



CLIMATE CHANGE RESPONSE STRATEGIC PLAN (MITIGATION & ADAPTATION OPTIONS)

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DRAFT CLIMATE CHANGE RESPONSE STRATEGIC PLAN (MITIGATION & ADAPTATION OPTIONS) FOR UTHUKELA DISTRICT

Background

This Climate change response plan has been set for UThukela District, in spheres that the different departments and components within the district municipality have direct control over and are able to influence. Responding to climate change will require collaboration with a number of sector departments and the municipalities, these have been noted here. Secondly there is clear and distinct need to educate and inform the residents of the UThukela district of the dangers of Climate change as well as explaining why some infrastructure developments are designed and built with the anticipated effects of climate change.

The need for a climate change response plan for the district

There is an overwhelming consensus amongst scientists that climate change is real, and human induced. Although the over the history of the earth, global temperature variations have occurred, it is the rate of change in the last 150 years that is most alarming.

It is widely accepted that the impact of the change in chemistry and associated warming is at a global atmospheric level, the impacts will be felt at the local level. As a result, the forecasts and predictions produced by atmospheric modeling data are very helpful in allowing the district to plan at the local level. As with all science, over time the accuracy should improve, but this detail should support decisions taken to minimize the loss of livelihoods, as well as the infrastructure that allows the residents of UThukela to lead healthy and fulfilling lives.

(Policy context.. white paper..)

Observed climate trends for South Africa (1960-2010)

The following information is drawn from the *Long term adaptation scenarios flagship research programme (LTAS) for South Africa. Climate trends and scenarios for South Africa, Department of Environmental Affairs, Pretoria.*

Temperature

- Daily Min and Max Temp are increasing annually, in almost all seasons.
- Hot extremes increased, and cold extremes decreased
- Rate of temperature change has fluctuated highest rates middle 1970- early 1980s and late 1990s - middle 2000s.

Rainfall

- High inter-annual variability
- Annual rainfall trends weak overall BUT tendency towards an increase in intensity of rainfall events and increased duration of dry spells.
- Marginal reduction in rainfall in Autumn months
- Extreme rainfall events show tendency towards increasing infrequency especially spring and summer.

Projected Changes for SA to 2050 and beyond

- Warming trend – as high as 5-8 deg C in SA interior, cooler at the coastal zones.
- If international mitigation works this could be 2.5 – 3 degrees warming.

- Wetter conditions to the east of South Africa especially spring.
- Drier in summer and autumn.

Further information is required, but the changes include:

- Changes in Frost patterns
- Increase in heat units in Summer
- Increase in Heat units in Winter
- Altering Seasonal conditions
- Increase in extreme climate events
- Net loss of cold to moderate climatic zones (Drakensberg)

Wetter conditions

During wet conditions there will be water quality issues as well as pollution. Turbidity is likely to increase as well as sediment will increase in the water. Pumps and motors are likely to be flooded. This is a particular problem if the pumps are burnt out- resulting in no water supply as well as problems where the sewer lines pollute the rivers.

Overall the water demand will decrease. However there is a risk of an increase in water borne diseases. Although the water treatment works could cope with wetter conditions, the cost of supplying clean water will increase.

This UThukela District Climate Response Plan is comprised of the following phases with clearly defined objectives:

- **Phase 1-Change in Climate Variables: Direct & Indirect Impacts (risks, vulnerabilities & opportunities)**
Objective: the tool introduces & makes the links between climate changes, changing environmental conditions & the impacts of this.
- **Phase 2-Sector Climate Change Response Options**
Objective: the tool provides each sector or related departments with an overview of the climate response options that fall within their functional areas.
- **Phase 3-Phase 3: Sector Plans to Climate Change Response**
Objective: the tool direct users to the key climate issues facing their sector and highlights relevant municipal mandates to tackle this. It also helps when sectors or departments are planning & prioritising new, climate responsive, projects, and programmes.

A. PHASE 1: Change in Climate Variable & Direct & Indirect Impacts: risks, vulnerabilities & opportunities to manage

Reduced Rainfall: Drought and Extended Dry Season

- Experiencing less soil moisture
- Emergence of 'climate refugees' forced off land and into urban settlements – increased joblessness and depletion
- Weakening of food security (crop failure, death of livestock, wind erosion of top soil), especially in poor communities that depend on subsistence farming
- Compromised biodiversity and associated impacts on agriculture and tourism
- Impacts negatively on livelihood
- Frequency of droughts increases
- Increased risk of wild fires in informal settlements

Response Action

- Water demand and supply management
- Change agricultural practices to improve resilience in drier conditions
- Drought relief programmes (including nutrition support) Research drought or peak water shortage options: consider emergency water provision through trucking, increased water storage capacity.
- Improved planning and disaster management to manage wild fires and fires in informal settlements, including alien plant control, fire breaks, spacing between houses.

Increasing Frequency of storms and erratic (unpredictable) rainfall

- Increase in damage to infrastructure from hail, wind, rain, (roads, dams, sewage systems. etc).
- Roads washed away or blocked can affect communication and local economy in remote areas.
- Damage to communication or energy network lines can affect economy, social, health etc.
- Soil erosion, which will affect agricultural livelihoods and biodiversity
- Inability to guarantee utilities (e.g. energy, water)
- Damage to agricultural crops and to personal property (e.g. homes, cars) – informal households particularly vulnerable to loss of household assets in floods.

Response Action

- Enhance natural barriers, such as wetlands and river courses and improve land care management (slows flooding and soil erosion, etc.)
- Ensure storm water infrastructure is well maintained and upgraded according to new water flow conditions
- Consider widening of dams for more capacity.
- Map high risk/flood prone areas and institute land-use planning and zoning to avoid development in such areas.
- Adapt/improved health services to manage increase in disease
- Develop early warning systems and disaster management plans to improve response to flood events, particularly in informal settlements.
- Poverty alleviation to build resilience to loss of personal assets, loss of annual agricultural crops.
- Institute sound waste management practises (rising water tables, flooding, can impact badly on disposed waste sites)
- Design and develop infrastructure resilient to increase in hail, wind, rain intensities (roads, dams, sewage systems, etc.)
- Develop relocation programmes in high risk areas

Increasing Temperatures: Higher Mean, and Maximum Temperature

- Less soil moisture
- Increased incidence of pests e.g. fruit flies
- Increased in alien invasive species and destruction of biodiversity hotspots
- Human health implications e.g. heat stroke, vector-borne diseases, dehydration, etc.
- Declining livelihood opportunities

Response Action

- Support livelihood development in areas less dependent on agriculture that might be under threat
- Set in place strong conservation measures for biodiversity
- Develop alien species clearing programmes
- Improve health services for increase in disease, consider approaches to reduce heat stress related health impacts
- Enforce building guidelines that improve thermal performance of buildings and efficient heating, ventilation and cooling appliances
- Develop infrastructure design that takes into account changing conditions, for e.g. less soil moisture means ground shrinkage

Higher Minimum Temperature: Fewer Cold Days and Frost Day

- Loss of tourism revenue in areas where cold/snow an attraction
- Increased incidence of pests e.g. fruit flies
- Increased wildfires danger and fires in informal settlements due to their risk prone locations.

Response Plan

- Research best agricultural options for new conditions and support transition, particularly for poor and subsistence farmers
- Where tourism reliant on disappearing weather condition (e.g. snow) or related plant/animal life, consider alternative livelihoods
- Management of vector borne diseases and associated health costs
- Fire management – improved informal settlement planning, early warning systems and fire fighting abilities

B. PHASE 2: Sector Climate Change Response Options (Mitigation and Adaptation)

Adaptation Options per sector

Adaptation- refers to the adjustment of natural and human systems into a new environment or changing environment.

A. Water Sector

- Improve monitoring and forecasting systems for floods and droughts – develop links with water research institutes to ensure early preparation for drought or flood years
- Water flow monitoring towards improved infrastructure planning and development
- Preservation of wetlands for current and future flood risk Water restrictions: prepare plans to balance the needs of competing users when water availability is reduced (drought years, peak seasons)
- Awareness and Education campaigns for water conservation
- Encourage use of water conservation technologies such as low flush toilets and low flow showerheads
- Changes in agricultural management practices in line with water scarcity (e.g. changes in crop types, dry land farming)
- Improve sanitation to curb disease spread
- Rainwater harvesting for uses such as toilet flushing, car washing, irrigation
- Re-use of grey water or water from sewage treatment
- Response options for peak supply in drought years need further investigation (from cost benefit perspective and development approach): increased storage capacity/widening of dams, trucking of water, desalination, development approvals, etc.
- Control of invasive alien vegetation
- Reduction of leaks

B. Environment/Ecosystem

- Vulnerability mapping and related management plans (e.g. informal settlement).
- Protect and increase existing ecosystems and green spaces for flood risk management, reduction of heat island effect and agriculture and biodiversity support, notably:
 - Watershed
 - Wetlands
 - River Streams
 - Landcare /Erosion Prevention
 - Dunes
- Monitor and control alien plants and pests

C. Infrastructure Planning and Built Environment

- Map vulnerable areas (flood lines, etc) and implement development bans in highly vulnerable zones
- Implement land use planning and zoning to avoid building and development infrastructure in flood or landslide prone areas
- Relocate existing development from areas of high risk
- Consider permeable pavements, green roofs and rain tanks to increase on-site retention of storm water
- Building regulation to ensure efficiency in all new buildings – monitor and enforce and encourage best practise development
- Densification of land use through zoning regulations to support high density living and work and mixed use
- Maintain and update drainage systems
- Development preference given to developments on public transport nodes
- Ensure thorough planning reduces incidence of unplanned population and economic growth and ensure contingency for unplanned settlements.

D. Human Settlement

- Improve standard of social housing (new and retrofit of existing), particularly to include ceilings to improve thermal performance
- Work to reduce fire hazardous settlements (too close together) in informal settlements
- Disaster risk reduction measures in informal settlements, including improved infrastructure , planning and management
- Efficient appliance programmes (fridges, kettles, lights) to reduce energy poverty and reduce GHG emissions
- Avoid settlement in flood prone areas – or work to plan for disaster events
- Green space in settlements to absorb intense rain runoff and improve sanitation
- Improve sanitation to inhibit disease spread
- Disaster response improvements for fires/floods in informal settlements

E.LED and Livelihood

- Assessment of vulnerable livelihoods and sectors dependent on natural resources or carbon intensive sectors
- Ongoing research and monitoring of climate change impact on vulnerable livelihoods, e.g. fisheries, agriculture and tourism
- Diversification of livelihood strategies (notably non-farm activities to cushion farming based livelihoods)
- Attract low carbon or 'green' economic activities, including renewable energy opportunities
- Consider tourism alternatives where impacts interfere with existing tourism bases such as snow, etc
- Invest in public transport to increase mobility and improve access to livelihoods
- Work with the community on community-based adaptation projects
- Reduce dependence on increasingly costly energy sources – improve efficiency across all sectors
- Changes in crop types, dry land farming to diversify agricultural activities
- Implement recycling to increase landfill life-span and provide jobs
- Show visible commitment to sustainable tourism

F. Environmental Health Services &Climate Change Response Options

- Improved sanitation to curb diseases
- Increased awareness on/ preparedness for climate related health threats (water-borne diseases, heat, air pollution, floods)
- Nutrition programmes where climate impacts affect livelihoods and food security
- Increase staffing and supplies (capacity support) for health facilities
- Interventions to reduce air pollution
- Pollution warning system

G. Fire and Disaster Management

- Install Early Warning Systems and develop links with key scientific and sector institutions to improve predictive ability
- Increase fire fighting capacity (predictive skills, plans, training and equipment, community liaison)
- Increase flood response capacity (predictive skills, plans, training and equipment)
- Have disaster management plans in place, particularly for informal settlements and vulnerable areas
- Encourage local voluntary action for disaster management
- Develop drought response plans and capacities
- Work to reduce fire-hazardous settlements (too close together)
- Work to eradicate unsafe fuels in households
- Installations of fire breaks

H .Community Services

- Documenting, developing and sharing information on climate change, vulnerability and adaptation
- Encouraging a sense of community – local voluntary action for disaster management
- Sharing experiences and lessons, to inform others and future actions and policies.
- Working with community based adaptation projects

I. Administration, Finance and Governance

- Address procurement to ensure it support efficient resource use and that tender specs, particularly for large infrastructure projects, incorporate the wide range of future climatic conditions
- Budget allocations must ensure that spending supports development of BOTH new infrastructure development AND maintenance of existing infrastructure.
- Consider best institutional location of climate change issues, and incorporate climate change within agendas of all structures, from Council to management and operations.

Mitigation options per sector

Mitigation- refers to efforts to minimize or reduce and prevent greenhouse gas emissions into atmosphere.

A. Air Quality Management

- Exercise authority in sectors to reduce GHG emissions and use air management approval processes to leverage efficiencies.
- Monitor and record local and global (GHG) air quality on a continuous basis.
- Greenhouse Gas emissions data capture and reporting.

B. Energy and Electricity (Mitigation)

Energy Supply and Electricity Service delivery

- Explore renewable energy development and procurement through PPAs, expeditious handling of EIA's and landfill gas to electricity.
- Work to ensure low income housing is thermally efficient (put in ceilings)
- Solar water heater roll-out programmes
- Explore free basic alternative energy sources for poor non-electrified households

Regulations / Incentives

- Solar water heater by-law for all new buildings requiring at least 40% of water heating requirements are from a renewable energy source.
- Implement thermally efficient housing delivery, e.g. legislate the provision of ceilings in government-delivered housing (ceilings a warmer house in winter; cooler in summer).
- Building regulation to ensure efficiency in all new buildings, e.g. require energy efficiency plans for building/development plan approval
- Provide incentives for energy efficiency when supplying new connections
- Use air management approval processes to leverage efficiencies

Behaviour / Awareness

- Focused behaviour-change campaigns on energy use
- Establish commercial and/or industrial energy forums that provide information and learning exchange on energy efficiency within sectors.
- Smart metering of top electricity consumers for better electricity management
- Green procurement to ensure all municipal motors, lighting is efficient
- Greenhouse gas emissions data capture and reporting
- Retrofit of municipal/public lighting and buildings
- Monitor and record local air quality on a continuous basis
- Implement energy efficient appliance programmes (e.g. fridges, kettles, lights)

C. Waste Management

- Promote and support recycling and 'buy back centre' development
- Landfill gas capture and conversion to energy to reduce Greenhouse Gas emissions
- Ensure proper disposal of waste (rising water tables, flooding, can all impact badly disposed waste sites)

D. Transport, Roads and Storm Water

- Road maintenance and storm water drainage maintenance and upgrade plans to cope with increased volumes and storm damage
- Effective transport planning and management towards encouraging a shift from private to public transport
- Increase government vehicle fleet efficiency
- Support walking and cycling modes, e.g. cycle lanes, etc.
- Park and ride facilities to encourage private car users to use public transport
- Increase cost of private transport such as through road space charges
- Allocate road space to public transport vehicles
- Roll out of bus rapid transport and school bus systems

Phase 3: Sector Plans to Climate Change Response

1. Spatial Development Framework (SDF)

Climate responsive spatial development is critical to avoid loss of life and assets through climate impacts and extreme weather events. Municipalities may even be liable in the future for losses resulting from 'irresponsible' planning decisions that failed to take climate change variables into account.

- Studies show that spatial form impacts on GHG per capita levels, with compact urban development showing less emissions per capita than sprawling development. This is because of transport and built environment efficiencies achieved.
- Climate responsive spatial development is critical to avoid loss of life and assets through climate impacts and extreme weather events. Municipalities may even be liable in the future for losses resulting from 'irresponsible' planning decisions that failed to take climate change variables into account.
- The SDF should consider the following impacts of climate change on these: :

- Identification of neighbourhoods that are vulnerable to climate change
- Impact of deforestation and the land use changes that may result from climate change
- Zones (hectares) of sensitive, vulnerable, highly dynamic and stressed ecosystems in the municipal area – by ecosystem type (e.g. wetland, dunes etc.)
- Ecologically sensitive areas: habitats of endangered species, tidal wetland areas
- Flood risk areas or low-lying areas
- Drought vulnerable areas
- Promotion of higher-density and mixed-use forms of development. Cities can encourage the growth of liveable, accessible communities. “Smart growth” planning—a strategy that highlights high-density, mixed-use, transit-oriented development— also has other goals, such as maintaining open space, farmlands, and other natural areas and directing city resources toward existing communities rather than diverting them to new development in outlying areas.

Municipal Powers and Functions

As part of the 5-year Integrated Development Plan, all municipalities are required to develop an SDF. Alignment with the provincial SDF is important as these plans form the basis for land-use and physical development.

Key guides and sector departments

- The National Spatial Development Perspective (2006) provides key principles guiding spatial development in South Africa.
- In 2010, the Department of Rural Development and Land Reform published draft guidelines for developing SDFs.
- The National Department of Rural Development and Land Reform, as well as the Department of Cooperative Government.

2. Integrated Environmental Programme (IEP)

- As the foundation for environmental management this would need to identify communities and ecosystems most vulnerable to the impacts of climate change in order to minimise its effect.
- Alien species invasion will reduce resilience to climate change by increasing the risk of runaway wild fires and reducing the functionality of natural barriers to extreme weather events.
- South Africa is substantially affected by invasive alien species in the terrestrial, fresh water and marine environments. These invasive species posed a threat to rich biodiversity and water resources. Predicted climate change will result in invasive biota also distributed in areas currently not invaded by such species.
- The environmental programme should consider the following:
 - Protect and increase existing ecosystems and green spaces
 - Reduce increased risk of wildfire danger
 - Protect and conserve watersheds
 - Enhance conditions for street tree survival and growth especially indigenous trees
 - Monitor and control alien plants and pests
 - Rehabilitate river banks

Key legislation and sector departments

- The National Environmental Management Act (NEMA), Act 107 of 1998, provides the overarching legal framework for environmental management in South Africa.
- The National Department of Environmental Affairs and the provincial equivalent departments are the main sector departments regulating and supporting municipalities for this function.
- Given the integrated nature of this function, other sector departments may also play a role, including the Department of Cooperative Governance and the Department of Water Affairs.

3. Air Quality Management Plan (AQMP) (mitigation)

- Local” emissions are those which affect air quality in an area and have local health and visual impacts. They include nitrogen and sulphur oxides, volatile organic compounds and particulate matter.
- The air quality management programme should consider the following:
- Pursuing use of cleaner transport fuels
- Exploring possible vehicle inspection & maintenance mechanisms to reduce engine emission.
- Exploring leverage for promoting low carbon development through exercising authority in emission.
- Developing an emissions data bank for monitoring and evaluation of global and local emissions. This should articulate well with the national GHG emissions registry and follow international GHG emission protocols (yet need not be very complicated).
- Establishing a comprehensive education and communication strategy for air quality management

Municipal Powers and Functions

Schedule 4B of the Constitution of South Africa (1996) assigns the air pollution function to municipalities.

Key legislation and sector departments

- The Air Quality Management Act (Act 39 of 2004) lists the minimum emissions standards and provides the overall legal framework for this function.
- The National Department of Environmental Affairs and the provincial equivalent department are the main departments regulating and supporting municipalities for this function.

4. Health Policy

- As temperatures rise, ground-level ozone and smog levels increase and can exacerbate respiratory illnesses, such as asthma and bronchitis. Localities face economic costs from increased air pollution—from such things as additional hospital admissions, absenteeism from work and school days, higher incidence of respiratory and heat-related illnesses and premature deaths.
- There are several important insect-carried diseases of humans and livestock which respond to climatic conditions. For example a small increase in temperature will allow malaria to spread into areas which are currently malaria-free, and will increase its severity in areas where it already occurs.
- Reduced agricultural potential in some areas could lead to reduced yields and subsequently poor nutrition, increasing the burden of diseases such as tuberculosis.
- Physical impacts from heat stress could also increase.
- A health plan and programme should consider:
 - Interventions to reduce air pollution
 - A pollution warning system
 - Improvement of emergency response systems
 - Increase support for health facilities
 - A heat alert system warning of heat stress impacting the young and elderly

Municipal Powers and Functions

Schedule 4B of the Constitution of South Africa (1996) assign municipalities the municipal health services function. Many municipalities also provide primary healthcare services (for example day hospitals and clinics). In this context municipalities are tasked with creating an environment which is healthy and safe.

Key guides and sector departments

- The National Health Act (Act 61 of 2003) provides the overarching legal framework for the health sector.
- A number of national sector departments may play a role in supporting municipalities with respect to poverty alleviation. These include the Department of Health, the Department of Human Settlements, the Department of Water and Environmental Affairs and the Department of Cooperative Governance. Relevant provincial departments also play a key role.

5. Integrated Waste Management Plan (IWMP)

- The IWMP should consider the following:
 - Reduction, re-use and recycling of waste
 - Demand Side Management (DSM) activities and waste recycling to reduce landfill related methane emissions
 - Correct disposal waste to improve emissions
 - Capture of methane from landfill sites

Municipal Powers and Functions

Municipalities are legally required to develop Integrated Waste Management Plans (IWMPs), which provide strategic direction for waste management in municipalities and identifies the resources needed to achieve their goals.

Key legislation and sector departments

The National Waste Act (Act 59 of 2008), provides the overarching legal framework for waste management in South Africa.

The National Waste Management Strategy of 2010 presents a long-term plan for the sector and stipulates the goals and objectives of the country with respect to waste management. It also identifies roles and responsibilities for various stakeholders in achieving this vision.

A number of national sector departments may play a role in supporting municipalities with respect to waste management. These include the Department of Environmental Affairs, the Department of Economic Development, the Department of Tourism, the Department of Cooperative Governance and the Department of Trade and Industry amongst others. Relevant provincial departments also play a key role.

6. Energy Master Plan

- The energy master plan should consider the following:
 - A focus on energy efficiency or demand side management for increased energy needs
 - Steadily reducing dependence on fossil fuels
 - The introduction of cleaner fuels such as natural gas into the current fossil fuel mix where feasible
 - Increased use of renewable energy (solar, wind, wave, etc)
 - Economic development based on efficient resource use
 - Social sustainability considerations - all households having access to safe, affordable and reliable energy sources.

Municipal Powers and Functions

Schedule 4B of the Constitution of South Africa (1996) assigns municipalities the responsibility for electricity and gas reticulation. As part of their Environmental Management Plan, municipalities may also specify their plans for reducing their reliance on fossil fuels, increasing renewable energy usage and minimising electricity consumption.

Key legislation and sector departments

- The National Energy Act (Act 34 of 2008), which seeks to ensure that South Africa has access to a diverse range of energy resources which are sustainable and affordable, provides the overarching legal framework for the energy sector.
- A number of national sector departments may play a role in supporting municipalities with respect to energy. These include the Department of Energy, the Department of Economic Development, the Department of Environmental Affairs, the Department of Cooperative Governance and the Department of Trade and Industry amongst others. Relevant provincial departments also play a key role and the National Energy Regulator of South Africa is also an important player in this sector.

7. Local Tourism Plan

- The tourism sector is climate-sensitive and has a direct interest in climate risks. For example, tourism infrastructure may be damaged due to increased intensity and frequency of storms. Spread of vector-borne disease may also negatively impact existing tourism destinations.
- The tourism development plan should consider the following:

- Promotion of biodiversity/nature-based tourism
- Compliance with energy, waste and water efficiency measures
- Partnering with relevant organisations such as Worldwide Fund for Nature (WWF) (sectors such as tourism may be focused on as lead sectors)
- Special events to promote environmental profiles of the municipality, for example incorporating zero waste, green electricity, efficiency, and recycling.

Municipal Powers and Functions

Schedule 5B of the Constitution of South Africa (1996) assigns municipalities the responsibility for local tourism. Given the cross-cutting nature of the tourism sector a number of other functions assigned to municipalities (for example beaches and amusement facilities, public places, cleansing and local sports facilities and many other aspects of municipal activity influence this sector. In this context municipalities are tasked with creating an environment which promotes tourism, while ensuring the sustainability of natural and other resources.

Sector departments

A number of national sector departments may play a role in supporting municipalities with respect to tourism. These include the Department of Economic Development, the Department of Tourism, the Department of Environmental Affairs, the Department of Co-operative Governance and the Department of Trade and Industry amongst others. Relevant provincial departments also play a key role.

8. Water Services Development Plan (WSDP)

- Extreme weather and changes in precipitation will require localities to re-examine water supply, storm water management, and the influx of pollutants into water sources.
- The water services development plan should consider:
 - Ensuring that the impacts of climate change are brought into future water resource projections or trends
 - An increase in the number of intense rainfall events requires thinking about increased leakages, insufficient storage capacity and damage to storm water and sewage infrastructure.
 - A reduction in drinking water supplies is exacerbated by unplanned population growth and unplanned settlements. Are additional water sources needed to match future demand? Are there contingency measures in place?
 - Industrial, domestic and agricultural users are highly dependent on a reliable supply of water. A reduction in rainfall amount or variability, or an increase in evaporation would further strain the already limited amount of water resources and water quality
 - More extreme rainfall may change storm water management requirements: for example, clearing storm water drains, designing sustainable drainage systems and improved maintenance of storm water infrastructure?
 - An increase in damaged infrastructure (dams, sewage systems, etc) because of an increase in the frequency and magnitude of storms will result in the need to improve infrastructure capacities
 - Improved monitoring and forecasting systems for floods and storms is likely to be more cost effective than paying for the damage from flooding.
 - Early warning systems to be introduced
 - Introduction of green roofs and permeable pavements or surfaces to increase on-site retention of storm water
 - Design of storm or flood resilient infrastructure and buildings
 - Rehabilitation of natural flood barriers, notably wetlands and river courses
 - A water conservation programme in anticipation of changing drought frequencies. Has the municipality considered water restrictions? This requires plans to balance the needs of competing users when water availability is reduced.

Municipal Powers and Functions

Schedule 4B of the Constitution of South Africa (1996) assigns municipalities the responsibility for water and sanitation services. Municipalities that are water services authorities (WSAs) take overall responsibility for the regulation of this service in their area of authority.

Key Legislation And Sector Departments

- The Water Act (Act 36 of 1998) provides the overarching legal framework for water services in South Africa.
- The Water Services Framework Strategy (2003) provides the strategic direction for the sector.
- A number of national sector departments may play a role in supporting municipalities with respect to water and sanitation. These include the Department of Human Settlements, the Department of Water and Environmental Affairs and the Department of Cooperative Governance amongst others. Relevant provincial departments also play a key role.

CONCLUSION

The strategic plan will guide all role players and stakeholders on how to respond to the current climate change phenomenon. The plan will be reviewed and updated annually.