risk reduction programmes are already taking place in Bitou Municipality and this Disaster Risk Assessment is the first step towards an integrated, municipal-led response that identifies potential disaster risk impacts and how to respond to these. To further ensure broader transparency the DRR plans should be co-ordinated and monitored by Bitou Municipality and aligned with other relevant strategies such as the Water Services Development Plans, the Integrated Waste Management Pan, the SDF, EMF, IDF and the Integrated Transport Plan.

In this summarized report each hazard has been highlighted with the corresponding risk rating colour. The four columns summarizing the risk rating, high risk areas, recommended DRR plan and implementing agents are as follows:

Please refer to the formal DRA report to see each recommended Disaster Risk Reduction Plan's exhaustive list of performance indicators - with which to measure the success of the various recommended DRR plans.

HAZARD RATING	HIGH RISK AREAS	DRR PLAN	IMPLEMENTING AGENTS
LOW MEDIUM HIGH EXTREME	Areas, communities, or households most at risk	Primary project objective is proposed	Lead department of agencies

Executive Summary

- Outlines the purpose of the DRA Report
- Offer a background to the Municipality
- Highlight the processes associated with the report

Introduction

-
- Offers context by familiarising the reader with the methodology, climate change, link between climate change and disaster managment
- Highlights the importance of Risk Reduction and offers guidance thereof

Natural Hazards DRR Recommendations

- Geological, Coastal, Hydro-Meteorological and Biological hazards.

Technological Hazards DRR Recommednations

- Transport, Urban, Critical Infrastructure and Socio-economic hazards.

Environmental Hazards DRR Recommendations

- Erosion, Harmful algal blooms, Loss of biodiversity and Predation.

NATURAL HAZARDS

RISK REDUCTION RECOMMENDATIONS

HAZARD: ANIMAL DISEASES

RISK: MEDIUM

AREAS, COMMUNITIES OR HOUSEHOLDS MOST AT RISK:

Commercial agriculture does not make a significant contribution in the Bitou Municipal area since only a relatively small area can be cultivated. The Wittedrift Valley and Fisanthoek is the only area where there are really commercial agricultural activities. The area consists of about 19 386 ha of which only 10% (about 2000 ha) can be cultivated. The major agricultural activity in the region is dairy farming. Small-scale farming is found scattered along Wittedrift/Uplands, Fisanthoek and Nature's Valley.

Furthermore, other vulnerable groups include:

- Smallholding farms;
- Beef production industry;
- People with socioeconomic problems and HIV-positive individuals;
- Important bird breeding sites along the estuaries;
- Pastoralists (emerging farmers, small-scale farmers);
- Rural wage labourers;
- Children, adults, the elderly.
- Areas with stray dogs such as Ward 3.

RISK REDUCTION RECOMMENDATIONS

RECOMMENDED ACTIONS	RESPONSIBILITY (IMPLEMENTING AGENTS)	COMMENTS AND MEASURES
Improve early warning systems	DOA; SPCA; Animal Welfare Societies	• It is recommended that the municipality develop a strategy aimed at monitoring and regulating small-scale farming within the area. All small-scale farms should be inspected and hygiene standards monitored.
Improve awareness during Thusong visits	DOA; Thusong Centres; PAWS; BLM	• It is a legal requirement in South Africa to have your pets vaccinated against rabies. However, vaccination with regards to stray dogs is uneven and is one of the contributing factors towards rabies risk within the area. • It is recommended that an ongoing structured and integrated campaign is implemented targeting general public especially in the poorer and informal areas to improve education and awareness regarding the spread of diseases, the risk of climate change and pre-notification of the movement of animals. • During the Thusong mobile clinic awareness-raising days the pet owners need to be educated not to neglect their animals after vaccination has been completed. Alternative homes could also be found for stray animal (after infected have been vaccinated). The poorer and vulnerable areas of Bitou Municipality should be the primary target.

Compile a Bitou Local Municipality Animal Disease Disaster Plan	DOA, Animal Welfare Societies, BLM	• Describe livestock value chains and identify people and organizations, particularly the communication between DoA, Garden Route District and Bitou Municipality, involved in those chains. • Continued financial assistance to animal welfare. • Determine how capacities can be improved for more effective and efficient response to animal diseases. • Determine how laboratory diagnostic capabilities need to be strengthened.
HAZARD: HUMAN DISEASES		
RISK: MEDIUM		
AREAS, COMMUNITIES OR HOUSEHOLDS AT RISK: • Only 15% of the population reside in rural areas which creates difficulties in providing services (health care)) due to the low thresholds. Unique and area specific initiatives would need to be developed to cater for the rural communities. • **The Bitou Municipality currently has good medical services but means of improving the quality of the care should be sought. No medical facilities have been indicated in Keurboomstrand, Nature's Valley, Covie or Platbos and the provision of medical services in these areas should also be explored.** • **Informal settlements tend to be densely populated**. These communities are generally considered vulnerable specifically to malnutrition and outbreaks of diseases such as typhoid, HIV/Aids and TB due to their rural profile. • In addition, these liminal spaces often lack readily available water and sanitation facilities, which significantly exacerbates the spread of disease by increasing their vulnerabilities. In addition, burning coal in the winter as a source of heat creates smokes, which combined with cold and wet conditions, increase the risk of upper-respiratory-tract infections. Also, most informal settlements have inadequate facilities for the proper disposal of faeces which increases the risk of soil contamination in and around areas adjacent to dwellings and especially. • **Bossiesgif** / **New Horizons** are the most vulnerable communities; • **Ward 1** mentioned the following concerns during a ward-based public participation workshop: - Limited service hours of the clinic (clinic opens 3 day a week with 1 sister nurse); - Poor turnaround time of the emergency and disaster management systems; • **Population densities are highest in Bossiesgif and in Kwa-Nokuthula;** • **The biggest growth occurs in the areas comprising Plettenberg Bay, Kwa-Nokuthula and Kranshoek** (the latter is experiencing the fastest growth of all settlements in Bitou).; • Diseases like cholera and gastro-intestinal infection result from contaminated drinking water, which is of inconsistent quality in South Africa; • Socio-economic statuses are also linked with poor health education with particular emphasis on personal hygiene and toilet habits; • Bacteria such as E. Coli in diarrheal stools of infected people can be passed from one person to another if hygiene or hand washing habits are inadequate. This is particularly likely among toddlers who are not yet adequately toilet trained. Family members and playmates of these children are at high risk of becoming infected; • The geographical position of Bitou in relation to the Eastern Cape makes it very vulnerable to people migrating to the Western Cape from areas with poor or no health services; • Due to the high population migration figures in the coastal areas it would appear that the prevalence of HIV/AIDS and TB in Bitou is high.		
RISK REDUCTION RECOMMENDATIONS		
RECOMMENDED ACTIONS	**RESPONSIBILITY (IMPLEMENTING AGENTS)**	**COMMENTS AND MEASURES**

Identify high risk areas subject to the outbreak of epidemics.	DoH; DoSD, SASSA, Thusong Centres	• The spread of disease is closely linked to socio-economic and environmental vulnerabilities (which includes but not limited to poor living conditions, unhygienic standard etc.). • The Bitou Municipality currently has good medical services but means of improving the quality of the care should be sought. No medical facilities have been indicated in Keurboomstrand, Nature's Valley, Covie or Platbos and the provision of medical services in these areas should also be explored. • Bossiesgif / New Horizons are the most vulnerable communities: Focused strategies are required to address service delivery and development needs in this area. This area is comparatively very highly endowed with working age males with relatively low levels of education and low levels of formal dwellings. • The focus should be on measures to improve sanitation, food production and handling practices in order to reduce poverty and overcrowding. • Lack of access to primary health care centers in low income areas; • The need to establish multi-purpose community centers; • Improving accessibility to community facilities for the communities they serve;
Continue with intensive health interventions	DoH; Relevant NGOs/CBOs/FBOs/NPOs; DoSD	• Particularly for HIV/AIDS and XDR-TB (Drug-resistant TB). • Support the development of vulnerable groups by compiling a strategy and plan aimed at emergency housing, water, sanitation and food for a large-scale influx of displaced people.
Continue with a structured and comprehensive multi-disciplinary and multi-sectoral strategy and plan that addresses the problem of substance (alcohol and drug) abuse in high risk areas.	DoH, DoE, SAPS, BLM	• Primarily target the most vulnerable communities (Wards 1 and 2); • Include rural surrounding areas; • Secondary roll-out a public awareness and education program in schools and through Thusong Centers.
Develop a strategy aimed at combating women abuse and domestic violence within the municipality.	DoH, DoE, SAPS, BLM	• Increase police presence in high-risk areas. • Create a safe space for abused women to report incidents.
Strengthen disaster mitigation in hospital facilities	DoH; WCDMC; GRDM DMC	• Advise managers of both private and public health care facilities, in areas potentially exposed to flooding, to undertake risk assessments to inform appropriate risk reduction efforts and planning. • Develop evacuation protocols which establish criteria for proactive action and decision-making. These should be based on a strengthened relationship between disaster management authorities and provincial EMS. • Ensure continuity of services by planning and preparing for communication and electricity failures/ interruptions. • Support vulnerable groups by compiling a plan for emergency housing, water and sanitation, and food for a large-scale influx of displaced people/communities.
Increase infectious disease capacity and infrastructure	DoH, BLM	• Ensure that all practitioners working with TB patients adhere to the International Standards for TB Care. • The nurse patient ratio needs improvement and improved levels of care for TB patients need to be provided • Where currently unavailable, and particularly in high risk areas, establish TB wards at the District Hospital or renovate

		deserted houses for Infectious Disease clinics. • Focus on high-density and informal settlement areas and the commercial export farms with regards to poverty alleviation and TB prevention. • Intersectoral collaboration focusing on poverty alleviation and TB prevention is prioritized.
Increase youth access to contraceptive and reproductive health care services	DoH; CDWs; Ward Councilors	• Educate community leaders, parents, and other community members concerning evidence-based strategies to reduce teen pregnancy and improve adolescent reproductive health. • Ensure clinical partners provide teen-friendly, culturally competent reproductive health care services that are easily accessible to all young people in the community. • Observe a decline in teenage pregnancies. • Essentially all births result from intended pregnancies. • Facilitate programmes to make pregnant women more aware of the advantages of a healthy lifestyle during pregnancy. • The success of such a strategy would have many other benefits, such as reducing disability and deaths among mothers and their children and freeing more women to earn money and participate actively in social affairs.
A structured programme based on the needs identified in the remote areas to recruit, train and equip volunteers to assist with area based first aid posts.	DoH; CDWs	• Recruit, train and equip volunteers, located in high risk areas, to assist as first-aid responders. • Every ward has one trained first aid volunteer.
HAZARD: WILDFIRES		
RISK: HIGH		
Areas at risk: • Areas within Bitou Municipality at risk are as follows: o South: **Kranshoek, Fisanthoek** (should a fire occur under the right conditions (wind) it would move over the mountain), Northern region of **Harkerville, Kwanokuthula** and **New Horizon** (especially areas which is lacking fire breaks); o North: West of **Keurbooms** along **R340** towards **Uniondale** (should a fire occur there then it'll put a large area at risk which includes a game farm); Uplands (due to being situated furthest from fire response); o East: The whole area from **Covie** to the **Tollgates** between Bitou Municipality and the Eastern Cape; **Keurbooms** – Southern Area (due to a lack of private landowner compliance to invasive vegetation clearing and fire breaks); Northern Part of **Crags/Redford Road** (due to dense vegetation and a lack of private landowner compliance); **Kurland** area (area near sawmill, R102 and runs all the way down to Nature's Valley); area between **N2, Pass and Mountains** to a lack of access – along R102; Nature's Valley (due to wooden houses being situated extremely close to urban interface). • The agricultural sector is largely at risk to wildfires. Most of the commercial activity takes place in the northern regions of the Municipality, namely **Wittedrift, Uplands** and **Fisanthoek**. • Valleys are more at risk to wildfire such as the **Wittedrift, Bitou and Nature's Valleys**. Considering the typography **Green Valley** was also highlighted as a difficult areas for effective and efficient fire response. • Areas with a high presence of invasive alien plants such as Black Wattle, Blackwood, Port Jackson Blue Gum trees, Pines, Eucalyptus, Hakea, Rooikrans; the result is that fires in the region are burning too hot and too frequently and are impacting on the production process of fynbos, hampering the ecology of the catchment areas for optimum water production. Areas that was mentioned in the workshops include **Plettenberg South** (from the airport to Harkerville), **Harkerville** along the N2 and **Nature's Valley** (due to dense forestation along the wildfire/urban interfaces)[131].		

- A wildland–urban interface refers to the zone of transition between unoccupied land and human development. The wild land-urban interface is where flammable vegetation and developed areas meet and consequently expose people and property to wildfires. These areas include nature reserves, vacant land often invaded by woody invasive alien plants, timber plantations (Bloukrans Timber Plantations), orchards, vineyards, and agricultural land. The Wildland-Urban Interface is the transition zone between open land that is generally unoccupied and contains flammable vegetation fuels and human settlements, the area where urban development meets wildlands (in town planning this area is sometimes referred to as the "urban edge"), where homes and structures are built among forests, shrubs or grasslands, or where there is a presence of people and permanent infrastructure in the proximity of flammable vegetation. This is where people live and earn their livelihoods, and it is here where people are exposed to the greatest risk of being injured or killed by wildfires, and property has the greatest potential to be damaged or destroyed by wildfires. This is an issues throughout the Municipality but prime example is The **Crags** and **Nature's Valley**. **The problem is further exacerbated with the population of wooden houses located in close proximity to dense vegetations**.
- Development in natural areas is an accelerating trend in many areas of the Bitou Municipality. Residential properties on the urban fringe are often sought after for their aesthetic value, especially if they are in close proximity to picturesque landscapes and natural vegetation. As mentioned above People like to live in 'green' areas, screened out from others. Therefore, it is inevitable that periodic veldfires will pose an occasional risk along the urban fringe. This is evident throughout Bitou Municipality but very evident in **Nature's Valley, The Crags, Kranshoek, Fisanthoek, Keurbooms, New Horizon, Harkerville (northern regions).**
- Areas far from fire stations. Dispatch is sent from the main station situated in Plettenberg Bay or a satellite fire station in Kurland. Response to the Northern regions (such as **Uplands**) is mostly a concern in this regard. **The northern regions are affected by the most delayed fire response, with units being dispatched from Plettenberg Bay main hub.** Other areas that will suffer from delayed fire response is Nature's Valley and The Crags.
- Nature's reserves and recreational areas, e.g. picnic areas where many fires tend to start such as **Keurbooms Nature Reserve, Robberg Peninsula, Nature's Valley and Lagoon, Kranshoek Picnic Site and Tsitsikamma National Park**.
- Roadsides and areas at the urban edge are additional areas of risk. Areas along the **R340, R102 and N2 at highlighted as a risk.**
- Retreats such as **Protea Wilds Retreat in Fisanthoek** and **Belamanga Country Escape** are at risk for being located in a secluded area and will unfortunely suffer from delayed fire response.
- Nature reserves and other areas with high endemism. Unscheduled burns are likely to burn areas not earmarked for management burns. Fauna is likely to suffer significantly given the rate and intensity of the burn. Particularly at-risk areas are the Critical Biodiversity Areas (CBAs).
- Farm sheds, fencing and other infrastructure of farms located in within Bitou Municipality. Areas such as **Uplands, Kurland, Covie, Wittedrift, The Crags and Nature's Valley** all have small farm holdings within the area. The commercial agriculture (mainly cattle) sectors is located in the northern regions of the Municipality.
- High voltage power supply lines. It was also highlighted in the workshop that electricity is fed to Bitou through one power line traversing from Knysna Municipality. Should a wildfire occur within Knysna's municipal boundaries and damage the powerline then electricity will be cut-off to whole Bitou area.
- Tourism rest camps and recreational lodges such as **Nature's Valley Rest Camp, De Vasselot Rest Camp (Nature's Valley), Rietvlei Bitou Valley Camping Site, Mouth Rest Camp Lodges and Bitou River Lodge**.
- The age of the veld (when it last burned) is an important factor to consider in planning and management, as older vegetation is more at risk to wildfires. DAFF remarks that the **fire intensity is linked to the available fuel load of e.g. alien vegetation**[131].
- IAPs tend to out-compete most endemic and indigenous plants, which require fire to germinate. Multiple fires over a short period (caused by IAPs) can therefore lead to the endangerment of certain species, an overall loss of biodiversity and micro-organisms present in soil. As a result, they can introduce fires into areas where fires did not occur historically, and by increasing the mass of plant material in fire-prone ecosystems, they can make fires more intense. **There is currently IAP regrowth in Plettenberg South from Airport area towards Harkerville. Also, been detected in Keurbooms** after the fires of 2017 that's complicated with a lack of municipal funds for removal and lack of landowners and private organizations' compliance.

RISK REDUCTION RECOMMENDATIONS

RECOMMENDED ACTIONS	RESPONSIBILITY (IMPLEMENTING AGENTS)	COMMENTS AND MEASURES
Defensible space for the future	BLM; GRDM; WoF, SANSPark; CapeNature, MTO Cape; SCFPA	• Timber plantations of exotic pine and eucalyptus need to be secured between corridors of Afro-Montane forest to mitigate wildfires burning across blocks. Planning against wildfires in the future needs to be a fine balance between defending farms, plantations and homesteads and urban centres and maintaining the vigour of the Fynbos. It is imperative

		that a 30-year spatial plan is compiled to defend against fires. • Both the 2017 and 2018 fires demonstrated that the Afro-montane forest, except under extreme fire conditions, acts as a natural fire break. Corridors of Afro-Montane forest need to be maintained, and in areas between plantations, need to be propagated to mitigate fires spreading between blocks of pine plantations. • Buffer zones between Fynbos and urban centers need to have regular managed burns with a high frequency program. These buffer zones should be at least 500m wide. Rural and agricultural properties need to maintain defendable zones of a minimum of 250m to protect structures, assets, infrastructure and valuable crops and livestock. • Controlled Fynbos burns in rotation blocks need to implemented to reduce the future occurrence of extensive wildfires. If integrated in a coordinated manner future wildfires can be limited to the Fynbos without risking the wellbeing of agricultural, plantations and urban centers, all the while maintaining the combined health of the Fynbos and the safety of Garden Route residents.
A provincial and/or district standard of permits and database for prescribed burning is compiled	WCDMC; DEA&DP; SAWS; CSIR; GRDM; SCFPA;	• Systems are created to reliably predict suitable weather in advance of prescribed burning. • GRDM is aware of approved prescribed burning permits to prevent the expense and energy of unnecessary call-outs. • Indigenous knowledge/historical data of prescribed burns from older farms are included, considered within the context of a changing climate. • The willingness from local farming communities to implement preparedness measures for the occurrence of wildfires exists. • The shortage of financial support is a hindrance and should be viewed as an opportunity for insurance companies to come onboard. • More research is conducted on determining ecologically acceptable fire intervals
Agricultural developments are planned from the outset to incorporate fire-scaping in defensible spaces, fire-resistant structures, and fire spread patterns into their design	WCDMC; DoA; SCFPA; WoF Organized Agriculture	• A guideline for holistic application of defensible space in the Western Cape is compiled and distributed. • The firebreak network and the creation of defensible spaces are viewed as an integrated system and not as disconnected entities. • The effectiveness of implementation is monitored.
Incentivize farmers to join FPAs	DoA; SCFPA; WCDMC	• Observe an increase in registered FPA members. • Insurance industry finds partnering solutions for joint risk management. • Efforts to recruit new FPA members are focused on properties identified as having high or extreme risk. This is a provincial undertaking – ensuring that all farmers are registered with their regional or local FPA to strengthen their preparedness and resilience.
Adhere to building codes	WCDMC; BLM; Fire Brigade Service; GRDM	• Ensure fire-proofing of buildings.
Develop and implement an alien invasive clearance and management strategy	BLM; CapeNature; SANSPark; DEA&DP; Insurance Sector; DoA	• Invasive alien plant clearing is accelerated, resulting in an increase in rural employment and social capital. • Chemical and mechanical IAP control methods are implemented in high risk areas and occur well before the fire season. • Municipal by-laws enforce the removal of IAPs. However, in cases where this system is not working, national legislation is enforced to get landowners to clear their properties.

		• Local community stewardship of biological corridors and unprotected areas is promoted. • Fire management practices, and the control and eradication of IAPs in catchments to address the hazard of wildfires, is improved. • EPWP can somewhat reduce the levels of unemployment within the region.
Ensure firebreaks are prepared in high-risk zones	WCDMC; Organized Agriculture; DoA; SCFPA; BLM; GRDM	• Within Bitou Municipality: - **South**: Kranshoek, Fisanthoek (should a fire occur under the right conditions (wind) it would move over the mountain) - Northern part of Harkerville, Kwanokuthula and New Horizon (especially areas which is lacking fire breaks); - **North**: West of Keurbooms along R340 towards Uniondale (should a fire occur there then it'll put a large area at risk which includes a game farm); Uplands - **East**: The whole area from Covie to the Tollgates between Bitou Municipality and the Eastern Cape; Keurbooms – Southern Area (due to a lack of private landowner compliance to invasive vegetation clearing and fire breaks); Northern Part of Crags/Redford Road (due to dense vegetation and a lack of private landowner compliance); Kurland area (area near sawmill, R102 all the way down to Nature's Valley); area between N2, Pass and Mountains to a lack of access – along R102. • Due to its typography, Green Valley is a difficult place to prepared firebreaks
Firebreaks are well maintained to ensure that there is little or no vegetation on them without causing any erosion	WCDMC; Organized Agriculture; DoA; SCFPA; GRDM	• Areas where firebreaks have consistently failed or succeeded are identified. The reasons for such failures or successes are assessed and used to develop guidelines for the strategic location of firebreaks in the landscape, in order to make them as effective as possible. • To ensure the effectiveness of firebreaks, consideration is taken of their optimal position in the landscape and their adequate width (the width needs to take into consideration the height of adjacent vegetation), and they are well maintained (not overgrown), especially before and during a fire season. Systems that can reliably predict suitable weather for firebreak burning in advance are created. This will enable fire managers to make full use of periods of suitable weather.
Early warning strategies to wildland fires be revised and updated.	WCDMC; DEA&DP; SANBI; CSIR; CapeNature	• Improved data sharing facilitates biodiversity tracking and EGS-related indicators. • Accelerate data sharing and early warning systems
Maintain and update an accessible Alien Invasive Species list within municipality.	BLM; DoA; CapeNature; SANSPark	• New invasive species infestation is detected early and eradiation of new infestations occur regularly. • Support research to determine and develop an understanding of the impact of climate change on invasive alien species and incorporate most research findings into management plans. This will assist with the restoration of degraded ecosystems as a result of alien invasive species as well as monitoring emerging potential risks
Plan for high-risk periods.	ESKOM; WCDMC; SCFPA; GRDM; WoF	• High-risk areas are those posing a threat to safety and to downstream catchments and ravines and man-made infrastructure. • Monitor and evaluate contingency plans to ensure that effectiveness and efficiency is maximized. • Ensure safe maintenance of Eskom power lines.

		• Ensure the availability of water. • More water points and fire hydrants are installed. • Recruit, train and equip volunteers to assist as first-line responders (especially in rural/outlying areas far from service hubs) such as what was done in Kurland. • Encourage availability of water trucks on farms during harvest (preventing fires).
Establish a satellite fire station in areas disadvantaged by poor response times.	BLM; GRDM; SCFPA; WoF	• The Northern parts of Bitou Municipality are at risk due to delayed response from Plettenberg Bay's main station. • Carefully assess places in need and attempt to source funding for such instalment. • Replicate efforts that were made to Kurland area.
Delineate buffer zones for alien grass invasion	BLM; DEA&DP; DoA; SCFPA	• Alien grasses are among the worst invaders in lowland ecosystems adjacent to farms, but are often the most difficult to detect • and control. To avoid alien grass invasion a buffer of at least 30m should be left along the edges between pristine natural • areas and vineyards, other agricultural lands & compost or manure piles. This can prevent disturbance, edge effects and nutrient • run-off into the veld, which promotes alien grass invasion.
SCFPA optimize their investments in constructing and maintaining firebreaks in relation to the value of protected assets	WCDMC; Organized Agriculture; DoA; SCFPA; GRDM	• A series of case studies, and possibly a synthesis thereof, will be required to develop efficient ways of estimating costs and benefits without needing every situation to be assessed. • FPA awareness, prevention and protection measures, including law enforcement, training and construction of firebreaks, are introduced and focus on properties with high and extreme risks. • SCFPA influence local authorities to improve property and building regulations through incorporating wildfire risk mitigation into designs, so as to restrict the use of flammable building and roofing materials for structures and promote the application of the defensible space principle.
Reduce the number of human-caused wildfires by promoting safe behavior when using fire	WCDMC; DoE; DEA&DP; SAWS; CSIR; GRDM; BLM	• Reduce accidental ignition of fires through raising fire awareness in vulnerable areas. These area include Kwanokuthula, Bossiegif, New Horizons, Green Valley, Harkerville. • The value of agricultural (and ecological) assets is generally not reflected in the budgets allocated for their protection, a disjuncture that needs to be addressed and brought to the awareness of the general public.
Organized Agriculture actively participates and utilizes the impact of recent fires as a platform to recruit more members	Organized Agriculture; DoA	• Organized Agriculture recruits more farmers. • Organized Agriculture implements more and/or smaller Fire • Management Units (FMUs).
Accelerate access to spatial information	WCDMC; DEA&DP; DoA; CSIR; GRDM	• A useful tool for FPAs and a 'quick and dirty' proxy for burns, to enable decisions on where a fire may or may not burn if the wind changes, is the 8-day rolling NDVI on Worldview, available at: https://worldview.earthdata.nasa.gov/. • A formal Memorandum of Agreement (MOA) is signed between the WCDoA, WCDMC and the CSIR.

Improve knowledge of stack burning	DoA; DEA&DP; CapeNature	• Stack burning is considered if the area from which the IAPs is to be cleared is small, or where the position of the vegetation is such that a prescribed burn would present too high a risk of uncontrolled fire spread. A perimeter firebreak, of at least 5m, is prepared before any cutting of the material for stacking, to prevent the possibility of runaway fires. Stacks should contain the vegetation cut from the surrounding 45m^2 of land. • Safer stack burning methods, such as chipping, is researched.
Raising awareness and training of both landowners and agri-workers	WCDMC; BLM; Organized Agriculture; DoA	• This training programme includes an overview of the NVFF Act and how climate change compounds the wildfire risk. • These training programmes can be provided by the district and/or local municipal fire brigade services.
Capable managers are employed and skilled to supervise local WoF teams	WoF; DEA&DP	• The problem of insubordination and mismanagement in WoF is approached and viewed as a strategic enabler for continuous improvement.
Wooden Houses needs to be prevented especially along wildfire-urban interfaces	BLM; GRDM	• There exist wooden houses along Keurbooms and Nature's Valley that's dangerously close to wildfire-urban interface. • Integrate a by-law in fire prevention policy that prevents wooden houses from developing along wildfire-urban interfaces.
800m Urban Interface needs to be mapped for all area to determine areas in need of fire-scapping.	BLM	• Especially applicable to Nature's Valley and Kranshoek area.
The forestry industry continues to adopt practices and cultivars that minimize risk	CapeNature; MTO Cape; SANParks	• MTO Cape should take responsibility for managing the pine plantations. • Organizations pursue a greater role for biocontrol to boost the effectiveness of alien vegetation clearing in the rugged mountains, where standard clearing methods are less effective.
HAZARD: REGIONAL SEA-LEVEL RISE		
RISK: MEDIUM		
AREAS, COMMUNITIES, HOUSEHOLDS MOST AT RISK: **Plettenberg Bay, Keurbooms/Bitou, Keurboomsstrand, ands Nature's Valley** are all at high risk for extreme events. Tidal Reach Evolution: - Lateral tidal reach at the Piesang Estuary may increase by 50m in 2100, affecting the caravan park and golf course; - Future lateral tidal reach at the Keurbooms - Bitou Estuary varies between 30-100 m, with similar areas identified by the swash run-up modelling being affected; - Lateral tidal reach may extend by 30-90 m along the western banks of the Groot Estuary, affecting the adjacent estuary developments of Nature's Valley. Coastal, Estuarine and Fluvial erosion risk areas:		

- **Plettenberg Bay**: Despite a 6.5 mamsl swash run-up being likely due to the Robberg Peninsula focusing wave energy, Plettenberg Bay southwards of Beacon Island remains unaffected due to the current protection offered by a thin portion of undeveloped foredune (10-20 m high, 40- 60 m wide). In contrast, the beach area between Beacon Island and Lookout Rocks will be highly eroded during a large storm event, with coastal developments also being vulnerable to damage due to development on and the removal of the foredune. The Piesang River estuary and floodplain are vulnerable to flooding and inundation, especially the caravan park, adjacent farmlands and part of the golf course along the river.
- **Keurbooms-Bitou Estuary**: The Tides, Gansevlei, Bitou, Keurbooms and Diep River floodplains, suburbs of Anath and Matjiesfontein, and Stanley Island are all vulnerable to flooding and inundation below 2.5 mamsl (which has been breached in the past). Large swells and an associated 4.5-6.5 mamsl swash run-up may erode the entire estuary mouth bar and Lookout Beach, which has occurred in the past. A relatively undeveloped 10-20 m high foredune northeastwards of the estuary is present, although coastal development at Keurboomsstrand has resulted in some areas been vulnerable to large swash run-ups and dune erosion and undercutting.
- **Nature's Valley**: The coastal development front of Nature's Valley is currently protected by a thin portion of undeveloped foredune (5-10 m high and 70 m wide), although a 150 m wide section of the town adjacent to the Groot Estuary is vulnerable to inundation from estuary flooding. A higher pocket beach enhanced swash run-up of 6.5 mamsl will erode the estuary mouth sand bars and beaches in the area.

RISK REDUCTION RECOMMENDATIONS

RECOMMENDED ACTIONS	RESPONSIBILITY (IMPLEMENTING AGENTS)	COMMENTS AND MEASURES
Maintenance and sustainable use of resources and infrastructure occurs	DEA&DP; GRDM; BLM; Consultant	• EMPs are finalized and implemented. • Standards are implemented for estuaries, possibly through the incorporation of a monitoring and evaluation component in all EMPs. This allows the state of each estuary to be monitored on a regular basis. • Operational plans are in place for all public launch sites. • Rates of coastal erosion and movement of mobile sediment is tracked in risk-prone areas of the province. • Report on spatial performance indicators in the coastal risk zones.
Insurance Market Correction	WCDMC; Insurance companies	• Incorporate sea level rise into long-term economic risk assessments. Coastal insurance premiums will increase and affect current coastal land owners in the short-term, but will prevent further excessive coastal development in the future.
A systematic approach to assessing and responding to coastal vulnerability, risks and damage is developed between District and Local Municipality	DEA&DP; GRDM; BLM	• A District Coastal Protocol for assessment and response to coastal vulnerability, risk and damage is compiled.
Delineate and promulgate coastal development setback lines that mitigate against impacts and reduce risks, and incorporate these into Municipal SDFs	DEA&DP; GRDM; BLM	• Enforce the coastal buffer zone restriction and prevent any further development within 100 m of the high-water mark or 10 mamsl contour (whichever is closest to the shoreline), until detailed coastal set-back lines have been developed. • Strictly monitor (and preferably prevent) future development below the 6.5 mamsl swash contour and 4.5 m estuary/river flood contour, as well as on any undeveloped portions of foredune or natural tidal estuary habitat.
Rehabilitate dunes and beaches	DEA&DP; GRDM; BLM; CapeNature	• Prevent the removal of natural dune vegetation or replacement with alien vegetation, sand mining, and the development of uncontrolled and unauthorized beach access tracks and pathways through dune cordons. • Remove alien vegetation. Plant indigenous vegetation, place synthetic material on dunes and exposed sand surfaces

		within a distance of 100 m inland of the high-water mark of the sea. • Retain Blue Flag status for current beaches and expand where marketing can be attained.
Prepare and implement architectural and urban design guidelines for coastal towns	BLM; GRDM; DEA&DP; Consultant	• Relocate threatened infrastructure inland and implement appropriate setback-lines (study has already been conducted). These requirements are included in the SDF and other zoning schemes. • Detailed adaptation studies on each high risk CZMU are conducted, in order to determine which best methodology should be developed to adapt to hazards induced by sea level rise. • A programme is developed to inform infrastructure investment and to support work creation. • A guideline for priority interventions for coastal rehabilitation is developed.
Improve future coastal modelling	GRDM; BLM; DEA&DP; Consultant	• A detailed tide gauge network is established at the various harbors along the Garden Route DM coastline. This will allow for a database of sea level records to be collected over time, and local sea level rise along the Garden Route DM coastline to be calculated and analyzed more accurately. • Develop a South African coastal and sea level rise literature database with an accessible online reference list.
Expand and effectively manage a system of coastal protected areas	DEA&DP; GRDM; BLM; Cape Nature	• Explore the designation of Special Management Areas (SMAs) in terms of the ICM Act for prioritized areas. • Identify and implement mechanisms for appropriate protection status of priority areas, including expansion of MPAs as identified in the Western Cape Protected Area Expansion Strategy (PAES). • Promote the conservation and responsible management of heritage resources situated within the coastal area. • Develop a feasibility report on the establishment of SMAs for identified priority areas. • Identification and mapping of known declared heritage resources. • Prioritize the development of CMPs for declared Provincial Heritage sites. • Ensure implementation and monitoring of rehabilitation programmes for prioritized areas.
HAZARD: COASTAL EROSION		
RISK: MEDIUM		
AREAS, COMMUNITIES OR HOUSEHOLDS MOST AT RISK: • The beach area between **Beacon Island** and **Lookout rocks** will be highly eroded during a large storm event, with coastal developments also being vulnerable to damage due to development on and the removal of the foredune; • Despite a 6.5 mamsl swash run-up being likely due to the **Robberg Peninsula** focusing wave energy, **Plettenberg Bay** southwards of Beacon Island remains unaffected due to the current protection offered by a thin portion of undeveloped foredune (10-20 m high, 40-60 m wide). • A relatively undeveloped 10-20m high foredune northeastwards of the estuary is present, although coastal development at **Keurboomsstrand** has resulted in some areas been vulnerable to large swash run-ups and dune erosion		

and undercutting.

- The **Tides, Gansevlei, Bitou, Keurbooms and Diep River floodplains,** suburbs of **Anath** and **Matjiesfontein,** and Stanley Island are all vulnerable to flooding and inundation below 2.5 mamsl (which has been breached in the past). Large swells and an associated 4.5-6.5 mamsl swash run-up may erode the entire estuary mouth bar and Lookout Beach, which has occurred in the past.
- Landward migration of the shoreline by ~ 5-20 m is possible, dependent on the dune gradient. This may affect coastal developments where the foredune has already been removed or degraded e.g. between **Beacon Island and Lookout Rocks.**
- Landward migration of the shoreline by ~ 20-30 m likely, causing dune migration and the possible movement of dunes into the first line of coastal developments at **Nature's Valley;**
- Communities/households/buildings located on low-lying topography and situated very close to the high-water mark of the coastline are vulnerable to coastal erosion.

RISK REDUCTION RECOMMENDATIONS

RECOMMENDED ACTIONS	RESPONSIBILITY (IMPLEMENTING AGENTS)	COMMENTS AND MEASURES
Implement dune rehabilitation plans	BLM; Coastal stakeholders; CapeNature; EPWP	• The coastal committee optimizes coastal biodiversity conservation, with a focus on the rehabilitation of dune vegetation, the reduction of artificial hardening along coastlines, and the avoidance of inappropriate development along the coast. • No construction (or other unnatural disturbance) should be allowed in sand movement corridors, on foredunes or in mobile Dunefields. All infrastructure should be placed inland of the secondary dunes, within the coastal management lines determined by DEA&DP or the Municipality, or contained in any current Coastal Management Plans. • Locate infrastructure and buildings so as to avoid damage from coastal processes and, where possible, to avoid the need for physical defenses against potential damage resulting from natural coastal processes. • Municipal planning decisions should include phased retreat of infrastructure along the coast, where possible. • Maintaining unimpeded sand mobility corridors (including headland-bypass dunes). • Restoring sand migration pathways that are infested with invasive species such as rooikrans. • Maintain indigenous vegetation structure and successional dynamics (including that of the primary and foredunes, and in dune slacks). • Retain a functional corridor of intact indigenous vegetation along the coast to link inland-trending river systems. This is crucial for facilitating the migration and dispersal of • plants and fauna. • Maintain decomposition processes at the high-water mark and on the backshore by prohibiting the removal of drift kelp and other organic material, except at popular • bathing beaches. • Minimize disturbance at the breeding, feeding and roosting sites of shore birds by people and dogs.
Enforce the coastal buffer zone	BLM	• As defined in the National Environmental Management: Integrated Coastal Management Act (Act 24 of 2008) immediately, and prevent any further development within 100 m of the high-water mark or 10 mamsl contour (whichever is closest to the shoreline), until detailed coastal set-back lines have been developed (currently under review for the Garden Route DM).

Limit the extension of existing footprints and volumes of structures already in the risk zones	BLM; Coastal stakeholders	• Consolidated access points / paths are developed to limit points of weakness in natural systems. • All municipal infrastructure is outside overlay zone, unless related to public amenity.
Develop and implement an estuarine management programme for Keurbooms/Bitou and Groot River Estuary	DEA&DP; GRDM; BLM; Consultant	• Keurbooms/Bitou and Groot River Estuary Management Plans has been developed and implementation is monitored and evaluated bi-annually. **Functions should include:** • Identify and facilitate the implementation of the appropriate legal mechanism to implement Coastal Management Lines (CMLs) and coastal overlay zones. • Coastal overlay zones are incorporated into reviewed local SDFs and Municipal zoning schemes. • Conduct beach profiling at selected beaches along the coastline, as well as detailed geophysical offshore bathymetry surveys, in order to determine various local variables and parameters that can be used in future detailed numerical modelling • Western Cape Coastal Regional Plan under LUPA is adopted as a Regional SDF. • With regards to the Garden Route DM coastline, future modelling updates should focus on the vulnerable areas identified, in order to improve the resolution of the modelling i.e. each specific vulnerable stretch of sandy coastline and estuary should have its own future coastal evolution model developed. • Flood lines for priority estuaries are determined. • Mouth Management Plans for Keurbooms/Bitou Estuary is developed. • Maintain mouth dynamics (opening and closure) that are as close to natural as possible. Any form of artificial mouth management should form part of the holistic estuary management plan • Considering sensitive biodiversity such the Knysna Seahorse, the priority habitats associated with estuaries are protected. • Estuarine management research is coordinated. • Ensure that harvesting or utilization of living estuarine resources (flora and fauna) is kept within sustainable limits. • Encourage land-use practices that minimize loss of natural habitat and erosion, and avoid the introduction of habitat-altering invasive alien species of plants and animals (such as large predatory fish). Where stands of invasive alien vegetation are present around the estuary or in its catchment, implement appropriate clearance programmes. • Maintain freshwater flow regimes that are as close to natural as possible; low (dry season) flows, seasonality and flood frequency are of utmost importance. • Maintain the minimum freshwater flows (i.e. the Ecological Reserve) required for maintenance of estuary health and protection of estuarine biodiversity. • Maintain and monitor water quality, particularly the quality of freshwater inputs
Implement a coastal education drive	BLM; CapeNature; DEA&DP; GRDM; Consultant	• Undertake a coastal education drive to make coastal residents aware of the importance of maintaining indigenous vegetated foredunes e.g. use provided walkways and pathways to the beach, as well as the possible hazards and risks faced if these natural barriers are removed. Further impacts of climate change through active adaptation, including implementation of provincial guidelines for land use in coastal risk areas are also communicated.

Additional activities in River Estuaries (Keurbooms/Bitou, Piesang and Groot RIvier) are aligned with the River EMPs	BLM; Cape Nature; DWS	• IDPs and SDFs are updated to fully incorporate coastal management principles. The importance of fresh water inflows into the estuary is highlighted. • Standardized and widespread monitoring of coastal water quality for the GRDM, according to the most recent national water quality guidelines, occurs.
Establish an overall conservancy institution for the biodiversity conservation of the coastal corridor	WCDMC; Cape Nature; BLM; GRDM; DEA&DP	• Key priority coastal and marine areas or special habitats that fall within the Bitou Municipality: - The area from Noetsie to Toegroeiberg, east of Kranshoek (Between Knysna and Bitou Municipalities' jurisdiction); - The marine extension of the Piesangs River Mouth at Plettenberg Bay; - The marine extension of the mouth of the Keurbooms Estuary; - The area extending from east of Keurboomstrand to the western boundary of the Tsitsikamma National Park. • The vegetation status of Critically Endangered and Endangered vegetation types should receive priority. These areas should be properly managed to improve their status. Specific attention needs to be given to: – The Endangered areas north of Kranshoek and Plettenberg Bay; and, – The Critically Endangered alluvial vegetation east of Wittedrift • Promote consolidation of Shale, Sand Fynbos remnants and encourage their protection though the establishment of stewardship areas and conservancies. • Estuary floodplain of Bitou Municipality is also labelled as Critically Endangered due to its sensitivity. • Ensure formal protection through a public body or private conservancies and stewardship areas. • Where absent, an environmental manager is appointed to oversee and facilitate the implementation of coastal zone management responsibilities.
Enable spatial integration and investment in, and protection of, coastal assets	DEA&DP; GRDM; BLM	• Identify and facilitate the implementation of the appropriate legal mechanism to implement Coastal Management Lines (CMLs) and coastal overlay zones. • Coastal overlay zones are incorporated into reviewed local SDFs and Municipal zoning schemes. • Conduct beach profiling at selected beaches along the coastline, as well as detailed geophysical offshore bathymetry surveys, in order to determine various local variables and parameters that can be used in future detailed numerical modelling • Western Cape Coastal Regional Plan under LUPA is adopted as a Regional SDF. • With regards to the Garden Route DM coastline, future modelling updates should focus on the vulnerable areas identified, in order to improve the resolution of the modelling i.e. each specific vulnerable stretch of sandy coastline and estuary should have its own future coastal evolution model developed.
Keurboom/Bitou, Piesang and Groot River Estuary breaching protocols are developed	DWS; DEA&DP; BLM; SANParks	• Breaching protocols integrated with EMPs or other management plans. • SLAs are entered into between stakeholders.
Promote sustainable coastal livelihoods among traditional fishing communities in the Western Cape	DEDT; DEA&DP; DoA; Consultant	• Ensure that any development along the coastal fore-dune considers future landward dune migration. A further dune migration buffer zone is placed behind the coastal buffer zone. • The small-scale fisher's policy is implemented by facilitating reasonable and equitable coastal access in partnership with the municipalities.

		• The implementation of co-management mechanisms for public launch sites and access to designated/approved small-scale fishing community areas is facilitated. • The development of the aquaculture sector is supported. This aquaculture strategy for the Western Cape is linked to the proposed Aquaculture National Act. A better understanding of the fisheries sector and the impact of climate change on the sector in the Western Cape is developed.
Identify and develop opportunities for work creation in integrated coastal development and management	EPWP; DEA&DP	• Identify and facilitate the implementation of priority dune, estuary and sediment management work creation projects.
HAZARD: STORM SURGES		
RISK: HIGH		
AREAS, COMMUNITIES OR HOUSEHOLDS MOST AT RISK: • The majority of the Garden Route DM CZMUs are at a moderate to high risk from extreme coastal events such as large storm surges and tsunamis. The regions at most risk include the Plettenberg Bay to Nature's Valley area, while the CZMUs with a high-risk ranking are Plettenberg Bay, Keurbooms-Bitou, Keurboomstrand and Nature's Valley. The areas of moderate to high risk reflect exposed low gradient headland-adjacent or inlet/pocket bay beaches, in association with areas of high population and extensive development close to the shoreline: Vulnerable areas: Plettenberg Bay to Nature's Valley; CZMU with a high ranking are **Plettenberg Bay, Keurbooms/Bitou and Keurboomsstrand and Nature's Valley.** • Within **Bitou Municipality, beaches, estuaries and lagoons can be identified as potentially high-risk environments because of their unconsolidated soft sediments, low relief and wide inland exposure.** It should be noted that such areas account for more than 50% of the South African coast, and these sections of coast are generally eroding rather than accreting. In addition is residential development, services and infrastructure along the coast that are exposed. Sections of coast that do not have natural defenses are vulnerable to storm surges. The local conditions and level of exposure may determine the level of risk i.e. how far or how high from the wave action. • The beach area between **Beacon Island and Lookout Rocks** will be highly eroded during a large storm event, with coastal developments also being vulnerable to damage due to development on and the removal of the foredune. The Piesang River estuary and floodplain are vulnerable to flooding and inundation, especially the caravan park, adjacent farmlands and part of the golf course along the river.		
RECOMMENDED ACTIONS	**RESPONSIBILITY (IMPLEMENTING AGENTS)**	**COMMENTS AND MEASURES**
Host a public and private coastal education drive	WCDMC; CapeNature; SAWS	• Ensure that emergency plans and responses to flood incidents are effective. • Coastal communities respond effectively to flood forecasts and warnings

Raise awareness amongst recreational users	DoE; GRDM; BLM; WCDMC; NSRI	• Signboards are erected at all access points where recreational users will swim in the sea (providing details of safe swimming areas, hazards such as riptides, sharks, blue bottles and boats). • Current contact details of lifeguards, DMC and NSRI are provided. • Undertake a coastal education drive to make coastal residents aware of the importance of maintaining indigenous vegetated fore-dunes, e.g. use provided walkways and pathways to the beach, as well as the possible hazards and risks faced if these natural barriers are removed.
Requirements of the ICM Act are included in the BLM SDF and IDP revisions.	GRDM; BLM; DEA&DP	• More local, detailed studies are funded for specified areas (as identified in the Phase 2 and Phase 3 reports) within the coastal LMs at risk to various coastal hazards. These can be packaged as one, two or five-year projects, depending on the size of the study area, the type of coastal hazard and the modelling detail required.

HAZARD: SEVERE WEATHER (STRONG WINDS)

RISK: MEDIUM

AREAS, COMMUNITIES OR HOUSEHOLDS MOST AT RISK:

- Strong damaging winds often occur along **coastal regions**, but also often occur during thunderstorm activity. These winds are sudden and can cause much damage.
- Farming communities: Most of the commercial activity takes place in the northern regions of the Municipality, namely **Wittedrift**, **Uplands** and **Fisanthoek**.
- Informal areas: **Kwanokuthula, Qolweni/Bossiegif, New Horizons, Kurland, Pine Tree, Wittedrift/Green Valley, Forest View, Tambo Transit Camp;**
- Motorists on road for prevailing strong winds can cause tree falls;
- Small boats on the open waters/sea;
- Poorly constructed houses;
- Gravel roads, coastal roads and municipal infrastructure;
- Areas near to high trees and/or forestry areas (falling trees);
- Communication infrastructure;
- The **Plettenberg Bay Airport** and other surrounding airports e.g. Mosselbay Airport, George Airport and Riversdale Airport;

RECOMMENDED ACTIONS	RESPONSIBILITY (IMPLEMENTING AGENTS)	COMMENTS AND MEASURES
Strengthen physical planning measures	DHS; DoA; Organized Agriculture; Insurance companies	• Retro-fitting of vulnerable buildings to ensure resilience to storms and severe weather. • Roll-out of hail/shade netting prevents or reduces hail damage. Innovative insurance. • Externally blemished produce is processed through new facilities and product lines.
Improve engineering and construction measures	Private companies; DHS; DoE	• Conduct a feasibility study of an area before construction projects commences. • Develop and maintain early warning systems for severe weather. • Install lightning conductors on roofs in high risk areas. • Implement robust construction methods according to building codes and in relation to known severe weather risks.
Institute and enforce fines for nonadherence to building codes	DHS; WCDMC; SAWS	• Educate building inspectors and infrastructure maintenance teams on known lightning threats. • Identify hotspots/high risk areas – develop a database of lightning events and damage/impact experienced.
Develop awareness training and workshops in high risk areas	WCDMC; DoE	• Community-based information on past severe weather/lighting events is collected and made publicly available for school and research projects
HAZARD: SEISMIC ACTIVITY		
RISK: MEDIUM		
AREAS, COMMUNITIES OR HOUSEHOLDS MOST AT RISK: • Low-lying sandy areas; • The poor and socially disadvantaged groups; • Informal settlements; • Hospitals; • Dams; • Main roads; • Fuel pipelines; • Chemical storage facilities (in towns and on farms); • Bridges; • Areas in close vicinity of the coastline;		

RECOMMENDED ACTIONS	RESPONSIBILITY (IMPLEMENTING AGENTS)	COMMENTS AND MEASURES
The Provincial Seismic Hazard Preparedness Plan is updated	WCDMC; DoE; DoH; CGS; BLM	• Raise awareness and conduct training in earthquake-resistant construction. • Include a place for reuniting when safe into the plan. • Practice at least twice a year DROP, COVER and HOLD ON – particularly at education and health facilities.
A risk assessment and awareness raising of high-risk areas is conducted	WCDMC; DoE; DoH; GRDM	• Obtain and update the following datasets annually: • Topography; Geology (from Council for Geoscience); Shore stability (historical data); Meteorological data (from SAWS); and wave modelling data (from the CSIR).
HAZARD: TSUNAMI		
RISK: MEDIUM		
AREAS, COMMUNITIES OR HOUSEHOLDS MOST AT RISK: • Bitou Municipality's coastline; • **Plettenberg Bay, Keurbooms/Bitou, Keurboomsstrand, ands Nature's Valley** are all at high risk for extreme events; • Key estuaries: **Keurbooms/Bitou, Groot Rivier, Piesang Estuaries;** • Communities/households/buildings located on low-lying topography and situated very close to the high-water mark of the coastline • Key priority coastal and marine areas or special habitats that fall within the Bitou Municipality: - The area from Noetsie to Toegroeiberg, east of Kranshoek (Knysna and Bitou Municipalities); - The marine extension of the Piesangs River Mouth at Plettenberg Bay; - The marine extension of the mouth of the Keurbooms Estuary; - The area extending from east of Keurboomstrand to the western boundary of the Tsitsikamma National Park.		

RECOMMENDED ACTIONS	RESPONSIBILITY (IMPLEMENTING AGENTS)	COMMENTS AND MEASURES
Develop standardized and coordinated tsunami hazard and risk assessment for the coastal region	WCDMC; GRDM DMC; BLM; CGS; Consultant; DEA&DP; SAWS	• Improve tsunami and seismic sensor data and infrastructure for • improved tsunami detection and warning. • Enhance tsunami forecast and warning capability along the coastline by increasing the number of Deep-ocean Assessment and Reporting of Tsunamis (DART) buoys, tide gauges, and seismic sensors feeding real-time data into on-line forecast models. • Methods for computing tsunami inundation are constantly updated and denser samples of results are integrated into models. • The substantial risks related to nuclear installation son high-risk coastlines are taken into consideration when planning for future tsunami disasters. • A Tsunami Warning System is initiated for Garden Route District Municipality's coastline.
Further investigate Tsunami risks for Bitou Municipality	GRDM, BLM, CGS, Consultant	• Conduct a research report that determines accurate tsunami-associated risks.
Identify coastal areas vulnerable to tsunami inundation	WCDMC; CGS; GRDM; BLM; Consultant	• Drill low-lying coastal areas of marine terraces to determine whether tsunami-related sedimentary deposits exist in the paleo record. • Regional and international disaster preparedness policies prioritize areas where the largest numbers of people are vulnerable to tsunami events, and consider how rapid demographic changes and rising sea levels can increase relative levels of exposure.
Tsunami evacuation routes are clearly sign-posted	WCDMC; NSRI	• Evacuation routes are clearly sign-posted.
HAZARD: DROUGHT		
RISK: MEDIUM		
AREAS, COMMUNITIES OR HOUSEHOLDS MOST AT RISK: • The urban poor's vulnerability will increase due to rising food prices; • Drought could mean casual farm labourers could potentially face longer periods of unemployment;		

- Farmers (smallholders and commercial) will be affected as low rainfall and soil moisture conditions will reduce fruit, crops and grazing capacity. It was mentioned that the dairy industry suffered under agricultural drought;
- All wetlands;
- Endangered (Palmiet, Bobbejaans. Bitou and Piesang Rivers) and critically endangered river systems (Upper parts of Keurbooms River);
- Areas reliant on boreholes;
- While agriculture is highly sensitive to climatic fluctuations, the impacts of future climate change will differ widely from place to place;
- Emerging farmers who may have limited capacity, resources and skills to adapt to and withstand economic pressures (high debt levels). In this regard farmers in the Uplands area are especially vulnerable;
- Those that are already under economic stress economically as a result of land degradation, loss of biodiversity, and those at (or close to) the threshold of their climate tolerance;
- Agri-businesses that are dependent on the export market;
- Threatened and critically endangered plant species with municipal boundaries might be under threat such as sand fynbos;
- Urban poor.

RECOMMENDED ACTIONS	RESPONSIBILITY (IMPLEMENTING AGENTS)	COMMENTS AND MEASURES
Revisit policies that hamper the building of new catchment dams	GRDM; BLM; DoA; DWS/ DEA&DP; Consultant	• Wadrift Dam, which is to be an off-channel storage dam for Keurbooms River water in the Uplands area above Wittedrift, continues to be plagued by various problems. This dam is crucial for Bitou's long-term water supply and will be filled from Keurbooms River in times of high flow. Under dry conditions, like that being experienced now, filling the dam could take several years. Currently, the deadline for completion of Wadrift Dam is 2022. **Recommendations include:** • Legislation allows for more on-farm dams. • The time-consuming and costly process of EIAs is undertaken by municipalities when building dams, with participation by the agriculture sector. • Soil moisture management is implemented to ensure effective irrigation and water management. • Over-irrigation remains a problem throughout the sector, sometimes deliberately due to current water licensing ("use it or lose it") policies, sometimes due to an overly conservative risk strategy by the farmer. Research identifies this and points out the negative impacts on yield, quality and profitability. • Further research on precision agriculture (including fertilization) using geo-spatial technologies and electronic data collection and transfer, as well as the tangible benefits to water resources and launching farm profitability of using these approaches. • Repair and maintain current dams, reservoirs, boreholes and irrigation systems to save water and prevent wastage.
Diversify farming activities and, where possible, complement with non-farming activities e.g. agri-tourism and agri-processing	DOA; DEDT; DAFF; BLM; AgriParks	• Drought-related policies and plans emphasize risk reduction (prevention, mitigation and preparedness) rather than relying solely on drought relief. • Energy efficiency and renewable energy case studies are communicated to inspire the transition to low-carbon

		agriculture. • Regulate water demand for agricultural purposes.
Foster and strengthen community participation in planning and implementation of drought management and mitigation actions	DoA; WUA; BLM; Organized Agriculture; DWS	• A shared set of early warning indicators for awareness-raising is used and communicated through various local channels, such as farmer associations, Water User Associations, and commodity organizations. • The monitoring of rainfall, stream flow, groundwater levels and water quality is strengthened. • Monthly agricultural and water risk management information between municipalities, DoA and DWS is updated and shared. • Farmers become members of a farmer association to receive important information and support, and to learn about drought preparedness.
Improve accuracy of seasonal weather forecasts	SAWS; WCDMC; DoA; DWS	• Develop a good network of weather stations and establish effective and accessible communication and dissemination channels.
Augment water supplies	Farmer Associations; WUA; DWS; DoA; DEA&DP; BLM	• Bitou Municipality have implemented quite a substantial amount of drought mitigation measures such as the addition of ten borehole throughout the area, it further recommended that: - Water demand management and enhanced irrigation efficiencies is further promoted. - Bio-farming and other techniques to reduce nutrient loads in hydrological systems are promoted. - Water rights for land reform projects are supplied. Borehole abstraction water and groundwater levels and recharge rates are monitored. - Farmers are subsidized for building weirs and reservoirs. - Alien vegetation is removed along catchment areas. - The monitoring of rainfall, stream flow, groundwater levels and water quality is strengthened. - Water management remains a priority on the national agenda.
Strengthen Management Plans for areas of biodiversity	DoA; Farmer Associations; GRDM; BLM.	• This requires an integrated approach between the DoA, municipal officials and farming associations. • Rotational grazing and other veld management best practices are continuously promoted to improve biodiversity and stocking rates. • Landowners manage water sources sustainably and responsibly. • Protect ecological water reserves. • Monitor biodiversity closely and eradicate alien vegetation. • Evaluate livelihoods based on threatened resources. • All land capable of crop farming, i.e. has sufficient water and arable land is protected from other uses. • Good veld management practices need to be promoted to improve biodiversity and increase stock carrying capacity. • Ecological corridors where grazing, crop farming and buildings are prohibited, should be declared along river banks.

		Their boundary should be a minimum of 30m from the bank or according to a setback line determined by a fresh water ecologist.
Safeguard inland water and coastal water resources and manage the sustainable use of water	DWS; WUA; BGCMA; DoA	• Different aquifers in the province have different recharge rates, and increased abstractions in some areas have led to overutilization. It's of vital importance that groundwater resources be more actively managed.
Promote conservation agriculture	DoA; Farmer Associations	• Replace monocultures of climate-sensitive, high-yielding varieties with drought-resistant varieties and inter-cropping or rotational systems. • Landowners are monitored to ensure that they are only utilizing a third of their land for grazing capacity • Use effective conservation farming methods and continued conservation and clearing of streams and river from alien vegetation (limit flooding), clearing of rural areas from dense alien vegetation that might result in a fire risk, maintaining • fire breaks around farms; • Promote alternative uses within conservation areas that support the sustainable management of these areas; • Effectively manage erosion using conservation agriculture methods, planting of perennial legumes and management of contour lines. The uptake or increased use of legume rotations build soils by contributing organic nitrogen, reduce soil and crop-borne diseases, help to reduce input costs and promote income diversification; • A shift towards minimizing soil disturbance during tillage. Similarly, by reducing tillage farmers cut down in diesel and labor costs while improving soil structure, soil organic carbon (SOC) and water retention; • Thick layers of compost and mulches helps to keep the moisture in the soil and the evaporation as minimum as possible. • Conservation of the hill landscape - areas contain pockets of natural vegetation that provide part of the natural backdrop in the rural landscape. The more biodiversity you have in an orchard or vineyard, the less evaporation occurs, so you don't have to irrigate as much, so water can be saved; • A bottom-up approach with active community participation for drought risk management in planning, decision-making and implementation, is essential to move from policy to practice. Share and implement indigenous/local knowledge regarding drought coping-capacities that have been effective for many generations; • With a drought onset implement a stock reduction scheme. Keep livestock young and uplift culling standard. This will improve the quality of animals for better breeding standards.

Improve water demand management through drought periods	BLM; GRDM, DWS; WUA; BGCMA; DoA	• All resources, especially surface water resources, need to be re-evaluated, especially where demand is close to the safe • one in twenty-year yields. It is therefore important to establish assurance of supply levels of all water sources; • Increase assurance of supply of the water resources by ensuring that there is at least 10% additional capacity (headroom), when considering the maximum 24-hour demand on the peak month of the year; • Do not undertake new developments unless a proper investigation of the implication on water sources and sustainability in the long term has been undertaken; • Reallocating water shares among users is one of the alternatives for a preparedness plan or during periods of drought; • Budget for water infrastructure e.g. additional pumps for water; • Provide incentives for water saving e.g. reduction in water use; • Vigorously implement Water Demand Management measures; • Public education is improved and water tariff/charges are increased. • Diversification options have been identified and implemented. • Water losses are restricted as far as possible. • Water efficiency is increased. • Incentives for water saving have been identified. • Frequent monitoring of water supply system initiated.

HAZARD: FLOODS (STORMWATER-RELATED/COASTAL/RIVERINE/FLASH/LANDSLIDES (DEBRIS FLOW))

RISK: HIGH

AREAS, COMMUNITIES OR HOUSEHOLDS MOST AT RISK:

LANDSLIDES (DEBRIS FLOW)

- Low lying mountainous areas that have recently burned, results in higher runoff and higher possibility for mudflows;
- **Landslides** are taking place during heavy rain periods: More and more in Bitou these are being taking place in **Bitou, Beacon Way, and Julia avenue and on the N2 above Beacon Way**. This is also partly due to inadequate stormwater infrastructure which results in high stormwater runoff during the wet season. This is also caused by inappropriate development in low-lying areas with no provisions made for stormwater mitigation measures during construction. People within the low-lying areas never acquired occupation certificates.
- Lands directly affected by fires and properties located below or downstream of burn areas are most at risk for more severe runoff and soil erosion. Normally, vegetation absorbs rainfall and reduces the amount of rainfall entering the stream channel. After a fire, the lack of vegetation causes rain to runoff along the soil surface, picking up debris and ash, increasing the risk for flooding, erosion, and mud and debris flows.

- Wildfires dramatically change landscape and ground conditions, which can lead to increased risk of flooding during heavy rains because the burned ground is unable to absorb the falling rain, producing runoff conditions much like a parking lot. Because of this, even modest rainstorms over a burned area can result in flash flooding downstream. These floods are typically much larger for a given sized storm than they were before the wildfire, so flooding is likely to be much more extensive following wildfire, endangering properties previously considered safe from flooding. These floodwaters typically transport surface debris such as downed trees, boulders, and gravel.

FLASH FLOODING

- There is a significant risk of flash floods occurring in the valleys that cut deeply through the coastal plains throughout the region such as **Green Valley, Goose Valley, Nature's Valley, Keurbooms Valley, Piesang Valley.**

COASTAL FLOODING

- The beach area between **Beacon Island and Lookout Rocks** will be highly eroded during a large storm event, with coastal developments also being vulnerable to damage due to development on and the removal of the foredune. The Piesang River estuary and floodplain are vulnerable to flooding and inundation, especially the caravan park, adjacent farmlands and part of the golf course along the river.

RIVERINE FLOODING

- The **Keurboom/Bitou Estuary** is situated in Plettenberg Bay on the wave-dominated, micro-tidal south coast of South Africa. The estuary is formed by the confluence of two rivers, namely the Keurbooms River itself, and its tributary the Bitou River. There were two notable floods with both the Keurbooms and the Bitou rivers coming down very strongly. November 2007 eroding away more than 500 000 m3 of sediment205. Lookout Beach, a hotspot in Plettenberg Bay, was just about swept away by floodwater during that weekend. Most of the beach's large car park and a section of the dunes disappeared as the mouth of the **Keurbooms River** shifted and the water swept the beach. The second flood occurred in July 2012 and opened up a new mouth about 1 km to the north-east; high waves also affected the position of the breach. **Roads closed included the old Bloukrans pass road, the Plettenberg Bay-Nature's Valley road, the Keurbooms Caravan Park road, and the road via Bitou Bridge to Wittedrift.**
- The estuary is extremely dynamic as evidenced by the floods of November 2007 which eroded Lookout Beach and the more recent floods (July 2012) which resulted in the breaching of the coastal sand bar to form a new (second) outlet to the sea. The instability of the river during flooding regularly causes a lot of damage to the river bank, private residences, and public infrastructure.
- An incident in 2015 caused the **Groot River in Nature's Valley to breach. The camp in Nature's Valley was also flooded;**
- Areas along the **1: 50-year flood lines of the Keurbooms include Silverstream Manor, Lemon Grass Restaurant, Milkwood Manor, Protea Hotel, Oakley Development, Blue Chalets.**
- The **Tshokwane River** rises in the foothills to the east of the Keurbooms River, arising as several short, steep streams that join a few hundred meters to the north of the N2 before flowing out of the hills into an unchanneled valley bottom wetland filled with the common reed (Phragmites australis). This wetland extends up to the N2 where the Tshokwane River has been diverted into a culvert under the highway. The **Thyme and Again shop and parking area are located at this southern end of the reedbed.**
- **Goose Valley** (most of which is low-lying areas) comprises the land between Plettenberg Bay Primary School and the Keurbooms River bridge including:
  - the Keurbooms River lagoon and its flood plain
  - the Bitou and Keurbooms River estuaries;
  - the N2 which crosses the rivers and their various tributaries
  - Keurbooms lagoon caravan park, Turtle Creek and Goose Valley golf estates;
  - Penny Pinchers industrial area located on the flood plain; and
  - some active and fallow agricultural fields.
- The township **in Nature's Valley/Covie** is located on an estuarine flood plain surrounded by steep hill slopes to the north, west, and east. Covie is situated on the small inland plateau to the east of Nature's Valley. This plateau drops off to the west and east through a complex of steep V-shaped gorges into the Groot and Klip River estuaries;
- Sewage treatment plants in close proximity to an international environmental asset cause a risk of contamination. **Keurboom River Pumphouse in Whiskey Creek** was identified in the workshop in Piesang Valley;
- In 2015 excessive showers of rain In Bitou closed the Wittedrift High School just outside Plettenberg Bay after the Bitou River washed over the road at the Wadrift low-level bridge. Eden District Municipality spokesperson, Marillia Veldkornet, confirmed that **Piesang Valley Road** had to be closed due to flooding, as well as the main road to Wittedrift. **The Old Keurbooms Road** had to be closed due to flooding debris.

URBAN DRAINAGE (STORMWATER-RELATED)

- Areas mentioned by local Disaster Manager that experiences flooding are: **Bossiegif, Airport Circular Road (which closed the back road in the past), Groot River Pass (Bridge), Kurland Southern Region (due to poor drainage**

systems), Poortjies area, Sanddrif/Keurbooms, Piesang Valley Road (due to ponding as a result of urban design), Stoffpad Road (in Wittedrif), Redford Road (The Crags).

- Stormwater flows i.e. Lateral watercourse management, bridge, and channel maintenance - This refers to outlying roads within the municipality which are often impacted and washed away by floods caused by inappropriate clearing of Invasive Alien Plants (IAPs) upstream – i.e. IAP biomass collects and causes localized flooding which washes away bridges. This has occurred in Nature's valley and some of the rural roads. Without these roads, access is often an issue. High-risk areas include **Nature's Valley, Groot River, and the Whole Uniondale road to Prince Alfred's pass (R40)**. One of the major contributors to this problem is inappropriate disposal of cleared IAP biomass. This also creates a flood and fire hazard in the municipality.
- Critical infrastructure close to rivers and estuaries may have to be moved further inland or away from stream banks as a result of climate change.
- The following issues attributing the stormwater problem were identified:
  - Poor conditions, slopes and gradients of channels
  - Poor drainage in open spaces between households
  - Poor maintenance of existing stormwater infrastructure which cause blockages of inlets and outlets such as in the poorer areas;
  - No clear stormwater system routing for minor and major flood events
- All the bridge areas where the rivers below are overgrown with trees and natural vegetation of the area increases the risk of stranding in case of a flood;
- Informal areas: **Kwanokuthula, Qolweni/Bossiegif, New Horizons, Kurland, Pine Tree, Wittedrift/Green Valley, Forest View, Tambo Transit Camp;**
- Areas with poor storm water infrastructure such as **Kranshoek, Kwanokuthula and New Horizon.**
- Within **Kranshoek,** the capacity of the current stormwater assets is insufficient to carry the amount of runoff water. Most of the roads were built without the proper storm water and curbing to channel the runoff water. The design of channels, especially crossing roads should be redesigned properly with storm water pipes underneath the roads
- The **Kwanokuthula and New Horizon's stormwater infrastructure** also needs to be extended as the current one is not coping during heavy rains/storms. There are areas in Kwa-Nokuthula and New Horizon that are built in flood zones, those nodes need to be identified and be catered with proper infrastructure.
- **Within Green Valley (Wittedrift**): The development of Green Valley has occurred within the low-lying valleys that drain towards the Bosfontein River. As such, the residents can experience minor to major flooding of their properties depending on the size of the rainfall event. This type of development layout goes against the guidelines (development outside of floodplain) as set out in the Red Book especially due to the damage that flooding can have on the properties, which results on a negative impact on the lives of the residents. The overall topography of the area is comprised of high ridges rising above the low valleys with steep slopes. The soil conditions are mostly clay which promotes increased runoff. This combination creates a scenario of a high volume of runoff flowing at high velocities. The flooding of adjacent properties due to the ineffectiveness of drainage structures acting as the main drainage route in addition to collecting surface runoff can have many negative consequences. Not only is there the risk of danger to life but the more probable damage to property with resulting monetary loss. Further to this it is important that an emergency overflow route free of obstruction be maintained and that an efficient drainage system is introduced to convey runoff towards the natural watercourses.

RECOMMENDED ACTIONS	RESPONSIBILITY (IMPLEMENTING AGENTS)	COMMENTS AND MEASURES
Strengthen management and institutional measures	DWS; GRDM; BLM	• Enforce bylaws relevant to BLM. • Take climate change into account when developing plans and protocols. • Develop and supervise programmes for storm water system maintenance and removal of debris. • Ensure that the SOP for flood incidents is maintained.
Redesign of stormwater norms and standards	DEA&DP; SALGA; DWS; SAWS; CSIR; CSAG; BLM	• The current design norms and standards are based on environmental and climate data that is outdated. What needs to be revised is the climate information for the country as a whole (which informs the subdivision of the country into design requirements for wetter, drier, and moderate regions). Over time these regions have changed. • This should also relook at current definitions of 1:100year floods etc. (flood timescales/Limits within these climate regions).

		• Changes in urban dynamics, rainfall changes within climate regions, redesign of floodplains which have been encroached by human settlements, flood lines etc. • The Department needs to look at initiating research between higher education institutions and government led research bodies at a National Level. • This project needs to look at the following: Climate data used to inform climate regions (i.e. wetter, drier and moderate) Revision of flood limits and occurrence/half-life.
Structural measures are planned for high risk areas	DWS; DoA; DEA&DP; Consultant	• Most floods within Bitou Municipality are localized: area that experiences some flooding include: Kwanokuthula, Bossiegif, Airport Circular Road (which closed the back road in the past), Groot River Pass (Bridge), Kurland Southern Region (due to poor drainage systems), Poortjies area, Sanddrif/Keurbooms, Piesang Valley Road (due to ponding as a result of urban design), Stoffpad Road (in Wittedrif), Redford Road (The Crags). • Measures should include: • Build structures such as groynes in rivers. • Protect or rehabilitate existing wetlands on farms to mitigate flood risks. • Use flood plains for their original purpose as temporary storage facilities for flood water. • Recalculate design flows. • Maintain drainage and flood protection infrastructure, bridges, culverts and roads. • Build permanent drainage and flood protection infrastructure, bridges and roads to correct specifications which can withstand current and possible.
Implement a comprehensive Stormwater Management Plan	BLM; Consultant	• Funding is sourced and a storm water management plan is developed or updated for all areas. • The stormwater network should be designed to accommodate the minor storm event (1:2 year) in pipes or open channels. The major storm (1:50 year) should be managed through controlled overland flows and above ground attenuation storage in the form of grassed swales. Where piped networks are required to transport collected runoff discharge special attention will be given to the design of the outlet point to ensure controlled discharge will take place. • New development should be managed in such a way that that the peak runoff from the post-development site should not exceed that of the predeveloped site for the full range of storm periods (1:2 to 1:50). Mitigation measures shall be incorporated into the site development plan to attenuate the post development flows to pre-development rates. • It should be envisaged that rainwater harvesting will be applied to stormwater collected from the roof of the buildings during minor storms. Emergency overflows will be included in the design of the rainwater harvesting system to allow controlled discharge of water during major storms. Harvested water will be used for general irrigation purposes of landscaped gardens and possibly even in wash bays. • Keep the residential roads free from rubble and debris to assist with mitigation of damage caused by flooding. • Ensure ongoing, frequent maintenance of water catch pits in and around communities. • Ensure that flood prevention and preparedness, including cleaning of drains, is implemented year-round (not just before winter rainy season). • Plant indigenous trees as windbreaks

Improve non-structural measures	DWS; DoA; Organized Agriculture; DEA&DP; Consultant	• Increase oversight of alien clearing processes, to ensure that cleared vegetation is removed properly from the riparian zone, as specified by the DWS. • Maintain a permanent organic soil cover in cultivated fields to facilitate water infiltration and control erosion and downstream sedimentation. • Undertake ecological restoration of upper catchments and clear vegetative debris away from the riparian zone.
Improve physical planning measures	WCDMC; BLM; GRDM; DWS	• Improve and upgrade stormwater reticulation systems regularly. • Plan and erect visible warning signs in low-lying areas. • Reposition farm buildings and infrastructure away from the riparian danger zone.
Improve awareness raising	DWS; WCDMC; Ward councilors; Neighborhood Watch; Technical Services;	• Flood prevention workshops or mass meetings are facilitated to create awareness. • Community response training is provided timeously to volunteers in all high-risk areas. • An awareness and education programme to inform informal dwellers on how to prevent flooding of their structures, and how to prepare for the rainy season, is developed and implemented prior to the rainy season. • The role of Neighborhood Watches and similar institutions as local resources is explored.
Improve disaster preparedness	DWS; WCDMC; SAWS; Consultant	• Collaboratively and urgently address gaps in weather radar coverage, especially for the Province's inland areas. This includes the establishment of new and additional radars so the • Flash Flood Guidance System can function protectively and enable impact-based forecasting. • Explore mechanisms to introduce integrated flash flood early warning systems at hotspots that combine SAWS warnings, an enhanced version of the South African Flash Flood Guidance System (SAFFG), radars (where feasible), automatic weather stations, real-time river gauges, cameras, community EWS, and in specific critical basins, complex hydrological modelling. • Provide more spatially-specific; impact-based forecasts to provide micro-scale information that captures meteorological variability between areas, and improves forecast information at the local level, to fine-tune pre-emptive responses.
Identify critical infrastructure exposed to flooding and establish Contingency Planning	WCDMC; BLM; DWS; DoH; EMS; DTPW: Roads	• Research the impacts of sediment accumulation on flow capacity for bridges and culverts carrying regional and district roads across flood-prone river channels. • Identify hospital and health care facilities that are potentially flood-exposed. • Adhere to and disseminate weather warnings. • Assist in clarifying the roles and responsibilities of employees in private health facilities in the case that they are faced with emergencies. While EMS is mandated and best placed to manage responses concerning health facilities, the respective roles and chains of command should be clearly defined. • Improve drainage in rural and urban areas. • Protection/retrofitting of water supply and sanitation systems to prevent damage and contamination. • Contingency planning is formulated for high risk areas and included in the PSDF.

Enforce legal restrictions on Infrastructure placement	Landowners; DoA	• Plan farms according to the principles of Water Runoff Control planning, opening up waterways (and contour banks and storm water banks where needed) from all lands and orchards to the main stream or river. • Consult LandCare officials or other authorized experts prior to undertaking river maintenance activities that involve the use of physical river protection technologies such as run-off channels.
Improve disaster relief funding	DWS; WCDMC; National Treasury; Sector Dept.	• Expedite post-disaster recovery and reconstruction funding processes to support risk reduction imperatives,
Restoration of wetlands and riparian zones reduces flooding risk	DWS; DoA; DEA&DP; BLM; Consultant	• Adequately-vegetated buffer strips are established along all riverine and wetland ecosystems. • Indigenous riparian plants are planted to stabilize river banks.
Participate in the development and implementation of a River Maintenance Management Plan for river(s) flows	DWS; DoA; BLM; DEA&DP; Consultant	• Over time, relocate agricultural activities from areas too close to river banks by gradually withdrawing land from production where it is at risk from flooding and erosion. • Where development is supported within 1:100-year flood lines, review the guiding documents from a disaster management and risk reduction perspective.

TECHNOLOGICAL HAZARDS

RISK REDUCTION RECOMMENDATIONS

RISK REDUCTION RECOMMENDATIONS: TECHNOLOGICAL

HAZARD: ELECTRICAL SUPPLY DISRUPTION

RISK: MEDIUM

AREAS, COMMUNITIES OR HOUSEHOLDS MOST AT RISK:

- Disruptions to critical infrastructures have rippling effects as they are dynamic and interdependent arrangements. Electricity forms part of a network of networks. It powers, connects to and synchronizes with other critical systems. **Blackouts affect pumps, refrigeration, traffic lights, trains, internet provision and cell phone towers among many other things**. This has serious consequences for **water, waste, food, transportation, finance and communication systems.** Modern social life is impossible to imagine without it.
- During February 2019, Motorists have yet again been warned to **avoid the N2 between Shell Ultra City and Airport Road** following reports of protesters pelting passing vehicles with stones and setting objects alight along the national road. A **large crowd marched from Kwanokuthula** to the municipal officers to voice their concerns over issues with electricity. Residents indicated that they, among other things, wanted their electricity directly from Eskom as the municipality used the prepaid system to recover rates and taxes. This has led to residents receiving less electricity units than they pay for.
- The areas mostly affected by unplanned outages are the rural areas where overhead line systems are exposed to storms and lightning, as well as birds flying into lines and monkeys climbing up the electricity poles.
- Farming communities with no cell phone reception;
- Abattoirs and businesses with no generators;
- Informal settlements in the municipality;
- Commerce and industry reliant on electricity as an energy source;
- Hospitals and frail-care facilities.
- Wards 1 and 2 contain the most informal settlements and which lack basic services;
- Many illegal electrical connections are found in Kurland, Kwanokuthula and Qolweni;
- ESKOM is not willing to increase the electricity supply because of the low carrying capacity of the Municipal network;
- The Municipality intends to improve its network but no long-term plan currently exists for electricity management in the municipality. Eskom have indicated a short supply for 8 to 10 years.

RECOMMENDED ACTIONS	RESPONSIBILITY (IMPLEMENTING AGENTS)	COMMENTS AND MEASURES
Source funding to improve institutional management	MIG; National Treasury; Eskom DoE	• Due to the lack of adequate funds, the maintenance of existing assets is in competition with the need to extend services to poor communities. • Improve training and contingency planning. • Improve maintenance of infrastructure. • Address rehabilitation and maintenance of existing infrastructure.
Prepare policy for sighting and approval of renewable energy projects	Consultant; Eskom; BLM	• Select sites and implement projects in a sensitive manner to mitigate negative impacts on the surrounding urban, agricultural or natural environment.

		• Promote domestic and large wind and/or solar energy projects, subject to appropriate guidelines and siting principles. Alternatively, identify off-grid solutions such as small package plants, methane gas digesters or Biolytic systems. Owners must bear responsibility for the maintenance of these systems. Investigate renewable energy for municipal structures e.g. rooftop PV or small-scale wind. • Use alien biomass for energy generation.
Research climate change projections to improve the operational preparedness of electricity grids	DEA&DP; DoE; Eskom; Consultant	• Conduct detailed studies of the changes in diurnal temperature ranges on a broader regional scale. • Distinguish local climate trends. This is essential as climate may not change uniformly across large areas. • Electricity grid operators must disconnect high voltage lines from the rest of the grid to protect high voltage transformers during solar storms.
Improve Physical Planning Measures	DoE; Eskom	• Provide back-up power sources. Provide emergency lighting where necessary.
Strengthen Societal Measures	Eskom; DoE; BLM	• Improve training and raise awareness on saving electricity, business continuity, response actions and crisis management.
Address Human Settlements and electricity needs in a changing climate	DHS; DoE; BLM	• Mainstream climate change considerations into the planning and design of human settlement developments. • Implement energy efficiency interventions in low income houses and communities. • Improve the resilience and adaptive capacity of informal settlements.
Address BLM's energy consumption and management	DoE; Eskom; BLM	• Address the management of electricity losses, energy use in the built environment and water pump stations. • Systematically collect information on sustainable energy interventions. • Consider how to record sustainable energy initiatives. • BLM should lead by example in sustainable energy drives by, for example, increasing the energy efficiency of buildings and departmental operations and improving the management of the municipal vehicle fleet.
Reduce risks associated with energy supply	Eskom; DoE; WCDMC; BLM	• Assess energy demands, storage facilities and capacity to cater for sufficient reserves in times of disaster and recommend appropriate strategies. • Reduce risk of exposure to poorly located fuel depots and power stations.
Regulate the format of municipal accounts in more specific terms	DWS; Consultant; CFOs; GRDM; BLM	• Thoroughly research and develop guidelines towards standardization and make these available to decisionmakers in Treasury, the Department of Water Affairs and the DWS, as well as to BLM Municipal Manager and CFO, in order to raise awareness of the need for improvement and standardization of municipal accounts.

		• Facilitate a series of training workshops for BLM focusing on best practices and standards relating to municipal invoices. • Develop a complete range of account templates in paper, electronic and SMS format, which provide municipalities with options of making selections to suit their specific circumstances. Investigate new software developments and technology that hold exciting possibilities for the design and communication of municipal accounts, and exploit the potential benefits thereof. E.g. accounts could be generated and distributed via SMS, email etc.
Enhance saving opportunities within the built environment	Retail outlets; BLM	• Encourage the mid-high-income band to use LPG, in order to reduce peak electricity demand. • Increase energy efficiencies and reduce energy costs. • Use renewable energy in areas of unmet demand to increase production efficiencies. • Make use of Smart Grid technology, the introduction of which provides some farmers with a potential additional source of income from renewable energy where current infrastructure will not be expanded. • BLM promotes off-grid development and renewable energy programmes.
Pursue energy diversification and energy efficiency to transition to a low carbon, sustainable energy future, and delink economic growth from energy use	DEA&DP; DoE; BLM; Eskom	• Support emergent Independent Power Producers (IPPs) and sustainable energy producers (wind, solar, biomass and waste conversion initiatives) in suitable rural locations. • Support initiatives that promote a shift from private to public transport and from road freight to rail, and reduce the need to travel (e.g. locate households closer to their place of work).
HAZARD: SEWERAGE AND WASTE REMOVAL		
RISK: MEDIUM		
AREAS, COMMUNITIES OR HOUSEHOLDS MOST AT RISK: • Main outfall sewer from **Kwanokuthula to Gansevlei:** Stormwater and sewer spillage erosion has undermined the existing outfall pipeline and it is at risk; • **Aventura pump station**: The Pump station is currently posing some challenges with reported spillages into the Keurbooms Estuary. Upgrades to the pump station are critical as it is currently monitored by DEA&DP. • **Kranshoek pump station**: There is currently only one pump working and sewage spillages still occur. The standby generator has been linked to activate on power failure. • **Wittedrif sewage pump station**: The provision of upgraded bulk sewer and upgrade of the Wittedrift pump station is at this stage crucial for any developments to continue in Green Valley. • Illegal dumping is a serious problem amongst the communities, especially rural areas but this problem has extended throughout the Municipality. People are dumping on all open spaces that they see and some instances people transport waste from affluent areas to dump illegally in some areas. Especially amongst the poorer areas especially Green Valley, Bossiegif, Qolweni, Kranshoek. Another area that was mentioned in the workshop is the area below Redford Road (The Crags) where people are dumping in the culverts and stormwater areas. • **Cuba (Qolweni)** is the most polluted area within Ward 2, with constant problem of damaged drainage system. • Pollution is also a health hazard. Pollution is produced in the catchment areas of lakes and estuaries; Lack of Effluent quality control programme to minimize the risk of pollution of the estuary and ground water resources. The pollution risks can further impact plant and other species.;	

- Fires, sharp objects, and hazardous waste pose a threat to anyone that may be working near the dump site, or to children who may play in or near the debris;
- **The declining state of municipal wastewater** infrastructure is one of the largest contributing factors to the numerous pollution problems and a major contributor to health problems in poor communities.
- **Communities that experience more problems are located in informal settlements where the density and demands are higher**. This affects the function of the infrastructure due to the high density of households and not because of the quality of the infrastructure. The biggest growth occurs in the areas comprising **Plettenberg Bay, Kwa-Nokuthula and Kranshoek** (the latter is experiencing the fastest growth of all settlements in Bitou)[1]. Specific attention needs to be paid to urban efficiencies and the provision of facilities and amenities in an integrated manner.
- **Bossiesgif/New Horizons** are considered the most vulnerable communities according to the latest IDP in terms of rendering of basic services;
- Poor and insufficient sanitation system in the informal settlement of Qolweni;
- Despite efforts to maintain the cleanliness of the town, particularly in close proximity to the estuary, forests, seashore and other conservation areas, it must be emphasized that any pollution within the urban area will ultimately impact upon the estuary as it is eventually carried along streams and storm water channels that terminate in the estuary. Similarly, the natural water courses, storm water channels and groundwater may be polluted from a number of human-induced factors. These can be summarized as follow:
- Informal settlement areas having limited or no access to adequate toilet and waste water disposal systems;
- Leaks and blockages in sewer infrastructure or sewer pipes are often in close proximity to storm water pipes;
- Private septic tank units leaking or not operating effectively;
- Operation failure and constraints at waste water treatment plants;
- Illicit disposal of chemicals in storm water system or natural watercourses;
- Leaks and contamination from industrial and business activities;
- In Bossiesgif the area is heavily affected with a substantial amount of free moving livestock such as pig, cows and goats that contribute towards the environmental decay and contamination and make the place more inhabitable.

WASTE MANAGEMENT/REMOVAL

- The municipality is no longer doing landfilling; the municipal landfill site has exhausted its life span. The municipality has constructed a waste transfer station where waste is sorted, compacted and transported. Waste is transported to the landfill site of PetroSA in Mosselbay at a hefty cost1. The municipality procured two trucks that run every day from Plettenberg Bay to Mosselbay. The challenge associated with this arrangement is:
  - The increasing cost of land filling;
  - The increase in operational coast e.g. fuel and vehicle maintenance costs; and
  - The effect on the road surface over time. =

The Municipality is currently sitting with the following issues:

- The cost for providing transferring waste to Mosselbay is then pushed onto the consumer who already has a heavy tax burden. Inflation in rendering waste removal services in Bitou has gone way above the norm and the general inflation announced by statistics South Africa. If no sustainable solution is devised, waste removal will be very high and might result in a non-payment of services and increase illegal dumping.
- Illegal dumping is a serious problem amongst the communities. People are dumping on all open spaces that they see and some instances people transport waste from affluent areas to dump illegally in some areas. Communities have been complaining about a lack of facilities for green and building waste. The municipality must expeditiously construct the waste drop-off facilities.
- The problem is further exacerbated by the ageing of fleet to transport waste is currently an issue within the Municipality. There is a general concern with regards to lack of capacity especially during season peak.
- There' also a lack of recycling within the Municipality.
- Another challenge is extending waste removal services to the rural areas. The rapidly growing quantities of garbage in communities pose threats to human health and the environment. Poverty perpetuates the problem as poor households cannot afford toilet paper and then make use of other materials (e.g. newspaper) that block the system

Bitou Municipality faces a number of challenges with regards to the delivering of an effective and sustainable waste management service, including insufficient budgets, skilled capacity and a lack of appropriate equipment.

RECOMMENDED ACTIONS	RESPONSIBILITY (IMPLEMENTING AGENTS)	COMMENTS AND MEASURES

Promote waste separation at source throughout urban settlements	BLM; Ward councilors	• The cost for providing transferring waste to Mosselbay is then pushed onto the consumer who already has a heavy tax burden. Separation at source to recover re-usable materials and also to extract hazardous matter such as medical waste, mercury batteries, oils and toxic chemicals can reduce the transport requirements, prolong the life of the site and allow for specialized treatment of the hazardous matter. • Increase waste separation at urban settlements. • Encourage waste recycling at households. • Evaluate and control the environmental impact of on-farm waste disposal. • Roll-out recovery/recycling facilities and related awareness programmes to minimize the need for new waste disposal sites. Prioritize the upscaling of waste recovery and recycling in the Municipality, which is the primary waste generator. • Current volumes of materials recovered at various transfer stations can be seen as an opportunity to employ more EPWP workers. The participation rate is not sufficiently high and as such, valuable job opportunities are lost.
Rehabilitation of closed landfill sites	BLM; Consultant; MIG	• The municipality is no longer doing landfilling; the municipal landfill site has exhausted its life span. • Current landfill site which have been closed need to be rehabilitated as soon as is financially viable. Rehabilitation is a key part of managing and mitigating the adverse environmental impacts of such facilities and cannot be ignored. • BLM receives support with the facilitation of the environmental regulatory requirements (waste license) to conduct feasibility study into developing a landfill site. • Project is registered with MIG. • With the information provided by the audits, the Municipality should continually evaluate the landfill available airspace so as to plan in advance so that sufficient landfill capacity is always ensured.
Implement a policy for informal reclaimers	BLM	• Illegal dumping is a serious problem amongst the communities. People are dumping on all open spaces that they see and some instances people transport waste from affluent areas to dump illegally in some areas. • Communities have been complaining about a lack of facilities for green and building waste. The municipality must expeditiously construct the waste drop-off facilities. • BLM Informal waste reclaimers access waste sites according to policy.
Capacitate management and institutional measures	DWS; DEA&DP; GRDM; BLM	• If no sustainable solution is devised, waste removal will be very high and might result in a non-payment of services and increase illegal dumping. **Measure should include:** • Enforce and adhere to industry standards. • Improve law enforcement and investigation of illegal dumping. • Test groundwater at regular intervals and record baselines. • Monitor waste removal and audit responsible service providers. • Address non-compliances from external audits of waste facilities. • The review and planned replacement of waste collection fleet vehicles operating beyond their effective lifetimes. Vehicle are pressured with mileage due to long travelling distances back-and-forth to Mosselbay (about 170km).

		Collection vehicles should ideally not be operated beyond 7 to 8 years in age since the maintenance costs increase dramatically with age. There's a serious need for fleet replacements
Improve Waste Reporting and Data Management	BLM;	• Accurate waste figures for each waste facility in BLM is maintained and assimilated in one system. This would serve to provide a comprehensive overview of the situation in the region and would better support planning and strategies to effectively service the community. • A Waste Information System is established as soon as is financially possible. Annual waste data is to be recorded onto SAWIS for this will feeds into national waste information system.
Develop a densification plan	BLM;	• Prepare precinct plans for all proposed urban nodes, new development areas larger than 5ha and future rural nodes. Prohibit new residential developments from being located below the 1:50 year flood lines. • Incorporate fine scale biodiversity layers in spatial planning. Ensure that all future green fields' developments are located on land that is identified for future residential purposes and discourage developments from being located on valuable agricultural land. • Introduce and retrofit appropriate water and sanitation systems, targeting informal settlements (Fairview, Kranshoek, Kwanokuthula, New Horizon, Bossiegif/Qolweni, Green Valley/Wittedrift and Kurland) and backyard shacks in formal neighborhoods.
Develop a comprehensive Stormwater Master Plan	BLM; GRDM	• Upgrade stormwater systems and train WWTW operators. • Source additional funding to develop outstanding Stormwater Master Plans. Include the use of permeable paving in urban development areas in these plans. • Close down illegal sites and locate new regional waste sites adjacent to rail facilities to decrease the operational costs and energy requirements associated with the need for road freight.
Continue with public cleansing initiatives	BLM, EPWP	• Public Cleansing involves the cleansing of streets (kerbs and gutters), public open spaces (other than parks and storm water ditches), beaches and areas of illegal dumping. • Manual street sweeping takes place daily in the CBD area. • Extend services to areas lacking of such service.
Promote and provide guidance on waste-to- energy opportunities	GreenCape; DoA; DEA&DP; BLM	• Improve recycling (household separation, separate systems, enforcement, markets, and incentives). • Simplify separation at source. • Assess and disseminate best practices and opportunities for waste-based co-generation to, for example, industries, intensive livestock operations, wineries and fruit processors. Participation in recycling initiatives improves.
Improve the maintenance and sustainable use of agricultural and ecological resources and infrastructure	DEA&DP; DWS	• Monitor river and estuarine (Groot Rivier, Keurbooms/Bitou, Piesang Valley) sites with respect to pollution control.

Improve Waste Management facilities at informal settlements	BLM	• Due to the fact that Bitou Municipality is made up of various towns/informal settlements that are geographically located along the coastline, it is important to consider the population distribution across these towns as this is an indication of where the waste will be generated and where the waste will be delivered to. • BLM provides skips for refuse removal at (Fairview, Kranshoek, Kwanokuthula, New Horizon, Bossiegif/Qolweni, Green Valley/Wittedrift and Kurland • Once skips have been made available, this information is shared with the public through a public awareness campaign.
On-going Public Awareness and Education campaign regarding Waste Minimization	BLM	• On-going public awareness and education in order to increase participation in waste minimization programmes and to reduce illegal dumping. • Generally, the lack of public awareness of the gravity of the problem of sustainable waste management has a significant impact on the effectiveness of the management of waste. • The successful implementation of the BLM IWMP will require that all persons within the Municipal boundaries are aware of waste issues as an integral part of the creation of a healthy environment: - The campaigns promote sustainable waste management and it will introduce the concept of composting. - Youth recycling awareness programmes in schools are held. - Create additional drop off points to curb illegal dumping.
Bitou Municipality quantifies prevention	BLM	• BLM assesses the possibility of using statistics and other data collected to quantify the success of prevention measures employed within the municipality. This will be done by populating a GIS system with relevant data. • The Council co-operates with the Waste Minimization groups in efforts to quantify waste avoidance through the use of performance indicators and by other means.
Post Collection Recovery rolled out	BLM	• Bitou Municipality will establish a Materials Recovery Facility Landfill where recyclable materials are recovered from the collected wastes so that only material of no value be forwarded for landfilling.
Conduct a feasibility study of a post Collection Composting	BLM	• Investigate the financial sustainability of a composting facility where the organic fraction of the collected waste stream is composted.
Rehabilitation of closed landfill sites	BLM	• Current landfill sites which have been closed need to be rehabilitated as soon as is financially viable. Rehabilitation is a key part of managing and mitigating the adverse environmental impacts of such facilities and cannot be ignored.
Garden Waste and Builders' Rubble	BLM	• Garden waste and builders' rubble entering the site is chipped and crushed respectively.
Manage tyres	BLM	• BLM develops an action plan in accordance with the Tyre Regulations to manage tyres generated within the municipal area.

Sanitation improves due to compliance of WWTWs	DEA&DP; BLM; GRDM	• Prevent the contamination of agricultural produce and the risk to agricultural workers. • Where practical and appropriate, intercept/ store/ evaporate irrigation return flows on farms. • Control further irrigation development on saline soils. Collaborate with aquatic ecologists to identify 'hotspots' where monitoring should be undertaken to protect the aquatic ecosystem. • Disposal of dried waste sludge in the most efficient way remains a challenge.
Address inadequate capacities of sewer pump stations and sewer drainage networks.	BLM; GRDM	• Upgrade existing sewer pump stations and provide new sewer pump stations for specific areas, as identified in the Sewer Master Plan. Upgrade sections of the sewer drainage network as proposed in the Sewer Master Plan. • Priority should be given to rehabilitating existing infrastructure as this generally makes best use of financial resources and can achieve an increased in (operational) services level coverage's most rapidly.
Extension of Basic Services in Informal Areas	BLM GRDM	• Improvement of ratio of sanitation facilities to households in informal settlements
Continue with maintenance and upgrade of sewage systems	BLM; MIG	• Address blockages. • Repair / replace sections of pipelines and increase public awareness / education on sewerage systems. • Upgrade of waste water treatment works when required. • Elimination of septic tanks by laying new sewer pipe networks and connecting properties to it. Ensure provision of sewer networks for new developments. • Additional tankers and the replacement of ageing tankers required.
Address industrial effluent in sewage system	BLM; DWS	• Industrial effluent discharge into the sewer system needs to be quantified. • All industries need to formally apply for the discharge of industrial effluent into the sewer system. • Regular sampling of the quality of industrial effluent discharged into the sewer system is necessary. • Any returns from the industries direct to the Water Resource System needs to be metered. Bitou Municipality is committed to ensure that all industries apply for the discharge of industrial effluent into the sewer system, to monitor the quality and volume of industrial effluent discharged and to implement the set of by-laws with regard to the discharge of industrial effluent into Bitou Municipality's sewer system in order to determine whether the quality comply with the standards and criteria. • The industrial consumers in Bitou Municipality's Management Area are not yet monitored, with regard to the quality and volume of effluent discharged by them. • Bitou Municipality needs to adopt an approach whereby the various parameters at all the industrial consumers are monitored, as well as volumetric monitoring at the larger users. • Adaptation of procedures must be undertaken in accordance with any changes to the wastewater discharge criteria set by DWS. It will also be necessary to consider limits above which volumetric monitoring will be necessary at new industries and existing smaller industries, where expansion is likely to take place.
HAZARD: WATER SUPPLY DISRUPTION		

RISK: MEDIUM		
AREAS, COMMUNITIES, HOUSEHOLDS MOST AT RISK: • Keurbooms River is the only source of water for the large Bitou municipal area. Many people wrongly believe that Roodefontein is our source of water, but it is in fact only an off-channel storage dam for water extracted from Keurbooms River - except for a small amount coming from the dam's own limited catchment area. Reduced rainfall and effect on dam level. • All wards can be impacted by service disruption; • **Communities that experience more problems are located in informal settlements where the density and demands are higher**. This affects the function of the infrastructure due to the high density of households and not because of the quality of the infrastructure. The biggest growth occurs in the areas comprising **Plettenberg Bay, Kwa-Nokuthula and Kranshoek** (the latter is experiencing the fastest growth of all settlements in Bitou)[1]. Specific attention needs to be paid to urban efficiencies and the provision of facilities and amenities in an integrated manner. • **Bossiesgif/New Horizons** are considered the most vulnerable communities according to the latest IDP in terms of rendering of basic services; • The communal water tap at Bossiegif is located in the most inaccessible area and need to be relocated. • Pump stations located in low-lying areas; • Informal settlements: Wards 1 and 2 contain the most informal settlements and which lack basic services. Kurland, Bossiegif, Qolweni amongst the most vulnerable; • Commerce, industry and the agricultural sector (dairy and beef production industries); • Domestic consumers; • Schools; • Hospitals and frail-care facilities.		
RECOMMENDED ACTIONS	**RESPONSIBILITY (IMPLEMENTING AGENTS)**	**COMMENTS AND MEASURES**
Improve physical planning measures	BLM; GRDM; WUA; BGCMA; DWS; MIG	• Plan for temporary/alternative water sources e.g. water storage tanks. • Ensure adequate reservoir storage capacity for the various towns • Enforce water restrictions. Increase water tariffs. • Inadequate capacities of water pump stations and reticulation networks. • Priority should be given to rehabilitating existing infrastructure as this generally makes best use of financial resources and can achieve an increased in (operational) services level coverage's most rapidly. • Records need to be kept of the number of breakages/failures per infrastructure type in order to assist the Municipality with their refurbishment and maintenance planning. • The Municipality needs to differentiate between budget allocated towards the operation and maintenance of the water and sewerage infrastructure and budget allocated towards the replacement of the water and sewerage infrastructure. • Ensure that all the assets, as listed under the various tables in this chapter, are included in the Asset Register Reduce leaks.
Monitor and prevent water resources pollution (estuaries and marine)	BLM; GRDM; DWS; WUA; BGCMA	• Ensure that the level of contaminants is below the requirements for recreational use. • Conduct weekly sampling at fixed sites. Improve water quality of aquatic sources.

		• Prevent contamination of marine and estuarine water sources. • Monitor and record water quality of discharged wastewater that has the potential to impact water resources.
Water resource protection is based on a participatory approach	BLM; DWS; WUA; BGCMA	• Take decisions on the management of our water resources at the lowest appropriate level, with full public consultation and involvement of users. • Sourcing of funding for implementation of water reclamation for potable purposes in the longer term.
Implement a multi-pronged water management strategy	BLM; GRDM; WUA; DWS; DoA	• Where groundwater specialists are absent, in municipalities, a specialist is appointed. • Bitou Municipality needs to continue with the monthly reading of all the existing bulk water meters. • Reduce water that is unaccounted for. • Promote rainwater harvesting and grey water recycling. • Set realistic targets for Water Conservation and Demand Management (rural and urban). • Consider the routine implementation of light water restrictions, so as to develop a change in behavior over time. • Review and improve efficiency of remote monitoring of minimum night flows in all zones. • Perform focused leak detection and repair programs in areas with highest minimum night flows. • Enhance public awareness on water demand management issues, e.g. the watering of gardens as determined by the bylaws, rain water harvesting, dam levels, and general water saving tips. • Identify users on financial data base with regular abnormal high or abnormal low water use, and physically inspect the causes. • Sourcing of external funds, e.g. from the DWS RBIG and ACIP programs, ORIO, Green Fund and Disaster Reduction Program. • Tariffs structured to discourage excessive use of water, including volumetric sewerage tariffs, and specific water restriction tariffs implemented for specific dam levels. • Continue with removal of alien vegetation in catchment areas. • Maximum use of treated effluent for irrigation. • Implementation of intelligent pressure management in specific areas. • See Recommendations: Alien Invasive Species to control alien invasive plant growth.
The value of water resources is recognised from an economic point of view and the social and environmental benefits of the resource are understood	BLM; DoE; DEA&DP; Consultant; DWS; DoA; WUA; Sector Depts	• Assist society to determine the economic value of water, account for water usage (for example, household water supply and irrigation for agriculture) and recognize the ecosystem services provided or supported by water resources (for example nutrient cycling, habitat provision, and recreation).

Research and forecast the requirements for bulk infrastructure in order to meet the future demands	DEA&DP; Consultant; DWS; DoA; BGCMA; WUA	• Conduct an in-depth analysis of the role of local level water in the economy. • Allocate budget towards basic services such as water, electricity, sanitation and refuse removal. • Improve measurement of water resource availability and use. • Develop detailed systems for monitoring water extractions and flows for each town.
Develop agricultural water demand management programmes, focusing on agricultural areas	DoA; DWS; WUA; BGCMA; Organised Agriculture	• Define more precisely the costs and benefits of agricultural water consumption (e.g. groundwater depletion, flood mitigation) in order to better inform policy and decision- making. • Provide farmers with technical advice and educate them on best practices, especially as climate change may render past farm practices obsolete. • Promote water-saving irrigation systems and scheduling, and • increase the use of FruitLook.
Reconsider the National Water Policy Review proposal to abolish WUAs	DWS; WUA; Sector Depts.; GRDM; BLM	• Research the benefits of increasing social capital via a polycentric governance approach, rather than decreasing social capital by abolishing local institutions. • View the improvement of local groundwater governance as an ongoing, organic process rather than as something that can be 'fixed' by a once-off intervention or the imposition of a specific governance design model.
Specialised monitoring of aquatic ecosystems	Consultant DWS; WUA; DEA&DP; BGCMA.	• Enable experts from several study fields (such as fish biology, entomology, botany, geomorphology and chemistry) to monitor aquatic ecosystems in a holistic way. • Design and maintain a monitoring and reporting programme to facilitate and encourage collaboration between the wide range of stakeholders involved in water ecosystem management. • Where water quality issues do occur at high risk locations, continuously monitor and review selected 'hotspots' with DWS and local authorities.
Integrate protection of aquatic ecosystems	DWS; WUA; DEA&DP; BGCMA	• Recognize the complex and interconnected nature of catchments as social-ecological systems and manage the aquatic ecosystem (water quantity and quality, habitat and biota) in an integrated way.
Strengthen integrated catchment management	DoA; BGCMA WUA; CapeNature; DEA&DP; WWF-SA; Organised Agriculture.	• Create a collaborative catchment management partnership. • Identify project sites and undertake a status quo assessment of each. • Develop projects and strengthen outcomes which have specific relevance to building climate resilience.
Update the Sustainable Water Plan with new climate change-related information and plans	DEA&DP; DoA; DWS	• Review of the Water Services Development Plan for BLM. • Develop an infrastructure maintenance and development plan for water.

		• Review the specifications of the Regional Bulk Infrastructure Grant (RBIG), Municipal Infrastructure Grant (MIG), Accelerated Community Infrastructure Programmes (ACIP) and other similar funds and allocations to determine their climate responsive state (and link to any other ongoing such initiatives). • Ensure that the Protection of Strategic Water Source Areas (SWSAs) is a strategic climate protection priority for the Western Cape. Evaluate SWSAs to ensure that they receive appropriate protection in terms of supportive zoning in SDFs.
Protection of water resources through classification of the resource	DWS; WUA; BGCMA	• Increase in the use of the gazetted classification process to classify all the major rivers, wetlands and aquifers. Ensure that this involves stakeholder engagement to create ownership of the water resources.
Strengthen assurance of equitable water access that incorporates climate change considerations	WRC; DWS; DoA; BGCMA; DAFF; WWF-SA;	• Explore the linkages between water licensing and climate change adaptation in terms of temporary transfer and innovative, context-appropriate licensing models that create more flexibility dealing with rainfall variability. • Diversifying water resources through further development of groundwater resources and through the construction of Wadrift Dam.
More effective aquifer management is implemented	WRC; DWS; WUA; BLM;	• Ensure that over-abstraction is curtailed and does not increase. In cases where over allocation has taken place, allow the validation and verification process to take its course. • Adopt a cautionary approach to further allocation
Streamline Data Sharing	DWS; BLM	• Capitalize on the extended drought conditions to modernize gauges with real-time telemetry, set up automated preliminary data processing and publish data directly to the World Wide Web. • Transfer surface water quality monitoring and data collected by local authorities and other institutions to a centralized water quality database, to make it easier to compare.
Create a centralised reporting mechanism and spatial capturing of invasive species along sensitive catchment areas	WfW; Consultant; DEA&DP; EPWP	• Continue with programmes (such as Working for Water) which reduce the presence of alien vegetation along river systems.
WC/DM is a pre-requisite for undertaking further development of new water supply schemes	DWS; WUA; BLM; BGCMA; WRC	• Revise building regulations as necessary, specifying that only water efficient fittings are permitted in new developments and in renovations/extensions.

Increase station density to better characterize spatial variability	DWS; WUA; BGCMA; WRC	• Use synoptic-scale monitoring to collect a snapshot of many sub-catchments in order to characterize the spatial distribution rivers. Identify any anomalies in runoff, as these are good candidates for locating new permanent gauges. Improve the estimations, in quantitative terms, of future climate change impacts on freshwater resources; • management.
Improve infrastructure refurbishment	BLM; DWS; WUA; MIG	• Reconsider existing funding models to encourage private investment where public funding is insufficient and consider the potential of operating government infrastructure on a commercial basis. • Continue with leak repairs at indigent households and installation of water management devices • Phased pro-active replacement of older water meters. • Obtain funding to maintain water infrastructure assets, e.g.: to replace leaking old cement asbestos pipes. • Continue with pipe replacement in priority areas with old reticulation networks and history of frequent pipe failures
Alien invasive species clearing strategy for water catchment areas	BLM; DEA&DP; SANBI; Flower Valley Conservation Trust; WfW; Cape Nature; WWF South Africa;	• There are currently large sections of alien invasion along the coast and no clear direction or policy/plan for the management of this. • There is the need for a policy on alien infestation/management within the municipality and an implementation plan to undertake this.
Continue addressing the lack of suitable qualified technical staff	BLM; Consultant	• On-going training of staff through implementation and management of the bulk water services support contract.
Implementation of water conservation and demand management at municipal level	BLM; GRDM; BGCMA; DWS; WUA	• Clearly define the responsibilities for implementing WC/DM, which is regulated by both the NWA and the WSA. Regulate municipalities (as the operators of the reticulation systems) in terms of their implementation plans and strategies, which generally only address urban efficiencies. Regulate sector efficiencies in terms of the NWA, either by the CMAs or DWA Regional Offices. • Encourage and manage payment for water services as the provision of water services is dependent on recovery of costs for such services. • Elevate the implementation of WC/DM to a core function within the municipalities and allocate specific technical and managerial resources. • Municipalities to draft WC/DM implementation plans in line with their WC/DM strategies. Adapt WC/DM interventions to the economic situation and geographic location of individual municipalities. Recognize that implementation action plans will differ between municipalities since certain interventions may be more viable than others. Similarly, cater for different audiences when promoting WC/DM awareness. “One size does not fit all”.

		• Address the lack of appropriately qualified municipal engineers and the lack of capacity for long-term planning, to effectively maintain and upgrade water infrastructure timeously. • BLM to complete a water balance prior to approving new developments and ensure sufficient treatment capacity.
Track Meteorological and other Parameters to Better Understand Variability	WUA; BGCMA; WRC; DWS; SAWS	• Explain the variations of different catchment areas that have different response characteristics. • Make use of data from air temperature, precipitation and soil moisture sensors data to reconcile basin inputs with outputs.

HAZARD: CIVIL UNREST

RISK: HIGH

AREAS, COMMUNITIES OR HOUSEHOLDS MOST AT RISK:

- **Plettenberg Bay has been plagued by riots,** mostly over housing, last year by various communities - some of which brought the coastal holiday town to a near standstill when residents gathered on the N2 blocking the road for traffic.
- During February 2019, Motorists have yet again been warned to **avoid the N2 between Shell Ultra City and Airport Road** following reports of protesters pelting passing vehicles with stones and setting objects alight along the national road. A **large crowd marched from Kwanokuthula** to the municipal officers to voice their concerns over issues with electricity. Residents indicated that they, among other things, wanted their electricity directly from Eskom as the municipality used the prepaid system to recover rates and taxes. This has led to residents receiving less electricity units than they pay for. A plan has since been put in place to address the housing shortage, but after a housing committee meeting during February 2019 residents voiced their unhappiness with the process so far. This spilled over into another wave of protesting on Tuesday evening, which included the burning of tyres and stoning of passing vehicles on the **N2 near the Plett footbridge.**
- Several Qolweni residents protested over housing issues during February as well. This included stone throwing and burning tyres.
- Informal settlement areas most notably **Fairview, Kranshoek, Kwanokuthula, New Horizon, Bossiegif/Qolweni, Green Valley/Wittedrift and Kurland** especially those situated in close proximity to key transport routes (N2);
- The population increase is approximately 2 000 persons per annum, and youth 0-14 makes up almost a quarter of the population. The total population of Bitou is set to increase with approximately 10 000 people during the 4th Generation IDP period, and will reach the 70 000 to 75 000 mark over the next decade or so should the growth patterns continue.
- The biggest growth occurs in the areas comprising **Plettenberg Bay, Kwa-Nokuthula and Kranshoek** (the latter is experiencing the fastest growth of all settlements in Bitou). Specific attention needs to be paid to urban efficiencies and the provision of facilities and amenities in an integrated manner. The SDF and IDP strategies need to provide clear guidance for public investment in this regard in these areas.
- **Bossiesgif / New Horizons are the most vulnerable communities**[1]**:** Focused strategies are required to address service delivery and development needs in this area. This area is comparatively very highly endowed with working age males with relatively low levels of education and low levels of formal dwellings.
- **Population densities are highest in Bossiesgif and in Kwa-Nokuthula.** Human settlement place-making responses are required to ensure quality living environments and inclusive and integrated development.
- Farm labourers residing on farmlands;
- Local businesses;
- Agriculture;
- Commerce;
- Industries;
- Fire risk areas cleaned with controlled burns can turn into land seize opportunities;
- It is said that the probability of protests runs parallel to a lack of livelihood opportunities and political season. The higher the socio-economic vulnerability (such as umployment rate) the high the risk of protests especially amongst the poor who demand basic services and housing.

RECOMMENDED ACTIONS	RESPONSIBILITY (IMPLEMENTING AGENTS)	COMMENTS AND MEASURES
Provide development support to the vulnerable	DoE; BLM	• Eliminate or support the reduction of school drop-outs. Strive towards economic wealth and the reduction of poverty by protecting natural resources, encouraging skills development and tourism awareness as well as growing new markets for potential investors. • Agriculture can potentially make a significant contribution in alleviating unemployment and creating wealth in the municipality and should be properly managed and developed to ensure maximum benefits for all Bitou's inhabitant • The small contribution which agriculture is making to the Bitou economy should be expanded. Only 50% of the available land is currently being utilized and ways of increasing agricultural production should be explored. • Expansion of the following agricultural activities are to be addressed: Diary production which has experienced positive growth since 2008. Beef production given the significant increases in demand. Honeybush farming should be expanded to also add value and develop a variety of products to meet the demands/preferences of consumers. Fynbos production to be increased to respond to the growing export market and the growing trend towards environmentally friendly and organic products. • Upgrade school libraries to supplement materials and encourage reading. • The population is growing which necessitate improvements in infrastructure. • Improved transportation should be provided for scholars in the area. • This also increases pressure on housing. • Provide free legal services. • The relatively young population indicates a sizable labor force. Initiatives to empower and develop skills in the labor force would be vital in improving the economy of the municipality and reducing unemployment figures. • Only 15% of the population of Bitou Municipality resides in rural areas which creates difficulties in providing services (health care, education, etc.) due to the low thresholds. Unique and area specific initiatives would need to be developed to cater for the rural communities.
Stimulate the local economy	WCG; BLM; EPWP; DED	• Address the lack of required skills for dominant economic activities in the area through the development of a structured empowerment campaign to develop skills in local communities. • Revise supply chain regulation to give preference to small businesses. • Establish a builders forum. • Develop mentorship programmes to address the high level of unemployed youth. • Establish innovative ways of disseminating information around tenders and quotations. • Provide support to small contractors with: - CIDB registration (Construction Industry Development Board) - NHBRC (National Home Builders Registration Council) registration • Provide tender training. • Provide security / bridging finance. • Provide legal support to small businesses.

Address housing backlogs	BLM; EPWP; EHP	• Compile a housing plan to accommodate the current backlog in 5 years. • Purchase land for integrated human settlements. • Investing in the upgrade of backyard structures should be considered as this can contribute to the provision of housing. • Pro-actively identify land through a land audit linked to a land release programme; • Continual monitoring of the waiting lists and yearly updates of census data. • Priority should be given to the development of housing Programmes that provide appropriate rental stock for low-income and GAP market beneficiaries. • Affordability of housing programmes focusing on the GAP market should be revisited to align with existing variable income levels of prospective beneficiaries • A detailed investigation should be conducted into systems and processes associated with the waiting list, beneficiary selection and housing allocation. • Cognizance should be taken regarding the perceptions of people in the informal settlements regarding ownership. • Policy must allow the municipality to employ local resources to address housing need, i.e. caravan parks.
Create a skills database	BLM; MQA; SETA; Dept Internal Affairs	• Create a database of all unemployed and employed skills in each municipal area. Approach the MQA SETA to assist with the development of such a programme. • Implement community and youth development programmes (skills development programmes) based on local needs.
Settlement policies	DHS; GRDM; BLM; EPWP; EHP	• Prioritize remote rural areas, small towns and low-income urban areas such as BLM for the distribution of broadband internet. • Develop a policy pertaining to affordable rental stock as an alternative to the BNG subsidy. • Development of a policy that sees the incorporation of the agricultural sector in the planning of future housing. • As a result of the growing pressure of available developable land for housing, the present policies and approaches of protecting fynbos, should be revisited. • Incorporation of skills training centers at Thusong community centers in collaboration with LED offices, NGOs and private sector, should become a focus point.
Develop dedicated human settlement legislation	DHS	• This includes, inter alia, the improvement of planning, design and development of settlements, which will present an opportunity to include climate change resilience. • It is recommended that plot sizes are increased in future developments to allow for extension of dwellings to counter overcrowding and negative social impact.
Identify areas to cluster public facilities	BLM	• Prioritize existing larger public facilities as the location for multi-purpose centers in settlements.

Informal settlements/ affordable housing areas are upgraded	BLM; DHS	• Upgrade informal settlements • Investing in the upgrade of backyard structures should be considered as this can contribute to the provision of housing.
Manage migration as efficient and effectively as possible	BLM; DHS	• To manage the impact of in-migration, it is proposed that the land release / subsidy provision programme should be balanced with the growth rate to ensure that in-migration is not supply side driven. • Regular socio-economic data should be compiled of informal households to determine the reasons for migration, ensure regular monitoring and to support pro-active planning.
Integrate the spatial component of bulk infrastructure master plans, public transport plans and housing/human settlement plans into one SDF, prepared at the appropriate scale (e.g. regional, district or local municipal)	DEA&DP; GRDM	• Consolidate and align the various regional economic infrastructure investment proposals (e.g. SIPs, SOEs, National or Provincial Departments) in integrated regional SDFs. • Align and synchronize bulk infrastructure, transport and housing investment programmes. • Provide spatial planning input and support to the sector plans of Provincial departments. • Assess biodiversity, heritage, scenic landscape and agricultural considerations in evaluating the suitability of sites for bulk infrastructure projects.

HAZARD: STRUCTURAL FIRES

RISK: HIGH

AREAS, COMMUNITIES OR HOUSEHOLDS MOST AT RISK:

- **Shopping centers, Liquid Petroleum Gas (LPG) outlets, electrical transformer stations, hotels, guest lodges, holiday resorts, wooden houses (such as those in Nature's Valley), thatched dwellings, and informal settlements such (Qolweni/Bossiegif, Kwanokuthula, New Horizon**).
- **Areas with a high presence of invasive alien plants** such as Black Wattle, Blackwood, Port Jackson Blue Gum trees, Pines, Eucalyptus, Hakea, Rooikrans. the result is that fires in the region are burning too hot and too frequently and are impacting on the production process of fynbos, hampering the ecology of the catchment areas for optimum water production. Areas that was mentioned in the workshops include **Plettenberg South (from the airport to Harkerville), Harkerville along the N2 and Nature's Valley (due to dense forestation along the wildfire/urban interfaces).**
- Many **illegal electrical connections are found in Kurland, Kwanokuthula, and Qolweni**. Too much illegal electricity connections at Qolweni, Cuba area, with some just lying on the ground due to electricity backlog at Qolweni.
- **A wildland-urban interface refers to the zone of transition between unoccupied land and human development**. The wildland-urban interface is where flammable vegetation and developed areas meet and consequently expose people and property to wildfires. These areas include nature reserves, vacant land often invaded by woody invasive alien plants, timber plantations, orchards, vineyards, and agricultural land. The Wildland-Urban Interface is the transition zone between open land that is generally unoccupied and contains flammable vegetation fuels and human settlements, the area where urban development meets wildlands (in town planning this area is sometimes referred to as the "urban edge"), where homes and structures are built among forests, shrubs or grasslands, or where there is a presence of people and permanent infrastructure in the proximity of flammable vegetation. This is where people live and earn their livelihoods, and it is here where people are exposed to the greatest risk of being injured or killed by wildfires, and the property has the greatest potential to be damaged or destroyed by wildfires. A prime example is **The Crags and Nature's Valley**.
- Development in natural areas is an accelerating trend in many areas of the Bitou Municipality. Residential properties on the urban fringe are often sought after for their aesthetic value, especially if they are in close proximity to picturesque landscapes and natural vegetation. People like to live in 'green' areas, screened out from others. Therefore, it is inevitable that periodic wildfires will pose an occasional risk along the urban fringe. This is evident

throughout the Bitou Municipality.

- Susceptible subpopulations include the very young or pregnant, the elderly, those having pre-existing respiratory and/or decreased lung function, and those with cardiac disease or people with physical disabilities.
- In terms of accessibility, households that are located far from access roads, in rugged terrain or far from the Fire Station are at greater risk, since this is an obstacle ineffective response time.
- Industrial areas where extensive use is being made of heat-sources or flammable liquids and gases.
- Footpaths are critical areas since fires are caused due to pedestrians throwing away their cigarette butts in this area.
- Occupational exposure of outdoor workers such as firefighters and emergency response workers.

RECOMMENDED ACTIONS	RESPONSIBILITY (IMPLEMENTING AGENTS)	COMMENTS AND MEASURES
Install an affordable, networked fire detector system in informal settlements	BLM; Lumkani	• Lumkani has developed an early-warning system to reduce the damage and destruction caused by the spread of shack/slum fires in urban informal settlements. Many cooking, lighting and heating methods used by people living in informal settlements produce smoke. For this reason, Lumkani detectors use rate-of-rise of temperature technology to accurately measure the incidence of dangerous fires and limit the occurrence of false alarms. • Install early warning detectors in high risk and informal settlements.
Implement an awareness and education programme	WCDMC; GRDM BLM	• Educate informal dwellers on the correct use of electrical and heating equipment and the dangers of cross wires, especially in the winter season, so as to prevent fire in their settlements. • Provide informal dwellers with the correct emergency numbers for emergencies.
Prepare a policy for the densification of settlements	GRDM; BLM	• Ensure that the spacing and configuration of informal dwellings complies with municipal requirements. • Improve access routes to informal settlements. • Monitor areas with illegal electrical connections and aging infrastructure.
Address staff and skills shortages	GRDM; WCDMC	• Attain disaster funds for fire management –and ensure the proactive protection of ecosystems and water, which is required for a long-term response. • Hold regular fire equipment inspections. • Host fire drills. • Standardize fire hydrants. • Source funding to establish local capacity to fire prevention. • Recruit, train and equip volunteers to assist as first-line responders.
Improve physical planning measures	WCDMC; GRDM	• Ensure compliance with applicable SANS 10090 Codes. • Prevent illegal electricity connections; • Use the integrated fire management plan to inform the placement of new work stations/areas and the required protection measures that would be required.

Strengthen engineering and construction measures	GRDM; BLM	• Use fire resistant building materials in high risk areas. Provide additional fire hydrants in high risk areas or where there are obstacles to water abstraction points. • Ensure that the fire extinguishers are assessed on an annual basis.
Improve access to funding	WCDMC; BDM	• Provide funds for upgrading of fire equipment. Fines/law enforcement for illegal electrical connections.
Ensure building compliance to fire safety standards	BLM	• SANS Compliance for certain buildings is currently a big issue within the Municipality. • The regulations for Fire Protection are contained in a 91-page document published by the SABS, SANS10400: Part T - Fire Protection. The bulk of the Standard is made up of a vast number of different "requirements" that relate not only to dwelling houses, but to every other possible type of building, from hospitals to parking garages. • The lack of fire preventions within the Municipality need to be addressed as a matter of urgency. • Fire hydrant availability needs to assessed prior to developmental efforts. • Any buildings raising concerns regarding fire safety need to inspected to determine compliance with national standards.
Lightning conductors as a prerequisite to thatch roof structures	BLM	• It was noticed in a workshop that there's an observed increase to lighting events within the municipality. • Lightning conductors needs to stand as a prerequisite for any thatch-roof developments within the municipality.
HAZARD: AIRCRAFT INCIDENTS		
RISK: MEDIUM		
AREAS, COMMUNITIES OR HOUSEHOLDS MOST AT RISK: • Although not a National or international airport, Plettenberg Bay Airport has flights arriving from and returning to OR Tambo International Airport in Johannesburg or Cape Town International Airport. • Bitou Municipality has one public airfield, namely the Plettenberg Bay Airport. It is located to the southwest between Plettenberg Bay town and Kranshoek. The airport precinct has a land area of approximately 62 hectares. • CemAir is operating sixteen sectors per week out of season and eight sectors per day in season. The airline moves approximately one hundred and seventy passengers per day in peak through the airport. This excludes all general aviation activities. • Plettenberg Bay Airport is home to a very successful sky diving operation as well as scenic gliding and aerobatics flights. • There are currently forty-five hangers with a waiting list for a further twenty-three hangers. In order to accommodate the number of passengers carried by CemAir the airport has to maintain a CAT/4 fire and emergency capability. • Areas below flight paths; • Private aerodromes; • Mountainous areas; • Residential areas located in the approach and take-off to Plettenberg Airport. Developments approximately 10km around airport Public roads adjacent to runway (George); and		

• Vulnerable communities located in approach way.		
RECOMMENDED ACTIONS	**RESPONSIBILITY (IMPLEMENTING AGENTS)**	**COMMENTS AND MEASURES**
Establish a permanent fire station at Plettenberg Airport	BLM; GRDM	• There are currently forty-five hangers with a waiting list for a further twenty-three hangers. In order to accommodate the number of passengers carried by CemAir the airport has to maintain a CAT/4 fire and emergency capability. • The major requirement by the CAA to maintain a CAT 4 grading is the permanent presence of a fire fighting unit/station at the airport. This requirement is at present being addressed by the development of a satellite fire station at the airport which would serve both the on-field requirements as well as catering for the surrounding community.
Upgrade Plettenberg Airport	DTPW; BLM; ACSA	• The re-awakening of the Plettenberg Bay Airport unlocks a significant opportunity. • Further critical infrastructure upgrades include: Airport Terminal building upgrade, staff training, and hangar space. • It is not desirable that hangar space at the airport is used for storage, whether for aircraft or household effects, boats and cars. Considerable economic value will be gained by carefully managing the tenant mix when new hangars are made available. Aircraft constructors, refurbishes, and AMOs (Aircraft Maintenance Organization) will all create skilled employment. • Appropriate development of the facility to accommodate air traffic that does not compromise the nature of the town should be carefully managed over a 10, 20, and 30- year timeline. • Development of additional hanger accommodation will make the airport increasingly attractive to aircraft assemblers, Aircraft Maintenance Organizations, high-value manufacturing/assembly, and logistics, and create much-needed employment opportunities. • In addition, the completion of the upgrade of the road between the Airport and Knysna, will result in a far larger pool of potential users, and will enhance the economic importance of the Plettenberg Bay Airport Specialist airport operators such as ACSA should be considered as partners. They bring vast technical and legal skill, access to resources, and well-established supplier networks, and importantly ensure airport neutrality and fair access for all. They are also well positioned to ensure profitability, as the airport should be run as a business with a profit motive, as properly run, it should make money. • Development possibilities include a 250-meter runway extension, a new terminal building, development of new hangars, a light industrial park, improved let-down facilities, and an extension of the ramp and parking facilities.
HAZARD: ROAD ACCIDENTS		
RISK: HIGH		
• Most severe accidents within Bitou Municipality occurs along the **N2**. The accident black spots are as follows:		

- Section **between Garden of Garden Route and the Garage** (Sasol in Harkerville);
- Area **between Airport Turnoff and Kwanokuthula;**
- **N2 Section by Keurbooms;**
- The **bends by The Crags;**
- **Toll gates** (there was boom collision in the past);

- The road section with the highest number of accidents is Main Street in Plettenberg Bay with 254 accidents over this period, resulting in 36.3 accidents per annum. Marine Drive in Plettenberg Bay follows this with 200 accidents over this period, resulting in 28.6 accidents per annum. The roundabout at the N2/ Marine Way/ Theron Street in Plettenberg Bay has also been identified as a road safety hazardous location. A total of 135 accidents were recorded for the period 2005 – 2012, i.e. 20 accidents per annum.
- Pedestrians and public transport passengers. Potential pedestrian crossing locations where identified where pedestrian tend to cross roads. Of great concern was the crossing of the N2 especially between Kwanokuthula and New Horizons. A need for a footbridge or a roundabout was identified;
- All residential and public areas along the N2 corridor. When driving into Plettenberg Bay from Knysna, residential properties along both sides of the N2 corridor are evident;
- Road construction workers and maintenance teams;
- High risk of car accidents on pedestrians due to speeding vehicle on the streets of Polar Park with too many children on the streets[182].
- There are two forms of freight transported in the area, namely those that are associated with deliveries to shops, and those associated with agriculture. Due to many narrow roads in the urban areas the movement of freight contributes greatly to the congestion in the area.
- In the Western Cape the road traffic accident death rate for males are more than two and half times than females and the majority of working-class group (age 25 to 40) are involved in road accidents;
- According to the latest IDP, only 1 ambulance is allocated per Municipality which is located in one town. Additional ambulances are required which could more efficiently service the Plettenberg Bay.

RECOMMENDED ACTIONS	RESPONSIBILITY (IMPLEMENTING AGENTS)	COMMENTS AND MEASURES
Improve landscaping	BLM;	• Plant indigenous trees in development corridors.
Strengthen physical planning measures	DTPW;	• Conduct regular roadworthy inspections.
Improve engineering and construction measures	BLM;	• Improve street lighting. • Ensure that pedestrian walkways are raised. • Address the backlog in road/ stormwater construction. • Establish a taxi-rank for to facilitate transport in different directions.
Research impact of climate change on road infrastructure	DTPW; GRDM; Consultant	• Identify high risk areas and infrastructure. • Conduct road safety audits on all new roads and on new infrastructure added to existing roads. • Improve the design specifications of infrastructure such as traffic lights and road surfaces to ensure that they are able to withstand warmer and/or more extreme temperatures.
Improve the road network	BLM; MIG; Partner with Safely Home, LeadSA, ChildSafe & IRAP	• Upgrade degraded roads and repair potholes and disintegrated tarred surfaces.

		• Improve the design of interlinked routes, which should have wide shoulders to accommodate bus stops and cycle lanes. Implement measures to reduce offences by and against pedestrians. • Reduce in the incidence of drunk, distracted and sleep- deprived driving. • Conduct additional awareness, education programmes and campaigns more regularly over holiday periods and during the wet season to inform pedestrians on the safe use of roads. • Ensure ongoing liaison with National Treasury and timely expenditure of available funds. • Maintain good relations with communities and encourage contractors to maintain good labor relations, including in terms of timely and fair remuneration.
Address operational development priorities	BLM; GRDM	• Create jobs through labor intensive roads and storm water projects as well as small works programme. • Source funding for an Integrated Transport Plan, adequate reseal programmes and a parking masterplan. • Address parking issues (particularly during holiday season).
Source funds to establish or improve Law Enforcement divisions	GRDM; BLM	• Address vacancies. • Improve employee safety and wellness. • Conduct annual roadworthy testing for all vehicles older than 5 years. • Launch an awareness and education programme to inform pedestrians on the safe use of roads.
Improve understanding and mitigation of GHG emissions	Consultant; GRDM BLM	• The biggest mitigation intervention for transport, particularly in the short term, is increasing vehicle occupancy numbers as opposed to improved uptake of public transport and efficient vehicles. • Develop a better understanding of the interventions that will cause people to make this change in order to understand how to distribute a programme to encourage higher vehicle occupancies.
HAZARD: HAZMAT INCIDENTS		
RISK: HIGH		
AREAS, COMMUNITIES OR HOUSEHOLDS MOST AT RISK:		

• Vehicles transporting hazardous materials such as radioactive, inflammable, explosive and toxic liquids and gases through Bitou are putting the town at risk by ignoring vital regulations governing the transport of dangerous goods. The N2 runs through the middle of Plettenberg Bay as it connecting corridor to the Eastern Cape, as well as other nearby Garden Route towns. The areas include residential as well as business areas flanking the highway on both sides; • There were incidences where trucks skipped the Toll Gate by taking alternate routes along the mountain from the Eastern Cape; • It was said that at any given moment 9 – 23 HAZMAT vehicles, with the potential of immediate impacts on communities, traverse through Bitou Municipality; • Transport routes, particularly the N2 on which Bitou Municipality relies heavily upon to traverse between areas; • Residential areas nearby, especially along the road network interface; • Biodiversity of concern such as Keurbooms and Bitou Estuary; • Communities or commercial complexes in the immediate vicinity of hazardous material installations; • Pedestrians; • Other drivers on road system; • Petrol stations close to main roads; • Major hazard depots such as Afrox Depot, Jet Fuel Depot around the Airport in Bitou Municipality; • There are plans for a potential harbor in Plettenberg Bay which could severely increase oil spill risks.		
Improve law enforcement	GRDM; BLM; Private HAZMAT companies; WCDMC	• Impose fines and higher license fees for offenders. • Improve roads and road signs. • Draft a MoU with BLM and registered HAZMAT cleaning companies. • Employ sufficient support teams to conduct frequent inspections. • Ensure fire extinguishers are in place and serviced regularly. • Provide training and special skills training. • Identify specialized role-players for HAZMAT cleaning.
Improve physical planning measures	Private companies; WCDMC	• Improve monitoring, restriction and management of routes for hazmat materials in transit (railways/roads). • Ensure availability of emergency decontaminators on site. • Plan for run-off from decontaminators. • Make adequate temporary storage available for high toxic/hazardous waste.
Strengthen engineering and construction measures	GRDM; DMC	• Identify containment sites and measures.
Improve management and institutional measures	WCDMC; GRDM DMC	• Ensure that each depot/industry has emergency temporary storage capacity.

Strengthen capacity to manage hazardous substance disposal and improve response to disaster events in relation to the spillage of hazardous substances	Private companies WCDMC	• Ensure that a plan is in place for the evacuation of people and the containment of spillage or fire. • Develop SOPs and conduct operational exercises. • Assess the needs of relevant agencies and procure appropriate equipment and materials. • Conduct annual table-top exercises.
Employ economic measures	BLM; GRDM; DEA&DP	• Fine service providers for indiscretions.
Implementation of higher order waste minimisation techniques should be implemented to minimise waste generation	DEA&DP; Consultant	• Companies generating hazardous and non-hazardous waste ensure that such waste is disposed of in an appropriate manner that does pose a threat to human health and the environment, especially the urban and rural poor. • Implement a uniform approach based on prescribed guidelines for the handling, storage and transportation of chemicals as well as hazardous waste by all Consumer-Formulated Chemical Industries. • DEA&DP to monitor the training of staff at the various companies to get an indication of the level of compliance and to identify facilities which may require support with regards to this issue. Monitoring of a proposed training programme for the staff at various companies can be used as an additional measure of compliance for the training component. • Circulate a list of good housekeeping techniques specific to a sector to all companies and assess the needs in terms of manpower, technical expertise and financial investment. This information provides the basis for the level of intervention required to assist these facilities. • Monitor the quality of all effluent and hazardous waste streams to determine the treatment regime required for stabilisation before disposal at a hazardous landfill facility. This requires an in-depth analysis of the exact composition of hazardous waste streams to ensure that the correct treatment regime is applied. The exact nature of this treatment regime is company and waste stream specific. • Ensure that all companies have a documented emergency plan.
HAZARD: MARINE POLLUTION/OCEAN SPILL AT SEA		
RISK: MEDIUM		
AREAS, COMMUNITIES OR HOUSEHOLDS MOST AT RISK: • All marine traffic, calling at South African ports or in transit around the coast, is at risk. Particularly smaller fishing vessels that do not carry transponders (see the South African Search and Rescue (SASAR) maritime area of responsibility;		

- Commercial activities such as fishing, refinery and aquaculture;
- Important breeding sites for endangered and threatened species such as penguins, gannets, cormorants and other seabirds. Sea birds are particularly vulnerable as they become water-logged and may drown. Others may lose insulation;
- Commercial considerations such as shellfish and seaweed collection, rock lobster catches, demersal and linefish landings;
- Illegal fishing vessels. Most go out in the evening and under any harsh conditions. Historically has not recognized traditional fishers. Rights application processes favored commercial operators and uneducated fishers lost out. Many resorted to poaching as a sole or supplementary source of income. 9 years since a successful Equality Court fight for legal recognition, the official Small-Scale Fisheries Policy has finally been implemented.
- Spawning and juvenile recruitment areas for species such as maasbanker and roundherring, hake, pilchard and anchovy;
- Rocky areas that cannot be cleaned;
- Nature conservation areas bordering the coastline such as Robberg. Estuarine environments are vulnerable since oil is likely to get trapped. A number of estuaries and lagoons which are important for bait organisms, fish, water birds and recreational amenities such as the Keurbooms Estuary.
- Beaches, recreational activities and marine developments;
- Although marine disasters are not the responsibility of local authorities their natural environment such as beaches, river mouths estuaries, lagoons and recreational facilities can be exposed to such oil pollution;
- New discoveries along the Outeniqua Basin can potentially increase the risk in the future.

RECOMMENDED ACTIONS	RESPONSIBILITY (IMPLEMENTING AGENTS)	COMMENTS AND MEASURES
Early warning system is improved to inform stakeholders	SAMSA; DEA&DP WCDMC	• Improve early warning systems to alert key stakeholders when a threat exists. • Complement early warning systems with professional training and capacity building activities and allocate resources to enable timely actions to avert loss.
Research, monitor and implement climate change adaptation measures	SAMSA; GRDM; WCDMC; SAWS	• Use heat-resistance construction and materials and ensure continuous inspection, repair and maintenance. • Adapt ship design, procure skilled labor and determine training requirements. • Integrate emergency evacuation procedures into operations. • Set up barriers and protection structures. • Relocate infrastructure and ensure the functioning of alternative routes. • Raise existing breakwater structures to counter additional overtopping. • Revise dredging maintenance programmes.
Implement pollution control and waste management measures in order to prevent, minimise and strictly control harmful discharges into coastal ecosystems	SAMSA; DEA&DP; DWS	• Map all point and diffuse sources of pollution in partnership with the relevant National Environmental Affairs and/or DWS for prioritized estuaries. • Coordinate DRR and management responses for pollution incidents for coastal areas and estuaries across relevant spheres of government. • Develop specialized databases. • Implement the national strategy for DRR and management responses for pollution incidents (oil spill contingency, sewage spills and load shedding and WWTW). • Impose higher fines on offenders.

Develop and implement water quality improvement programmes for prioritised coastal areas	SAMSA; DEA&DP	• Report on priority water quality interventions identified from reviewed EMPs. • Facilitate water quality improvement interventions. Establish fact-based climate change targets for this focus area. • Update contingency plans.

AIR POLLUTION

RISK: LOW

AREAS, COMMUNITIES OR HOUSEHOLDS MOST AT RISK:

- As can be deduced from the various sections above, a relatively small number of emissions sources exist in the Bitou municipal district;
- While everyone's health can be affected by air quality problems, certain people are especially at risk:
  - People with allergies or asthma.
  - People with lung diseases.
  - People with suppressed immune systems.
  - Children.
  - Neighborhoods located in the close vicinity of illegal waste disposal sites.
- Ambient particulate concentrations are likely to be high in low – income residential areas where wood is used as primary fuel source;
- The air quality in the Western Cape is generally good, except in localized areas where air quality can be poor at times;
- Mobile emissions are those caused by sources that are not stationary and can be grouped as follows:
  - Road traffic
  - Aircraft
  - Ships

  Of these the greatest risk is associated with motor vehicles as emissions occur more frequently in close proximity to people and are the only road traffic sources applicable to Bitou;
- Regardless of whether it is legal or not, some garden refuse burning activities occur within the GRDM and must be regarded as a notable source of air pollutants as a result of the wide variety of pollutants that are released and the nuisance created by the smoke produced;
- It is well known that municipal solid waste (MSW) disposal sites, or "tip sites" as it is generally referred to, are sources of significant emissions, the most prominent being methane (CH4) and carbon dioxide, both of which are known greenhouse gases. However, no MSW disposal sites are in operation as all such waste is transported to the new MSW disposal site in Bitou;
- Ambient particulate concentrations are likely to be high in low-income residential areas where wood is used as the primary fuel source and activities, such as refuse burning. Motor vehicle congestion in holiday towns results in elevated ambient concentrations of particulates and NOx. Pesticide spraying of crops results in local areas of poor air quality;
- High particulate concentrations are likely to occur in low-income residential areas where wood and other fuels are used for cooking and heating.

RECOMMENDED ACTIONS	RESPONSIBILITY (IMPLEMENTING AGENTS)	COMMENTS AND MEASURES

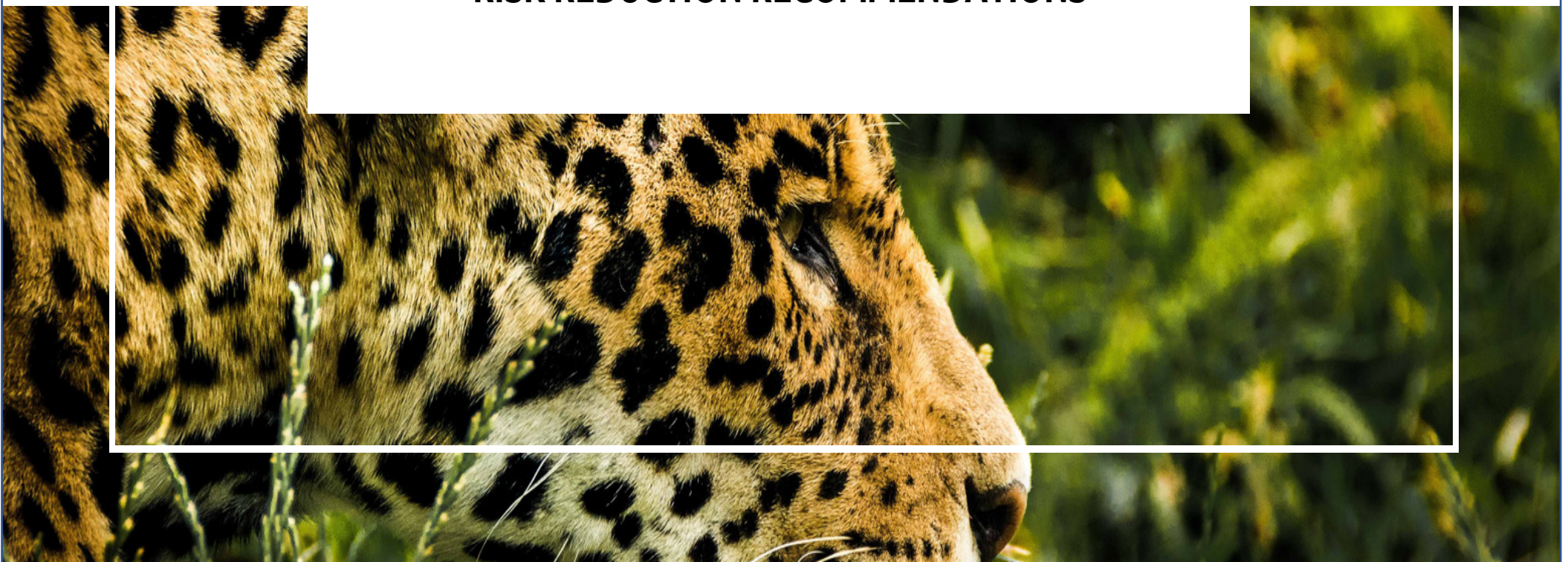
Improve residential air pollution	DEA&DP; BLM	• Establish an emission reduction strategy. • Liaise with fire services to assist in air pollution practices. • Develop an emissions inventory of waste burning sources (incinerators, sewage and waste water treatment works) • Obtain information from Fire & Rescue Department with regards approved burning permits, location of veld fires and extent of areas burnt, in order to maintain and update a database. • Apply lessons from the CoCT's Khayelitsha Air Pollution Study, on the control of particulate emissions at sources, throughout the Province, e.g.: paving of un-surfaced areas to reduce windblown dust, regulations to control tyre burning and improved service delivery to reduce waste burning. • Ensure all operating incinerators are permitted. • Maintain a current database of permitted and non-permitted landfill sites. • Compilation, approval and implementation of an air quality by-law for Bitou Municipality. • Ensure that industries/small businesses adhere to air quality by-law.
Town and transport planning	DEA&DP; BLM	• Create awareness amongst town and transport planning officials with regards to the synergies that exist between planning and air quality management. • Promote a shift from private to public transport modes. Provide low-income areas with access to electricity and/or off-grid renewable energy sources, and systematically upgrade informal settlements.
Pursue greater cooperation with agricultural authorities to address shared environmental priorities related to air quality management	DEA&DP; DoA; BLM; Organised Agriculture	• Participate in agricultural union meetings to promote air quality on their agendas and to identify opportunities to address emissions control issues. • Preliminary monitoring of identified 'hotspot' areas determines air pollutant concentrations and the contribution of agriculture to ambient air quality. • Establish measures to control emissions from these sources. Appropriately address crop spraying that occurs without informing citizens of the date, time and possible health impacts. • Replace the common practice of burning crops, waste, tyres, etc. for various purposes with more 'environmentally friendly' options that do not impact on air quality.
Strengthen institutional functions	DEA&DP; BLM	• Ensure that the division of roles and responsibilities between Local and District Municipalities is clearly understood by municipalities. • Attend and facilitate training and development in air quality management to the staff of the Environmental Management Section

		• Attend District Air Quality Officer 's Forum to engage in air quality and climate change related matters • Attend Provincial Air Quality Officer 's Forum to engage in air quality and climate change related matters • Attend National Air Quality Lekgotla to engage in air quality and climate change related matters • Conduct and facilitate environmental education sessions with civil society. • Develop context-specific AQMPs for BLM in order to address unique air quality management issues. The development of the AQMP and the associated implementation costs are motivated for through the Municipal IDPs. • Draft District and Local Municipality AQMP by-laws to ensure better management of air quality.
Increase licensing of listed activities	DEA&DP; BLM; Industries	• Train officials with regards to AQM and Atmospheric Emission Licensing. • Acquire and improve human resources. • Motivate for financial resources to administer the AEL function. • Streamline the atmospheric emission licensing process with the EIA and Town Planning authorization processes. • Increase the number of Emission Control Officer appointments at industries with listed activities. • Inspect all licensed facilities to ensure compliance with the AELs.
Ambient air quality data is continuously monitored	DEA&DP; BLM	• Use the results of the passive sampling screening programme to identify areas of possible air quality exceedances, where continuous monitoring should be implemented. • Report all emissions data using the South African Air Quality Information System (SAAQIS). • Adhere to municipal by-laws and industry standards. Address current limitations regarding in-house skills for maintaining and operating monitoring equipment and networks. • Sign Service level agreements with District and Province to assist with air quality monitoring within the Bitou municipal area
Update the emissions inventory regularly so as to ensure that the data remains current	DTPW; GreenCape; DEA&DP; BLM	• Investigate opportunities for alternative low-carbon transport fuels, including bio-fuels and lower-carbon modes of transport.

Intensify efforts to manage trans- boundary air pollution	DEA&DP; DEA; BLM	• Explore efforts to reduce emissions from the contributing sources. • Avoid developing new residential areas in proximity to agricultural areas that utilize crop spraying.
Strengthen capacity in air quality management within the Building Control section	BLM	• Provide continuous training and development
Compile an emissions inventory for BLM	BLM	• Maintain a database including traffic, industries, BLM fleet, agriculture, biomass burning, waste treatment and disposal. • Ensure all operating incinerators are permitted. • Maintain a current database of permitted and non-permitted landfill sites
Improve education and awareness	BLM	• Encourage the distribution of alternative forms of domestic energy. • Create awareness campaigns around the negative health • impacts of domestic fuel burning. • Compile an emissions inventory of all industrial sources • Compile an inventory of all small boilers.
Motor vehicle emissions	DEA&DP; BLM; GRDM	• Develop a Provincial strategy which includes a regular vehicle emission testing programme, in line with a license renewal programme; legislation that supports roadside vehicle emissions testing; strategies to control vehicle emissions, in line with ambient air quality standards; and strategies to effectively control VOC emissions. • Assess human health risk to air quality and reporting on air quality management and monitoring activities. • Research measures to reduce vehicle emissions e.g. implementing higher emissions and efficiency standards to reduce black carbon and other co-pollutants from fossil fuels. • Establish measures to control emissions from these sources.

ENVIRONMENTAL HAZARDS

RISK REDUCTION RECOMMENDATIONS



RISK REDUCTION RECOMMENDATIONS: ENVIRONMENTAL HAZARDS

HAZARD: ALIEN INVASIVE SPECIES (VEGETATIVE)

RISK: HIGH

AREAS, COMMUNITIES OR HOUSEHOLDS MOST AT RISK:

- Fynbos ecosystems are remarkably prone to invasion by alien woody species. Alien invasive species pose a strong threat to some bionomes, especially the fynbos. Fynbos is considered to be more susceptible to alien plant invasions than forest. Due to burning at a higher temperature, alien invasive species also heavily increases the risk of wildfires within the area;
- Conservation areas: Keurbooms River Nature Reserve; EC Soetkraal Nature Reserve; Robberg Nature Reserve; Plettenberg Bay Country Club; Wadrift Nature Reserve; Kiaruna Nature Reserve; Backenburn Nature Reserve; Annex Arch Rock Nature Reserve; Tsitsikamma National Park; Robberg Nature Reserve;
- Smaller areas of coastal vegetation are associated with estuarine and seashore habitats.
- Vacant and poorly managed public and privately-owned land (especially dry land);
- Areas along water channels and river beds;
- Invasive alien plant species (IAPs) suck up chunks of water in areas close to water sources;
- Agricultural land and commercial forestry plantations;
- Critically endangered vegetation such as Sand Fynbos: Knysna Sand Fynbos is susceptible to invasion by Port Jackson willow (Acacia saligna), species of gum (Eucalyptus), the Australian myrtle (Leptospermum laevigatum), and some annual grasses (such as Avena and Briza species).
- These represent a significant threat to midland and mountain fynbos ecosystems. Without natural enemies to control them, invasive alien species out-compete the indigenous plant species for space, nutrients and light:
- Pines and hakeas are the main invasive alien species affecting midland fynbos ecosystems. Long-leafed wattle (Acacia longifolia) and, locally, poplar (species of Populus) invade seeps and gullies in sandstone fynbos habitats. Gullies are also vulnerable to infestation by bramble (Rubus) in granite, hale, ferricrete, conglomerate and silcrete fynbos ecosystems. Species of gum (Eucalyptus) can be invasive on slopes in these ecosystems. Black wattle (Acacia mearnsii) can spread virulently along mountain streams;
- In addition, in many fynbos vegetation types the introduction of alien animal species such as the Argentine Ant (Iridomyrmex humilis) displaces the indigenous dispersal and pollinating agents that are vital for maintaining these ecosystems;
- Alien Invasive Species biomass collects and causes localized flooding which washes away bridges. This has occurred in Nature's valley and some of the rural roads. Without these roads, access is often an issue. High risk areas include: Nature's Valley, Groot River, and the Whole Uniondale road to Prince Alfred's pass (R40). One of the major contributors to this problem is inappropriate disposal of cleared IAP biomass. This creates a flood and fire hazard in the municipality;
- Areas of potential importance in climate change adaptation include:
  - Kloofs, which provide important connectivity and provide both temperature and moisture refuges;
  - South facing slopes, which similar to kloofs provide refuge habitats;
  - Topographically diverse areas, which contain important altitudinal and climatic gradients which are important for climate change adaptation as well as ensuring a range of microclimates are protected;
  - Riverine corridors, which provide important connectivity in extensive arid environments.

RECOMMENDED ACTIONS	RESPONSIBILITY (IMPLEMENTING AGENTS)	COMMENTS AND MEASURES
Delineate riparian zones according to the DWS policy	DWS; DEA&DP; DoA WUA; Organised Agriculture; WWF-SA	• Re-establish riparian zones with indigenous vegetation. • Provide incentives for farmers to conserve riparian zones. • Create a 30 m buffer zone between agricultural lands and rivers. • Identify priorities for conservation of biodiversity within rivers. • Strengthen collaboration between research institutions, industry and government on invasive alien species research issues.
Fund alien clearing projects	BLM; EPWP DWS DEA&DP; DoA	• Invasive alien plants create opportunities for job creation and income generation. • Formulate and implement property rates policies that promote/provide incentives for responsible environmental and resource management e.g. alien clearing and fire • management.
Ensure that the management of IAPs is consistent with the relevant legislation	BLM; DEA&DP; DoA; DWS; EPWP	• Understand and address the legal and policy constraints. Implement incentives, where possible, to encourage compliance. • Recommend adapting and improving legislation. • Address legal and policy constraints. Increase compliance with legislation.
Facilitate the development of a protocol to inform prioritisation decisions based on scientific research findings	BLM; DEA&DP; DoA; DWS; EPWP; Consultant	• Planning is coordinated on a regional scale to improve IAP management. • Catchment management tariffs are internalized and / or the costs and methods related to alien invasive clearing are considered.
Targeted clearing secures the ecological flow requirements of the rivers and estuaries	BLM; CapeNature; DEA&DP; SANBI	• A quantification of IAPs impacts, as well as an understanding of the management needs, occurs on the basis of ongoing and comprehensive monitoring – both the mapping of the extent of invasions, and monitoring of the actual benefits of rehabilitation. • Maps are updated regularly. • The estimates of the actual IAP extent in the Western Cape Province, and the impact on water resources, are improved. Estimates include species, location (key area, and position in the landscape), and density.
Prevent new IAPs establishing or spreading through early detection and rapid response	DEA&DP DoA DWS; BLM; EPWP Consultant	• Continue to strengthen control of IAPs in response to pathway analysis and risk assessments. • Facilitate the development of best practice guidelines for early detection and rapid response. • Predict spread rates and potential new infestations based on susceptible land use e.g. plantation forestry. • Ensure that new species with invasive potential do not enter via identified pathways. • Best practice guidelines are compiled and implemented.

		• Risk management practices are implemented.
Maintain and update an accessible endemic species list	CapeNature DoA; SANBI; BLM	• Support research to determine and develop an understanding of the impact of climate change on invasive alien species and incorporate most recent findings into management plans. This will assist with the restoration of ecosystems degraded by invasive species. • During programmes, consult and update the list of IAPs frequently. • New invasive species infestations are detected early and new • infestations are eradicated regularly.
Guidelines for future monitoring projects to assess for the efficacy of rotenone treatments with regard to removing alien fish, and for monitoring the responses by macro- invertebrates and fish to these treatments	CapeNature; DEA&DP; SANBI	• Sampling recommendations include: appropriate sampling periods, site selection and number of sampling sites, water quality parameters and site descriptions. • Recommendations for assessing fish communities make use of multiple sampling methods (snorkel survey, underwater video and electro fishing) to assess fish diversity and abundance. • Invertebrate sampling methods include the use of the SASS 5 scoring system and stone samples to provide the best quantitative data for monitoring.
Collaboration between government departments is ensured by means of appropriate institutions, agreements and/or joint decision-making mechanisms	CapeNature; DEA&DP; DWS; DoA; SANBI	• Lines of responsibility for biological invasions costs are clearly defined and agreed upon, based on the "polluter pays" principle. • For alien species that are already within the country, the focus should be on those species where control would have the greatest chance of reducing projected impacts that would arise from invasion debt. • An imperative is to focus on species that are known to be problematic, or are predicted to increase.
Investigate possible alternative uses for biomass such as for energy or building materials	BLM; DEA&DP,	• Post clearing biomass, particularly the woody component, has a significant potential for reuse as raw material in a wide range of fields. UNEP9 states that the total available biomass of invasive plants in 2004 was estimated to meet the annual requirements for all of South Africa's pulp, paper, and board mills. There are other opportunities for use of resultant biomass from alien vegetation, including conversion to energy from projects such as the production of biofuels, charcoal and biochar. • Other options for using biomass include the Working for Water's Value-Added Industries Programme whereby wood is made available for processing, such as for building materials, indoor and outdoor furniture, screens and blinds, wooden toys furniture and fencing and even coffins and wood-sheet boards for insulation, all creating jobs, especially in rural areas. • There is thus a vast market for cleared alien vegetation which can increase local economies, provide jobs and opportunities for employment beyond the jobs created by the clearing operations and therefore promote social upliftment on a wider scale.

REDUCING ENVIRONMENTAL VULNERABILITY: BIODIVERSITY PROTECTION

RISK: HIGH

AREAS, COMMUNITIES OR HOUSEHOLDS MOST AT RISK:

- Bitou has one of the largest percentages of formally protected land of any municipality in South Africa. This land is incorporated in the Garden Route National Park and comprises mountains, inland plateaus, a coastal corridor and a marine reserve. Large parts of the Bitou Municipality are currently under conservation. • The municipality is home to some of the most pristine parks in South Africa and areas with very high conservation status;
- The vegetation status of Critically Endangered and Endangered vegetation types should receive priority. These areas should be properly managed to improve their status: Specific attention needs to be given to: The Endangered areas north of Kranshoek and Plettenberg Bay, South-East of Kwanokuthula, Western region of The Crags; and, The Critically Endangered alluvial vegetation east of Wittedrift;
- The Bitou Municipality is also home to the following parks and protected areas:
  - National: Keurbooms River Nature Reserve
  - Provincial: EC Soetkraal Nature Reserve; Robberg Nature Reserve
  - Private: Plettenberg Bay Country Club; Wadrift Nature Reserve; Kiaruna Nature Reserve; Backenburn Nature Reserve; Annex Arch Rock Nature Reserve.
  - Marine Protected Areas: Tsitsikamma National Park, Robberg Nature Reserve.
- Key priority coastal and marine areas or special habitats that fall within the Bitou Municipality:
  - The area from Noetsie to Toegroeiberg, east of Kranshoek (Knysna and Bitou Municipalities);
  - The marine extension of the Piesang River Mouth at Plettenberg Bay (Bitou Municipality);
  - The marine extension of the mouth of the Keurbooms Estuary (Bitou Municipality);
  - The area extending from east of Keurboomstrand to the western boundary of the Tsitsikamma National Park (Bitou Municipality).
- The Bitou Municipality contains the large Keurbooms River Estuary located to the east of the town of Plettenberg Bay. It is separated from the sea by a coastal barrier, which has a tidal inlet linking it to the sea. It is an important nursery area for fish, is home to the Knysna Seahorse, and is ranked number 16 in South Africa in terms of conservation importance. The Bitou Estuary, which feeds into the Keurbooms, has a unique mixture of plant and animal species, and no alien fish species. This system supports several important fish species, e.g. Eastern Cape Redfin (Pseudobarbus afer). The river and estuary are also home to several red data bird species). Bitou/Keurbooms estuary is a highly sensitive environment and its ecological health is essential to the economy of this mainly tourist town as a recreational resource and for its natural beauty;
- The Bitou wetlands located near the N2 Bridge are consider to one of the last undeveloped floodplains along the Western Cape coast and the most valuable ecological resource of the entire catchment. They comprise a series of typical open freshwater marsh systems, supra- and inter-tidal saltmarsh, river channels and the Bitou Estuary channel itself.
- The forests are very rich in plant species and are highly conservation worthy. They are protected by the National Forest Act occurring throughout all 3 municipalities.
- The Brak and Salt River Mouth enter the Indian Ocean to the west of Nature's Valley, where the Groot River (west) estuary is periodically open to the sea. The Groot River has important saltmarsh beds, two red data fish species and is a relatively diverse and pristine system. Two Lagoons, the Helpmekaar and Kliprivier, are located just east of the Groot River.
- Salt River – in an ecologically healthy and natural state. It's ecological and importance sensitivity rating is Very High, requiring a high level of protection.
- Roodefontein Grassy Fynbos – This is a Critically Endangered Fynbos vegetation type that grows only in the Bitou Municipality, and nowhere else.
- Bitou Corridor (includes the Bitou and Keurbooms Rivers) – is vital in maintaining ecological processes, which in turn, increases resilience against climate change.
- Ericaceous Fynbos: This habitat grows on the steep upper mountain slopes and serves an important water catchment function. It is the source of most perennial streams.
- Most of the shale fynbos in the municipality has been classified as Endangered by SANBI with a small core near Wittedrift in the flood plain classified as Critically Endangered Riverine Saltmarsh: This is an important habitat for estuarine species living in the Keurbooms Estuary (Bitou Municipality) and the Groot River Estuary (Bitou Municipality). There are already a number of private nature reserves serving as precedent, particularly in the Keurbooms, Kurland area. The Wadrift Private Nature Reserve north of Wittedrif is conserving some of the Critically Endangered Shale fynbos in this area. Endangered Shale Fynbos is also found in the Piesang Valley. The Plettenberg Bay Country Club Private Nature reserve is found here and could form the core of a complex of private nature reserves in this vicinity.
- Knysna Sand Fynbos is considered critically endangered;
- Bio-physically the municipality is extremely diverse comprising;
  - three major river valleys; Piesang, Bitou, and Keurbooms;

- the forest covered Tsitsikamma mountains to the north; and,
- a varied coastal corridor comprising rocky headlands, flood plains, estuaries and sandy beaches.

- Endangered vegetation is competing with cultivated land and urban development. This competition is particularly evident in the built footprint of Plettenberg Bay as well as the Wittedrift Valley, which means that development needs to be sensitive to this;
- The valley regions of the municipality appear to be endangered, including the Piesang Valley and Bitou Valley;
- Endangered and Endemic Species: Bretton Blue and Knysna Skolly butterflies are critically endangered and other species endangered; Knysna Seahorse (critically endangered), Grysbok, Blue Duiker, Leopard and Honey Badger etc. Many bird species: African Marsh Harrier; Blue Crane; Lesser Kestrel. Martial Eagle. Peregrine Falcon. Knysna Spiny Reed Frog; Blue-spotted Girdled Lizard; Pulmonate/False Limpe; The nationally protected Pansy Shell and the rare Knysna Sandgoby; Cape Kurper; Eastern Cape Redfin; Slender Redfin

RECOMMENDED ACTIONS	RESPONSIBILITY (IMPLEMENTING AGENTS)	COMMENTS AND MEASURES
Source funding for long-term climate change research projects	GRDM; BLM; DEA&DP; Consultant	• Ensure that research addresses local climate change impacts with a firm scientific monitoring and evaluation of the impact thereof. • Ensure that ecological risk assessments evaluate the likelihood of adverse ecological effects caused by stressors related to human activities.
Implement conservation plan for protected and critical biodiversity areas (terrestrial, forest and aquatic)	GRDM; BLM; DEA&DP; Cape Nature	• Prohibit transformation of areas of Critically Endangered or Endangered natural vegetation. • Protect the biodiversity and ecosystem functioning of the Conservation Area. • Protect the distinctive landscape character of the area. • Promote sound management of natural resources. • Permit use of natural resources if and only if such use would be sustainable and would not jeopardize biodiversity conservation. • Safeguard areas identified as important for key ecological and evolutionary processes. • Eradicate alien invasive species. • Promote the restoration of degraded or disturbed areas. • Promote awareness of the significance and uniqueness of natural vegetation and ecosystems of the area amongst local landowners and communities, visitors and tourists
Include landowners in biodiversity protection	ABI; BLM; DoA Farming Associations	• Encourage landowners to register their highly biodiverse land conservation status, which may include tourism activities to provide income to manage the land. • Ensure that areas outside of Critical Biodiversity Areas are still managed to improve their biodiversity and veld carrying capacity through rotational grazing methods. • Remove invasive alien species as required by set standards (obtain advice from CapeNature or Working for Water).
Honey bee populations are protected	ABI; DoA; Consultant	• Ensure that chemicals are used cautiously.

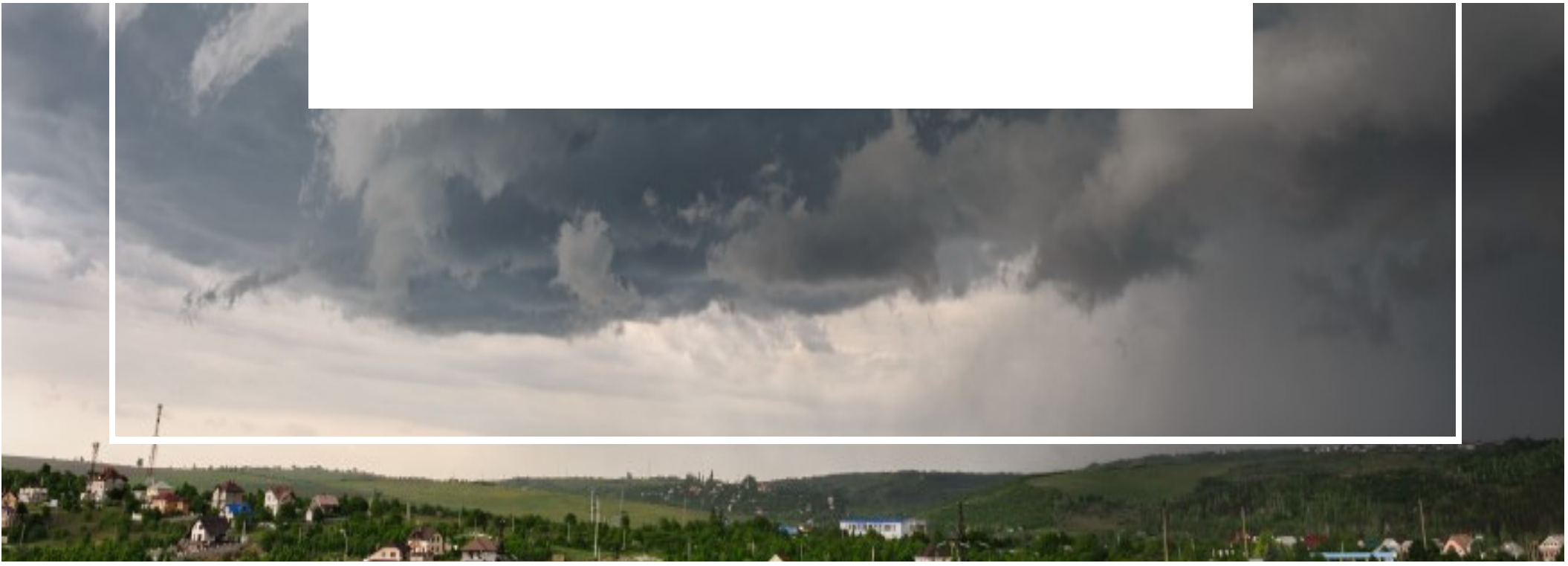
		• Promote foraging sites and avoid the unnecessary clearing of virgin land. • Plant bee-friendly plants. • Ensure that bee farmers are registered and their hives inspected in order to protect horticultural industries. Ensure that the industry receives direct financial support from government.
Support aquaculture farming without compromising the conservation of indigenous fish species	DAFF; DEA&DP; DoA; CapeNature	• Factors that address resilience in freshwater ecosystems include preventing water quality impacts, maintaining and managing adequate riparian corridors and setbacks from adjacent land-use, controlling invasive alien plant spread and ensuring that natural biodiversity patterns and processes are maintained.
Avifauna is monitored	ABI; CapeNature SANParks; DEA&DP	• Implement a monitoring programme for coastal and inshore birds. • Ensure that substantial research and surveys into the food supply of endemic species receive attention.
Develop a conservation plan for coastal areas	BLM; Consultant CapeNature; Tourism	• In addition to the more obvious seaside attractions of the coast such as the beaches, surfing and fishing are opportunities for a strong overlap between biodiversity conservation and wilderness tourism. • Market conservation and wilderness tourism. • Prohibit construction (or other unnatural disturbance) in sand movement corridors, on foredunes or in mobile Dunefields. • Monitor species composition and abundance of shore birds, as assessed by a specialist.
Awareness and education on the importance of habitat protection	BLM; CapeNature, DoE; WESSA	• The CWCHS already has a number of marine conservation areas aimed at protecting marine habitat and key marine species, including the Marine Big Five • As with all conservation, environmental education is key to ensuring that the public is aware of threats to habitats and species.
Improve institutional capacity	CapeNature	• Appoint skilled staff to undertake site assessments or to stay up-to-date on the latest science innovations. • Set up of a system whereby all approved development • footprints as well as areas with improved conservation security are spatially captured.
Apply indicators to assess and monitor ecosystem health	CapeNature; Consultant	• Assess and monitor the abundance, health and distribution of threatened species populations and other species of conservation concern (as per the Red List and annual online updates), with benchmarks determined by a specialist. • Contract a specialist to assess the type, age and condition of indigenous plant cover, species richness and the presence of key ecological guilds (groups of plant species that use resources in similar ways).
Improve endangered and endemic animal conservation	ABI; CapeNature; SANBI; SANParks; DEA&DP	• Continue to collect distribution data on all Threatened and Near Threatened WCP butterfly, animal, bird and reptile species.

		• Create and maintain sensible firebreaks and tracer belts. More generally, ensure that the prediction responses to climate change incorporate temperature variation and precipitation regimes and not only changes in average temperature.
Apply unmanned aerial vehicle (UAV) in monitoring programmes	CapeNature; SANParks; DEA&DP	• UAVs provide low-cost and low-impact solutions to environmental managers working in a variety of ecosystems. Drones used for these purposes are referred to as 'eco-drones' or 'conservation drones.' Their agility and quality imaging abilities make them an advantageous mapping tool for environmental monitoring.
Manage invasive alien species before it impacts on indigenous biodiversity and ecosystem functioning escalates	ABI; SansPark; CapeNature; WfW; DWS; DoA; DEA&DP	• Ensure that of clearing contracts are aligned with areas identified for prioritization. • Compile data on current levels and extents of infestation and clearing history and ensure that the data standards are maintained. • Through constant vigilance, assist in identifying new and potentially invasive plant species. • Prioritize restoration and clearing of invasive alien species in degraded habitat linkages that would otherwise be lost if neglected.
A comprehensive fish conservation plan for the WCP with clear goals and project plans is developed	CapeNature; WWF; Consultant	• Initiate a study to quantify the effects of agrichemicals, with a focus on pesticides in critical fish conservation areas. • Implement river rehabilitation interventions, including the management of alien fish populations, in priority conservation areas following comprehensive stakeholder engagement.
Research climate change impacts on insects	ABI; DEA&DP; CapeNature; Consultant	• Compile a coordinated inventory for arthropod species for the Western Cape, which includes information on endemism and threat status of species. • Undertake specialist studies and monitoring, as this provides much needed information.
Improve wetland status	BLM; DEA&DP; GRDM BGCMA;	• Investment in the maintenance of healthy wetlands (such as Bitou Wetlands) and the rehabilitation and restoration of damaged or degraded wetlands will not only ensure wetland resilience to climate change but will ensure increased resilience of the BLM and GRDM to the impacts of climate change. • All wetlands are protected under the National Water Act (Act 36 of 1998). • Delineate all wetlands within 500m of a land use activity as per DWAF (2008), and apply for a Water Use Licence. • Conduct a buffer determination assessment around all wetlands, regardless of ecological condition or ecosystem threat status. Refer to the NFEPA Implementation Manual for specific guidelines (for example, mining should not take place within 1 km of the boundary of the buffer around a wetland.
Protect the Estuaries (Bitou/Keurboom, Groot and Piesang)	BLM; GRDM; WUA; Tourism	• Maintain freshwater flow regimes that are as close to natural as possible; it is of the utmost importance to maintain low (dry season) flows, seasonality and flood frequency. • Maintain the minimum freshwater flows (i.e. the Ecological Reserve) required for maintenance of estuary health and protection of estuarine biodiversity.

		• Maintain and monitor water quality, particularly the quality of freshwater inputs. • Maintain mouth dynamics (opening and closure) that are as close to natural as possible. Any form of artificial mouth management should form part of the holistic estuary management plan. • Ensure that harvesting or utilization of living estuarine resources (flora and fauna) is kept within sustainable limits. Prevent poaching of organisms. • Encourage land use practices that minimize loss of natural habitat and erosion, and avoid the introduction of habitat-altering invasive alien species of plants and animals (such as large predatory fish). Where stands of invasive alien vegetation are present around the estuary or in its catchment, implement appropriate clearance programmes.
PREDATION		
Support and market the diversification for farming development	DoA; DAFF; GRDM; BLM; Organised Agriculture; NDPW	Support coastal towns that have the potential to strengthen their aquaculture value chain. Ensure that marine Aquaculture, in particular abalone farming, is further developed since it has a number of advantages, including: a very favourable natural environment (coastline); an enabling local government environment for development; and an excellent profile for renewable energy, especially solar and wind. Thousands of jobs are created through the development of abalone farming.
Improve spatial risk mapping of predation	DoA; PMF; Consultant	Appoint a service provider to spatially map the distribution and location of various predator species. Circulate the data to stakeholders.

CLIMATE CHANGE

RISK REDUCTION RECOMMENDATIONS



CLIMATE CHANGE ADAPTATION/RISK REDUCTION RECOMMENDATIONS

CLIMATE CHANGE ADAPTION

AREAS, COMMUNITIES OR HOUSEHOLDS AT RISK:

- Climate modelling for the Western Cape unanimously show that future increase temperatures across the region are almost a certainty. The greatest increases are likely to be inland with the lowest increases being along the coast, due to a moderating effect from the oceans. Projected average temperature changes for the 2040– 2060 periods are in the range of 1.5°C to 3°C, depending on the model and the location. Extreme temperatures increase on either side of the average range are also expected.
- Fluctuating rainfall patterns will cause damage to infrastructure through changes in precipitation volumes and spacing. Periods of low rainfall will put strain on municipal infrastructure systems. Particular attention should be paid to areas where dwellings and municipal infrastructure occur on dune systems close to the shoreline as well as low lying areas of settlements near floodplains. Applications for new developments in low lying areas should be scrutinized for possible vulnerability to the effects of climate change.
- Climate change is associated with the potential increase of storms, winds, flooding, drought; coastal storm surges, epidemics, and veldfires. Therefore, areas already prone to flooding, wildfires and areas with emerging flood and/or fire risk.
- Coastal areas;
- Riparian land;
- Projected climate change impacts relevant to biodiversity in the GRDM includes:
  - Changes to wetland and estuary ecosystems due to sea level rise, erosion and saline intrusion;
  - Changes in the distribution of invasive species and associated loss of biodiversity and altered veldfire intensity;
  - Changes in the geographical distribution of indigenous fauna and flora;
  - Increased risk of species extinction;
  - Reduced ecosystem resilience;
  - Increased stress on ecosystems and ecosystem services; and
  - Changes in habitats due to saline intrusion.
- Many poor people live in rural areas and rely on subsistence agriculture and fishing to support their livelihoods. The impact of climate shocks and stresses are therefore likely to have negative implications for their food security, human capital, health and overall welfare. Many of these areas have unreliable access to safe water and water-related services which, along with high levels of existing food insecurity, will be negatively impacted by climate change.
- Climate change also has implications for the urban poor and for rural-urban transition zones such as informal settlements. Most informal urban settlements are built illegally and without formal planning. Limited availability of potable water and water/sanitation services, high child and infant mortality rates and a very high disease burden (malaria, tuberculosis, diarrhea etc.) are common characteristics of such informal settlements. Planning for climate change in such situations will be extremely challenging, particularly as governments have limited authority and capacity to address the risks posed by existing hazards.
- Differences in the level of vulnerability and degree of exposure to climate-related risks and hazards tend to arise from non-climatic factors. Heightened vulnerability is rarely due to a single cause but is the product of intersecting social processes that result in multidimensional inequalities caused by uneven development processes (very high confidence). Such processes include, for example, discrimination on the basis of gender, class, ethnicity, age, and (dis)ability. People who are socially, economically, culturally, politically, institutionally, or otherwise marginalized are especially vulnerable to climate change and have less capacity to effect adaptation and mitigation responses

MUNICIPAL INFRASTRUCTURE

The Garden Route District has a significant amount of infrastructure and settlements located near or on the coast. Based on sea-level rise scenarios combined with the risk posed by coastal erosion, the majority of the GRDM's coastal infrastructure is at risk. This includes recreational facilities, water management infrastructure and transportation infrastructure such as ports and road networks. Increased intensity of precipitation events and increased temperatures associated with climate change will require the GRDM to incur increasing costs for maintaining, replacing and upgrading infrastructure such as roads, water and sewer systems. In general, the management of municipal infrastructure comes with many challenges which are often compounded for smaller municipalities with limited resources. These challenges are posed by the management of ageing infrastructure, population growth or decline, public demands, regulations, liability and risk management. To date most of the municipalities in the GRDM have implemented a reactive approach towards infrastructure management. In order to provide reliable levels of service, municipalities will have to review how they plan, design and manage their infrastructure to incorporate climate change considerations:

Exposed municipal infrastructure:

- Transportation: roads, culverts and bridges;
- Buildings: residential and commercial/industrial;
- Critical infrastructure: Fire Stations; Hospitals; Schools; Police Stations; Emergency medical services; and Water treatment facilities. Critical infrastructure close to rivers and estuaries may have to be moved further inland or away from stream banks as a result of climate change;
- Storm & Wastewater Infrastructure: Pipes; Manholes; Storm water Management Facilities; Lift/Pumping Stations; and Outlets;
- Water Distribution Network Water mains under bridge;
- Flood Protection Structures Dams; Coastal protection; Flood walls; Bridges and culverts; and Channels.

RECOMMENDED CLIMATE CHANGE ADAPTATION ACTIONS	RESPONSIBILITY (IMPLEMENTING AGENTS)	COMMENTS AND MEASURES
Develop user-friendly sources of information on climate change	BLM Libraries; GRDM; DEA&DP; DWS DoA; DoE	• Maintain and promote a credible, accessible, user-friendly and up-to-date information portal for building a more climate-resilient community, with links to other sectoral and private portals. • Maintain a central portal/knowledge hub to disseminate climate change information. Make stakeholders aware of where they can access information on climate change. Promote climate change knowledge-sharing at grassroots level, e.g. capture and make available local knowledge and institutional memory relating to climate variability, impacts and responses. • Ensure that communities are aware of changes in weather patterns and that households know the appropriate actions to take. • Identify a community advocate to communicate local adaptation needs with authorities.
Mainstreaming climate change into municipal planning through the Garden Route District Municipality Climate Change Response Framework	GRDM; BLM; ABI	• Through the establishment of partnerships, secure the implementation of climate change mitigation and adaptation projects.
Strengthen spatial information on climate change	WCDMC; DEA&DP; BLM	• Develop maps of possible climate change impacts, focusing on parameters with lower uncertainty, and which can be more easily interpreted and used for shorter term assessments.
Climate risk management is integrated into all local planning and regulatory processes	BLM	• Incorporate risk assessments for flood, run-off, slope failure and subsidence into development planning. • Tighten land-use regulations to avoid further unravelling of protective environmental services.
Reduce GHG emissions	WCDMC; DEA&DP; Sector Depts.; DoA BLM	• Reduce energy consumption and switch to renewable energy sources (wind, solar, biogas). • Sequester carbon through land-based interventions such as restoring rangelands, reducing degradation of soils and land cover, and promoting conservation agriculture. • Assist farmers to adopt low carbon footprint strategies that render them more competitive in export markets. • Observe growth in renewable job sector. Promote Conservation Agriculture (with partners). • Promote reduction of energy consumption and switch to renewable and energy efficiency where feasible. • Transition from measuring carbon footprints to reducing them, with appropriate policy support.
Strengthen climate data and services	SAWS; CSAG; CSIR DEA&DP	• Strengthen existing weather forecasting services and assess the feasibility of new forecasting services to more effectively deal with climate variability under climate change. • Provide effective leadership in negotiations concerning open access to data and data integration.
Improve institutional capacity at municipal level	DEA&DP; BLM	• Address climate change mitigation measures in the Municipal SDFs and mainstream energy efficiency and demand- side management in settlement design and upgrading.

Planning stresses urban infrastructure as central to the protection of assets amongst poor and food insecure communities	DoA; Research and training institutions; GreenCape; WWF-SA; DAFF; DEA&DP; DoH	• Periodically assess the effects of climate change on current and future disaster risks and uncertainties. • Integrate knowledge of changing risks and uncertainties into planning, policy and programmes to reduce the vulnerability and exposure of people's lives and livelihoods. Strengthen collaboration and integration between stakeholders working on climate, disasters and development. • Increase the collaboration between agriculture and health with regards to the occupational climate change risks of agricultural workers. • Retrofit infrastructure to accommodate extreme weather events (e.g. flooding) in settlements where vulnerable communities cannot be relocated.
Implement a simple and effective mechanism to raise adequate finance for climate change response projects	BLM	• Apply economic instruments in the form of subsidies across sectors, including a variety of policy designs such as tax rebates or exemptions, grants, loans and credit lines. • Incentivize proactive climate change disaster risk reduction. Promote the green economy as an effective means of contributing towards climate change responses, and secure resources to support these interventions. • Consolidate and extend existing initiatives towards a climate resilient economy. • Overcome operational hurdles to create long-term investments. • Develop a high level of capacity and expertise to access International Climate Finance, which will lead to the drafting of successful project concepts/ bankable proposals. • Address challenges relating to high upfront costs and long pay back periods when implementing technological changes. • Assess the accuracy of projected returns to finance investment in climate change response projects in relation to new or alternative technology.
Development of DAFF's fisheries climate change adaptation plan	DAFF; DEA&DP	• Reduce overfishing, habitat degradation, pollution and other anthropogenic factors and improve fisheries management to make the sector more sustainable and more adaptable to climate change.
Promote and expand conservation agriculture	DoA; DAFF Organised Agriculture	• Address existing financial hurdles and create long-term financial incentives to sustain the expansion of CA practices. • Initiate research to optimize mixed crop-livestock climate adaptation farming systems, with training opportunities. • Initiate short- and long-term projects to develop less costly • Climate adaptation technologies aimed at implementation on subsistence and smallholder vegetable farms, with training opportunities for farmers. • Appeal to National Treasury and DEA&DP to include CA in the national Carbon Tax Framework and potential carbon offset mechanisms. • Promote the development of financial and crop insurance products linked to climate adaptation practices.
Integrate climate change into joint disaster planning and strengthen disaster relief mechanisms	SAWS; DEA&DP WCDMC; Provincial Treasury; Insurance companies	• Incorporate climate change risks into disaster planning and optimize internal and external co-operations. • Improve early warning systems in cooperation with stakeholders. • Streamline and speed up rapid response mechanisms (including fast-release of financial aid) to address climate- • related disasters.
Lead strategic research partnerships	DEA&DP; DoA GreenCape; WWF-SA; DEDAT; Consultant	• Promote and incentivize practical, locally relevant research on climate change impacts, adaptation and mitigation. • Identify key research areas and deliver this information to the Cape Higher Education Consortium (CHEC).

		• Jointly map research gaps against current data availability and knowledge, and then identify new research needs for targeted focus and implementation. • Conduct and disseminate case studies for different contexts concerning energy efficiency improvements and for renewable energy implementation. • Among the urgent research needs are those that may lead to reducing uncertainty, both to better understand how climate change might affect groundwater and to assist water managers who need to adapt to climate change. • Therefore, focus research on reducing uncertainties in understanding; observations and projections of climate • change and its impacts; and vulnerabilities.
Climate-proof future projects	DEA&DP; DoA; DWS; GreenCape; BLM; GRDM	• Build and maintain infrastructure to increase resilience to extreme weather events. • Incorporate climate change into the situational and risk assessment for each Agri-Park being developed in the Western cape. Prioritize climate-resilient crops and livestock and resource-efficient processing options in Agri-Parks. • Conduct climate change risk assessments for critical infrastructure and design new infrastructure with the future climate in mind, so as to reduce potential risks. • Improve climate science-supported decision making. "Stress test" various systems to identify the key risks and critical thresholds for understanding the climate risk. Based on the "stress test" results, design monitoring systems to provide early warning or risk-based decision making for future management options. • Recognize and further research the uncertainty inherent in multi-model climate change projections, and particularly in projecting possible changes in climate-related hazards over short, medium and long term, and distil this information into clear and actionable messages.
Increase ecological infrastructure to slow, spread and sink water run-off	BGCMA	• On-farm furrows and swales, contour farming, improving the biodiversity status of wetlands and riparian areas, gabions. This will allow more water infiltration into soil and groundwater and decrease flood impacts.
Water-related infrastructure responses	BGCMA	• Implement water re-use: To increase overall water supply and security. • Investigate alternative water desolation options e.g. wave/wind/solar power. • Investigate alternative water storage options e.g. underground/dam expansion where appropriate.
Replace retrofit/upgrade infrastructure	Road and stormwater Engineering	• Replace damaged/destroyed infrastructure. • Retrofit municipal infrastructure for increased energy efficiency. • Upgrade infrastructure to be hazard resistant e.g. raised electrical boxes at camp sites. • Increase the capacity of storm water systems • Build defensive infrastructure e.g. groynes and dolosse off shore reefs and stabilize river banks. • Increase maintenance of roads and storm water systems.
Environmental planning, conservation and management	BLM; Cape Nature; GRDM; SANBI	• Expand conservation areas where appropriate, encourage private landowners to practice conservation practices. This will contribute to carbon sequestration. • Develop and implement coastal management programme including dune management to provide buffers to extreme storm surges and sea level rise. • Implement EMPs. • Regulate groundwater abstraction to prevent over- abstraction of groundwater and improve water security.
Relocate infrastructure	BLM; DHS	• Relocate infrastructure way from flood plains/areas prone to flooding/other risk areas. • Decentralize strategic infrastructure in order to ensure sea level rise or extreme events do not affect large

		areas.
Environmental rehabilitation	BLM	• Rehabilitation of degraded natural areas or abandoned farmland to contribute to carbon sequestration, flood attenuation, improved flow rates and decreased disaster risk. • Rehabilitation of water catchment areas. • Wetland/flood plain/estuary/dune cordon rehabilitation.
Improve municipal open space management	BLM	• Ensure trees are trimmed and planted away from overhead line structure. • Plant wind breaks. • Focus on urban greening to improve flood attenuation and air and water quality.
Risk and vulnerability mapping	BLM	• Map areas that are at high risk from fires, flooding, extreme winds, sea level rise and/or storm surge. • Assess informal settlements for climate vulnerability.
Pollution management	BLM; Consultant	• Manage potential point source pollution. Conduct water quality monitoring. • Develop and implement air quality management plans that take climate change into account.
Improve public environmental awareness and coordination	BLM; Libraries	• Create green information hub for collection of all data. Find ways to engage private sector in this process. • Increase public awareness on the impacts of climate change and benefits of best practices environmental management.
Health management	BLM; DoH	• Raise awareness on health impacts from extreme heat – symptoms, what to do prevent and treat, target vulnerable groups. • Research and increase medical preparedness and rapid response as well as general awareness on potential changes in disease incident/vectors due to climate change. • Implement family planning programmes to decrease the population growth rate, emissions and impact on natural resources.
Water management to improve water security and disaster preparedness	BLM; BGCMA	• Diversify water sources to reduce dependence on surface water as the only source available during drought periods. Develop drought management plans for areas that don't already have such plans. • Increase drought awareness, • Continual water demand side management to increase preparedness for dry periods. • Develop and implement catchment management strategies.