



Durban's Municipal Climate Protection Programme:

CLIMATE CHANGE ADAPTATION PLANNING

FOR A RESILIENT CITY



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DATES

The Municipal Adaptation Plans that appear in
this booklet were produced over a 15 month
period from September 2008 to November 2009.
Post November 2009 review meetings have
been held with the three sectors on a quarterly
basis. This has resulted in the ongoing updating
and refinement of the original plans reproduced
here.

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WHAT IS CLIMATE CHANGE ADAPTATION AND WHY DO I NEED TO KNOW ABOUT IT?

Human-induced climate change is here to stay. The Intergovernmental Panel on Climate Change (IPCC), the world's leading body for the assessment of climate change, has indicated that the jury is no longer out, and that the climatic changes that the Earth is currently experiencing, and will continue to experience, are due to human activities¹. This statement has been further endorsed by 32 national science academies from across the world.

Human-induced climate change is one of the most complex and serious developmental and environmental challenges facing the world today. Predicted impacts of climate change vary, but most places around the globe will experience an increase in temperatures and changing rainfall patterns. These changes are likely to lead to a range of impacts, including:

- an increase in storm and flood events,
- sea-level rise,
- more droughts in some parts of the world,
- a decrease in water and food security,
- negative health impacts.



SO WHAT IS CLIMATE CHANGE ADAPTATION?

Climate change scientists now acknowledge that, even if we stopped producing greenhouse gases (which cause climate change) tomorrow, there is a level of climate change that is now simply unavoidable. If we want to ensure the sustainability and resiliency of our city, we will have to find ways of adapting to this change.

Climate change adaptation has been described by the IPCC² as “initiatives and measures to reduce the vulnerability of natural and human systems against actual or expected climate change effects”. We can anticipate change and adapt before it occurs or we can react to change after it occurs. The latter is far more costly in terms of the human and financial resources required. Essentially climate change adaptation is therefore about “managing the unavoidable” impacts of human induced climate change.



¹ IPCC (2007) Fourth Assessment Report

² Glossary of Terms used in the IPCC Fourth Assessment Report:
http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr_appendix.pdf

WHY ARE CITIES IMPORTANT?

Climate change impacts are diverse and far-reaching; they affect the individual, the household, the community, the city, the country and the globe. But the impacts are most directly felt at the local level, where communities have to deal with the impacts first hand. It is therefore not surprising that cities have become focal points of climate change adaptation. Cities are where the majority of the world's people now live (currently over 50%) and “where the rubber hits the road” climatically speaking. They have to deal with impacts of increased temperatures and more erratic rainfall, as well as sea-level rise, floods and droughts, reduced food and water security, negative health impacts, environmental refugees, insurance losses and greater demands on disaster relief resources, to name but a few. This situation will worsen through time as it is anticipated that by 2050 up to 70% of the world's population will live in cities and that by the end of this century this figure could be as high as to 80-90%!



WHY IS CLIMATE CHANGE ADAPTATION CRITICAL IN DURBAN?

Durban already experiences the negative impacts of existing climate variability and this risk will be further exacerbated by incremental climate change. In addition, Durban is faced with an extensive range of developmental challenges, such as:

- An unemployment rate of 30-40%.
- Only 37% of residents have completed high school.
- A housing backlog of 370 000 units.
- A life expectancy of 47 due to the impact of HIV/ Aids.
- A 2.3 % decline in Gross Domestic Product between 2008 and 2009.³

These factors increase the vulnerability of many of Durban's residents, and this situation is likely to be exacerbated as the impacts of climate change place further strain and demands on limited resources and infrastructure. In order to ensure that the city can fulfill its vision of being “Africa's most caring and liveable city” by 2020 it is critical that tackling climate change is placed at the top of the city's developmental agenda.



SO HOW DO WE PLAN TO DEAL WITH CLIMATE CHANGE?

To plan for climate change and hence to adapt to its impacts, both the risks and opportunities that climate change will bring, must be understood. Thereafter flexible adaptation strategies and plans that have multiple tangible benefits can be developed and implemented.



³ eThekweni Municipality Draft Medium Term Budget Report 2010/2011to 2012/2013.

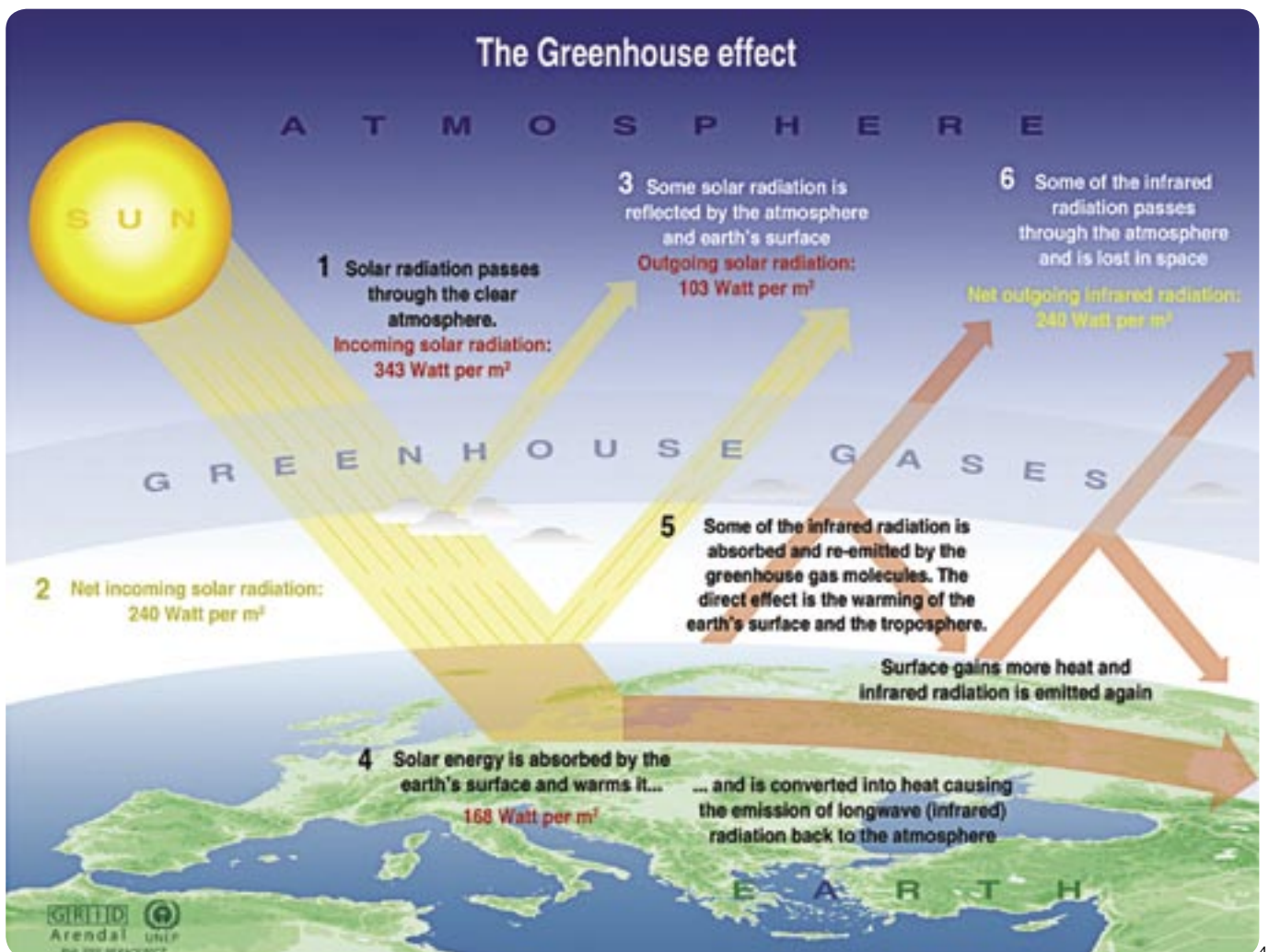
BACK TO BASICS: WHAT IS CLIMATE CHANGE?

Climate change is, as the distinguished broadcaster and naturalist, Sir David Attenborough states: “the major challenge facing the world”. The diagram below shows how the sun’s radiation is trapped in the Earth’s atmosphere by greenhouse gas molecules (e.g. carbon dioxide, methane and nitrous oxides).

This process is essential for human existence on the planet, as it keeps the planet warm enough for ourselves and other members of the Earth’s biosphere to survive comfortably. The Earth would be a lot colder if we did not have greenhouse gases occurring naturally in our atmosphere. The problem currently being experienced is caused by the Enhanced Greenhouse Effect. This Enhanced Greenhouse Effect occurs as a result of the fact that humans have

been burning copious amounts of fossil fuels since the industrial revolution, clearing forests and producing waste. All of these activities emit greenhouse gases, such as carbon dioxide and methane, which increase the amount of radiation absorbed by our atmosphere.

There are several implications of an increase in global average temperature. These include the fact that the atmosphere becomes more energised and hence the frequency and intensity of storms is likely to increase, and rainfall patterns across the globe change, with some places getting wetter and others drier. The knock-on effects of these changes are the ones felt on the ground, like sea-level rise, heat stress, lower agricultural yields, increases in disaster events etc.



⁴ Okanagan University College in Canada, Department of Geography, University of Oxford, School of Geography and the United States Environmental Protection Agency. 1996. *Climate Change 1995: The Science of Climate Change. A Contribution of Working Group I to the Second Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press: Cambridge.

WHAT ARE THE EXPECTED IMPACTS OF CLIMATE CHANGE IN DURBAN?

The changes in our climate are happening at a global level and are influenced by a myriad of complex processes. Presently the best method for us to understand the impacts of climate change at the local level is to downscale Global Circulation Models (GCMs). GCMs model potential future climatic conditions on a global scale and are based on various scenarios of future emissions of greenhouse gases.

Current projections suggest that:

- An increase of 1.5–2.5 °C in mean annual temperature by 2045-2065.⁵
- Rainfall is likely to increase slightly overall, but this rainfall will fall over shorter time periods, which means that streamflows will be higher and faster.⁶ This will increase the strain on the city's stormwater system, flooding homes located inappropriately and increasing levels of erosion. There is also likely to be an increase in the number of severe and tropical storms.
- The sea-level along Durban's coastline rose at a rate of 2.7 mm from 1970 to 2003.⁷ This rate of sea level rise is likely to accelerate, hence eThekweni Municipality is considering three potential sea-level rise scenarios: 300, 600 and 1000 mm of sea level rise above the 1980-1999 base by 2100.

These impacts are expected to lead to secondary impacts such as:

- Increase in cases of heat stress, particularly for vulnerable groups such as the poor, homeless, children and the elderly.
- Increase in the prevalence of diseases such as cholera and malaria.
- Increase in near-surface ozone (O₃) levels, negatively affecting respiratory health.
- Decreased food security due to a reduction in yield of staple crops (e.g. through decreased maize yields). Increased storage and food preservation required for crops whose yields improve under future climate conditions (e.g. sugar). Changes in crop yields will require research into seasonal shifts in planting and harvesting dates and altered crop and cultivar choices.
- Decrease in biodiversity as species struggle to adapt to the rapidly changing climate, and struggle to compete with invasive alien species which are expected to benefit from future climate change conditions.



⁵ Climate Projections based on downscaled GCM data from the school of BEEH, University of KwaZulu-Natal.

⁶ Schulze, R.E., Knoesen, D.m., Kunz, R.P. and van Niekerk, L.M. 2010. Impacts of Project Climate Change on Design Rainfall and Stream flows in the eThekweni Municipal Area. ACRUcons Report 62, August 2010. School of Bioresources Engineering and Environmental Hydrology, University of KwaZulu-Natal, Pietermaritzburg.

⁷ Mather, A.A. 2007. Linear and non-linear sea-level changes at Durban, South Africa. South African Journal of Science, 103, 509-512.

WHAT IS ETHEKWINI MUNICIPALITY DOING?

EThekwini Municipality, recognising the impact that climate change will have on the long-term sustainability of the city and the quality of life of its residents, has developed a Municipal Climate Protection Programme (MCPP). The MCPP aims to assist the municipality in adapting to and mitigating climate change. This programme was initiated in 2004, and began with the assessment of the likely impacts of climate change on Durban. This led to the development of a Headline Adaptation Strategy which examined the vulnerability of all key municipal sectors to climate change. This in turn provided the basis for the development of more detailed adaptation plans for the Health, Water and Disaster Management sectors which are regarded as being particularly vulnerable to the impacts of climate change. These **Municipal Adaptation Plans (MAPs)** were developed in collaboration with sector representatives and include:

- interventions which were prioritised using a multi-criteria analysis,
- individuals responsible for enactment of the interventions,
- time-frames for implementation, and

- alignment of the proposed interventions with the Integrated Development Plan.

These plans can be found on Page 8 to 23. Implementation of these interventions is being undertaken by the sectors themselves and the Environmental Planning and Climate Protection Department monitors this implementation on a quarterly basis.

These plans aim to assist sectors in adapting to the projected climate change impacts over the short, medium and long-term. Preparedness and the ability to cope with adverse consequences and respond to new opportunities can radically reduce the costs that are associated with climate change. Due to the fact that climate change science and the related modelling capacity are constantly evolving and improving, eThekwini Municipality has taken the stance of choosing adaptation interventions that are flexible and have multiple benefits to ensure that money is spent wisely and that as many individuals as possible benefit from the interventions. So called “no regrets” options. Given that the principles of good climate change adaptation practice are only just beginning to emerge, eThekwini Municipality is in this sense, at the forefront of a rapidly evolving discipline.

MULTI-CRITERIA ASSESSMENT

An important innovation during the development of the MAPs was the use of a Multi-Criteria Assessment (MCA) approach to prioritise the identified adaptive interventions. This can be found on Page 24 to Page 31. The MCA prioritises the interventions by identifying those that are most urgent and provide the greatest benefit. This is especially important in a resource scarce municipality such as eThekwini Municipality. The MCA used a scoring system to prioritise the interventions,

combining an assessment of merit and urgency to arrive at a final score. It is important to note that the real value of the MCA is not the final score; rather it is in the process of debate and discussion amongst diverse stakeholders that leads to the final prioritisation.

Please refer to the table below for a brief explanation of each of the criteria used.

Table 1 MCA criteria explanations

Impact on risk	The level of climate change risk that the intervention will reduce.
Ancillary Benefits	How beneficial is it to undertake this intervention regardless of climate change impacts, as the intervention promotes sustainable development.
Reversible or Flexible	Climate change science is not perfect and hence interventions that can be reversed or adjusted based on the latest science are better than those that cannot.
Impact on emissions	How does the intervention affect the amount of greenhouse gases in the atmosphere?
Allows complementary options	Are there complementary options in association with the intervention? Does the intervention reduce, retain or enhance the set of options available for responding to climate change.
Ease of implementation	Indicates the likelihood of the intervention being successfully implemented.
Institutional complexity	This criterion also indicates the likelihood of the intervention being implemented. If the intervention requires complex municipal processes and procedures and many departments working together, its likelihood of success is lessened.
Cost: benefit	A broad judgement of whether the intervention has ‘high cost: low benefit’ or ‘high benefit: low cost.’
Risk of ‘maladaptation’	Ill-considered implementation of an intervention is considered ‘maladaptation’ as it may have unintended adverse impacts.

WHY CLIMATE CHANGE IS AN ECONOMIC ISSUE: KOREA'S GREEN GROWTH PLAN WORKS

The South Korean economy is the fourth largest in Asia. The President of this country, which emits copious amounts of greenhouse gases, Lee Myung-bak, sees a crisis coming, and this crisis is an economic one linked to climate change. President Lee Myung-bak fears that South Korea's economy could be crippled if it is not ready for the mandatory emission cuts that may be imposed through international commitments or higher trade barriers on large emitters. He has therefore initiated a "five-year green growth plan" which aims to spend approximately \$87 billion on emission reduction projects and research into greener technologies. As the presidential secretary for national future and vision aptly states: "Without this, we can't get out of energy vulnerability, and growth will remain stagnant, that's why we say this is a strong growth policy." It is the government's drive that has led to large companies such as Samsung Electronics and Hyundai-Kia Automotive Group announcing multibillion dollar investment plans in green technology.⁸

The 2010 Framework Act on Low Carbon and Green Growth aims to improve the level of self-sufficiency in energy and to enhance energy use for low-income groups, allowing more equitable use of energy, so that every citizen can benefit from low carbon, green growth.⁹

"Green Growth" is now being touted as ecologically sustainable economic progress that fosters low-carbon, socially inclusive development and a solution for addressing developmental challenges in Asia and the Pacific. The stimulation of which can occur via a number of fiscal pricing measures.¹⁰

This case study may come from across the globe, but the challenges that Asian and Pacific countries face are not dissimilar to those faced by South Africa and Durban – that is, increasing demand for food, water, shelter, sanitation, energy, health services and economic and human security. The Asian and Pacific region leaders though, have decided to respond with "Green Growth" instead of traditional carbon-intensive development. The South African government has shown some intent to do the same, by hosting the first Green Economy Summit (18-20 May 2010), where the development of a job-intensive green economy was discussed and President Jacob Zuma, in his keynote address, made the following statement: "We believe that by stimulating investment in green industries, we will be able to contribute to the creation of decent work."¹¹

TO CONCLUDE

This booklet has outlined what climate change adaptation is, what the impacts of climate change on Durban are likely to be and highlights one of the projects that the municipality has embarked upon to adapt to climate change. Developing and monitoring Municipal Adaptation Plans is one of the best ways to ensure that Durban is taking climate change into account and ensuring that the economic, environmental and social goals of the city are achieved.

This work is significant and pioneering; there may be a number of motivations for combating climate change, as Sir Richard Branson states, "Our generation has inherited an incredibly beautiful world from our parents and they from their parents. It is in our hands whether our children and their children inherit the same world."



⁸ The Associated Press (September 22, 2009) South Korean President pushes Green Growth. Web reference: <http://www.greengrowth.org/gg-initiative.asp>

⁹ Framework Act on Low Carbon, Green Growth. Ministry of Government Legislation. Act No. 9931, Jan. 13, 2010. South Korea.

¹⁰ United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) Green Growth Capacity Development Programme : Map to Green Growth for Asia and the Pacific.

¹¹ See <http://www.sagreeneconomy.co.za/President%20of%20Republic.pdf> .

Table 1 Water Sector Adaptation Interventions

Ref	Adaptation Category	Sub-category	Impact	Intervention	Implementation of plan (including policy framework for addressing issue)
W1	Water	Infrastructure Protection (New)	Flooding	Detailed analysis of latest rainfall/run-off projections and modelling of systems to be finalised.	<ul style="list-style-type: none"> University of KwaZulu-Natal to finalise detailed analysis of quinary level projections. Water sector officials to work with researchers to understand the nature of and how to interpret results. Expand municipality's rain gauge network by 30 gauges.
W2	Water	Infrastructure Protection (New)	Flooding	Revise rainfall data in line with latest projections (as of 30 September 2009) and review every 5 years.	<ul style="list-style-type: none"> Coastal and Storm Water Catchment Management officials to commission revision of rainfall data for Durban based on projections as of 30 September 2009. Revised report to be published on eThekweni Municipality website.
W9	Water	Infrastructure Protection (Existing)	Flooding	Protect and restore riparian vegetation so as to protect integrity of river banks and retain biological buffers against flooding.	Initiate a 'Working for Rivers' programme on a catchment by catchment basis.
W5	Water	Infrastructure Protection (New)	Flooding	Develop Master Drainage Plans for all river catchments within eThekweni municipal boundaries.	<ul style="list-style-type: none"> Based on rainfall projections at 30 September 2009, revise 1:50 and 1:100yr flood lines to take revised rainfall and run-off data into account. Identify priority areas for interventions to reduce risk.
W6	Water	Infrastructure Protection (New and existing)	Sea Level Rise	Revise coastal set back lines.	Determine and demarcate the High Water Mark based on sea-level rise modelling and revise coastal set back lines accordingly.
W8	Water	Infrastructure Protection (New and existing)	Sea Level Rise	Prepare Coastal Management Plans for entire Durban coastline.	<ul style="list-style-type: none"> Identify and prioritise coastal areas at highest risk from storm damage and flooding using sea level rise model. Prepare Shoreline and Estuary Management Plans for whole Durban Coastline (focusing initially on Central Beach Front, Amanzimtoti, Bluff Dunes and Umhloti).

Outcome	Priority ¹	Responsible Parties (1st listed = lead)	Resource Availability (within lead party)	Timing	Aligned with IDP?
Improved understanding of the impact of climate change on rainfall and run off and identification of particularly vulnerable areas.	H	<u>Environmental Planning and Climate Protection Department.</u> University of KwaZulu-Natal, Coastal and Storm Water Catchment Management.	Available - work in progress.	Ongoing	Plan 1: Sustaining our Natural and Built Environment Plan 3: Quality Living Environments
<ul style="list-style-type: none"> Impact of climate change on rainfall patterns, flooding and run-off embedded into surveys, planning and design. New infrastructure to be designed to manage increased runoff/reduced water availability (e.g. pipe size fits amended run-off projections). Increased resilience of Durban's infrastructure and development to extreme weather events. Any changes in projected rainfall patterns incorporated into planning through regular review of latest research. 	H	<u>Coastal and Storm Water Catchment Management.</u> Coastal Policy.	In house, in the normal course of business.	Revised data to be published by December 2009, 5 yearly review.	Plan 1: Sustaining our Natural and Built Environment Plan 3: Quality Living Environments
<ul style="list-style-type: none"> Reed beds and wetlands retained. Ecosystem services secured. Reduced risk of flooding to residential and public property. 	H	<u>Coastal and Storm water Catchment Management.</u> Environmental Planning and Climate Protection Department.	None at present, resource requirements to be determined.	<ul style="list-style-type: none"> Identify budget/resource requirements by end FY² 2009/10. Develop work plan by end FY 2010/11. Implement in FY 2011/12. 	Plan 1: Sustaining our Natural and Built Environment
<ul style="list-style-type: none"> Impact of development on flow better understood and reduced. Floodlines reflect flood risks modified for climate change influence on run-off. Newly identified developments potentially at risk required to comply with the Flooding Annexure and become resilient to climate change. Better alignment of planning and risk. 	H	<u>Coastal and Storm Water Catchment Management.</u>	In house, in the normal course of business.	From October 2009 - ongoing.	Plan 3: Quality Living Environments
Coastal set back lines modified for climate change influence on sea level and storm surges.	H	<u>Coastal Policy.</u> Coastal and Storm Water Catchment Management.	In house, in the normal course of business.	By 30 September 2009 for a new set-back line.	Plan 1: Sustaining our Natural and Built Environment
<ul style="list-style-type: none"> Detailed understanding of the impact of coastal storms and flooding on coastline. Mitigation of risk through prevention, reduction or adaptation. Rehabilitation plans following storm events. Better management of estuaries. 	H	<u>Coastal Policy.</u>	In house, in the normal course of business.	Ongoing for 3-5 years	Plan 1: Sustaining our Natural and Built Environment

Table 1 Water Sector Adaptation Interventions

Ref	Adaptation Category	Sub-category	Impact	Intervention	Implementation of plan (including policy framework for addressing issue)
W17	Water	Water security	Water Availability	Incorporate requirement that Umgeni Water consider the impact of climate change on rainfall and run-off into eThekweni Municipality's water purchase agreement.	<ul style="list-style-type: none"> • Head of Water and Sanitation Department to negotiate with Umgeni Water. • Umgeni Water to work with Department of Water Affairs to ensure detailed analysis of future water availability takes into account the impact of climate change on rainfall and run-off by adopting the modelling carried out by University of KwaZulu-Natal and other recognised research.
W18	Water	Water Demand Management	Water Availability	Develop an overarching water use strategy which captures existing interventions being undertaken within the Municipality, identifies additional interventions, creates clear priorities and an implementation plan for responding to the challenges of a current water shortage impacted on by climate change and it's further impact on water security.	<ul style="list-style-type: none"> • Draft note seeking budget and recruit staff. • Develop strategy which is aligned with Strategic Environmental Assessment and ensures that the implications of climate change are placed at the forefront of all spatial land use planning considerations, to ensure that any planning proposals or development approvals compliment these adaptation measures. Interventions to include: <ul style="list-style-type: none"> - Domestic, commercial and industrial water use efficiency measures (demand side management), including possible incentives. - Measures to reduce non revenue water including billing efficiency and reducing water loss. - Water being placed at the forefront of all planning decisions to ensure that decisions that rely on a steady water supply, both in qualitative and quantitative terms, adequately factor in water availability. - Review of existing practices for the use of water by the Municipality with the aim of changing these to reduce water demand (e.g. water green spaces at night/less often, use of recycled water). - An ongoing public awareness programme. - Alternative water resources such as re-use of effluent and de-salination.
W14	Water	Infrastructure Protection (Existing)	Flooding, Sea Level Rise	Relocate informal settlements which are highly vulnerable to flooding and sea level rise.	<ul style="list-style-type: none"> • Housing Department to be provided with revised floodline and coastal setback data. • Housing Department to review priority informal settlements and low cost housing for relocation in light of revised flood and coastal set back lines. • Review to be carried out every 5 years based on population growth and subsequent revisions to flood lines and coastal set back lines.
W15	Water	Infrastructure Protection (Existing)	Flooding, Sea Level Rise	Protection of municipal infrastructure (e.g. transport, storm water, sewerage, electrical etc).	<ul style="list-style-type: none"> • Identify key assets at risk following development of: <ul style="list-style-type: none"> - Master Drainage Plans (W5). - Shoreline Management Plans (W8). - Asset Management Plans (W10&11). • Protect infrastructure through relocation or reinforcement/protection.

Outcome	Priority	Responsible Parties (1st listed = lead)	Resource Availability (within lead party)	Timing	Aligned with IDP?
<ul style="list-style-type: none"> Climate Change incorporated in Department of Water Affairs and Umgeni Water's strategic planning. Umgeni Water meets its contractual "assurance of supply" commitment to eThekweni Municipality. 	H	<u>Water and Sanitation.</u>	In house, in the normal course of business.	March 2010	Plan 1: Sustaining our Natural and Built Environment Plan 3: Quality Living Environments
<ul style="list-style-type: none"> A reduction in the growth of future water demands. Development approvals being subject to adoption of water use efficiency measures. Gradual shift to a more water rational society through behaviour change. Gradual shift to a more "water rational" economy in which existing water resources are allocated to create jobs and revenue. 	H	<u>Water and Sanitation.</u>	None at present, resource requirements to be determined	Identify budget and recruit resources by end FY2010/11 Begin work FY2011/12.	Plan 1: Sustaining our Natural and Built Environment Plan 3: Quality Living Environments
<ul style="list-style-type: none"> Priority relocation list more accurately reflects populations at risk. Reduced number of people living in flood risk area. 	H	<u>Housing.</u> Coastal and Storm Water Catchment Management, Coastal Policy.	In house, in the normal course of business.	Every 5 years from 2010.	Plan 1: Sustaining our Natural and Built Environment Plan 3: Quality Living Environments Plan 4: Safe, Healthy and Secure Environment
<ul style="list-style-type: none"> Better understanding of highly vulnerable assets/infrastructure. Reduced risk to infrastructure. Opportunity to implement new, efficient, low emissions technology. Simultaneous protection of adjacent private property. 	H	<u>Coastal and Storm Water Catchment Management.</u> <u>Coastal Policy.</u>	In house review of plans in the normal course of business.	Initial review by end June 2010, subsequent reviews every year as plans are developed.	Plan 1: Sustaining our Natural and Built Environment Plan 3: Quality Living Environments

Table 1 Water Sector Adaptation Interventions

Ref	Adaptation Category	Sub-category	Impact	Intervention	Implementation of plan (including policy framework for addressing issue)
W3	Water	Infrastructure Protection (New)	Flooding	Elevate Flood Annexure to Council Policy.	Write covering report and submit to council for approval.
W16	Water	Infrastructure Protection	Flooding	<p>Develop co-ordinated procedure for inspection, clearance and maintenance of all storm water channels, attenuation infrastructure and water courses in order to:</p> <ul style="list-style-type: none"> • Maximise use of resources and community support. • Remove blockages. • Remove obstructions to free flow of water at bridges and culverts. • Remove conditions conducive to the spread of water borne diseases. • Remove alien invasive species and improve biodiversity. 	<ul style="list-style-type: none"> • Hold workshop with all affected parties to discuss needs and initiate framework development. • Develop plan of action and procedures in consultation with all stakeholders. • Develop a co-ordinated procedure with due consideration of biodiversity and the ecological impact of the activities drawing on community programmes where possible.
W12	Water	Infrastructure Protection (New)	Flooding	Amend Town Planning 'Scheme Controls' to incorporate fixed parameters for run-off in order to reduce storm water run-off from new developments.	<ul style="list-style-type: none"> • Develop overarching control to ensure compliance with the "storm water management plan", which states developments may not harden more than 40% of their total area and to encourage installation of green roofs, retention/wet basins, detention/dry basins, infiltration basins etc. • Identify existing controls in all areas which need to be repealed to remove conflict. • Liaise with Town Planning Department to ensure public acceptance of changes and correct phrasing.
W4	Water	Infrastructure Protection (New)	Flooding	Reduce risk to developments in flood plains through amendment of Bylaw 5.2 (2) (iii) to require developments within the 1:100 year floodline within eThekweni boundaries to comply with the Flood Annexure.	<ul style="list-style-type: none"> • Coastal and Storm Water Catchment Management officials and Legal Department to produce an appropriate bylaw. • Report to be drafted and submitted to Infrastructure Committee and the Executive Committee and published for public comment before approval.

Outcome	Priority	Responsible Parties (1st listed = lead)	Resource Availability (within lead party)	Timing	Aligned with IDP?
<ul style="list-style-type: none"> Enables more sustainable development in Durban. Reduces risk of flooding to property. Will ensure that the implications of climate change are placed at the forefront of spatial land use planning considerations and will help ensure that any planning proposals or development approvals complement the adaptation interventions listed in this plan. 	H	<u>Coastal and Storm Water Catchment Management, Coastal Policy.</u>	In house, in the normal course of business.	December 2009.	Plan 3: Quality Living Environments
<ul style="list-style-type: none"> Water and drainage infrastructure is operating to its design specification. Community takes greater responsibility for water courses. Prevents back flooding and inundation of drainage systems. Reduced flood and disease risk. Clearance of alien invasive species and improved bio-diversity. 	H	<u>Coastal and Storm Water Catchment Management,</u> Communicable Disease Control, Environmental Planning and Climate Protection Department, Parks.	In house, in the normal course of business.	Meeting by end October 2009, plan in place by June 2010.	Plan 1: Sustaining our Natural and Built Environment Plan 3: Quality Living Environments Plan 4: Safe, Healthy and Secure Environment Plan 7: Good Governance
<ul style="list-style-type: none"> New developments have neutral or positive impact on run-off in urban areas. Reduced intensity of flood peaks. Increase in recharge of ground water resources. 	H	<u>Coastal and Storm Water Catchment Management, Town Planning Department.</u>	In house, in the normal course of business.	<ul style="list-style-type: none"> Propose changes by end December 2009. Consultation January/February 2010. Council approval February - May 2010. In force end May 2010. 	Plan 1: Sustaining our Natural and Built Environment
Compliance with the Flood Annexure will ensure revised rainfall data and hence climate change are incorporated in planning and designs.	M	<u>Coastal and Storm Water Catchment Management,</u> Legal Department.	In house, in the normal course of business.	Issue instruction by December 2009.	Plan 3: Quality Living Environments

Table 1 Water Sector Adaptation Interventions

Ref	Adaptation Category	Sub-category	Impact	Intervention	Implementation of plan (including policy framework for addressing issue)
W7	Water	Infrastructure Protection (New)	Sea Level Rise	Develop Council Policy and By-laws or scheme controls covering development within coastal set back lines.	Coastal Policy officials to: <ul style="list-style-type: none"> • Draft policy. • Discuss potential bylaws or scheme controls with the Legal Department and Town Planning Department. • Report to be drafted and submitted to the Infrastructure Committee and the Executive Committee and published for public comment before approval.
W13	Water	Infrastructure Protection (Existing)	Flooding	Public awareness campaign to raise awareness of the benefits of retrofitting storm water run-off reduction techniques e.g. green roofs, retention/wet basins, detention/dry basins, infiltration basins, rain water harvesters etc. to reduce runoff from existing developments.	<ul style="list-style-type: none"> • Implement pilot projects within the municipality to demonstrate benefit of interventions. • Develop public awareness strategy.
W10	Water	Infrastructure Protection (Existing)	Flooding	Ensure that Asset Management Plans consider revised rainfall/runoff data in assessment of the condition of storm water and catchment management assets.	Develop asset management plans and programme for replacement in order of priority.
W11	Water	Infrastructure Protection (Existing)	Sea Level Rise	Ensure that Asset Management Plans consider revised sea level rise scenarios in assessment of the condition of coastal assets.	Develop asset management plans and programme for replacement in order of priority.
W19	Water	Water Demand Management	Water Availability	Revision of the water level regulation licences to promote water demand reduction.	Water and Sanitation to discuss with provincial and national government.



Outcome	Priority	Responsible Parties (1st listed = lead)	Resource Availability (within lead party)	Timing	Aligned with IDP?
<ul style="list-style-type: none"> Developments potentially at risk through a climate induced increase in sea levels and storm damage required to adhere to the requirements of the Coastal Council Policy and become resilient to climate change. Will ensure that the implications of climate change are placed at the forefront of spatial land use planning considerations and will help ensure that any planning proposals or development approvals complement the adaptation interventions listed in this plan. 	M	<u>Coastal Policy</u> , Legal Department.	In house, in the normal course of business.	Policy developed and instructions to Legal Department by 31 December 2009.	Plan 1: Sustaining our Natural and Built Environment
<ul style="list-style-type: none"> Reduced run-off from existing infrastructure in urban areas. Increase in green areas in city. 	M	<u>Environmental Planning and Climate Protection Department</u> , Coastal and Storm Water Catchment Management, Water and Sanitation, Architectural Services.	None at present, resource requirements to be determined.	<ul style="list-style-type: none"> Identify budget/resource requirements by end FY2009/10. Develop work plan by end FY 2010/11. Implement in FY2011/12. 	Plan 3: Quality Living Environments Plan 5: Empowering Citizens
<ul style="list-style-type: none"> Drainage infrastructure capable of managing increased run-off (e.g. bigger pipes). Prioritisation across projects with regards to urgency and impact. 	M	<u>Coastal and Storm Water Catchment Management</u> .	In house, in the normal course of business.	October 2009 - ongoing.	Plan 3: Quality Living Environments
<ul style="list-style-type: none"> Drainage infrastructure capable of managing increased run-up Prioritisation across projects with regards to urgency and impact. 	M	<u>Coastal Policy</u> .	In house, in the normal course of business.	October 2009 - ongoing.	Plan 3: Quality Living Environments
Reduced water demand.	L	<u>Water and Sanitation, Department of Water</u> .	In house resources to initiate discussion. Future requirements to be identified in due course.	Discussion to be initiated and future timing agreed by end December 2009.	Plan 1: Sustaining our Natural and Built Environment



Table 2 Health Sector Adaptation Interventions

Ref	Adaptation Category	Sub-category	Impact	Intervention	Implementation plan (including policy framework for addressing issue)
H1	Health	Disaster Management	All	Improve the ability of Health Care Systems to respond effectively during emergencies.	<ul style="list-style-type: none"> • Presentation to Member of Executive Council and Provincial Government as first step to getting National Government to incorporate climate change adaptation in National 10 Point Plan. • Undertake a structured review of primary health care system to identify interventions required to enhance institutional capacity and develop plan for implementation. • Implement interventions identified during review. • Develop umbrella Health Unit Emergency Plan to enhance emergency response capability, resourcing, co-ordination and prioritisation of cases between primary, secondary and tertiary response units. • Contingency plans should be developed for each response unit including the following aspects: <ul style="list-style-type: none"> - Early warning of disease outbreaks and extreme weather (heat waves/storms). - All hospitals to be equipped with back-up energy (renewable or generators) to cope with the combination of heat related stress and simultaneous power outages. - 'Cool rooms' to be identified in local communities (e.g. air-conditioned church hall). - Particular focus on care for HIV/AIDS patients.
H2	Health	Disease control	Disease	Enhance analysis of data on existing "notifiable medical conditions" surveillance and prevention programmes.	<ul style="list-style-type: none"> • Recruit an Epidemiologist to work in the Health Unit. • Joint report to Treasury setting out strategic planning for climate change seeking budget from council for: <ul style="list-style-type: none"> - Funding research on causal relationships between climate change impacts and human health. - Housing needs. - Water requirements. - Increased resources within Health Unit.
H9	Food	Disease control	Disease	Investigate research on the impact of climate change on food e.g. red tide poisoning and impact of increased survival of microbes in the warmer temperatures on food poisoning.	<ul style="list-style-type: none"> • Desktop review of existing research. • Link findings with the food programme. • Ensure that existing disease reporting procedures build on this work to ensure rapid detection of contaminants and source identification, in order to respond quickly to climate-related contamination of food.



Outcome	Priority	Responsible Parties (1st listed = lead)	Resource Availability	Timing	Aligned with IDP?
<ul style="list-style-type: none"> Strengthening of Primary Health Care Services. Heighten the ability of primary health care units to respond to emergencies with fewer referrals to already overburdened hospitals. Health Care Units across the region operate under the same reporting structures and provide consistent services. 	H	<u>Health - Clinical Support</u>	Review to be carried out in house in the normal course of business in order to identify future resource requirements.	Presentation by end December 2009, incorporate review in revised IDP in early 2010.	Plan 3: Quality Living Environments Plan 4: Safe, Healthy and Secure Environment
<ul style="list-style-type: none"> Better understanding of the factors affecting transmission of disease will facilitate an improved response. Improved monitoring and analysis of causal factors and spread of “notifiable medical conditions” which includes malaria, cholera, and diarrhoea. 	M	<u>Health - Communicable Disease</u>	Development of report within normal course of business. Future resource requirements to be identified.	Recruitment by end December 2009, report by March 2010.	Plan 4: Safe, Healthy and Secure Environment
<ul style="list-style-type: none"> Increased understanding of link between climate change and disease risk. Will facilitate awareness raising and associated behavioural change. 	M	<u>Health - Communicable Disease</u>	In house, in the normal course of business.	Issue instruction by December 2009.	Plan 3: Quality Living Environments



Table 2 Health Sector Adaptation Interventions

Ref	Adaptation Category	Sub-category	Impact	Intervention	Implementation plan (including policy framework for addressing issue)
H4	Health, Water	Disease control	Disease	<p>Develop a framework within which all responsible parties work together to identify and manage problem sources of contaminated water including:</p> <ul style="list-style-type: none"> • Routine assessment of water quality in problem areas. • Illegal connections to sewer mains and potential backwashing locations. • Increase penalties for dumping and failure to comply with water quality regulations. • Identify and implement actions to improve water quality (considering impact on environment and longer term disease control). 	<ul style="list-style-type: none"> • Hold workshop with all affected parties to discuss needs and initiate framework development. • Develop plan of action and procedures in consultation with all stakeholders.
H3	Health	Disease control	Disease	<p>Public awareness campaign on:</p> <ul style="list-style-type: none"> • Conditions favourable to rodent/ mosquito breeding. • Preventative measures (e.g. use of mosquito nets). • Identification of related illnesses. 	<p>Review Clean, Green and Healthy public awareness campaign and if required, develop training program for Environmental Health Practitioners targeting climate change and disease awareness. This information to be disseminated to public through Clean Green and Healthy Campaign.</p>
H7	Food	Disease control	Disease	<p>Expand public awareness programme to increase awareness of:</p> <ul style="list-style-type: none"> • Food hygiene and good food handling practices. • Food borne illnesses and reporting process. • Infection prevention and control from contaminated water. 	<ul style="list-style-type: none"> • Social Development facilitators to include this in training package to community health workers. • Community Health Workers to spread the word within communities.
H6	Health	Health	Temperature	<p>Increase public awareness of how to keep cool in a heat wave without increasing electricity consumption, through use of fans and air conditioners. Activities could include:</p> <ul style="list-style-type: none"> • Shade north and west-facing windows. • Paint buildings and surrounding walls white to reflect heat. • Plant small trees and shrubs around buildings. • Replace metal blinds with curtains with white linings to reflect heat outwards where possible. 	<ul style="list-style-type: none"> • Develop guidance note or public announcements for extreme weather events. • Incorporate Climate Change in workshop to be held in November 2009.
H8	Food	Disease control	Disease	<p>Environmental Health Practitioners (EHPs) to:</p> <ul style="list-style-type: none"> • Raise awareness of increased risk of disease through higher temperatures and changing conditions during routine audits of formal and informal food trades. • Encourage food industries to develop contingency plans to manage food supply chains to reduce the impact of hot weather. 	<ul style="list-style-type: none"> • Environment Health Practitioners Health Education Programme to be reviewed. • Hazard Analysis Critical Control Point (HACCP) systems to be applied to the Municipality's food chains. • Skills development programme. • Expand 5 keys to safer food programme beyond 2010.
H5	Health	Health	Temperature	<p>Research to create a better understanding of heat related morbidity and mortality which could help with disaster management.</p>	<ul style="list-style-type: none"> • Encourage tertiary institutions to carry out research. • Take part in development of graduates. • Use registrars on their 6 month "attachments".

Outcome	Priority	Responsible Parties (1st listed = lead)	Resource Availability	Timing	Aligned with IDP?
<ul style="list-style-type: none"> Improved quality of recreational water sources in Durban. Reduction in conditions conducive to the spread of and the incidence of water-borne diseases. Fewer illegal connections to sewers. Drainage and storm water system operates to its specification. Improve ecosystem services. 	M	Health - Environmental Health, Water and Sanitation, Communicable Disease, Environmental Planning and Climate Protection Department.	In house, workshop to be held in the normal course of business. Additional resource requirements will be identified through this process	Meeting by December 2010, plan in place by June 2011.	Plan 3: Quality Living Environments Plan 4: Safe, Healthy and Secure Environment Plan 7: Good Governance
<ul style="list-style-type: none"> Reduction in vector breeding areas. Reduction in disease transmission (e.g. malaria, cholera, diarrhoea etc). Reduced incidence of disease/ death. 	M	Health - Environmental Health, Clinical Support, Communicable Disease.	In house review, funding may be required for training.	Review by end June 2010, training to last 24 months.	Plan 4: Safe, Healthy and Secure Environment
Behavioural change with regard to cultural, social, societal preferences as well as food handling and processing norms resulting in reduced risk of food poisoning, diarrhoeal diseases, death.	M	Health - Environmental Health, Social Development, Communicable Disease.	In house, develop training package in the normal course of business.	By June 2010 and ongoing.	Plan 4: Safe, Healthy and Secure Environment
<ul style="list-style-type: none"> More comfortable living conditions during hot weather will reduce incidence of heat stress and reduce pressure on health services. Better communication of climate change risks leads to more appropriate public responses; less panic. 	M	Health - Environmental Health, Social Development.	In house, develop guidance note in the normal course of business.	By end December 2010.	Plan 4: Safe, Healthy and Secure Environment
<ul style="list-style-type: none"> Early warning on food disease outbreaks (including fisheries) via a disease reporting protocol. Increased resilience of food industry to outbreak of disease. Traceability of origin of disease outbreaks. 	L	Health - Environmental Health.	In house, curriculum is continually being revised.	Develop initial programme by end December 2009.	Plan 4: Safe, Healthy and Secure Environment
Better understanding of the factors affecting heat related morbidity and mortality.	L	Health - Clinical Support	Normal course of business, Clinical Health officials to identify external resource needs.	Raise resources; June 2010 for implementation in FY2010/11.	Plan 4: Safe, Healthy and Secure Environment

Table 3

Disaster Management Sector Adaptation Inter

Ref	Adaptation Category	Sub-category	Impact	Intervention	Implementation plan (including policy framework for addressing issue)
DM2	Disaster	Disaster Management	All	Implement Disaster Risk Management Framework.	<ul style="list-style-type: none"> • Determine priorities and ultimate outcomes desired. • Establish institutional arrangements required to support the framework including the establishment of an advisory forum and restructure Disaster Management within the City.
DM3	Disaster	Disaster Management	All	Undertake a detailed assessment of all risks in Durban.	<ul style="list-style-type: none"> • Terms of Reference to be developed and contracting to be arranged through liaison between Disaster Management and Environmental Planning and Climate Protection Department. • Contract consultants to: <ul style="list-style-type: none"> - Undertake a systematic assessment of all risks in Durban building on work done for the FIFA 2010 World Cup™ and by the military for the province and including the impact of climate change. - Develop a Disaster Management Policy and Business Plan.
DM1	Disaster	Disaster Management	All	Secure additional resources for Disaster Management Unit.	<ul style="list-style-type: none"> • Report to Treasury around critical vacancies and motivating for additional staff: <ul style="list-style-type: none"> - Keep a log of time spent by existing staff on different tasks (e.g. admin, external meetings etc). - Link staff requirement to FIFA 2010 World Cup™ to prioritise with politicians. • Chase Human Resources Department to proceed with recruitment for vacancies. • Interview and hire new staff.
DM4	Disaster	Disaster Management	All	Revise Contingency Plans for key risk areas.	<p>In the short term:</p> <ul style="list-style-type: none"> • Prioritise dealing with South Durban through Major Hazard Installation assessments. • Revise contact details in existing plans and develop templates and train individual departments to develop their own plans. • Following completion of the risk assessment project, revise plans to ensure they address all risks and are able to withstand the increased frequency and severity of emergencies likely due to climate change. Plans should include provision for: <ul style="list-style-type: none"> - Well resourced and organised Emergency Operations Centre linked to early warning system. - Involve all affected departments and agencies across the Municipality. - Must link with Energy and Health Disaster Plans. - Include arrangements for facilities to house displaced populations and maintain hygiene standards to prevent outbreaks of disease in refugee camps. - Emergency centres (operational control, temporary shelter, mobile clinics etc.) should be set up in 'safe areas' where infrastructure and access are unlikely to be severely impacted. - Schedule for regular live rehearsal exercises to keep people involved, to identify any shortcomings in plans and to ensure all parties are aware of their responsibilities before, during and after an emergency.

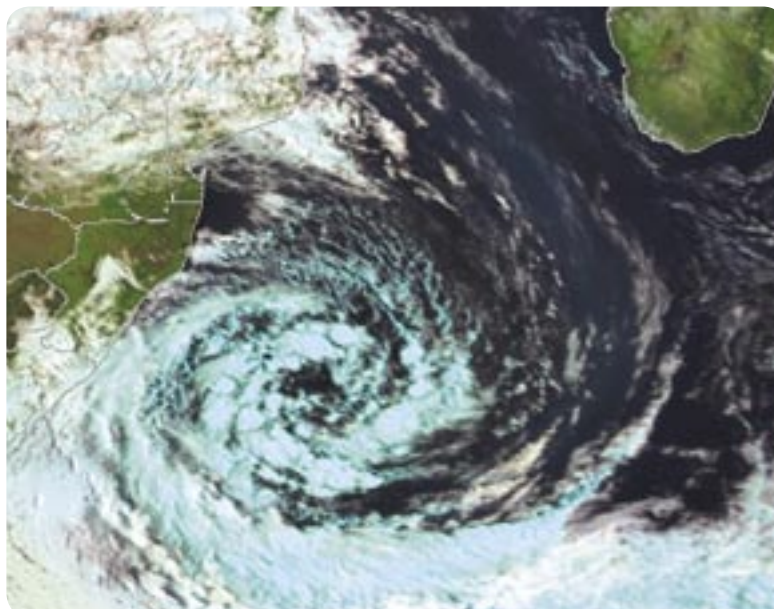
ventions

Outcome	Priority	Responsible Parties (1st listed = lead)	Resource Availability (within lead party)	Timing	Aligned with IDP?
<ul style="list-style-type: none"> Better Disaster Management function within the Municipality. Departments and organisations mandated to undertake certain activities. Framework for escalation of emergencies - Bronze (Operational); Silver (Tactical); Gold (Strategic). 	H	<u>Disaster Management.</u>	In house, meetings within the normal course of business.	Initiate work by March 2010.	Plan 4: Safe, Healthy and Secure Environment.
<ul style="list-style-type: none"> Comprehensive understanding of the scope and nature of risk facing Durban and the vulnerability of the city and its people. Baseline from which to develop contingency plans and enhance Disaster Management capability in Durban. 	H	<u>Disaster Management, Environmental Planning and Climate Protection Department.</u>	<ul style="list-style-type: none"> External expertise required. Some budget available in FY2009/10. Additional budget required. 	<ul style="list-style-type: none"> Terms of reference issued 31 December 2009. Contract signed 31 May 2010. Project Complete 30 November 2011. 	Plan 4: Safe, Healthy and Secure Environment
<ul style="list-style-type: none"> Disaster Management function within the Municipality will operate more effectively. Branch able to do more: <ul style="list-style-type: none"> - Strategic planning. - Contingency planning. - Public awareness. - Social welfare. 	H	<u>Disaster Management.</u>	Recruitment process within the normal course of business.	<ul style="list-style-type: none"> Start logging time end November 2009. Report to Treasury by end March 2010. Have resources in place by November 2010. 	Plan 4: Safe, Healthy and Secure Environment
<ul style="list-style-type: none"> Disaster Management capability in the region enhanced and co-ordinated emergency response and contingency plans developed for all agencies and departments involved in the response to emergencies. Better capacitated and resourced Joint Operations Centre. Hazard Management Plans more widely understood and acted upon. More effective and efficient response and recovery from emergencies. Reduced loss of life and property. 	H	<u>Disaster Management, Fire Department.</u>	Following DM1, resources available in house.	<ul style="list-style-type: none"> Revision of contact details by March 2010. Fully revised plans July 2011 - June 2012. Live exercises - biannual from June 2012. 	Plan 4: Safe, Healthy and Secure Environment

Table 3

Disaster Management Sector Adaptation Inter

Ref	Adaptation Category	Sub-category	Impact	Intervention	Implementation plan (including policy framework for addressing issue)
DM5	Disaster	Disaster Management	All	Disaster Management Summit - to raise awareness of Disaster Management function and unit responsibilities - refer to hosting a successful FIFA 2010 World Cup™ and managing climate change risk.	<ul style="list-style-type: none"> • Workshop with all parties involved in Disaster Management activities. • Invitation from the City Manager to encourage senior management attendance. • Events covering: <ul style="list-style-type: none"> - Disaster Management Framework. - Concept of Operations (once revised). - Summary of risk assessment project progress. - Summary of risk assessment project results. - Contingency Plan development. - Live exercises to rehearse emergency response (see DM4).
DM6	Disaster	Disaster Management	All	Develop a reliable early warning system alerting residents and disaster management to the likely occurrence of emergencies: <ul style="list-style-type: none"> • Storms. • High river levels (flooding). • Extreme rainfall (flooding). • Extreme high tide. • High temperature and humidity levels. • Disease outbreaks (e.g. cholera). 	<ul style="list-style-type: none"> • Link to implementation of Disaster Management Framework (DM2). • Manager of Communications Centre to tighten protocols and develop procedures for: <ul style="list-style-type: none"> - Collection of information from appropriate sources. - Analysis of data and dissemination of alerts as appropriate. - Guidance to call centre operators on what to do upon receipt of alert or emergency call.
DM7	Disaster	Disaster Management	All	Public awareness campaign alerting population to: <ul style="list-style-type: none"> • How they can reduce the potential impact of an emergency and what to do when one occurs. • How to maintain health during hot periods (reduce exercise, consume liquids, stay indoors etc). • Linking risk reduction with development. 	<ul style="list-style-type: none"> • Formulation of health network systems and dissemination of information on heat stress. • Enhance current work with vulnerable communities. • Link with Air Quality communication strategy.



ventions

Outcome	Priority	Responsible Parties (1st listed = lead)	Resource Availability (within lead party)	Timing	Aligned with IDP?
<ul style="list-style-type: none"> • First step in capacity building process. • Begin discussions on the risk to the city and the need for holistic, multilateral response. • Departmental stakeholders ready to participate in risk assessment project (e.g. sharing data sets). • City's Disaster Management Plan in line with the, "National Disaster Management Strategy". 	H	<u>Disaster Management</u>	Following DM1, resources available in house.	Incorporate in revised IDP in early 2010.	Plan 4: Safe, Healthy and Secure Environment
<ul style="list-style-type: none"> • Communication to emergency services and vulnerable communities will allow contingency plans to kick into action and for preparations to take place in advance of the event (e.g. sandbags to protect houses, cool rooms to be prepared). • Communications centre ready to manage emergencies in advance of the FIFA 2010 World Cup™. 	M	<u>Disaster Management - Communications Centre</u>	In house, in the normal course of business in the Communications Centre.	30 April 2010.	Plan 4: Safe, Healthy and Secure Environment
Better informed public able to take action and reduce risk to themselves and therefore reduce burden on disaster management.	M	<u>Disaster Management, Health - Environmental Health.</u>	Following DM1, resources available in house.	Incorporate in revised IDP in early 2010.	Plan 4: Safe, Healthy and Secure Environment



Table 4 Multi-Criteria Assessment of the Adaptation

Ref	Adaptation Category	Sub-category	Impact	Intervention	Impact on risk 3 = Risk reduced 2 = None 1 = Risk increased	Ancillary benefits 3 = Yes 2 = No
W1	Water	Infrastructure Protection (New)	Flooding	Detailed analysis of latest rainfall/run-off projections and modelling of systems to be finalised.	2	3
W2	Water	Infrastructure Protection (New)	Flooding	Revise rainfall data in line with latest projections (as of 30 September 2009) and review every 5 years.	2	3
W9	Water	Infrastructure Protection (Existing)	Flooding	Protect and restore riparian vegetation so as to protect integrity of river banks and retain biological buffers against flooding.	3	3
W5	Water	Infrastructure Protection (New)	Flooding	Develop Master Drainage Plans for all river catchments within eThekweni Municipal boundaries.	3	2
W6	Water	Infrastructure Protection (New)	Sea Level Rise	Revise coastal set back lines.	3	3
H1	Health	Disaster Management	All	Improve the ability of Health Care Systems to respond effectively during emergencies.	3	3
DM2	Disaster	Disaster Management	All	Implement Disaster Risk Management Framework.	2	3
DM3	Disaster	Disaster Management	All	Undertake a detailed assessment of all risks in Durban.	2	3
W8	Water	Infrastructure Protection (New)	Sea Level Rise	Prepare Coastal Management Plans for entire Durban coastline.	3	3
W17	Water	Water Security	Water Availability	Incorporate requirement that Umgeni Water consider the impact of climate change on rainfall and run-off into eThekweni Municipality's water purchase agreement.	2	3
W18	Water	Water Demand Management	Water Availability	Develop an overarching Water Use Strategy which captures existing interventions being undertaken within the Municipality, identifies additional interventions, creates clear priorities and an implementation plan for responding to the challenges of a current water shortage impacted on by climate change and its further impact on water security.	3	3
DM1	Disaster	Disaster Management	All	Secure additional resources for Disaster Management Unit.	3	3
DM4	Disaster	Disaster Management	All	Revise Contingency Plans for key risk areas.	3	3
DM5	Disaster	Disaster Management	All	Disaster Management Summit - to raise awareness of Disaster Management function and unit responsibilities - refer to hosting a successful FIFA 2010 World Cup™ and managing climate change risk.	3	3
W14	Water	Infrastructure Protection (Existing)	Flooding, Sea Level Rise	Relocate informal settlements which are highly vulnerable to flooding and sea level rise.	3	3

* Please note that included in the Multi-Criteria Assessment table are interventions for sectors other than the health, water and disaster management sectors, these are denoted with the reference O. The 'other sector' intervention table will be provided on request.

Plan Interventions*

Reversible/ Flexible? 3 = Yes 2 = Neutral 1 = No	Impact on emissions 3 = Reduced 2 = None 1 = Increased	Allows complementary interventions 3 = Yes 2 = Neutral 1 = No	Ease of implementation 3 = Easy 2 = Neutral 1 = Difficult	Institutional complexity 3 = Simple 2 = Neutral 1 = Complex	Cost: Benefit 3 = Low cost/high benefit 2 = Neutral 1 = High cost/low benefit	Risk of maladaptation 3 = Low 2 = Medium 1 = High	Merit (sum of criteria)	Urgency 1 = Medium 2 = High 3 = Very High	Priority (Merit x Urgency) H = >45 M = 22 - 45 L = <22	
3	2	3	3	3	3	3	25	3	75	H
3	2	3	3	3	3	3	25	3	75	H
3	3	3	2	2	3	3	25	3	75	H
3	2	3	3	2	3	3	24	3	72	H
3	2	3	3	1	3	3	24	3	72	H
3	2	3	1	2	3	3	23	3	69	H
2	2	3	3	1	3	3	22	3	66	H
3	2	3	2	1	3	3	22	3	66	H
3	2	3	1	1	3	2	21	3	63	H
3	2	3	1	1	3	3	21	3	63	H
2	2	3	2	1	3	2	21	3	63	H
2	2	2	1	2	1	3	19	3	57	H
2	2	2	1	1	3	2	19	3	57	H
3	1	3	1	1	3	1	19	3	57	H
1	3	3	1	1	2	1	18	3	54	H

Table 4 Multi-Criteria Assessment of the Adaptation

Ref	Adaptation Category	Sub-category	Impact	Intervention	Impact on risk 3 = Risk reduced 2 = None 1 = Risk increased	Ancillary benefits 3 = Yes 2 = No
W15	Water	Infrastructure Protection (Existing)	Flooding, Sea Level Rise	Protection of municipal infrastructure (e.g. transport, storm water, sewerage, electrical etc).	3	3
W3	Water	Infrastructure Protection (New)	Flooding	Elevate Flood Annexure to Council Policy.	3	3
W16	Water	Infrastructure Protection	Flooding	Develop co-ordinated procedure for inspection, clearance and maintenance of all storm water channels, attenuation infrastructure and water courses.	3	3
O2	All	All	All	Raise public awareness of issues associated with climate change to build capacity, encourage early action and facilitate national policy development.	3	3
W12	Water	Infrastructure Protection (New)	Flooding	Amend Town Planning 'Scheme Controls' to incorporate fixed parameters for run-off in order to reduce storm water run-off from new developments.	3	3
H2	Health	Disease control	Disease	Enhance analysis of data on existing "notifiable medical conditions" surveillance and prevention programmes.	2	3
H9	Food	Disease control	Disease	Investigate research on the impact of climate change on food e.g. red tide poisoning and impact of increased survival of microbes in the warmer temperatures on food poisoning.	2	3
DM6	Disaster	Disaster Management	All	Develop a reliable early warning system alerting residents and disaster management to the likely occurrence of emergencies.	3	2
O3	Agriculture	Adaptive farming	Food	Develop a system to provide financial support to rural communities in order to encourage an approach of adaptive farming including access to credit, investment in the rural economy and support to institutions.	3	3
O4	Agriculture	Adaptive farming	Food	Develop training programme to encourage farming approaches that include greater awareness of climate change.	3	3
H4	Health, Water	Disease control	Disease	Develop a framework within which all responsible parties work together to identify and manage problem sources of contaminated water.	3	3
W4	Water	Infrastructure Protection (New)	Flooding	Reduce risk to developments in flood plains through amendment of Bylaw 5.2 (2) (iii) to require developments within the 1:100 yr flood line within eThekweni boundaries to comply with the Flood Annexure.	3	2
W7	Water	Infrastructure Protection (New)	Sea Level Rise	Develop Council Policy and By-laws or scheme controls covering development within coastal set back lines.	3	2
O9	Housing	Water Conservation, Health	Water Availability, Temperature	<ul style="list-style-type: none"> Design requirements for low cost housing to incorporate water conservation and temperature regulation measures such as rain water harvesting tanks, solar water heaters, ceilings, size of windows and orientation etc. Developments to include communal renewable energy, grey water and/or sanitation systems. 	3	3

Plan Interventions

Reversible/ Flexible? 3 = Yes 2 = Neutral 1 = No	Impact on emissions 3 = Reduced 2 = None 1 = Increased	Allows complementary interventions 3 = Yes 2 = Neutral 1 = No	Ease of implementation 3 = Easy 2 = Neutral 1 = Difficult	Institutional complexity 3 = Simple 2 = Neutral 1 = Complex	Cost: Benefit 3 = Low cost/high benefit 2 = Neutral 1 = High cost/low benefit	Risk of maladaptation 3 = Low 2 = Medium 1 = High	Merit (sum of criteria)	Urgency 1 = Medium 2 = High 3 = Very High	Priority (Merit x Urgency) H = >45 M = 22 - 45 L = <22	
1	1	2	3	3	1	1	18	3	54	H
3	2	3	3	2	3	3	25	2	50	H
2	2	3	2	2	3	3	23	2	46	H
3	3	3	1	1	3	3	23	2	46	H
3	2	3	1	1	3	3	22	2	44	H
3	2	3	2	1	3	3	22	2	44	M
3	2	3	3	1	3	2	22	2	44	M
3	2	3	2	3	3	1	22	2	44	M
3	3	2	1	1	3	3	22	2	44	M
3	3	2	1	1	3	3	22	2	44	M
3	2	3	1	1	3	2	21	2	42	M
3	2	3	1	1	2	3	20	2	40	M
3	2	3	1	1	2	3	20	2	40	M
2	3	3	1	1	2	1	19	2	38	M

Table 4 Multi-Criteria Assessment of the Adaptation

Ref	Adaptation Category	Sub-category	Impact	Intervention	Impact on risk 3 = Risk reduced 2 = None 1 = Risk increased	Ancillary benefits 3 = Yes 2 = No
O12	Water	Infrastructure Protection	Flooding	Incorporate response to the impacts of climate change in Integrated Transport Plans from 2010.	3	2
W13	Water	Infrastructure Protection (Existing)	Flooding	Public awareness campaign to raise awareness of the benefits of retrofitting storm water run-off reduction techniques e.g. green roofs, retention/wet basins, detention/dry basins, infiltration basins, rain water harvesters etc. to reduce runoff from existing developments.	3	3
H3	Health	Disease control	Disease	Public awareness campaign on: <ul style="list-style-type: none"> • Conditions favourable to rodent/mosquito breeding. • Preventative measures (e.g. use of mosquito nets). • Identification of related illnesses. 	3	3
H7	Food	Disease control	Disease	Expand public awareness programme to increase awareness of: <ul style="list-style-type: none"> • Food hygiene and good food handling practices. • Food borne illnesses and reporting process. • Infection prevention and control from contaminated water. 	3	3
H6	Health	Health	Temperature	Increase public awareness of how to keep cool in a heat wave without increasing electricity consumption through use of fans and air conditioners.	3	3
O1	All	All	All	Develop socio-institutional learning capacity within the Municipality to facilitate better decision making and avoid mal-adaptive approaches.	3	3
W10	Water	Infrastructure Protection (Existing)	Flooding	Ensure that Asset Management Plans consider revised rainfall/runoff data in assessment of the condition of storm water and catchment management assets.	3	2
W11	Water	Infrastructure Protection (Existing)	Sea Level Rise	Ensure that Asset Management Plans consider revised sea level rise scenarios in assessment of the condition of coastal assets.	3	2
DM7	Disaster	Disaster Management	All	Public awareness campaign alerting population to: <ul style="list-style-type: none"> • Reducing the potential impact of an emergency and what to do when one occurs. • Maintaining health during hot periods (reduce exercise, drink more liquids, stay indoors etc). • Linking risk reduction with development. 	3	3
O6	Agriculture	Disease control	Disease	Develop disease reporting protocol to provide early warning of crop and livestock disease outbreaks and to facilitate tracing and containment/isolation of vectors and dangerous food.	3	3
W19	Water	Water Demand Management	Water Availability	Revision of the water level regulation licences to promote water demand reduction.	3	3
H8	Food	Disease control	Disease	Environmental Health Practitioners (EHPs) to: <ul style="list-style-type: none"> • Raise awareness of increased risk of disease through higher temperatures and changing conditions during routine audits of formal and informal food trades. • Encourage food industries to develop contingency plans to manage food supply chains to reduce the impact of hot weather. 	3	3

Plan Interventions

Reversible/ Flexible? 3 = Yes 2 = Neutral 1 = No	Impact on emissions 3 = Reduced 2 = None 1 = Increased	Allows complementary interventions 3 = Yes 2 = Neutral 1 = No	Ease of implementation 3 = Easy 2 = Neutral 1 = Difficult	Institutional complexity 3 = Simple 2 = Neutral 1 = Complex	Cost: Benefit 3 = Low cost/high benefit 2 = Neutral 1 = High cost/low benefit	Risk of maladaptation 3 = Low 2 = Medium 1 = High	Merit (sum of criteria)	Urgency 1 = Medium 2 = High 3 = Very High	Priority (Merit x Urgency) H = >45 M = 22 - 45 L = <22	
1	3	2	2	1	2	1	17	2	34	M
3	2	3	3	2	2	3	24	1	24	M
3	2	3	3	3	3	1	24	1	24	M
3	2	3	3	2	3	2	24	1	24	M
2	3	3	2	2	2	3	23	1	23	M
2	2	3	3	1	3	3	23	1	23	M
3	2	3	2	3	3	1	22	1	22	M
3	2	3	2	3	3	1	22	1	22	M
3	2	3	1	1	3	3	22	1	22	M
3	2	3	1	1	3	3	22	1	22	M
2	2	3	1	1	3	3	21	1	21	L
3	1	3	1	3	2	2	21	1	21	L

Table 4 Multi-Criteria Assessment of the Adaptation

Ref	Adaptation Category	Sub-category	Impact	Intervention	Impact on risk 3 = Risk reduced 2 = None 1 = Risk increased	Ancillary benefits 3 = Yes 2 = No
H5	Health	Health	Temperature	Research to create a better understanding of heat related morbidity and mortality which could help with disaster management.	2	3
O10	All	All	All	Encourage insurance industry to reassess risks taking climate change impacts into account.	2	2
O8	Energy Office	Health	Temperature	Promote cooling technologies that do not increase the consumption of fossil fuels and exacerbate greenhouse gas emissions.	2	3
O11	All	All	All	Assess infrastructure inventory against age, location, climate change risk, insurance value and maintenance budget to better understand potential cost to Municipality.	3	2
O7	Agriculture	Other	Food	<ul style="list-style-type: none"> Improved market access so as to increase the geographical spread from which food in Durban is sourced. Improved rail freight for farmers food so as to allow wider access to food markets. 	3	3
O5	Agriculture	Adaptive farming	Food	Link crop development programmes to climate change projections.	3	2



Plan Interventions

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3	2	3	3	1	2	1	20	1	20	L
3	2	3	3	1	3	1	20	1	20	L
1	3	2	1	2	2	3	19	1	19	L
2	1	3	1	1	3	3	19	1	19	L
3	1	2	1	1	2	2	18	1	18	L
1	3	3	1	1	2	1	17	1	17	L





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