Western Cape Government
Environmental Affairs and Development Planning

WESTERN CAPE CLIMATE CHANGE RESPONSE STRATEGY:

3rd Biennial Monitoring & Evaluation Report 2019/20

Progress in preparing for climate change –
Empowering Business Unusual

MARCH 2020

ABOUT THIS REPORT

This is the third report highlighting the implementation efforts relating to the focus areas outlined within the Western Cape Climate Change Response Strategy 2014 in achieving lower carbon development and increased resilience. The document aims to:

i) coordinate and bring sources of existing information and inputs from stakeholders together to achieve this purpose;
ii) identify gaps and emerging areas of development, planning and implementation;
iii) raise awareness of the urgency of responding to climate change in the Western Cape and our collective response in this critical societal and economic challenge, cognisant that climate change has been identified globally as a threat multiplier to occurrences of natural and environmental disasters;
iv) identify further opportunities for partnerships and upscaling;
v) plot trends where data are available, and identify emerging risks, gaps and opportunities; and
vi) provide an opportunity to influence strategic cross-sectoral economic and development planning and implementation in both the public and private sector of the Western Cape.

The document is not intended to be a report that tracks climate change hazards and risks (i.e. trends in temperature, rainfall etc.), although the latest information on the topic has been included. This report is also not a source of primary/newly collected data, unless they are already being tracked, given the limited resources and capacity allocated towards climate change response in the province. At this stage we may not be able to track whether each of our efforts is the exact 'right response' to each climate related challenge, as many of these evaluations will not be possible with the current data availability, human resource base, knowledge and uncertainty with regards to some climate stimuli. The report will include information on these where they are obtainable and forthcoming from partners, and where rational conclusions and discussions can be derived.

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THE FUTURE OF THIS REPORT

This is the third iteration of a multi-sectoral climate change response stocktake for the Western Cape. It gives recommendations and highlights opportunities for rapidly strengthening Western Cape stakeholder's climate change response thereby creating a low carbon and resilient province.

This report, along with additional national commitments to international climate change decisions will assist in providing further clarity and a way forward on more informed targets for the province in future.

As the current (2014) Western Cape Climate Change Response Strategy is due for a review in 2020/2021, future iterations of this report will be responding to priorities and targets set in the revised strategy. Likely, this will include an agreed set of proportional targets for the province based on national and international commitments, for both mitigation and adaptation. If national directive is not as ambitious as desired by the Western Cape Government, a self-determined set of ambitious provincial targets will be adopted. These will be inspired by the 2021 - Provincial Strategic Plan and related Vision Inspired Priorities, while also linked to the Subnational Global Climate Leadership MOU 'Under2 MOU' of which the Western Cape Government is a signatory.

As the Western Cape Climate Change Response Strategy is a strategy that covers a diverse range of sectors and activities in the Western Cape, its scope is broad and thus reporting on implementation equally as broad. You The reader is invited to contact the coordinating team if you:

i) wish to contribute to the report in future iterations,
ii) have identified an indicator or data set that your organisation owns and is willing to share in a particular form;
iii) have identified an area / topic that should be covered in the next iteration of the Western Cape Climate Change Response Strategy; or
iv) would like to showcase innovative climate response projects and initiatives.

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ABBREVIATIONS AND ACRONYMS

ACF	Alternative Crops Fund
ACIP	Accelerated Community Infrastructure Programme
AFOLU	Agriculture, Forestry and Other Land-use
APPs	Annual Performance Plan
BGCMA	Breede-Gouritz CMA
BLC	Better Living Challenge
BRIP	Berg River Improvement Plan
BRT	Bus Rapid Transit
BUR	Biennial Update Report
BW	Bid Window
CAPA	Climate Change Adaptation Plan of Action
CARA	Conservation of Agricultural Resources Act (Act 43 of 1983)
CBA	Critical Biodiversity Area
CC	Climate Change
CCC	Climate Change Corridor
CDI	Craft and Design Institute
CDM	Clean Development Mechanism
CHEC	Cape Higher Education Consortium
CMA	Catchment Management Agency
CML	Coastal Setback / Management Line
CMP	Coastal Management Programme
CO_2	Carbon dioxide
COGTA	Department of Cooperative Governance and Traditional Affairs
COP	Conference of the Parties
COP21	21st UNFCCC Conference of Parties
CRP	Climate Resilience Project
CSA	Climate Smart Agriculture
DEA	Department of Environmental Affairs (now DEFF)
DEA&DP	Department of Environmental Affairs & Development Planning
DEDAT	Department of Economic Development and Tourism
DEFF	Department of Environment, Forestry and Fisheries
DMA	Disaster Management Act (Act 57 of 2002)
DMRE	Department of Mineral Resources and Energy
DoE	Department of Energy
DORA	Division of Revenue Act
DRR-M	Disaster Risk Reduction Management
DTPW	Department of Transport and Public Works
DWS	Department of Water and Sanitation
EDGE	Excellence in Design for Greater Efficiencies
EEDSM	Energy Efficiency Demand Side Management
EGS	Ecosystem Goods and Services
EIA	Environmental Impact Assessments
EIIF	Ecological Infrastructure Investment Framework
ENSO	El Niño-Southern Oscillation
ESA	Ecological Support Areas
EV	Electric Vehicle
EVD	Ebola Virus Disease
EWS	Early Warning System
FEPA	Freshwater Ecosystem Priority Area
GCF	Green Climate Fund
GDP	Gross Domestic Product

GGHHN	Global Green and Healthy Hospitals Network
GHG	Greenhouse Gas
GW	Gigawatt
HEI	Higher Education Institution
HFO	Heavy Fuel Oil
IAP	Invasive Alien Plant
ICE	Internal Combustion Engine
IDP	Integrated Development Plan
IPCC	Intergovernmental Panel on Climate Change
IPP	Independent Power Producer
IPPU	Industrial Process and Product Use
IPTN	Integrated Public Transport Network
IPWIS	Integrated Pollutant and Waste Information System
IRT	Integrated Rapid Transit
ISSF	Informal Settlement Strategic Framework
IWMP	Integrated Waste Management Plan
LPG	Liquified Petroleum Gas
LTAS	Long Term Adaptation Scenarios
LUPA	Western Cape Land Use Planning Act (Act 3 of 2014)
M&E	Monitoring & Evaluation
MIG	Municipal Infrastructure Grant
MPA	Marine Protected Area
MW	Megawatt
NAS	National Adaptation Strategy
NBA	National Biodiversity Assessment
NBSAP	National Biodiversity Strategy and Action Plan
NCCRWP	National Climate Change Response White Paper
NCMP	National Coastal Management Programme
NDC	Nationally Determined Contribution
NDMC	National Disaster Management Centre
NDMF	National Disaster Management Framework
NEMA	National Environmental Management Act (Act 107 of 1998)
NEMP	National Estuarine Management Protocol
NFEPA	National Freshwater Priority Area
NGO	Non-Governmental Organisation
NMT	Non-Motorised Transport
PBSAP	Provincial Biodiversity Strategy and Action Plan
PDMC	Provincial Disaster Management Centre
PHA	Philippi Horticultural Area
PPTIF	Provincial Public Transport Institutional Framework
PRASA	Passenger Rail Association of South Africa
PSDF	Provincial Spatial Development Framework
PSP	Provincial Strategic Plan 2019 – 2024
PSTP	Provincial Sustainable Transport Programme
PV	Photo-Voltaic Solar
R&V	Risk and Vulnerability
RBIG	Regional Bulk Infrastructure Grant
REIPPPP	Renewable Energy Independent Power Producer Procurement Programme
SACAD	South Africa Conservation Area Database
SANBI	South African National Biodiversity Institute
SAPAD	South Africa Protected Area Database
SBT	Sustainable Building Technology
SDF	Spatial Development Framework
SDG	Sustainable Development Goal

SET	Sector Emissions Target
SmartAgri	Smart Agriculture for Climate Resilience
SoCR	State of the Coast Report
SOEOR	State of Environment Outlook Report
SONA	State of the Nation Address
SPLUMA	Spatial Planning and Land Use Management Act (Act 16 of 2013)
SSEG	Small-Scale Embedded Generation
SWH	Solar Water Heater
SWMP	Sustainable Water Management Plan
SWSA	Strategic Water Source Area
TMF	Table Mountain Fund
TNC	Third National Communication
UISP	Upgrading of Informal Settlements Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention of Climate Change
UNISDR	United Nations International Strategy for Disaster Reduction
USA	United States of America
VIP	Vision Inspired Priority
VSD	Variable Speed Drive
WC/WDM	Water Conservation / Water Demand Management
WCCCRS	Western Cape Climate Change Response Strategy 2014
WCDHS	Department of Human Settlements
WCDM	Western Cape Disaster Management
WCG	Western Cape Government
WCG: DoA	Western Cape Government: Agriculture
WCSWMP	Western Cape Sustainable Water Management Plan
WCWSS	Western Cape Water Supply System
WISP	Western Cape Industrial Symbiosis Programme
WMA	Water Management Area
WRC	Water Research Commission
YLL	Years of Potential Life Lost

1. Introduction

1.1. An Unfolding Emergency

In our first Western Cape Climate Change Response Strategy 2014[1] (WCCCRS) Monitoring & Evaluation (M&E) report in 2016[2] we stated "*…the science on climate change is unequivocal – it is happening, it is anthropogenic in origin and it is happening in a 'worst case scenario' as global and local responses are proving to be inadequate…*". This message has become amplified globally in the past five years with the terminology now shifting to a global Climate Emergency, which has been formally declared in many instances (see Box 1). The evidence base is certainly worse than most climate scientists anticipated.

Box 1. Recent Global Events Highlighting the Narrative of the 'Climate Emergency'

The following notable events have occurred since the publication of the previous Monitoring & Evaluation Report published in 2018:

In 2018 the Intergovernmental Panel on Climate Change (IPCC) special report on the impacts of global warming of 1.5°C (the 'IPCC 1.5°C report'), highlighted that warming above 1.5°C will devastate vast regions of the planet, and be intolerable for hundreds of millions of people. It further stated that **globally we have until 2030 (essentially one decade) to create a radical reduction in emissions** that will enable the achievement of net zero emissions globally by 2050.

Since the 1.5°C report was released, it was followed in 2019 by the United Nations Environment Programme (UNEP) Emissions Gap report[3], which quite starkly states that the world is on track to produce about 50% more fossil fuels in 2030 than would be consistent with limiting warming to 2°C and 120% more than would be consistent with limiting warming to 1.5°C. Countries must increase climate ambitions threefold to achieve the 2°C goal, and fivefold to achieve the 1°C goal. ***"The scale of future action required becomes even more challenging for every year that the world delays meaningful climate action. These numbers, more than any others in the report must push policy makers to act with a sense of urgency."[4]***

In addition to the 1.5°C report, and the Emissions Gap Report, an article in Nature warns of "*Existential threat to civilisation as impacts lead to cascade of unstoppable events*", noting that several tipping points may have already been reached, if not just on the horizon[5]. In the **2020 State of the Nation Address (SONA) by President Cyril Ramaphosa echoed this point when he stated "*…humankind faces its greatest existential threat in the form of climate change.*"**

In terms of the narrative behind the term 'Climate Emergency' that is now being utilised, multiple groups and individuals have engaged this term. 11 000 scientists from 150 Countries (in counting), have signed a formal declaration to the UN imploring nations to declare a Climate Emergency. In November 2019, the European Union formally announced the declaration of a Climate Emergency. Climate Emergency declarations in 1432 jurisdictions and local governments cover 820 million citizens globally

[1] https://www.westerncape.gov.za/text/2015/march/western_cape_climate_change_response_strategy_2014.pdf

[2] https://www.westerncape.gov.za/eadp/files/atoms/files/WC%20Climate%20Change%20Response%20Strategy%20Biennial%20M%26E%20Report%20%282015-16%29.pdf

[3] https://www.unenvironment.org/resources/emissions-gap-report-2019

[4] *"On the new mantra of net zero carbon emissions, the report notes 65 countries and major subnational economies, such as the region of California and major cities worldwide, have committed to net zero emissions by 2050. However, few have submitted plans to the UNFCCC committing to a timeline, none of whom was a member of the G20 which accounts for 78 per cent of global emissions. While five G20 members (the EU and four of its individual members) have committed to long-term zero emission targets (not all with a target date), the remaining G20 members are yet to commit to achieving zero emissions."* https://www.downtoearth.org.in/blog/climate-change/climate-emergency-cop-25-a-gap-that-keeps-growing-68211

[5] https://www.theguardian.com/environment/2019/nov/27/climate-emergency-world-may-have-crossed-tipping-points

reached post-United Nations Framework Convention of Climate Change (UNFCCC) Conference of the Parties (COP) 21 Paris Agreement Global Stocktake[6].

The challenge at hand is, however, stimulating and catalysing a wave of bold economic shifts globally. For example, in 2019 the European Union announced a Euro Green Deal in assigning 1 Trillion Euro in investments (one quarter of its budget) towards tackling climate change over the next 10 years[7].

A note on COVID19

As the World Health Organisation declared the - SARS-COV-2 (the virus) which causes the coronavirus disease officially named COVID19 – a global pandemic at the time of writing of the report, a global state of emergency is unfolding to this health crisis. The result of which time will tell. Whilst the suffering and devastation caused by the global pandemic unveils itself, it will also provide us with unique insights and hope that as a global civilisation we can understand and rise to the challenge of responding to the global Climate Emergency, which even more so (but with a slower onset) is a scientifically proven existential threat to humanity.

Closer to home, since the first of these M&E reports was published, the Western Cape has experienced a considerable onset of several climate-related disasters, the drought being the most far reaching and economically and socially devastating. The drought is still not broken, with only two months of the 2019 winter experiencing slightly above average rainfall. Many regions of the interior of the Western Cape, and South Africa, remain in a drought-stricken state. In addition to the drought a number of significant fires created havoc and left destruction in their path in 2018 and 2019, particularly in the southern cape.

Although the outlook may seem dismal, we do know the facts, and can act on them now. Climate change presents us with the most unprecedented opportunity of our time to leapfrog our development practices to be more just, equitable, innovative and sustainable – and to develop a 'New Climate Economy'[8]. As climate related disasters are experienced in the Western Cape, the time is now to translate reactive, short term, largely expensive disaster responses, into proactive long-term planning that will prove to be cost-effective in the long term.

For South Africa, under the current emissions trajectory, there is projected to be an average increase above the 20th century average of 1.5°C around the coast, to 3°C in the interior, by 2050, with a doubling of these figures to 3°C and 6°C by the end of the century. As a result, coastal regions like the Western Cape are likely to see significant in-migration from the interior of the country.

Globally, 2015 was the hottest year recorded since modern records began, and 2019 was the second hottest on record, with 14 of the hottest 15 years recorded all occurring in this century[9]. The global average temperature increase has already reached 1.1°C as of December 2019[10]. Furthermore, globally, 90% of all disasters are now climate-related[11], and since the first United

[6] https://climateemergencydeclaration.org accessed 3 March 2020.
[7] The Green Deal plans to boost the goal to between 50 and 55 percent cut, a move that experts agree will be essential to accelerate emissions cuts in line with a 2050 net zero goal.
[8] Development model that fosters positive socio-economic growth while dealing with the risks posed by climate change.
[9] https://www.climatecentral.org/gallery/graphics/top-10-warmest-years-on-record
[10] https://public.wmo.int/en/media/press-release/2019-concludes-decade-of-exceptional-global-heat-and-high-impact-weather
[11] http://www.un.org/apps/news/story.asp?NewsID=53418#.VuK5_PI97IX

Nations Framework Convention of Climate Change (UNFCCC) Conference in 1995 over 600 000 lives have been lost and 4.1 billion people injured, left homeless or in need of emergency assistance as a result of weather-related disasters[12]. The 2014-2020 drought in the Western Cape has been described as once-in-a-millennium drought.

In recognition of the urgent need to rapidly reduce greenhouse gas (GHG) emissions and adapt to climate changes already being experienced, the Western Cape Government (WCG) has stated that it recognises the necessity to contribute to global efforts to reduce its GHG emissions, particularly with a longer-term view to reducing climate change impacts to 1.5°C globally as agreed on at the 21st UNFCCC Conference of Parties (COP21) in the form of the 'Paris Agreement' in December 2015. On an international level, in November 2017 the WCG committed in an international setting to responding to climate change as a regional government by joining 'The Climate Group – States and Regions Alliance', an international non-profit network of like-minded regional governments determined to contribute to the international response to climate change in order to keep the global average temperature increase below 2°C. As part of this, in April 2017 the WCG signed the Subnational Global Climate Leadership MOU 'Under2MOU', a commitment to contribute to reducing global GHG emissions to net-zero by 2050.

Equally significant, the WCG also recognises in strategic policy the need to adapt to the impacts of the unavoidable climate changes already occurring and those in the longer term, particularly as it is the most disaster-prone province in South Africa[13]. This is articulated in the Provincial Strategic Plan 2019 – 2024 (PSP) which identifies the Growth & Jobs and Mobility & Spatial Transformation Vision Inspired Priorities (VIPs) as the low hanging priorities for implementing climate resilient strategies. Historical methods of dealing with climate hazards will not be sufficient to cope with the frequency and magnitude of anticipated climate change impacts. To date, however, limited resources have been allocated towards climate-proofing each of the sectors, sector departments and thus the risks are not being lowered sufficiently to create a resilient province.

Climate change will reconfigure economic competitiveness regionally and globally, but can also provide the catalyst for investment in climate adaptation that increase economic competitiveness of the Western Cape. The 'Assessment of Economic Risks and Opportunities of Climate Change Resilience in the Western Cape' undertaken by the Western Cape Government's Department of Environmental Affairs & Development Planning (DEA&DP) Climate Change Directorate in 2017-18 provides the following (amongst others) astounding findings from modelling and analyses:

i) By investing in improved climate resilience, the Western Cape Economy could be 33% better-off in 2040 than if the province does not adapt to the impacts of climate change (Failure to invest could result in contraction of economy by 17%; whilst effective investment in climate resilience could boost provincial GDP by 15% above the no-adaptation baseline);
ii) Employment levels could increase by as much as 12% by 2040, if the province leads in adapting to climate change;
iii) Regional exports from the Western Cape could increase by 6.4% by 2040 with enhanced climate resilience; and

[12] CRED. 2015. The Human Cost of Weather Related Disasters (1995 -2015).
[13] RADAR Western Cape. 2010. Risk and Development Annual Review.

iv) A more climate resilient province will result in a lower cost of living and better quality of life for the Western Cape's people (through impacts on the Consumer Price Index).

The forecasts are clear, and can already be seen in the impacts of the drought and fires. Unless massive scaled responses are prioritised and implemented as a matter of urgency, the hard-won development gains to-date, and any other planned ones are all at stake.

Planning, preparedness, and innovation are therefore required to maximise the province's adaptive capacity to this global and local threat. Taking action now will reduce the risk and limit damages, possible loss of life, and economic costs over the coming decades and, if strategically and urgently considered, will add to the Western Cape's global competitive edge into the future. In addition, to creating a safe haven for people to reside and withstand the onslaught of disasters that are likely to hit South Africa, and Africa more broadly. The 'Assessment of Economic Risks and Opportunities of Climate Change Resilience in the Western Cape' as mentioned above, makes the case that trade-offs in terms of provincial short-term priorities may have to be made, however, and it is imperative that these are explicit rather than realising unintended consequences as a result of disastrous events. We have an imminent window of opportunity that presents us with exciting and innovative growth paths for the Western Cape.

The Stern Review completed in 2006 estimated that the percentage of global governments' Gross Domestic Product (GDP) being consumed by recovering from climate related disasters could increase to between 5% and 20% by 2100, although these figures may be even greater in the current context. **As stated in the 2015/16 M&E report: *"…against the backdrop of the socio-economic challenges facing the country and the province, such increased disaster recovery costs pose a significant risk to the achievement of the Western Cape's growth and development goals (including those related to job creation)…"* – this statement is ever more true and current given the state of climate related disasters in the province and the economic costs of responding.**

Short, medium and long term adaptation interventions specifically, and thoughtfully, designed to ensure that the Western Cape does not compromise its growth and development strategy are, therefore, critical to ensuring reduced vulnerability to the impacts of climate variability and climate change across the province.

1.2. Global Context

Since the development of the WCCCRS, the global context on climate change has reached several catalytic turning points. Of pivotal importance, nations reached a global agreement at the UNFCCC COP21, 'the Paris Agreement', on 12 December 2015. As of February 2020, all UNFCCC members have signed the agreement, 189 have become party to it, and the only significant emitters which are not parties are Iran and Turkey. The United States of America (USA) has, however, submitted a notice to withdraw from the agreement, which would come into effect after the next presidential elections.

Despite the USA's stated intent to withdraw from the Paris Agreement by 2020 a separate coalition of American cities, states and businesses, called the United States Climate Alliance and representing more than 50% of the US economy, committed to continue working to achieve the Paris Agreement. The overall international response to the USA's withdrawal has been a reaffirmation of commitment to the Paris Agreement and overall UNFCCC goals.

The key commitment by all nations is holding the increase in the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels. This will require all nations to set targets for contributing to these emissions reductions. Governments agreed on the need for global emissions to peak as soon as possible, recognizing that this will take longer for developing countries, and to undertake rapid reductions thereafter in accordance with the best available science. The global community has also established a global goal on adaptation - on enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change, with a view to contributing to sustainable development and ensuring an adequate adaptation response across all sectors in the context of the temperature goal.

Significant progress has also been made in shaping a post-2015 development agenda, and the Sustainable Development Goals (SDGs) were agreed upon in 2015 to replace the Millennium Development Goals. Among the SDGs, the responsibility for the climate change related goal (SDG 13: Climate Action) is handed over to the UNFCCC. This is the only body subject to binding targets for the SDGs. The SDGs themselves are not binding; it is up to the individual governments to decide how to implement them. The main goal of the climate objectives (to keep the rise in global average temperature below 2°C at the very least, and preferably below 1.5°C) and the main goals of the SDGs (including poverty eradication by 2030) should, however, be central to all development measures and cannot be compromised.

Financing for Development was established as a vehicle to support implementation of the SDGs. The initiative emphasises the need to prioritise climate and disaster resilience in development financing as a way of strengthening the capacity of national and sub-national stakeholders to manage and finance disaster risk and climate resilience. In addition to the SDGs, advancement was made in 2015 that speaks directly to the economic and social impacts of climate change.

The United Nations International Strategy for Disaster Reduction (UNISDR) facilitated the process of developing the Sendai Framework for disaster risk reduction (replaces the Hyogo Framework) which has strong cross linkages with climate change adaptation and resilience. The strong link to disaster risk is pivotal as is identified by the World Economic Forum in their latest annual report[14] on the top global risks – for the first time, the top 5 global risks in terms of likelihood where all environmental risks and linked to climate change, including extreme weather, climate action failure, natural disasters, biodiversity loss and human-made environmental disasters. Global Risks in terms of Impacts include climate action failure, biodiversity loss, extreme weather and a water crisis (as well as weapons of mass destruction) as the top five global risks. Since 2011, every annual global risk report has listed climate change within the top 5 global risks.

1.3. South African Context

The National Climate Change Response White Paper (NCCRWP) presents the South African Government's vision for an effective climate change response and a long-term, just transition to a climate-resilient and lower-carbon economy and society. South Africa's response to climate change has two objectives:

[14] World Economic Forum (2018). The Global Risks Report 2018, 13th Edition. Downloaded from: http://www3.weforum.org/docs/WEF_GRR18_Report.pdf

1. Effectively manage inevitable climate change impacts through interventions that build and sustain South Africa's social, economic and environmental resilience and emergency response capacity; and
2. Make a fair contribution to the global efforts to stabilise GHG concentrations in the atmosphere at a level that avoids dangerous anthropogenic interferences with the climate system within a timeframe that enables economic, social and environmental development to proceed in a sustainable manner.

The National Climate Change Response Policy highlighted eight near-term Priority Flagship Programmes that are being undertaken; these have since been expanded to ten Flagship programmes[15]:

1. The Climate Change Response Public Works Flagship Programme;
2. The Water Conservation and Water Demand Management Flagship Programme;
3. The Energy Efficiency and Energy Demand Management Flagship Programme;
4. Low Carbon, Climate Resilient Transport Systems Flagship Programme;
5. The Renewable Energy Flagship Programme;
6. The Waste Management Flagship Programme;
7. The Carbon Capture and Storage Flagship Programme;
8. The Adaptation Research Flagship Programme;
9. The Agriculture, Food Systems and Food Security Flagship Programme; and
10. The Low Carbon, Climate Resilient Built Environment, Communities and Settlements Flagship Programme.

Further at the national level, South Africa has developed a 'flagship research project', on Long-term Adaptation Scenarios[16]. The Long Term Adaptation Scenarios (LTAS) are designed to provide a consistent framework for adaptation planning for the country, as well as identify as early as possible where significant trade-offs may need to be made in terms of both national and sub-national development targets, for example, over competing water use. The LTAS brief on Water states unequivocally that "*Climate change impacts on South Africa are likely to be felt primarily via effects on water resources; significant trade-offs are likely to occur between developmental aspirations…with significant social, economic and ecological consequences through restricting the range of viable national development pathways*". The LTAS series of reports produced since the development of the WCCCRS is a critical resource for guiding downscaled action at the provincial level and useful resource for all sectors to utilise.

There is thus important work which will need to be undertaken nationally, provincially and locally to ensure that our targets meet proportionate contributions and adaptation responses. The South African Nationally Determined Contribution (NDC) spells out how this progress will be achieved in South Africa (see section below).

The national Department of Environment, Forestry and Fisheries (DEFF) (then the Department of Environmental Affairs, DEA) developed the National Adaptation Strategy (NAS) which covers all the key sectors in South Africa in terms of preparing for climate change. The NAS will link with the Climate Change Bill once that comes into effect. It provides strategic direction on what sectors should be doing to respond to climate change, although the details still need to

[15] DEA (2016). South Africa's 2nd Annual Climate Change Report. Downloaded from: https://www.environment.gov.za/sites/default/files/reports/southafrica_secondnational_climatechnage_report2017.pdf

[16] https://www.environment.gov.za/branches/climatechange_airquality

be further elaborated by each sector in many cases. Much work still lies ahead for South Africa in terms of preparing for climate change both socially and economically.

The Climate Change Bill, which is under development, is intended to become the primary legal instrument regulating and supporting climate change response in South Africa. The Bill is due to be enacted in 2021. In the absence of mitigation targets set by the Bill, the key document outlining South Africa's ambition currently is the South African NDC which speaks to the Paris Agreement. All signatories to the Paris Agreement have an NDC outlining ambition and programmes to achieve such ambition.

As part of the national Climate Change Mitigation System, the DEFF has developed Sector Emissions Targets (SETs) as one of the key elements for the implementation of South Africa's long-term climate mitigation goal. SETs are GHG emission allowances allocated to an emitting sector or sub-sector over a defined period. SETs will be allocated to government departments responsible for the sector and therefore differ from carbon budgets which are set a company level. The Carbon Tax Act (Act 15 of 2019) further introduced a long-awaited carbon tax, and together with the declaration of Greenhouse gas emissions as priority pollutants under the National Environmental Management: Air Quality Management Act (Act 39 of 2004), strongly support the mitigation agenda in South Africa by putting requirements in place on industry and other sectors to reduce their emissions and report on these reductions. Work on the finalisation of the National Climate Change Mitigation System is still underway.

DEFF, as custodian for international climate change reporting obligations, is responsible for the National Climate Change Response Monitoring and Evaluation System Framework, which was completed in 2015[17]. As part of this DEFF (then DEA) published the National Greenhouse Gas Emission Reporting Regulations in 2017, which function as a single national reporting system for greenhouse gas emissions. This feeds into the National Greenhouse Gas Inventory, South Africa's national communications to the UNFCCC and informs the implementation of legislation and policy. DEFF submitted South Africa's Third National Communication (TNC) to the UNFCCC in 2018, which communicates the country's actions to implement our commitments under the convention. Part of the intention of this reporting exercise within the WCG is to contribute to the national M&E and assess the degree to which this is feasible in various themes. DEFF also published South Africa's 2nd Annual Climate Change Report in 2017 as an overview of South Africa's progress in catalysing action in response to climate change impacts and risks.

1.4. Western Cape Context

The WCCCRS[1] was approved by the Western Cape Cabinet in 2014. The Strategy is developed as a coordinated climate change response; it aims to guide the implementation of innovative projects and the search for opportunities that combine a low carbon development trajectory with increased climate resilience, enhancement of ecosystems and the services they provide, and economic stability and growth. The WCCCRS, which is aligned to the NCCRWP, also acknowledges the important role that sub-national governments play in responding to climate change, since adaptation and mitigation actions necessary to tackle climate change are, or will be, implemented at this level of governance. Subnational governments are willing to address the issues of climate change and the economic difficulties many of them are facing, by turning these challenges into an opportunity.

[17] DEA (2017). South Africa's 2nd Annual Climate Change Report. Pretoria: Department of Environmental Affairs.

The WCCCRS document highlights nine focus areas:

- Energy efficiency;
- Renewable energy;
- Built environment – critical infrastructure, disaster management, integrated waste management, human settlements;
- Sustainable transport;
- Water security and efficiency;
- Biodiversity and ecosystem goods and services;
- Coastal and estuary management;
- Food security; and
- Healthy communities.

Building on the WCCCRS, in August 2014, the Western Cape Climate Change Response Implementation Framework[18] was released. This discussed each focus area in greater detail in order to identify impact potential / benefit for the priority programmes and to discuss the opportunities for and barriers to the implementation of the priority programmes identified in the strategy document. The impact potential / benefits were then used to finalise a basket set of indicators that provide a reporting structure for this M&E report series. The WCCCRS will be updated in the 2020/21 financial year.

A number of significant milestones have been reached in the WCG to assist the delivery of the transversal climate response programme. In February 2017 the Western Cape Cabinet Bosberaad reached a resolution that identified climate change and water security as enterprise level risks that need to be addressed by all Departments in the WCG. In response to this all Departments have been tasked to include climate change response in their annual performance plans (APPs), starting in 2018 and becoming more integrated over the next two years until all APPs clearly outline the Departmental response to climate change risks.

On an international level, in November 2017 the WCG committed to fighting climate change as a regional government by joining The Climate Group – States and Regions Alliance, an international non-profit network of like-minded regional governments determined to contribute to the international response to climate change in order to keep the global average temperature increase below 2°C. As part of this, in April 2017 the WCG signed the Subnational Global Climate Leadership MOU 'Under2MOU', a commitment to contribute to reducing global GHG emissions to net-zero by 2050.

1.5. Report Objectives & Principles

The overarching objectives of this report, which will be published every two years, over time will be to provide a narrative of, as well as track the transition to a low carbon, climate resilient and more prosperous Western Cape through the implementation of the WCCCRS.

This will include:

- Providing a clear picture of the various response measures included in climate change mitigation and adaptation programmes;
- Providing an assessment of the effectiveness of these response measures, where feasible;

[18] https://www.westerncape.gov.za/eadp/files/atoms/files/WC%20Climate%20Change%20Response%20Implementation%20Framework%20%282014%29.pdf

- Moving towards a consistent approach to these assessments to allow for greater comparability, where feasible;
- Increasing co-ordination of climate change response measures and M&E;
- Demonstrating the impact of response measures over time;
- Increasing transparency on finance flows relating to climate responses; and
- Increasing awareness of observed and projected climate impacts.

As climate change impacts all sectors, this is a highly ambitious, complex and yet critically important piece of work for all economic sectors, public and private sector implementers, and communities alike. It is complex, not least because of the uncertainty of the exact climate change impacts we will experience, but due to the plethora of activities required to respond by a multitude of different actors. Many organisations and stakeholders are grappling globally with the scope and extent of climate change responses required and the way in which to track and monitor them.

The WCCCRS was developed in a manner that would focus in on specific programmes of work, and thus whilst covering most of the key sectors of the economy and governmental functions at provincial and local level, the degree of focus of each is not extensive, but rather specific and focused on priority programmes. These focus areas have been selected based on the urgency of action required. In many cases, work in these focus areas is already being implemented by WCG departments, local authorities, the business sector, non-governmental organisations (NGOs) and other key stakeholder groups. The focus areas will include both the scaling up of existing climate change initiatives and the development of required new initiatives. There is thus opportunity to additionally shift the scope and to adaptively manage our climate change response as new and emerging priorities surface and our knowledge base improves. The focus areas will be reviewed every five years to assess the relevance of those selected for the last period and to address priorities for that period. If necessary, the focus areas may be adjusted to a sectoral approach in order to mainstream climate change into all programmes.

The authors have taken a pragmatic approach to initiating this reporting platform with this third iteration biennial report. It thus takes the WCCCRS 2014 as basis, along with the first two M&E reports, in responding to and reporting on progress being made in the identified focus areas. Some additional information is also provided that may sit outside of these focus areas, along with some data and discussion of underlying vulnerability. Each section has some follow up recommendations for future analysis, action and focus. It thus aims to build a robust platform upon which we can all collectively build our knowledge base. The nature and detail of the recommendations will also inform the approach taken in the full review of the WCCCRS during 2020/21.

2. Cross-cutting Climate Change Responses

2.1. Institutional Arrangements & Governance

The newly released PSP sets out the Western Cape Government's vision and strategic priorities and builds on the work that has been done over the last 10 years. Five VIPs have been developed to support the achievement of the Provincial objective of "*A Safe Western Cape where everyone prospers*". The VIPs for the next five years are:

1. Safe and Cohesive Communities – The Western Cape is a place where residents and visitors feel safe;
2. Growth and Jobs – An enabling environment for the private sector and markets to drive growth and create jobs;
3. Empowering People – Residents of the Western Cape have opportunities to shape their lives and the lives of others, to ensure a meaningful and dignified life;
4. Mobility and Spatial Transformation - Residents live in well-connected, vibrant and sustainable communities and move around efficiently on safe, affordable, low carbon public transport; and
5. Innovation and Culture – Government services are delivered to the people of the Western Cape in an accessible, innovative and citizen-centric way.

In 2017 the Provincial Cabinet escalated both climate change and water security as enterprise level risks for Western Cape Government. These risks will require all departments to include climate change (and water security) responses in their Annual Performance Plans; responses will address how climate change will impact on sector department's operations, and what actions are being implemented to achieve improved resilience and decrease carbon emissions. Many actions evident to date have been driven by the drought currently being experienced in the Western Cape, but other challenges linked to climate change also need to be addressed.

Under the previous Provincial Strategic Plan, a Climate Change Response Work Group was established as part of the Provincial Strategic Goals, which included representatives from provincial departments and met on a quarterly basis and led by the DEA&DP. A Climate Change Response Forum, which included municipalities and external stakeholders, also met on a regular basis to share information and updates on the provincial response programme under the direction of the WCCCRS. There is currently no formal structure for coordinating Climate Change Response in the VIP structures, but the review of the Western Cape Climate Change Response Strategy, should allow for consultation on the establishment of new structures and systems in order to coordinate the climate change response in the Western Cape.

2.2. Policy Alignment

Responding to climate change is a transversal priority for the Western Cape Government and as such requires responses and accountability within all departments. Furthermore, it requires the implementation of key overarching strategic directions for economic growth, investment, and social upliftment, which are informed by climate impacts and threats. One of the critical aspects of the Western Cape Climate Change Response Strategy is that the implementation is the responsibility across the whole of provincial government and all associated stakeholders. It must thus be carried out, at the most strategic level, by mainstreaming the key priorities directly into sectors policies and plans, and overarching strategies that will require critical analysis of policy trade-offs. The expected benefits of mainstreaming climate change

adaptation and mitigation into the performance plans and prioritised development activities include avoided policy conflicts; reduced risks and vulnerability; greater efficiency compared to managing climate change separately; and the potential of leveraging much larger financial flows in sectors affected by climate risks than the amounts available for financing climate change separately. Lastly it will allow for a defensible response on the part of provincial government to stakeholders and citizens that the best contemporary science has been utilised systematically in our decision- and policy-making, reducing the future potential for negative legal and accountability responses.

The DEA&DP has identified gender mainstreaming as a priority and seeks to mainstream gender into its function and mandate. Gender considerations will therefore be included and adequately considered in the review of the Western Cape Climate Change Response Strategy.

2.3. Municipal Support

Municipalities play a vital role in addressing the country's social, economic and environmental needs. Local government is tasked with the provision of services in a sustainable and equitable manner which includes climate change resilience, the facilitation of social and economic development and the promotion of a safe and healthy environment for all. Climate change and climate variability already have a direct impact on the ability of municipalities to meet these objectives. Extended dry seasons, increasing temperatures, extreme storms (including hail) and sea level rise, are resulting in impacts such as: drought, crop loss/failure, livestock death, damage to infrastructure, runaway fires, vector-borne disease, loss of livelihoods and damage to household assets.

In response to an uncertain future and immediate development needs, municipalities should align climate responses with existing climate and development challenges and deepen existing response capacity as well as:

- Develop links with research institutions and community bodies to improve the flow of information, in particular early warning systems, for extreme events;
- Incorporate climate change information into sector planning and plan for a wide range of longer term changes in average conditions;
- Improve cross-sector integration of management and development planning. As mitigation and adaptation efforts fall under the responsibility of a range of departments, some form of institutional coordination is important; and
- Move hard and faster on core development objectives, which will provide immediate benefits and long-term climate response benefits.

Climate change impacts all sectors and integrating climate change into existing policies and plans is considered the most effective way of mainstreaming the required climate change response. This approach builds increasing flexibility into planning decisions and helps to avoid "lock-in" systems or infrastructure not suitable to future climate conditions.

The Climate Change Municipal Support Programme within DEA&DP was initiated in 2012 from an expressed need by municipalities for support on climate change and led to a programme to support municipalities in the development of Climate Change Response Frameworks and Plans. As the first Province in South Africa to roll out such a programme the Western Cape has been at the forefront of learning and modifying this programme as it has developed to create best practices for the country. The Climate Change Municipal Support Programme forms part of the larger WCG: Municipal Support Programme as well as the national Department of Environmental Affairs Mitigation and Adaptation Climate Change Municipal Support

Programme, which included training for municipal staff on climate financing and funding during the 2019/20 financial year. WCG is also monitoring and evaluating the progress of municipalities in responding to climate change. In assessing this, an annual Integrated Development Plan (IDP) assessment of all local and district IDPs is undertaken utilising a Climate Change IDP Assessment Framework. This framework was developed to assess the integration of all climate change responses in municipal IDPs and sector plans.

The municipal IDPs are then scored according to one of the following categories, as shown in Figure 1:

- Non-performance: climate change is not included, or only briefly mentioned in the text of the document;
- Compliance performance: specific climate change response programmes/projects are included in the IDP; or
- Optimum performance: specific climate change response programmes / projects with budget and capacity are included in the IDP.

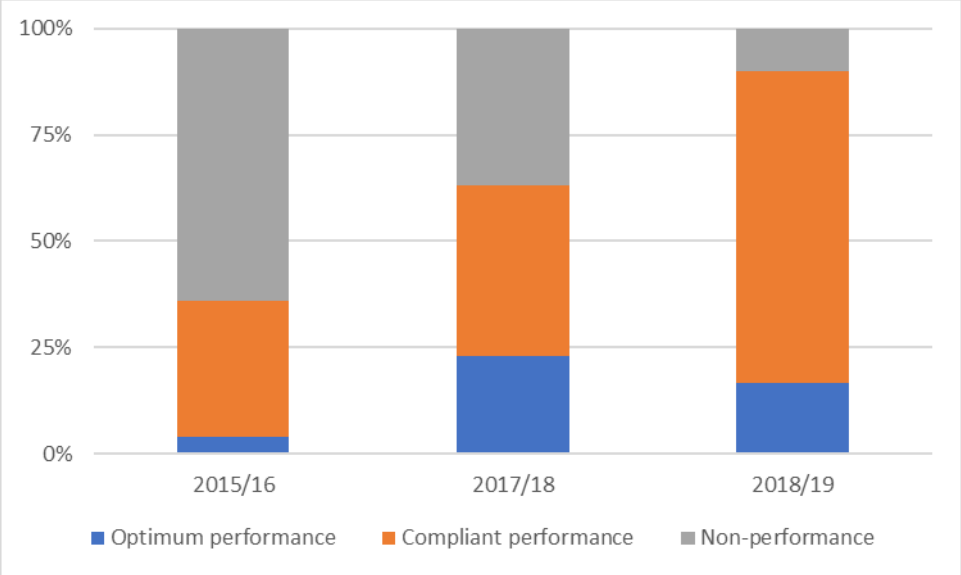

Figure 1. Climate Change IDP Assessment results for the 2015/16 IDP review, the 2017/18 IDP review and the 2018/19 IDP review (based on the Climate Change IDP Assessment Framework)

The figure above shows that there has been a significant improvement in the integration of climate change and climate change responses in municipal IDPs. In 2016 the Climate Change Directorate developed a municipal specific Climate Change Advisory based on the final update of the 3rd generation IDPs, in order to enhance climate change integration into the development of the 4th generation IDPs (2017 – 2022). There has been tremendous support for the advisories evidenced by the fact that Climate Change advisories content have been captured into the latest draft IDPs. We also noted that a number of municipalities focussed on the drought in their IDPs and acknowledged the link to climate change and the need to consider this in their planning.

The WCG Greenest Municipality Competition also contains a comprehensive assessment of climate change response – questions are designed to not only provide a platform for competing in the competition, but also as a mechanism to upscale local government responses on climate change integration into planning. The 2019 Greenest Municipality Competition was the final year for the competition and was only open to local municipalities.

Thirteen local municipalities completed the Climate Change element of the 2019 Greenest Municipality Competition and Drakenstein Municipality received the highest score.

2.4. Awareness

Although climate change has entered into general public awareness, it is yet to find traction within spheres of government that are not directly involved in water or environmental management issues. As was evidenced by the policy review exercise mentioned earlier, a number of key government policies need to bring climate change mitigation and adaptation considerations into the workstreams of sector departments and different tiers of government if day-to-day decisions and implementation actions are to yield results in terms of reducing the carbon intensity of the Western Cape's economy and the adaptive capacity or overall resilience of communities.

There also remains differences in the level of understanding of climate change held by the public in general, non-governmental agencies and government actors, and hence a lack of consolidation and action alignment. Often, 'government' as a single body is accused of inaction, when the blame lies with a specific government entity – this is often the case where specific service delivery mandates are allocated to national, provincial and local levels of government.

2.5. Climate Change Finance

One of the primary constraining factors to transitioning to a low carbon and climate resilient Western Cape is finance; an issue that is complex, requires trust among parties and is politically sensitive. In developing countries, climate change investment needs are significant. Direct government funding is generally scarce, and the billions of dollars committed by industrialised countries remain inadequate to the magnitude of the challenge of stabilising a steep trajectory of greenhouse gases and responding to the associated impacts[19].

In the 2009 Copenhagen Accord, developed countries pledged to raise US$ 30 billion by 2012, increasing to US$ 100 billion per year by 2020, to support climate change projects in developing countries. These commitments were reiterated in the Cancun decision (2010), the Durban Platform in 2011 and the Paris Agreement in 2015. The current annual finance goal is set to continue until 2025 when a new collective goal will be set.

South Africa is committed to mobilising the resources that are necessary to overcome the challenges in mitigating and adapting to climate change[20]. Under the UNFCCC, there are climate finance channels and instruments available for accessing funds. Theoretically, South Africa as a developing country has access to this finance. An assessment of country case studies highlighted that a mixture of four broad categories of funding sources were utilised to finance Climate Change Response projects: two types of International Climate Funds- Bilateral and Multilateral Development Assistance; Domestic Public sector; and Private Sector Financing.

The bilateral loans and grants received / committed per donor country between 2000-2014 has been covered by the first Biennial Update Report (BUR) -1[21] and referenced in a previous version of this M&E report, whilst figures for the period 2015 – 2017 are presented below. A total

[19]OECD (2015), "Climate finance in 2013-14 and the USD 100 billion goal", a report by the Organisation for Economic Co-operation and Development (OECD) in collaboration with Climate Policy Initiative.
[20] South Africa's Third Biennial Update Report, 2019. https://unfccc.int/sites/default/files/resource/Final%203rd%20BUR%20of%20South%20Africa%20100.pdf
[21] South Africa's First Biennial Update Report, 2014. https://unfccc.int/resource/docs/natc/zafbur1.pdf

amount of US$ 160 734,349 million was received by South Africa. The largest proportion of bilateral grants was received from Germany at 54.9%, followed by Belgium 17.5% and European Union funding 12.6%. The remaining 15% was received from various other donor countries/parties.

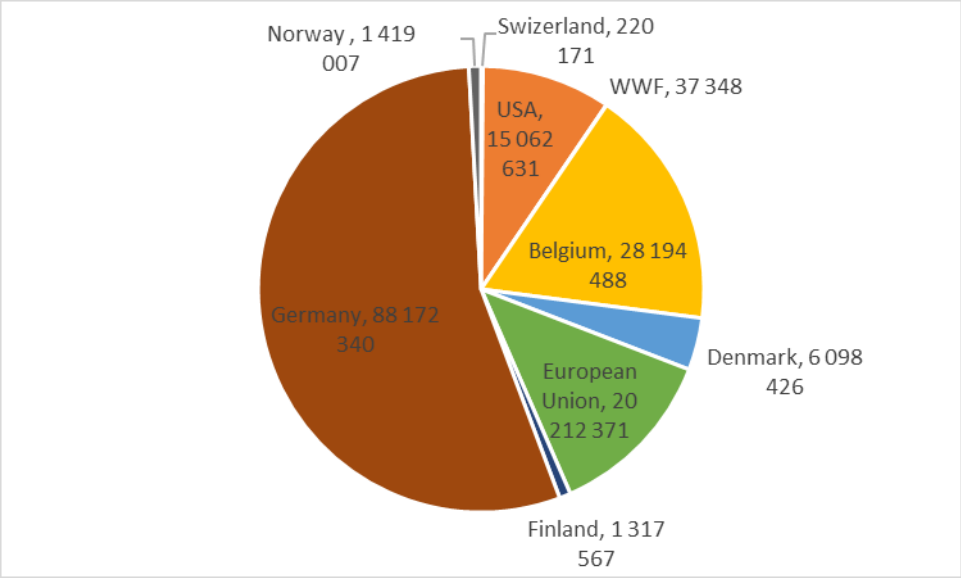

Figure 2: Indication of the bilateral support South Africa has received / or that which has been committed by bilateral lenders to develop its climate change response, in USD[22]

The multilateral support South Africa received between 2015 – 2017 was US$ 44 429 257 in the form of multilateral grants and US$ 950 000 via multilateral loans. From the total multilateral grant allocation, the biggest proportion came from the Global Environment Facility (98%) which in turn got channelled through the Development Bank of Southern Africa (55%), United Nations Industrial Development Organisation (27%), United Nations Environment Programme (12%) and United Nations Development Programme (6%). The Green Climate Fund received US$ 380 000 and the Adaptation Fund US$20 000 for the period 2015-17.

The South African Government has also played an increasing role in directing domestic financial flows for climate response through the creation of local funding source such as the Green Fund and the Energy Efficiency and Demand-side Management Fund with approximately US$643.9 million in grants and US$45.4 million in loans being made available for response and research programmes[20].

Subnational governments have been able to access some sources of funding with varying degrees of success; indicating that municipalities and provincial government departments are willing to engage in climate change response projects. These sources include international multilateral and bilateral grants; municipal own revenue; intergovernmental grants to both municipalities and provinces; and concessionary loans for very large infrastructure projects. However, the ability of smaller municipalities to access or raise finance is limited, and the ability of all municipalities to upscale and replicate projects remain challenging[23].

The Climate Change Response Projects Database which is a record of western cape located projects across the various focus areas defined in the WCCCRS indicates that the bulk of the

[22] South Africa's First Biennial Update Report, 2014.
[23] Increasing Investment in Climate Change Related Projects at the Sub National Level- report, 2013.

focus of finance is on emissions reductions, with very limited focus on resilience and climate change adaptation[24]. This may seem particularly concerning for infrastructure, the built environment, food security, water and human settlements where the largest financial risks lie, and where the greatest losses are already being observed. However, the adaptation part of the database is not as robust as the energy part of the database and in this current iteration such conclusions may not yet be fully warranted. The consensus is that more funding is still being allocated towards mitigation than adaptation, but the database is not a full reflection of the actual numbers. Massive upscaling of adaptation finance is however required, and for integration of climate change risks into all development planning and infrastructure investments.

In order to address the latter, the South African National Biodiversity Institute (SANBI) was accredited as a Direct Access Entity of The Green Climate Fund (GCF) under the UNFCCC which supports the implementation of the Paris Agreement in developing countries. The Accredited Entities support the development of funding proposals and oversee, supervise, manage and monitor their respective GCF-approved projects and programmes. In December 2017, SANBI issued a call for Expressions of Interest from institutions wishing to make use of SANBI's services as an Accredited Entity of the GCF. This call was widely advertised and at the time of closure, a total of 126 Expressions of Interest were received.

All submissions were reviewed against the SANBI's GCF Funding Framework. The outcome of this extensive review process was the shortlisting of six project themes which SANBI will be developing into project proposals for submission to the GCF.

Two of these project themes are being developed into first stage GCF Concept Notes for submission to the GCF before the end of 2020. These are:

- Scaling up ecosystem-based approaches to managing climate-intensified disaster risks in vulnerable regions of South Africa, focusing on droughts, floods and fire that builds on a submission by DEFF's Natural Resources Management unit.
- Climate resilient agro-ecological farming systems in rural landscapes in KwaZulu-Natal, the Eastern Cape and Limpopo, that builds on a submission by the University of KwaZulu Natal, in partnership with DAFF/DEFF.

The remaining four project themes have been identified as SANBI's GCF project priorities and will need substantial further development in the near future; these are:

- A Strategic Water Source Areas project in Mpumalanga that focuses on vulnerable communities affected by South Africa's energy transition.
- An aquifer recharge project that focuses on Ecological Infrastructure and the enhancement of natural recharge mechanisms (Submitted by WCG).
- A coastal Ecosystem-based Adaptation / Ecological Infrastructure that incorporates natural and built infrastructure.
- A project that seeks to mainstream Climate Change into South Africa's Early Warning System for pests and diseases.

[24] There has been challenges in keeping the database current due to staff shortages as well as lack of stakeholder inputs

3. Climate Risk Management

The current priority areas for addressing climate change related disaster management is through a move towards climate risk management in the Western Cape and includes the initial focus on:

1. Consideration and incorporation of climate change into disaster management plans across the province.

Since the development of the WCCCRS in 2014, a Disaster Management Amendment Act (Act 16 of 2015) has been promulgated which provides the legal mandate for all tiers of government to include climate change adaptation into all disaster management plans. In addition, multiple high impact disasters have occurred in the Western Cape between 2016 - 2020, and as such the integration of climate change into disaster risk management is a highly evolving, relevant and urgent programme area. Climate related disasters in the Western Cape are getting larger in extent and magnitude, and the economic and social impacts are growing as disasters impact larger areas, last for longer (causing permanent impacts on agriculture), and urban-wildland interfaces[25] are being surpassed by events such as fires impacting on infrastructure, homes, businesses and livelihoods.

Table 1. Climate Risk Management Indicators for the WCCCRS

Indicator	2015/16	2017/18	2019/20
Spatial risk and vulnerability assessment for climate change			
Provincial Spatial Climate Change Risk and Vulnerability (R&V) Assessment.	Provincial Risk profile is under development and will include climate change. A specific spatially explicit climate change R&V assessment has not yet been undertaken for all sectors.	Provincial Risk Profile complete, and includes climate change narrative. Original 2008 Climate Change R&V Assessment (part of the first provincial strategy) – updated by DEA/CSAG/ACDI in 2017 specifically for the climate risk management and health sections[26]. A feasibility assessment for a spatially explicit Climate Change Spatial R&V Assessment completed in 2018. A specific spatially explicit climate change R&V assessment has not yet been undertaken for all sectors.	Legal process to identify hazard owners for the Provincial Risk Profile underway. DEA&DP climate change risk and vulnerability mapping underway. A specific spatially explicit climate change R&V assessment has not yet been undertaken for all sectors.
Number of Municipal Climate Change	Varying degrees of R&V assessment exist for municipalities on some	No update	

[25] Urban-wildland interfaces refer to the zones of transition between unoccupied land (wild or farm) and human development. These areas are typically getting larger in the Western Cape as urban and semi-urban (nature estates etc.) creep into natural and farm areas. These are high risk areas to manage particularly in terms of fire.

[26] The original component of the first Western Cape Climate Change Strategy contained a section on Risk and Vulnerability for the province. This was updated through a DEA funded project in 2017 with support of CSAG and ACDI, funded by GIZ. The update drew strongly on key national documents namely the National Adaptation Strategy, the Third National Communication to the UNFCCC, and the LTAS programme documents (from 2013/14). This study recommended that a spatial risk and vulnerability assessment would likely be required for the province.

Indicator	2015/16	2017/18	2019/20
R&V assessments	climate change related risks (specifically flooding), however, the degree to which these systematically cover the full range of climate change risks is currently not fully assessed.		

Table 2. Additional High Level Climate Risk Management Indicators

Indicator	2015/16	2017/18	2019/20
Economic costs of disasters			
Losses from climate related disasters in the Western Cape between 2003 – 2014	2003 – 2014: **R 5 billion** (2003 – 2008[27] and 2003-2014[28] data was utilised) (floods and storms)	No comprehensive update from these sources **R4 billion to R6 billion[29]:** Cape Town storm & Knysna fires property damage (single event - June 2017)	No new economic data.
Losses from the El Niño and climate change driven drought of 2015-2018 and associated fires in the Western Cape[30]	**± R2 – 4 billion** (Projected impact on Agriculture: loss of 5-10% of normal production)[31]	Drought continued into 2017/18[32]: • **R5.9 Billion** in losses in the 2017/18 Agricultural season[32] • **R14 Billion** in losses in total to Agriculture[33] • **20% Reduction** in average Agricultural production[32] ; • **>30 000** seasonal Agri-workers will not have a normal income or any income at all[32] Avian flu outbreak 2017: **R800** million in production losses[34]	New information: **R700 million to 1.7 billion** in potential losses from GDP in the tourism sector in 2018 alone[35].

[27] These events are described by RADAR in their 2010 Risk and Development Annual Review (https://www.westerncape.gov.za/text/2013/July/radar-eng.pdf). The costs are direct damage costs sustained and reported primarily by public sector entities, and are likely and underestimate of total costs from a range of storms and cut-off low pressure systems.
[28] http://www.riskreductionafrica.org/wp-content/uploads/2014/09/OFF-THE-RADAR-SYNTHESIS-REPORT.pdf (this data was utilised, and non-cut off low pressure systems from the 2010 report added to this figure of R4.9 billion to reach a total of R 5 billion).
[29] http://city-press.news24.com/Personal-Finance/knysna-fires-lessons-for-our-home-insurance-20170801 Date of access: 24 January 2018.
[30] Losses are currently challenging to calculate, with only the Agriculture sector putting out reliable figures, later analysis will likely provide significantly higher numbers across the full breadth of economic sectors, and livelihoods.
[31] MEC Alan Winde, Cape Argus 4 February 2016.
[32] https://www.fin24.com/Economy/drought-impact-on-w-cape-economy-worse-than-anticipated-minister-20180301
[33] https://www.businesslive.co.za/bd/economy/2018-02-05-farmers-lose-r14bn-as-cape-drought-bites/
[34] https://citizen.co.za/news/south-africa/1674873/bird-flu-costs-the-western-cape-an-estimated-r800m-in-production-losses/ Date of access: 24 January 2018.
[35] WESGRO.2019. A case study to assess the impact of the water crisis on the tourism industry in Cape Town/Western Cape.

3.1. Climate Risks

The Western Cape is the most disaster-prone province in South Africa, and is particularly prone to the effects of climate-related hazards, which pose a significant risk to the Western Cape's economy, ecosystems and population. At the time of writing of the first 2015/16 M&E report, direct damages from extreme climate events over a 10-year period were in the vicinity of R5 billion, and the drought at that point had resulted in estimated R4 billion in losses. Since 2015 the drought has persisted into 2020 and the Agriculture sector alone in the Western Cape is tallying up to R14 Billion in losses. Other sector loss estimates (such as Agriculture, Industry, Building, Film, etc.) have yet to be calculated. The tourism sector for example though has been estimated to have lost between R700 million and 1.7 billion in GDP in the 2018 period at the height of the "Day Zero" threat. The single Fire/Storm event of June 2017, particularly in relation to the fires in the Garden Route (Knysna/George area), resulted in up to R6 Billion in losses. These disaster-related damages place a significant financial burden on service delivery and the economy, without taking into account the indirect costs of social, environmental and other disruptive impacts that typically characterise such events. National disaster response funding is substantially inadequate to respond, and is not able to provide for the private sector and the public at large who have all contributed and re-budgeted in order to respond to the crisis. The impacts associated with the future climate projections for the region will result in an increasing economic burden, particularly if climate vulnerability is not reduced across the province.

Already a significant portion of the ecological infrastructure which should buffer against climate-related hazards, such as coastal barrier dunes, wetlands, and floodplains is compromised (see Biodiversity and Ecosystem Goods and Services), and continues to be through reactive responses even in a drought period. Increasing magnitude and frequency of extreme events, temperature increases, altered rainfall patterns and changes in evaporation rates, etc. will further compromise the ability of the natural environment to buffer human settlements and infrastructure against the impacts of climate hazards. More information on the importance of, and loss of biodiversity and ecosystem services is provided in the Biodiversity and Ecosystems chapter.

The possibility of increased disaster risk is considered to be one of the most concerning and potentially costly impacts of climate change in South Africa and globally. Understanding these risks and identifying key areas of concern is critical for developing suitable and sustainable adaptation policies and scenarios. A consistent message from the LTAS analysis of drought-related risks over the medium and long term is that there will be increased water supply limitations in the Western Cape. The LTAS also indicated there will be an increase in amount of rainfall in the southern Cape likely resulting in high flood risk. Linking the potential increased flooding risk with the location of current key infrastructure shows the potential for 'high" or "very high" impacts on the current flood design standards for more than 30% of bridges (road and rail), 19% of dams and 29% of Eskom transmission line crossings across the country by mid-century[36].

[36] Long Term Adaptation Scenarios Research Flagship Program, Technical Report No 3.

Box 2. 2015-2018 Drought: linking disaster response and long term climate change adaptation

Many disaster events are not being attributed to a changing climate, even though we have already seen a global average increase of 1 Degree Celsius[37]. Furthermore, 90% of all disasters globally are now climate related, and the latest science points to the attribution of climate change being a driver behind many extreme weather events[38]. We need to formally recognise the economic costs and risks of climate related disasters as ones that will increase in magnitude and frequency.

As an example the El Niño phenomenon of 2016-17, which is a naturally occurring one, was the worst on record, because it was occurring on top of an already one degree of warming. The oceans are much warmer than ever before and as a result the severity of the impacts of the 2015/16 El Niño has been substantial globally, including in South Africa and the Western Cape. El Niño events can result in either more severe flooding or drought. The drought of 2015-20 in the Western Cape has been classified as a potentially once-in-a millennium event by some climate scientists[39]. The drought persists into 2020 in the interior of the province in the karoo regions with severe impacts on these rural communities and agriculture.

In response to the El Niño and climate change driven drought, the cumulative totals of the impact of the drought are still being calculated on an ongoing basis. Initial reports in 2015/16 stated loses to the agricultural sector alone of R4-6 billion rand. This has since been added to with ongoing drought impacts of R14 Billion in the Agriculture sector. In addition, the single storm, and Knysna fires in June 2017 caused R4 – 6 billion losses in damage; and the avian influenza outbreak (associated with the drought) caused losses of R800 million to the poultry sector. Over 30 000 seasonal jobs in agriculture have been lost. Many of the costs are still being determined. The responses in reactive disaster funding have been but a fraction of the economic cost: R1 billion in 2017; and close to another half a billion rand has been requested from national disaster management funds in 2018[40]. The situation is a clear indicator of the economic cost of failure to adapt to climate change. Proactive planning and adaptive measures, rather than reactive measures, are likely to be less costly or may even translate into cost savings.

In addition to water supply challenges, the accelerating impacts on inflation and to the cost of basic food staples is a key consideration in responding to the current drought.

A similar drought situation was experienced in South Africa in 1992/3 (although the drought of 2015-2020 is seen to be worse). In 1992/1993, undoubtedly one of the most widespread droughts of the last 45 years (until 2015-2020), maize had to be imported to South Africa (as well as the rest of southern Africa). The knock-on effect of crop failure could be seen in the population drift from rural areas into the cities, farm labour lay-offs and farm closures as well as an increasing indebtedness in the agricultural sector[41]. According to the Reserve Bank the loss of GDP during the 1992 drought was approximately 1.8 percent, representing US$500 million which is a substantial impact from a sector playing a relatively small role in the economy[42]. The drought of 2015-20 has substantially far surpassed these impacts. Disasters, particularly drought, have a direct impact on the most vulnerable communities, households and individuals across the country. We can take the current disaster situation as a warning for the future and a timely reminder that the early climate change adapters will be the economic winners of the future.

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[37] This is already 2/3rds of what is considered the safe limits of warming that human communities and systems can withstand – this is seen as 1.5C of warming globally, and we have already surpassed the mark of 1C of warming.
[38] National Academies of Sciences, Engineering and Medicine. 2016. *Attribution of extreme Weather Events in the Context of Climate Change*. Washington, DC: the National Academies Press. Doi: 10.17226/21852.
[39] http://www.csag.uct.ac.za/2017/08/28/how-severe-is-this-drought-really/. Date of access: 20 February 2018.
[40] Personal communication, Western Cape Disaster Management Center.
[41] Long Term Adaptation Scenarios Research Flagship Program, Technical Report No 2.
[42] Ibid.

To respond to disasters, and climate related disasters specifically, the South African national policy framework provides a robust basis from which to develop our responses. South Africa's legislation and policy instruments for disaster risk reduction, which includes early warning systems (EWSs) are one of the best in Africa, having adopted a proactive rather than a reactive approach[43]. Both the Disaster Management Act (Act 57 of 2002) (DMA) and the National Disaster Management Framework (NDMF)[44] guide Disaster Risk Reduction Management (DRR-M) implementation in the country, with the National Disaster Management Centre (NDMC) being the lead institution for DDR-M. The Disaster Management Amendment Act (Act 16 of 2015) specifically refers to climate change adaptation, ecosystem-based adaptation and community based adaptation measures and investments being required by all tiers of government (National entities, provincial entities, and local entities). There is a strong risk reduction mandate contained in the DMA, and this should be included in provincial and district disaster management planning. This provides an opportunity to align infrastructure risk reduction measures with the provincial and district infrastructure frameworks and plans. The Act places the onus for rehabilitation and reconstruction of infrastructure on the organ of state responsible for maintaining such infrastructure (7.7.14 of the NDMF).

The NDMC promotes integration and coordination with a special emphasis on prevention and mitigation. It works with National, Provincial and Municipal organs of state, statutory functionaries, other role players and communities. The NDMC currently resides within the Department of Cooperative Governance and Traditional Affairs (COGTA). The Western Cape Disaster Management Advisory Forum is the key coordination forum for the province and meets quarterly, as well as on an *ad hoc* basis as required in relation to disaster protocol. The DEA&DP Climate Change Directorate feeds into this forum in order to integrate and synergise on climate change and disaster management plans, programmes and activities. All District Municipalities in the Western Cape have Disaster Management Advisory Forums.

Table 3. Recent Western Cape Disaster Management Tools

Enhanced disaster management tools	Early Warning Database and EWS (complete) GIS and web-based Decision Support Tool to guide district disaster management planning (Undertake upgrades/updates annually) Provincial disaster risk and vulnerability assessment (2002) (complete) Provincial Risk Profile (To be endorsed through Cabinet) Flood Hazard Index Tool (complete) Recovery Dashboard Fire Collector Mobile App

Western Cape Disaster Management (WCDM) ensures the maintenance of an early warning database that includes all the critical role-players within disaster management. The unit also disseminates warnings to all relevant stakeholders. This ensures that all the necessary line functions and department are kept abreast of all impending hazards. WCDM has a well-maintained Geographic Information System and web-based decision support tool which includes a large number of climate related hazard information. Most recently this has included a consolidation of all flood related data for the Western Cape; a roll out of the decision support tool to all municipalities in the Western Cape; and general maintenance and update of the datasets in its central data repository. A preliminary disaster risk and vulnerability assessment

[43] Long Term Adaptation Scenarios Research Flagship Program, Technical Report No 2.
[44] https://www.gov.za/sites/default/files/gcis_document/201409/275340.pdf

was undertaken in 2002 and forms the baseline for any subsequent disaster risk assessments by the Province. While these assessments take climate related hazards into account, the assessments fall short of a comprehensive assessment of climate change projections, the consequences for infrastructure and spatial planning, and need for disaster risk reduction measures.

3.2. Municipal Responses

WCDM works closely with municipalities to strengthen the link between development and prevailing disaster risk including climate change. WCDM is in the process of ensuring all fourth generation IDPs include a dedicated disaster management chapter. Furthermore, in the past three years updated risk profiles (of all disaster related risks including climate change) have been undertaken for all municipalities in the Western Cape. This has assisted in high level planning and spatial mapping of the most prevalent hazards. The risk assessments will be updated on a rolling basis every three years, with the City of Cape Town, West Coast and Cape Winelands being revisited during 2020.

All Municipalities in the Western Cape have overarching Disaster Management Plans which cover climate change related risks to varying degrees. As these are updated they are becoming more uniform in approach. Now that the Disaster Management Amendment Act has provision for climate change adaptation specifically, this area of work is likely to evolve substantially in the near future. In addition to Disaster Management Plans various municipalities have specific plans for some climate related hazards and could be utilised in future to further enhance planning[45].

3.3. Disaster Risk Financing

Financing risk reduction remains a significant barrier to implementing identified climate risk reduction actions. Disaster damaged critical infrastructure is often just replaced in its previous form due to constraints such as lack of finance, Environmental Impact Assessment (EIA) demands, lack of specialist studies, the lack of appetite to do things differently and the need to quickly resolve the problem. Long lead times in transferring the Municipal Infrastructure Grant (MIG) results in the delay in the release of funds (between when a disaster occurs and when funds are released)[46]. This is due to the conditions that need to be met before funding can be channelled from the national budget to the Department of Cooperative Governance and eventually to the MIG fund. One project has been initiated to investigate a mechanism to overcome these obstacles – the Feasibility Assessment for a Municipal Risk Pooling Facility is being assessed in the Western Cape (This is a multi-partner collaboration funded by the IDRC), and is in its stakeholder engagement phase. Should it prove to be feasible a pilot Risk Pool could foreseeably be implemented from 2021.

3.4. Opportunities, Gaps and Recommendations

- Assess the lessons learnt from the current drought period, and analyse ways forward to shift from 'reactive disaster response' to 'long term climate change adaptation' decision making.
- Further refine requirements for appropriate climate change risk and vulnerability assessments in relation to ongoing disaster interventions, and as per the Disaster Management Amendment Act provisions.

[45] Information taken from the most recent Western Cape Disaster Management quarterly report – Q3 2015/16.
[46] Long Term Adaptation Scenarios Research Flagship Program, Technical Report No 2.

- Related to the above point, clearly determine which municipalities adequately include climate change in current Risk and Vulnerability Assessments in the province. In addition, to improve the spatial understanding of these risks and vulnerabilities in relation to climate change.
- Put in place a system to ensure that the outcome of risk assessments directly informs local government policy and investments decisions.
- Develop a coordinated reporting mechanism for the financial costs of climate related disasters in order to enhance analysis of the increasing economic and social impact across the province.
- Prioritising and ensuring that all development plans and investments approved across the province are screened for disaster and climate risk and that they integrate appropriate resilience measures where risks exist.
- Whilst many plans, policies and systems are in place for disaster management, the capacity at local and district level is limited, and it is highlighted that in a changing climate with an increasing intensity, severity and frequency of many climate-related disasters that urgent attention to funding centres, and human resources must be elevated. Disaster management is a severely underfunded public service globally, particularly in fiscally constrained environments such as in South Africa, and particularly at the local level this is a concern.

4. Water

The current WCCCRS priority areas for addressing water security in the Western Cape in a changing climate include:

1. Invasive alien vegetation clearing;
2. Spatial prioritisation, valuation, mapping, protection and restoration of ecological infrastructure in catchments;
3. Effective utilisation of irrigation water;
4. A collaborative and multi-sectoral resource nexus decision support; and
5. Develop ecosystem goods and services (EGS) investment opportunities.

The WCCCRS also covers the following in this focus area, which is in addition to that coordinated under the Western Cape Sustainable Water Management Plan (WCSWMP) and activities of the Department of Water and Sanitation (DWS):

i) Invasive alien vegetation clearing;
ii) Effective utilisation of irrigation water; and
iii) Ecosystems goods and services and ecological infrastructure (these are further covered in Biodiversity and Ecosystem Goods and Services).

Given the current drought in the Western Cape, and the fact that the WCSWMP has been recently updated, it is likely that some of the focus areas of this chapter of the WCCCRS will change in the future.

Table 4. Water Indicators for the WCCCRS

High level category	Indicator	2015/16	2016/17	2017/18	2018/19	2019/20
More Crop per Drop	Number of hectares registered for the FruitLook* Tool for broad scale management [indicating increasing water efficiency]	89 623 ha[47]		123 100 ha[48]	303 783ha[49]	
Alien Clearing	Number of hectares of Invasive Alien Plants (IAPs)	85 244 Ha	138 694 Ha	114 407 Ha [mostly follow-up; data up to	No update	

[47] 89 823 ha (45 963 ha for 2015/16 and 43 860ha historic) is registered for broad scale management utilising the tool as of 30 April 2016. Of this 41 023 ha is registered for farm scale management. The area for which FruitLook data can be obtained on a weekly basis is 170 000 ha. Data obtained from WC DoA.
[48] 123 100 ha (75 422 ha for 2017/18 and 47 679 ha historic) is registered for broad scale management utilising the tool as of 15 February 2018. Of this, 71 636 ha is registered for farm scale management (running season: 41 755; historical seasons: 29 881). The area for which FruitLook fruit crop data can be obtained on a weekly basis is 200 000 ha (2018). Data obtained from the FruitLook Progress Report 2018.
[49] Total area ordered 303 783ha (115 365ha for 2018/2019 season, 188 418ha historic seasons),
At farm scale level (up to 25ha field size): Total area ordered 107 292ha (55 998ha for 2018/2019 season, 52 810ha historic seasons).
[50] Total area ordered 127 519ha (75 480ha for 2019/2020 season, 52 039ha historic seasons). At farm scale level (up to 100ha field size): Total area ordered 93 257ha (60 771ha for 2019/2020 season, 32 486ha historic seasons).

High level category	Indicator	2015/16	2016/17	2017/18	2018/19	2019/20
	cleared per annum through Working for Water projects in Western Cape (represents 95% of clearing in the province)	[Initial Ha Cleared = 14865.2 Follow-Up Ha Cleared = 70378.83]	[predominantly follow-up work]	end of January 2018]		
*Fruitlook is discussed in additional detail in the food security, and invasive alien clearing sections of this report.						

Table 5. Additional High Level Water Related Indicators

High level category	Indicator	2015/16	2017/18	2019/20
Water	Total water supply versus total water demand per annum [for the Western Cape Water Supply System, which supplies the City of Cape Town and regions downstream of the Berg River]	Supply: 596,000,000 m^3 Demand: 508,100,000m^3 [2013 data][51]	Supply: 596,000,000m^3 Demand[52]: 547,260,000m^3 [2014 data][53]	No data received at the time of writing report
Blue Drop score	Average Blue Drop score for the Western Cape	89%[54]	No Blue Drop Assessment was carried out	No data received at the time of writing report
Green Drop score	Average Green Drop score for the Western Cape	84.5%[55]	No Green Drop Assessment was carried out	No data received at time of writing report
Household Sanitation	% households with access to sanitation	94.8%[56] [2013 data]	94.6% [53] [2014 data]	

4.1. Western Cape Water Supply

4.1.1. Western Cape Water Supply System

The Western Cape Water Supply System (WCWSS) supplies water to the City of Cape Town and surrounding smaller towns in the province. The system consists of dams and infrastructure components owned and operated by both the City of Cape Town and the DWS. The system's hydrological year runs from 1 November to 31 October. According to the Constitution, DWS is

[51] Western Cape Government Green Economy Report 2014.
[52] Adjusted water use figure that refers to the actual domestic use plus the current capped volume for agriculture.
[53] Western Cape Government Green Economy Report 2016 [2014 data].
[54] Briefing notes on the 2014 Blue Drop Report (Annexure C)
[55] Western Cape Government Green Economy Report 2014 [2013 data].
[56] Western Cape Government Green Economy Report 2014 [2013 data].

responsible for bulk water planning and implementing water resource schemes so that they meet water demand for cities, industries, mining and agriculture. Planning is carried out at a 1 in 50-year level of assurance. This means that during droughts with a severity of 1:50 years or more, restrictions need to be imposed to reduce demand. Distribution of the water resource at the local level is the responsibility of the municipality. Municipalities and particularly the City of Cape Town (as one of the largest water users in the province) thus have a key role in water management. A snapshot on the demand for water in 2018 indicated that Cape Town exerted the greatest demand for water of around 64% from the WCWSS followed by agriculture with an estimated demand of 29% while other urban areas in the province had an estimated demand of 7% [57](Figure 3).

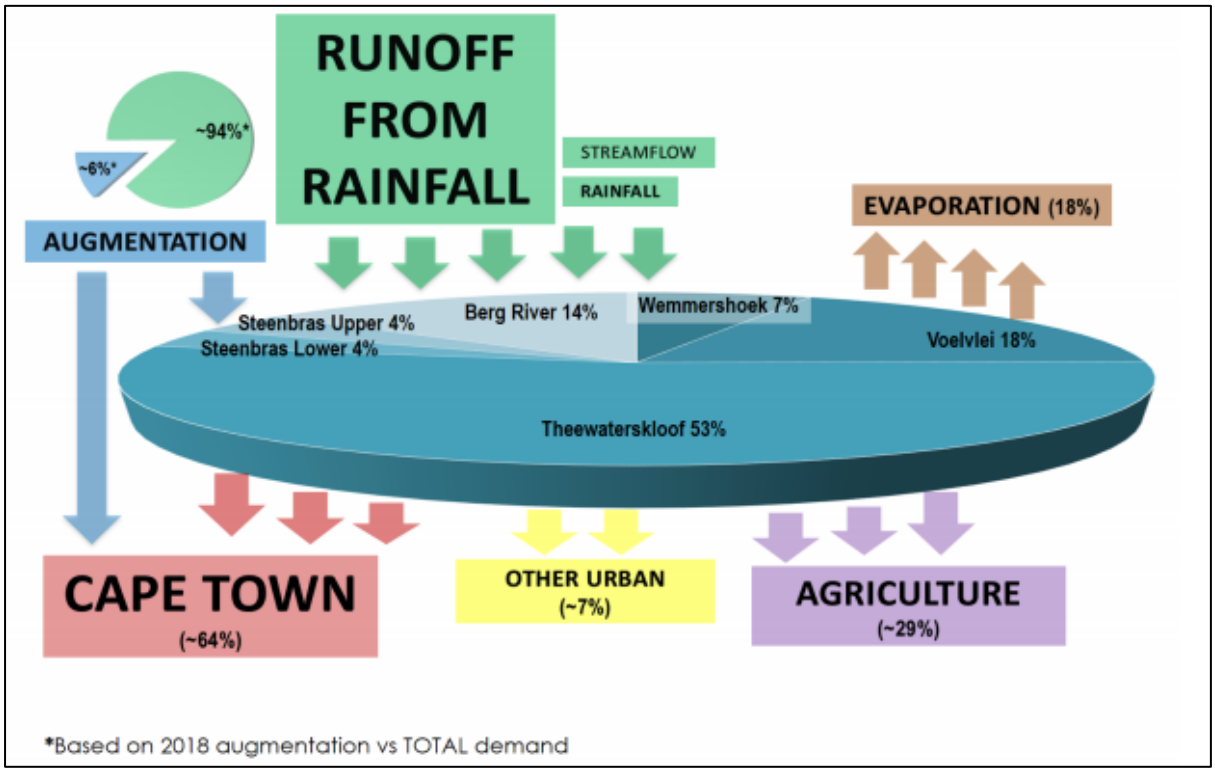

Figure 3: Demand and supply from the Western Cape Water Supply System (based on 2018 augmentation vs. total demand

The WCWSS system is currently almost entirely dependent on rainfall with water amounts hardly sufficient to meet the demand of the growing population, agriculture and industrial needs. The spread of alien invasive vegetation poses an additional threat to water availability in the WCWSSS. Growth of alien invasive vegetation such as eucalyptus, black wattle and pine trees has been noted to reduce the surface flow in the WCWSS. According to research carried out by CSIR, the risk of alien invasive species infestation in critical catchments has been acknowledged globally and within South Africa. The research indicated that within the WCWSS, there is a reduction in 98% of the assured yields of an amount of ±38 million m^3/annum (the equivalent of Wemmershoek Dam) as a result of alien invasive species growing in the catchment regions. The volume of water lost could increase to 130 million m^3/annum (± the

[57] City of Cape Town Water Outlook Report 2018 https://www.green-cape.co.za/assets/Uploads/Water-Outlook-2018-Rev-30-31-December-2018.pdf

capacity of the Berg River Dam) by 2045 if the clearing of invasive alien plants for some reason was halted[58]. Research carried out by Aurecon in 2016 assessing the impacts of invasive alien vegetation on the assured yield for catchments supplying the system (Figure 4). The recent drought caused by extremely poor rainfall further placed the WCWSS under enormous pressure which resulted in efforts by various stakeholders exploring and setting up (albeit at pilot scale) initiatives to augment water sources for the province. These considered both engineering and nature-based options.

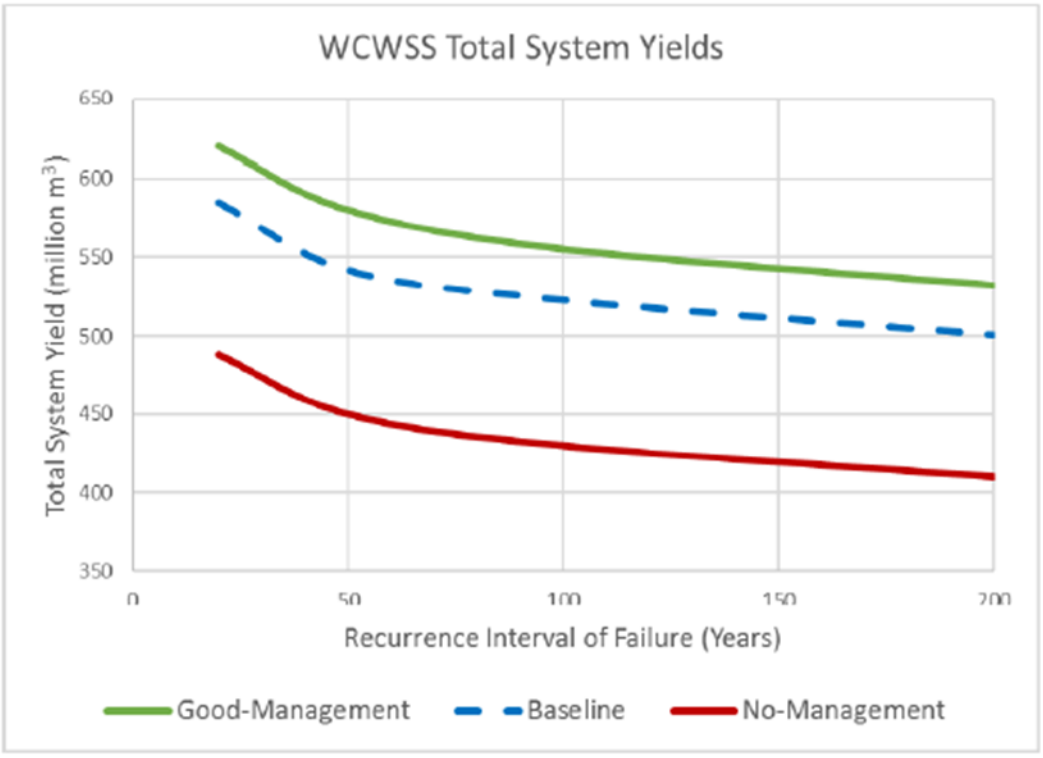

Figure 4: Impacts of IAPs on the yield of the Western Cape Water Supply

From Table 6 below it can be inferred that even as far back as 2005 there were insufficient water resources available to meet the demands for the Province. All Water Management Areas (WMAs), except the Breede, were recorded with a negative water balance as a result of overutilization[59]. This often correlates with the ecological condition of the fresh water systems being degraded. As a result, the WMAs are severely stressed and vulnerable to any major changes in rainfall e.g. from drought and long-term climate change, as has been keenly felt during the previous five years of drought. Figure 5 gives an indication of the water uses per WMA in the Western Cape based on data collected in 2015.

[58] Le Maitre, C.D., Forsyth, G., Dzikit, S., Gush, M.B., 2016. Estimates of the impacts of invasive alien plants on water flows in South Africa. Water SA 42, 505–517.
[59] Western Cape State of Environment Outlook Report 2013.

Table 6. A comparison of the overall water resource supply and consumption between 2000 and 2005, per Water Management Area[60]

WMAs	Year: 2000 (million m³ per annum)			Year: 2005 (million m³ per annum)		
	Water Supply	Water Use	Balance	Water Supply	Water Use	Balance
Berg	676	704	-28	709	745	-36
Breede	865	828	37	1090	1071	19
Gouritz	275	339	-64	351	415	-64
Olifants / Doorn	338	373	-35	372	406	-34
Provincial Total			-90			-115

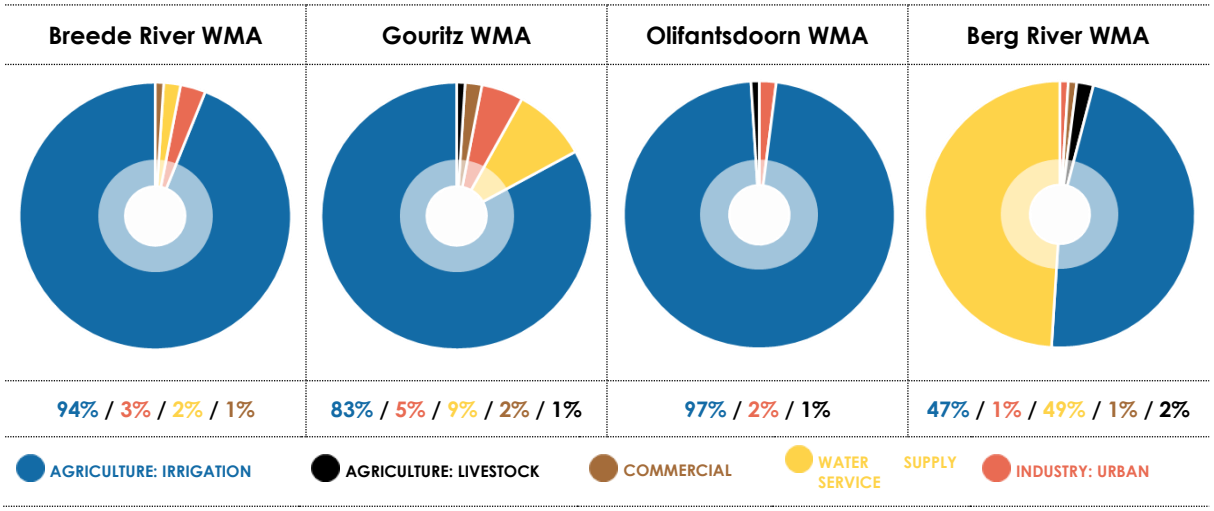

Figure 5. Registered water use per WMA – Western Cape Areas[61]

4.1.2. Implementation of the Water Reconciliation Strategy

In early 2005, the then Department of Water Affairs and Forestry (now DWS), as the custodian of the country's water resources, in partnership with the City of Cape Town, commissioned the Western Cape Reconciliation Strategy Study to facilitate the reconciliation of predicted future water requirements with supply available from the WCWSS for a 25-year planning horizon. The Strategy is used as a decision-support framework for making timeous and informed recommendations on those interventions that should be implemented to meet the future water requirements. The Planning scenario used in this study, however, does not include climate change as the uncertainty of the impacts on rainfall is deemed too high for planning in the short term.

Currently the WCWSS Reconciliation Strategy identifies the following key recommendations[62]:

1. A need to prioritise implementation of the Berg River – Voëlvlei Dam (Phase 1) Augmentation project and the extraction of groundwater from the Table Mountain Group Aquifer (Phase 1). The latter also considers drilling of boreholes in the Theewaterskloof basin.

[60] Annual Report on the Western Cape Sustainable Water Resource Management Plan 2014/15.
[61] GreenCape Water Market Intelligence Report, 2015.
[62] GreenCape Water Market Intelligence Report, 2015.

2. Coordinated implementation of the Invasive Alien Vegetation removal to accelerate improving the yield of the WCWSS by 2020. Identified priority riparian zones to clear alien vegetation and rehabilitate are the Berg, Breede, Riviersonderend and Sandveld rivers and their major tributaries.
3. Refurbishment of some of the existing bulk water infrastructure and improving annual operating rules through curtailment.
4. Accelerate completion of feasibility studies for sites identified in the 2007 Reconciliation Strategy and 2015 Scenario Planning.
5. The City of Cape Town, surrounding municipalities and the agricultural sector to continue with implementation of the approved and updated Water Conservation / Water Demand Management (WC/WDM) Plans. meeting the short-term requirements of water for the WCWSS.
6. Regular review and update of the Reconciliation Strategy to ensure that the objectives and targets set in the Strategy are achieved.
7. Implementation of real time monitoring system of the dams to be fully utilised and regularly updated.
8. Work towards meeting the Resource Quality Objectives when gazetted.
9. Calibration of the yield model in line with definitive yield value versus using the preliminary value currently being used.

At the Municipal level, municipalities have Municipal Water Services Strategies and Plans which include mechanisms such as water metering, by-laws and stepped tariff structure. As these get updated they might include increasing consideration of climate change. Currently many are dealing with increasing conservation and demand side management of water which is a key priority for all water users. Protection of water resources from pollution is also an effort to protect our dwindling resource, but non-revenue water [63] losses constitute significant losses even before reaching the consumer. The DWS, through bilateral engagements (among other) with local municipalities, have effected a monitoring system to determine which municipalities are adversely affected by such losses.

4.1.3. Climate Change and Water Supply in the Western Cape

Water security is affected by climate change in three general ways: changes in annual rainfall, increased runoff which affects quality of water in streams and rivers and increases in sea level (discussed in the Coastal Chapter). Climate change increases pressure on water resources through increased temperature and associated evaporation likely accelerated by the high wind speeds and related increases in frequency of extreme weather events. The Long Term Adaptation Scenarios for South Africa - brief on Water, states unequivocally that "*Climate change impacts on South Africa are likely to be felt primarily via effects on water resources; significant trade-offs are likely to occur between developmental aspirations …with significant social, economic and ecological consequences through restricting the range of viable national development pathways*". The updated State of Environment Outlook Report (SOEOR 2018) for the Western Cape indicates a general baseline decline in water quantity and quality. Many areas in the Western Cape have poor water quality, water resources are generally over-abstracted and ecosystems are heavily degraded and invaded by alien plants.

Climate change and climate variability also pose a variety of risks to all water infrastructure in the water service value chain. Traditionally, the design and installation of water and

[63] Non-revenue water includes free basic water and water to communities that do not pay for the water. Water losses are included under non-revenue water but it is a subset of this category.

wastewater infrastructure in South Africa considered several factors that include projected population growth, sustainability of operations during prevailing weather events and consideration for circumstances that could potentially affect services. These designs did not necessarily cater for occurrences of more frequent extreme weather events such as prolonged droughts whose end is usually marked by a period of intense rainfall resulting in flash floods and localized flooding, increases in mean annual temperatures and heat waves. These extreme conditions were historically classified as once in a million-year events. Currently, the Western Cape is recovering from one such severe five-year drought period which resulted in Climate Change and Water Security being elevated in the Enterprise Risk Register for the WCG. In addition, operating beyond the design capacity of the water systems, lack of good water governance and age are some of the factors that add strain to the water infrastructure. With respect to water infrastructure, the Blue Drop, Green Drop and access to sanitation scores indicate that currently very small proportions of the Western Cape have underlying vulnerability related to access to potable water and adequate sanitation. However, these can easily decline with ageing infrastructure which is exposed to changing weather patterns and increased demands for water in the province (Table 5).

4.2. 2015 – 2019 Western Cape Drought

As previously mentioned, over the last four years the Western Cape has experienced a devastating drought which has been classified as a potentially once-in-a-millennium event by some climate scientists[64]. This drought has also been linked to the El Niño-Southern Oscillation (ENSO) phenomenon. The drought conditions began to ease in the last half of 2019 as the region received some rainfall which could be attributed to the strong westerly winds which drove the winter cold front. Scientific observations still indicate presence of the expansive area of high pressure over the Atlantic Ocean. This high-pressure system is said to have been interfering with the rainfall weather pattern over the past four years[65] (Figure 6).

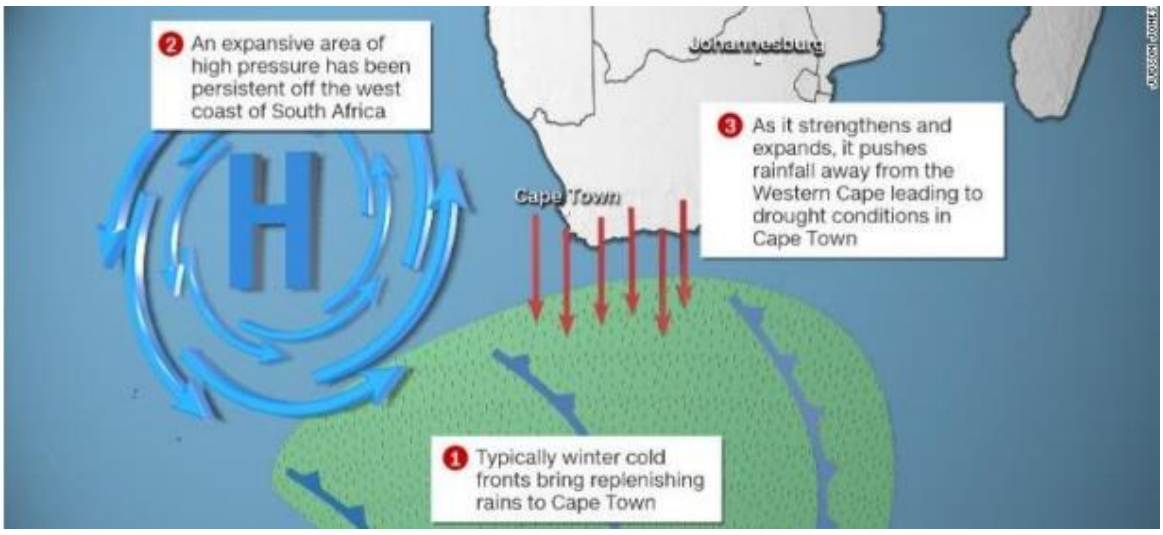

Figure 6: ENSO (El Niño-Southern Oscillation) and how it influences weather patterns in the south-western parts of South Africa[66]

[64] http://www.csag.uct.ac.za/2017/08/28/how-severe-is-this-drought-really/. Date of access: 20 February 2018.
[65] City of Cape Town Water Outlook Report 2018 https://www.green-cape.co.za/assets/Uploads/Water-Outlook-2018-Rev-30-31-December-2018.pdf
[66] City of Cape Town Water Outlook Report 2018 https://www.green-cape.co.za/assets/Uploads/Water-Outlook-2018-Rev-30-31-December-2018.pdf

According to the IPCC's fifth assessment report, long-term climate models indicate that a significant drying trend will continue across western portions of South Africa, possibly reducing annual rainfall by up to 40%i[67].

While it is difficult to determine exactly to what degree climate change might have contributed to such an extreme event, it is accepted that climate change will increase the impacts of such extreme events including impacts of floods and sea storm surges. The already-measured increase in average temperature of 1°C in the Western Cape undoubtedly contributed to the overall severe impacts of the drought. We can therefore no longer look to the past climate as an accurate predictor of the future climate, which combined with population growth means that we must prepare for a much more water-constrained environment. The recent drought demonstrated that reducing the risk of such a crisis and effective response will be determined by a number of factors that include availability of finance, human capital, capable institutional resources as well as new forms of innovative governance systems. It is also imperative to diversify water sources and that responsible authorities become smarter about capturing rainfall, treating and storing storm water, and reusing treated water and effluent for a variety of purposes. The drought also elevated the need for responsible authorities to have reliable data which should inform decision making and that informed citizens across the spectrum (commercial and industrial, agriculture, residential) are willing to cooperate and contribute positively to proposed water saving efforts.

The 2018 edition of the reconciliation strategy report acknowledged the successful implementation of the WC/WDM which was critical in ensuring sustainable provision of bulk water supply in the system during the drought period[68]. The report makes a specific mention of the City of Cape Town's efforts in implementing water demand management campaign that resulted in the reduction of average daily usage from 1.2 billion litres a day in February 2015 to 515 million litres a day in February 2018[69]. This most likely prevented the realisation of a 'Day Zero' scenario in the summer of 2019. Attempts by the City of Cape Town to decouple water use from population/economic growth through water demand management in the years leading up to the drought enjoyed some degree of success (despite population increases the City of Cape Town saw negative growth of its water requirements for three years until 2013/14), but whether this trend can be maintained into the future is questionable. Several innovative response mechanisms were also put in place across several sectors to ensure business continuity during the drought period. Some of these sectors and mechanisms they adopted are outlined in the table below:

Table 7: Business continuity measures implemented across various sectors during the recent drought period

Sector	Impact	Coping mechanisms
Commercial and industrial sectors	The drought created an awareness among businesses of their vulnerability to water security risks. The impact of drought on surface water availability has necessitated businesses to invest in measures to reduce their	• improved monitoring and metering systems for water quality and use; • installed water efficient devices; • implemented wastewater reuse schemes; and • considered alternative water systems.

[67] Information compiled by the Department of Water & Sanitation, City of Cape Town (https://www.green-cape.co.za/assets/Uploads/Water-Outlook-2018-Rev-30-31-December-2018.pdf)
[68] DWS. 2018. The support for the implementation and maintenance of the Water Reconciliation Strategy for the Western Cape Water Supply System. Report November 2018. Prepared by NFM Multi Consulting/Tlou Consulting (Pty) Ltd.
[69] Cape Argus, 7 March 2018. *City's water savings hailed as 'global first'*.

Sector	Impact	Coping mechanisms
	dependence on municipal supply Businesses tended to invest in technologies and services which led them to reduce their dependence on municipal water supply and hence demand for municipal water consumption was reduced compared to pre-drought levels. It remains unlikely that even in more secure water periods, the demand for water will return to pre-drought levels.	
Residential	During the drought, residential users in the Western Cape were motivated to invest in water technologies due to severe water restrictions, high tariffs, and risk of water shortages.	• alternative water installations (groundwater and rainwater harvesting, including treatment systems); • on-site reuse systems (greywater and pool backwash water reuse); and • water efficient devices (e.g. low-flow shower heads and tap aerators, and pool covers) • purchasing of water efficient appliances (such as washing machines and dishwashers) when they need to be replaced, as consumers are more water conscious.
Agriculture	Agricultural restriction was set at 60%. DWS is responsible for regulating and controlling use, including releasing water for agriculture.	The City of Cape Town has been working with DWS and the Western Cape Provincial Government to ensure that releases are controlled – as at the end of February 2018, DWS stopped releases to those irrigation boards who had reached their allocation increasing confidence that the agricultural restriction target would be met.
Other urban areas		DWS is responsible for water supplies to small towns and other urban areas in the Western Cape. Cumulatively other urban centres met restrictions and were monitored to prevent exceeding targeted consumption.70

(Source: GreenCape analysis 2018 report)

4.3. The Western Cape Sustainable Water Management Plan

The WCG:DEA&DP: Pollution and Chemicals Management Directorate updated the Western Cape Sustainable Water Management Plan (2017/18) (SWMP), and in the process reprioritised areas of action. Relevant reprioritised actions focus on including climate change considerations in estuary management plans, the development of a water sensitive design strategy and benchmarking tool for municipalities, implementation of the Western Cape Ecological Infrastructure Investment Framework, improved monitoring and information management minimisation of non-revenue water and water losses, a provincial integrated communication strategy on sustainable water management, commissioned an economic qualitative and quantitative valuation of selected wetlands close to the Theewaterskloof Dam as well as various other actions to improve water resilience in the province.

[70] https://www.green-cape.co.za/assets/Uploads/Water-Outlook-2018-Rev-30-31-December-2018.pdf

The Freshwater Forum: The Department is facilitating establishment of the forum as a means to ensure a coordinated approach amongst key sectors (Public, Private/NGO and Academia) in implementing the SWMP. The Forum will serve to:

- Provide strategic advice and influence decision making towards promoting resilient and sustainable investment in ecological infrastructure in the province;
- Facilitate knowledge exchanges and connections in project implementation across sectors to promote optimal use of resources and investments in the landscape;
- Clear presentation and communication of funding opportunities, streams and landscape for investment.

4.4. Water Provision as an Ecosystem Service

The water sector is critical for climate change adaptation. DWS through the National Water Act has recognised the importance of the maintenance of the ecological infrastructure and an ecological reserve is actively set aside for this purpose and that the protection of important areas is recognised through appropriate Water Resource Quality Objectives and the identification of National Freshwater Priority Areas (NFEPAs)[71]. A primary concern for managing water into the future is to protect the very sources of where it is produced, and thus to maintain ecosystems – rivers and wetlands – and their surrounding water catchments. Freshwater Ecosystem Priority Areas (FEPAs) describe the "*strategic spatial priorities for conserving freshwater ecosystems and supporting sustainable use of water resources*"[71] and are one of the emerging tools for protecting freshwater ecosystems. The maintenance of supportive ecological infrastructure such as wetlands and healthy riparian zones is highly dependent on sound land management which is supported by Agriculture under the Conservation of Agricultural Resources Act (Act 43 of 1983) (CARA) regulations and should also be built into Area Wide Planning Processes and the establishment of River Management Maintenance Plans, as set out in the National Environmental Management Act (Act 107 of 1998) (NEMA) regulations. These issues further emerged out of the Smart Agriculture for Climate Resilience (SmartAgri)[72] project as priority climate change response priorities (see Food Security chapter). The Sustainable Water Management Plan has enabled a review, update and publication of new guidelines for the development of River Maintenance Management Plans which includes consideration to be made to improvements in ecological infrastructure as a form of preventative maintenance.

In the Western Cape, irrigation to support agriculture is the major water use in the four currently designated WMAs, as shown in Figure 5. In the Berg WMA however, water supply service to the metropolitan area of Cape Town also represents a major source of consumption[73]. As a result of the importance of the Berg River in the province, a number of strategic projects have been initiated under the 'Berg River Improvement Plan (BRIP)' (Box 3). One of the key project priorities in the BRIP project is rehabilitation of river banks cleared of invasive alien vegetation. In addition, numerous other partner organisations are conducting invasive alien clearing in priority catchment areas throughout the province. The data on this will over time be reported on as an indicator of expenditure on ecosystem maintenance for water security.

[71] Nel, J.L., Driver, A. and Swartz, E. 2011. National Biodiversity Assessment 2011: Freshwater component. CSIR Report, CSIR Natural Resources and the Environment, Stellenbosch, South Africa
[72] https://www.greenagri.org.za/smartagri-2/smartagri-plan/
[73] GreenCape Water Market Intelligence Report, 2015.

Box 3. Berg River Improvement Plan[74]

The Berg River contributes significantly to agriculture in the Western Cape. The value of the market based on agricultural surveys in **the Berg River area and linked to market sales figures is over R3 billion (with over 80% destined for export)**. It is essential that the water quality in the Berg River comply with the appropriate standard - this is important for maintaining the rand value of both the local and export market. As part of implementing the Water Plan, a Berg River Improvement Plan was endorsed by the Western Cape Government during January 2013. Under this plan, short and long-term actions are currently being implemented and integrated across the various departments of the Western Cape Government towards a common outcome, viz. a Water Stewardship Programme for the Berg River that facilitates the recognition of the Berg River for its value for ecosystem services, and its natural resource state as it relates to water quality and quantity returns, while promoting sustainable growth and development in a green economy. Improvements are prioritised into a series of tasks which include riparian zone rehabilitation, bioremediation, water quality monitoring and associated economic analysis. These efforts have been further enriched through river stewardship and successful propagation at the on-site nursery. Since the initiation of the active riparian rehabilitation programme in 2013, just over half a million plants of local species have been utilised for the Berg and Upper Breede River catchments, leading to a total of over 40 ha of riparian land being rehabilitated.

Although there was an intention by national government to establish Catchment Management Agencies (CMAs) to oversee the maintenance of catchments, the current development is to follow on from the development of the National Water and Sanitation Masterplan, through which the organisational structure and oversight authority of CMAs is to be streamlined. The current uncertainty could have implications for climate change adaptation management, but these are unknown at this stage. At the moment, the Breede-Gouritz CMA (BGCMA) functions as a formally established CMA.

Opportunities, Gaps and Recommendations

- Both climate change and the impact of invasive alien plants have been taken into account in the WCWSS Reconciliation Strategy. A high-level assessment of the impact of climate change on the yield of the WCWSS has been determined to reduce the yield by close to 1 million m^3/a. monitoring of the impacts of climate change on the hydrology is one of the key recommendations of the WCWSS Reconciliation Strategy.
- Review the Specifications of the Regional Bulk Infrastructure Grant (RBIG), Municipal Infrastructure Grant (MIG), Accelerated Community Infrastructure Programmes (ACIP) and other similar funds and allocations to determine their climate responsive state (and link to any other ongoing such initiatives).
- Protection of Strategic Water Source Areas (SWSAs) (previously termed High-Water Yield Areas - these areas which are mostly in the mountains, cover 8% of the countries surface area but produce 50% of the water) should be a strategic climate protection priority for the Western Cape. SWSAs should be evaluated to ensure they receive appropriate protection in terms of supportive zoning in Spatial Development Frameworks (SDFs).
- Continued support for local municipalities in the province to develop ground water management plans and building capacity of officials to maintain and update plans.
- Whilst coordination of clearing and rehabilitation has become more streamlined and effective in recent years, further cooperation between IAP clearing authorities and rehabilitation programmes for wetlands and rivers will be beneficial in a changing climate. Currently there is no centralised reporting mechanism and spatial capturing of initiatives.

[74] Annual Report on the Western Cape Sustainable Water Resource Management Plan 2014/15.

- Continued focus on the way in which we manage our water systems, and increased emphasis on Water Sensitive Urban Design and promoting integrated water management that considers optimal use of stormwater and urban waterways for the purposes of flood control, aquifer recharge, water reuse and recreation, and is based on sound ecological principles.
- Demand side management – water saving campaigns to effect/affect behaviour change - translating technical information for general understanding and public use will assist in future communications campaigns on municipal services.
- Water Mapping: Promoting public awareness by transparently providing ample information to empower citizens has been a cornerstone of the City of Cape Town's drought response and a key aspect of its conservation strategy.

5. Food Security and Agriculture

The current WCCCRS priority areas for addressing food security and an economically sustainable agricultural industry in the Western Cape in a changing climate include:

1. Farming practices that are in harmony with nature, i.e. 'conservation farming';
2. Climate smart agriculture;
3. Agricultural water technologies that reduce consumption and increase efficiency (see Water Chapter);
4. Research on climate resilient and alternative crops and livestock applicable to the Western Cape;
5. Addressing climate vulnerability through the Municipal Support Programme; and
6. Assessing food security in the context of the resource nexus.

These priority areas will be updated and refined, along with M&E reporting in the next iteration of the M&E based on the revision of the WCCCRS and evaluation of the SmartAgri plan[75].

Table 8. Agriculture and Food Security Indicators for the WCCCRS

High level category	Indicator	2015/16	2016/17	2019/20
Sector climate change strategy	'Smart Agriculture for Climate Resilience' Strategy [SmartAgri] developed and implemented.	Strategy and Implementation Framework launched May 2016 and implemented from 2016/17 financial year.	Implementation continued in 2017/18 financial year	Evaluation underway[76]. Implementation continued in the 2019/2020 financial year.
More Crop per Drop	Number of hectares users utilise by the FruitLook Tool [indicating increasing water efficiency]	2014/15[77]: 15 608 ha 2015/16[78]: 25 672 ha	2016/17[79]: 35 000 ha 2017/18[80]: 71 636 ha	Gross land area of 9.5 million hectares[81] comprising of irrigation agriculture, rainfed agriculture and natural land
Climate Science backed decision-making	Identification of historical climate trends and projections for future climate in the WC.	SmartAgri Status Quo Assessment report 2014	No update[82]	No update[82]

[75] https://www.greenagri.org.za/smartagri-2/smartagri-plan/
[76] The SmartAgri plan is currently being evaluated to assess whether the plan was properly designed and relevant, to what extent its outcomes have been achieved after three years of implementation, whether there are indications that the sector is more resilient and how the plan and its implementation can be strengthened. The final report of the evaluation is due at the end of March 2020 and the outcomes of the evaluation will be used to improve the SmartAgri plan to ensure a more resilient agricultural sector and department.
[77] Smart Agri Case Study: FruitLook (2016): http://www.greenagri.org.za/assets/documents-/SmartAgri/Case-Studies/1.-Case-Study-FruitLook-FINAL.pdf
[78] Fruitlook Newsletter, January 2017
[79] Fruitlook for Efficient Farming, September 2017
[80] Fruitlook Summary Report 2017/18
[81] Fruitlook 2019-20: Progress Report 2: January 2019
[82] Current project implementation is based on historical climate trends and projections for future climate in the WC as identified in the SmartAgri Status Quo Assessment report 2016. No updated data is available for the agriculture sector.

High level category	Indicator	2015/16	2016/17	2019/20
SmartAgri Research Agenda	Identification of key research areas for stimulating and facilitating shift to climate smart agriculture	Developed under SmartAgri project, sent to Cape Higher Education Consortium (CHEC).	Research focus areas implemented in research agendas of various research institutions	Research focus areas implemented in research agendas of various research institutions

Table 9. Additional High Level Agriculture and Food Security Indicators

High level category	Indicator	2013	2014	2015	2016	2017	2018
Land	Agricultural land improved through conservation measures annually (ha)	29 076[83]	18 036[83]	7 342[83]	12 918[84]	8383[85]	5956a
Household Food Security	% households with measure of food insecurity	22.70%[86]	25.5%[83]	24 %[87]	22.3 %[88]	2016 is latest info	2016 is latest info

The improvement of agricultural land through conservation measures depends on the availability of funding and the degree of degradation per financial year[89]. Other influencing factors include, impact on service delivery and performance due to increased capacity demands as a result of natural and manmade disasters, increased environmental resource degradation due to increased demands by all sectors, the inability to implement succession planning due to skills shortages[90].

The agricultural sector is an important backbone of the economy of the Western Cape; it is further pivotal for food security. By nature, the sector is highly sensitive to climatic changes, with the Western Cape already having experienced gradual warming of approximately 1°C over the last five decades. The region is expected to be particularly hard hit by the combination of warming and additional stress on already constrained water supplies; a scenario that does not bode well for the sector that is also the single largest user of water in the province. The consequences of the current drought (2015-ongoing) included severely decreased water allocations of between 60 % and 86 % for the agriculture sector. Climate projections for the Western Cape indicate continued warming of the region and an increase in the frequency and magnitude of extreme weather events such as the drought. Apart from planning for post disaster mitigation and recovery, it is also necessary to have a pro-active approach towards climate related disasters. Without an adequate and timeous response, climate change could further constrain the future development and sustainability of the agricultural sector and threaten economic growth, livelihoods and food security.

[83] Western Cape Government Green Economy Report 2016 [2014 Data]
[84] Western Cape Department of Agriculture, Annual Performance Plan, 2017-2018
[85] Western Cape Department of Agriculture, Annual Performance Plan 2019-2020
[86] Western Cape Government Green Economy Report 2016 [2013 Data]
[87] StatsSA General Household survey, 2015
[88] StatsSA General Household survey, 2016
[89] Communication with Francis Steyn, March 2018. Western Cape Department of Agriculture
[90] Western Cape Department of Agriculture, Annual Performance Plan, 2017-2018

Farmland constitutes 89% of the total land in the province, and generated approximately R40.6 billion gross production value in 2018. The Western Cape has the highest market value of agricultural assets in South Africa with gross fixed capital formation totalling R4.4 billion[91]. The Agriculture sector of the Western Cape contributes to around 4% of the province's economy with the total value added in 2018 of R23.181 billion[92]. Products originating from the province's agricultural value chains which include agricultural and agri processed products contributes 54% of all Western Cape exports. To put this in a national perspective, the Western Cape's share in South Africa's agricultural exports were 37%[93] with steady increases in exports of wine, fruit and livestock products contributing positively to economic growth and rural incomes. In 2019, the agricultural sector employed approximately 216 000[94] people in the Western Cape, whilst the strong forward linkages to the manufacturing sector adding another 133 000 jobs in the agri processing industries[95]. The sector however suffered a loss of around 30 000 jobs over the drought period 2015 -2017[96], but have seen some recovery in 2019. Further, losses in agricultural exports dropped by between 13-20% and was attributed to reduced farming outputs and additional income losses as export volumes declined[97]. There were also strong backward linkages to input suppliers such as feed, equipment, fertiliser and packaging companies. These industries contribute significantly to employment in the province.

In addition to the climate change threats to agriculture, there are additional underlying vulnerabilities as highlighted in the SOEOR 2018 (Annexe 3) which indicate a general declining environment (including water, ecosystems and land transformation) which render the agriculture sector even more vulnerable to climate change. Various baseline activities are underway such as LandCare programmes to improve the quality of agricultural land. Almost all the adaptive responses which are already being implemented in the province are driven primarily by non-climatic drivers, particularly economic drivers (both on-farm and consumer-driven), and in some instances the need for greater ecological and social sustainability[98]. Farmers and agri-businesses adopt new ways of doing things only where it makes economic sense and/or the market demands it. However, future climate resilience is often acknowledged as a co-benefit. Good examples of 'no-regrets' approaches providing multiple benefits are Conservation Agriculture and the FruitLook Project. Interventions are required that additionally respond directly to climate change threats on top of business as usual responses, which is where the SmartAgri Plan has been pivotal in redirecting the whole sector. Increased drought resilience has been observed on farms practising sustainable agriculture and applying principles according to the SmartAgri Plan.

Box 4: Conservation Agriculture Case Study of effectiveness in 2015-18 drought[99]

In 2002, full conservation agriculture principles were implemented on three conservation agriculture trial sites of the Western Cape Government: Agriculture (WCG: DoA). The farms are located in Moorreesburg (Langgewens Research Farm), Riviersonderend (Tygerhoek Research Farm) and in Riversdale. Commercial yields to supply enough food and ensuring a famer's profitability depends on the efficiency of utilisation of the amount of water received above 110mm. During the 2017 season, several areas in the Swartland for example received less than 100mm of rain, producing either very low yields or no harvest.

[91] Quantec, 2020. Regional Service: RSA Standardised Regional Capital Formation. Easy Data. Pretoria: Quantec
[92] Quantec, 2020. Regional Service: RSA Standardised Regional Capital Formation. Easy Data. Pretoria: Quantec
[93] Quantec, 2020. Regional Service: RSA Standardised Regional Capital Formation. Easy Data. Pretoria: Quantec
[94] Quarterly Labour Force Survey, Quarter 4, 2017. StatsSA.
[95] QLFS, 2020. Quarterly Labour Force Survey (Revised): 2019. Pretoria: Statistics South Africa.
[96] Drought Policy brief 2018, Western Cape Agriculture. Compiled by the Western Cape Department of Agriculture and the Bureau for Food and Agricultural Policy.
[97] WWF -SA. 2018. Agricultural water file: Framing for a drier future. Western Cape. South Africa.
[98] SmartAgri Status Quo Summary report.
[99] SmartAgri Newsletter, December 2017

During the 2017 season, rainfall and wheat yields for the production season at these trial sites were 157mm (wheat: 2.45 t/ha), 147mm (wheat: 2.8 t/ha) and 126mm (wheat: 1.8 t/ha) respectively. The wheat yields were produced with an excess of the 110 mm rainfall threshold. During the three driest years for the agriculture sector, 2003, 2015 and 2017, the average wheat yields at these production sites were 1 t/ha, 2.1 t/ha and 2.4 t/ha respectively.

During the 2018 and 2019 seasons, the results from the various sites again indicated that Conservation Agriculture during dry years does enhance yield and is a positive adaptation response to increasing drought risk.

Water resource management along the Breede River was addressed through a joint initiative between DEA&DP, WCG: DoA Cape Winelands LandCare team, land owners along the Breede River banks and the Breede-Gouritz Catchment Management Agency (BGCMA). Implementation actions for improved management of water resources along the river banks include clearing the riverbanks of invasive plants and rehabilitating the river's watercourses. This approach ensures the "restoration of natural ecosystems including riparian buffers and wetlands" which is a SmartAgri solution. After clearing 1 000 ha of invasive plants along the Breede River banks, observations from farmers involved in the project include, increased water availability in the Breede River than the previous year (2016). As a result of the removal of trees, farmers noted that the air flows more freely through the vineyards which has reduced frost.

Globally, GHG emissions from agriculture, forestry and other land use are steadily increasing. They now stand at just under a quarter of global emissions, and future emissions may further increase by up to 30% by 2050[100] although this could be attributed to the loss of sink potential due to land use changes and with some of the increasing coming from direct emissions from the agricultural sector. Therefore, in the agricultural sector there is potential for mitigation through an enhancement of GHG removals and emission reductions through management of land and livestock, and demand-side management.

The agricultural sector accounts for only 2% of energy consumption in the province. The National Greenhouse Gas Inventory (2000-2015)[101] attributes 9.2% of national GHG emissions to the Agriculture, Forestry and Other Land-use (AFOLU) sector, in terms of gross emissions for the sector (and 4.1% of total net emissions in South Africa). The agriculture sector of the Western Cape accounts for 4%[102] of the province's total energy-related emissions in 2015/16 even though we have not completed a full GHG inventory for the province. The WCG will be undertaking a 2050 Emissions Pathway Analysis over the next two years, which will include the completion of the GHG inventory for the AFOLU Sector. This will give us a better understanding of the contribution of the sector in terms of GHG emissions as well as the mitigation potential.

In the Western Cape, the agricultural system has proven its resilience to the inherent variability of the local climate in the past. Recent disruptions and climate-related disasters such as the 2009 drought and the 2015 – 2020 drought has nevertheless impacted sector stability and resilience. Similar systems in other parts of the world such as Spain and South Western Australia have recently had significant negative impacts on agriculture as a result of a changing climate.

To respond to climate change in the Agriculture sector, the Western Cape has developed an innovative climate change resilience strategy called "SmartAgri", see Box 5. The SmartAgri plan and its proposed actions has changed the service delivery environment of all the programmes of the WCG: DoA and is not only providing a roadmap for climate change

[100] SmartAgri Status Quo, 2016
[101] Department of Environmental Affairs, 2019. GHG National Inventory Report South Africa (2000 – 2015). Pretoria: Department of Environmental Affairs
[102] Western Cape Energy Consumption and CO_2 Emissions Database Reports (2015/16 Data)

support to the Agriculture Department, but has assisted the sector to becoming climate change resilient. This strategy builds on all the existing initiatives that are contributing to resilience and low carbon management of systems, such as LandCare, FruitLook, Conservation Agriculture, the Climate Resilience Project and Green Economy initiatives. Climate Smart Agriculture takes a systems approach to securing sustainability and resilience by addressing both adaptation and mitigation in agriculture while providing economic, ecological and social benefits.

Additional supporting policies and initiatives also aim to enhance climate responses to a certain degree, such as through the WC Green Economy Strategy Framework (2013).

Box 5. SmartAgri

SmartAgri – 'Smart Agriculture for Climate Resilience' is a sector climate change response plan developed in partnership between the WCG: DoA and DEA&DP. The launch of the SmartAgri plan announced the end of a 20-month long project and a plan of proposed action to lead the agricultural sector to being more climate change resilient.

SmartAgri continues to play a major role in the agricultural sector in emerging and existing projects and platforms as the increasing devastation of the drought (2015 - 2018) continues to impact the sector. Since its launch, the SmartAgri plan has been communicated and work shopped with various stakeholders in the agricultural sector. The plan has landed in strategic discussions and decision making of various organisations and commodities and has undoubtedly contributed to make stakeholders more climate change ready and resilient and increase their ability to take decisions based on science based information and knowledge.

The Drought Dialogue hosted by the WCG: DoA in mid-2016 built on the SmartAgri plan and aimed to address and discuss the drought, lessons learnt and ways to mitigate future drought conditions and thereby increase the resilience of the sector. The multi stakeholder dialogue identified 32 high-priority, actionable interventions for the WCG: DoA to strengthen the response to current and future droughts. Within these priorities, five areas were highlighted for immediate action. The five priority areas are closely aligned with the SmartAgri Plan and i outlined below:

- Bridging finance to keep farmers on farms
- Optimise water usage (surface and ground water)
- More accurate predictions of droughts and disasters
- Develop a social security net to support mostly rural communities and agri-workers adversely affected by drought
- Revisit water management and policies currently hampering new infrastructure

An action plan for the five priorities has been developed under the guidance of the Rural and Agricultural Sector Support Committee, in partnership with Agri Western Cape and the African Farmers Association of South Africa. Initially known as the Drought Committee, the Rural and Agricultural Sector Support Committee was expanded to include industries and other stakeholders as a result of the escalated impacts of the drought. SmartAgri is represented on the committee and provides insight into the alignment between knowledge and action on climate change, and the current response to the drought in the agricultural sector. A key output for the committee was the Drought Fact Sheet 2017 for the agriculture sector. Tasked to the SmartAgri team, the document focusses on the cross-cutting aspects of the Western Cape drought which includes scientific information on climatology and hydrology, the impacts on crops and livestock, social welfare, jobs and the overall food system. The Rural and Agricultural Sector Support Committee convenes every quarter to update members on the actions and fast track new actions and initiatives.

5.1. Promoting Climate Smart Agriculture

Climate Smart Agriculture (CSA) is one of the primary responses initially being pursued and is also highlighted as a priority in SmartAgri. This approach includes improved soil management

techniques, minimising carbon release and maximising carbon sequestration; rehabilitation of ecological infrastructure will also enhance sequestration. Climate Smart Agriculture further focusses on climate adaptation by building farmers' climate resilience, as well as improving livelihoods through poverty reduction. Programmes such as LandCare and ongoing extension support services will continue to promote Climate Smart Agriculture practices.

Through the LandCare initiatives, farmers have and will continue to receive support through extension, awareness campaigns and capacity building exercises as well as with the removal of alien vegetation. In this way the agricultural sector will continue to save water, re-establish natural vegetation in the river riparian zones, improve land use through conservation measures and update farm plans for sustainable farming purposes.

The Climate Resilience Project (CRP) is an initiative from the WCG: DoA to link GreenCape activities to the outcomes of the SmartAgri project. The project was launched during 2017 in collaboration with the Farmer Support and Development Programme and is specifically focused on building climate resilience in small holder farmers through agricultural extension as part of the SmartAgri Priority Project 6 - Climate Smart Agricultural Extension.

Several new initiatives to communicate awareness on climate smart agriculture in particular, and climate change in the broader sense, have been implemented by WCG: DoA during the last two years. A quarterly SmartAgri e-newsletter – SmartAgri Barometer – are published to showcase implementation actions, whilst the first radio programme on climate change awareness, called "Die Kwik Styg" on RSG, will be concluded on the 3rd of April 2020 after two series and 104 programmes were aired.

The Water Research Commission (WRC) runs various projects in South Africa's water sector in collaboration with academic institutes and other partners. The WCG: DoA has high interests in the outcome of these projects, specifically the outcomes of one of the key strategic areas of the WRC which focusses on Water Utilisation in Agriculture. The projects under this theme are closely related to the concept of Climate Smart Agriculture, a component of the SmartAgri plan. The two projects are "Enabling participation of emerging farmers in water resources management" and "Water footprint as a sustainability indicator for table and wine grape production", which is currently still in progress.

Programmes such as FruitLook additionally support farmers' ability to reduce input costs, while optimising water-use efficiency and increasing crop production. The programme is an example of the leading role that has been played by the sector in climate change adaptation. The FruitLook programme has had a substantial uptake by many farmers to improve their water efficiency and the tool now covers a gross land area of 9.5 million hectares[103] comprising of irrigation agriculture, rainfed agriculture and natural land. The FruitLook programme has been extended to cover all irrigation areas in the province, to assist farmers to optimise the little available water during the drought. The tool has been proven to help farmers in improving their water management, create increased awareness of crop development and detecting growth issues[104]. Information and technical support will also be provided to dry land grain and rooibos tea farmers to assist them to change from conventional farming to conservation farming practices with the objective of increasing soil fertility and retaining moisture in the soil. The current drought situation has emphasised the importance of the optimal utilisation of the current limited water resources. The Programme: Sustainable Resource Management of the

[103] Fruitlook 2019-20: Progress Report 2: January 2019
[104] Fruitlook Summary Report 2017/18 (2017/18 Data)

Agriculture department will provide relevant information to irrigators to assist them to increase their water use efficiency to produce more crops with less water.

5.2. Promoting Food Security at the Municipal Level

Urban and peri-urban agriculture is part of the overall food system, although participation rates by poor households in Cape Town (5% in 2007) and in the province (2%) are very low. However, the Philippi Horticultural Area of Cape Town makes a very important contribution to the supply of fresh vegetables to the city's supermarkets. Other urban production areas such as the Joostenbergvlakte contribute to the chicken and pork supply. More recently a Food Security and Nutrition Strategy for the Province was commissioned and particularly prioritises urban food security issues.

As seen in Table 9, food insecurity in the Western Cape is variable over time and will be important to continue monitoring in relation to climate change impacts.

Box 5. Philippi Horticultural Area Court Case Findings[105]

After a decade of legal arguments to protect the Philippi Horticultural Area (PHA) against urban development, the PHA Food and Farming Campaign, backed by 33 civil society organisations, won a significant victory in the Cape High Court in February 2020, with a judge finding that neither the City of Cape Town nor the provincial government paid proper attention to the impact housing and other urban developments will have on the Cape Flats Aquifer. The court also found that a crucial appeal decision in this regard was made using old reports. The judge ordered that the MEC consider the impact that the development will have on the Cape Flats Aquifer in the context of climate change and water scarcity.

5.3. Research on Climate Resilient and Alternative Crops and Livestock

The Western Cape can draw on its very strong research and knowledge base on natural resources to devise strategies that strengthen the linkages with agriculture and its productive potential into the future. This will require a targeted focus on better understanding and monitoring such linkages, and improved collaboration between the agriculture, water and biodiversity sectors. The private sector has taken the lead in providing research support, with some areas of research covered by WCG: DoA. An extensive spectrum of research gaps and priorities has systematically been identified through the development of the SmartAgri project and the current list has been shared through CHEC. The list will also be shared with other research organisations and commodity groups to incorporate into their respective research programmes.

The challenges associated with climate change and the consequences of the current drought has created a continuously high demand for research and technology development services to assist farmers in sustaining their production against a set of climate challenges. The focus on climate smart research, including minimum or zero tillage for soil conservation, crop rotation for higher production, increased crop cover to prevent evaporation (these are the three pillars of conservation agriculture), judicial fertiliser use, alternative farming practises and possible new and alternative crops for the Western Cape, has intensified. Conservation agriculture in the small grain and potato industry will also be advocated and promoted in focussed technology transfer efforts. The focus on soil health will be intensified. "Soil reform", and not only land reform, will ensure a sustainable agricultural sector with soil being the most important medium to physically support sustainable crop production and subsequently animal

[105] Text in this box is taken from the Daliy Maverick https://www.dailymaverick.co.za/article/2020-02-18-victory-in-court-for-philippi-horticultural-area/ accessed 12 March 2020.

production[106]. Since its inception in 2014, the Alternative Crops Fund (ACF) of the WCG: DoA has funded research projects of the smaller, niche crop industries (honeybush, cherries, berries, figs, persimmons, olives, pecan nuts, Cape flora, pomegranates, prunes, guavas, to the value of R11 115 606. A carbon footprint calculator for the cherry, pecan nuts, pomegranate, protea, honeybush and berry industries will also be developed in 2020/2021 as one of the funded projects of round six of the ACF.

5.4. Opportunities, Gaps and Recommendations

- The current potential to respond is hampered by the limited availability and additionally the loss of institutional and human capacity (and institutional memory) in critical areas in government. Research capacity and expertise at municipal decision-making level is limited and collaboration and co-operation is lacking.
- This review has found that, although the agricultural value chain is known to be extremely important in the Western Cape, limited work has been done to assess the impacts of climate change across the value chain. Growth opportunities in the value chain should be well assessed against climate change risks and impacts, including the question of limiting resources (water, energy) required for these activities.
- Focus should be on promotion of carbon sequestration through land-based interventions such as restoration of rangelands, reducing degradation of soils and land cover and promoting conservation agriculture (with partners).
- Continue to promote reduction of energy consumption and switch to renewable and energy efficiency where feasible.
- Transition from measuring carbon footprints to reducing them with appropriate policy support.
- Increased collaboration between agriculture and health with regards to occupational climate change risks of agricultural workers.
- A more integrated approach between agriculture and food security is needed, that also gives consideration to urban food systems.
- Continued refinement of disaster risk management and climate risk management approaches in relation to agriculture.
- The following have been identified through the SmartAgri project as priority programmes, and these are likely to be an immediate focus, and there will be continued drive for programme development and funding:
    - Conservation Agriculture for all commodities and farming systems
    - Restored ecological infrastructure for increased landscape productivity, socio-ecological resilience and soil carbon sequestration
    - Collaborative integrated catchment management for water yield and quality and job creation
    - Climate-smart energy case studies are needed to inspire the transition to low-carbon agriculture. Explore opportunities for implementing smart/optimum water-food connections towards sustainable economic development, improved quality of life and environmental protection
    - Climate-proofing the growth of agri-processing in the Western Cape
    - Integrated knowledge system for climate-smart agricultural extension

[106] SmartAgri Update, March 2018

6. Energy

The Energy Chapter covers the Renewable Energy, as well as the Energy Efficiency and Demand Side Management focus areas that are discussed in the Western Cape Climate Change Response Strategy, 2014. Transport has a strong link to the energy chapter, particularly in terms of the emissions associated with the use of transport fuels, such as petrol and diesel. The role of transport as part of the total energy and emissions profile is discussed here, but the detail around responses for that sector are addressed in the Transport chapter.

The current priority areas for addressing energy efficiency and renewable energy in the WCCCRS in a changing climate include:

1. Implementation of building energy efficiency programmes and awareness raising, including improved energy efficiency of WCGs own building stock;
2. Promotion and rollout of solar water heaters (both low- and high-pressure systems);
3. Development of the renewable energy economy in the Western Cape, in terms of both the appropriate placement of utility scale renewable energy generation as well as manufacturing opportunities; and
4. Development of opportunities around small-scale embedded generation.

Table 10. Energy Indicators for the WCCCRS

High level category	Indicator	Data 2012/13	Data 2015/16	Data 2018/19
GHG emissions	GHG emissions associated with the energy sector	36 345 753 tCO_2e (2012)[107]	38 901 581 tCO2e (2015)[108]	No new data available [109]
Energy Consumption in the Western Cape	Energy Consumption (total)	276 333 250 GJ (2012)[110]	299 401 470 GJ (2015)	No new data available[109]
	Sector Breakdown			
	Industry	85 383 982 GJ	87 530 766 GJ	No new data available[109]
	Transport	146 296 370 GJ	161 817 293 GJ	
	Agriculture	6 968 221 GJ	5 092 440 GJ	
	Commercial	10 921 301 GJ	14 430 141 GJ	
	Local Government	2 111 886 GJ	1 561 059 GJ	
	Residential	24 652 305 GJ	28 969 771 GJ	
Solar Water Heaters (SWHs)	Number of SWHs installed in the Western Cape	14 889 HP SWH [111]	No new data available	No new data available

[107] Western Cape Energy Consumption and CO_2 emissions database report (2015).
[108] Western Cape Energy Consumption and CO_2 emissions database report (2018)
[109] The Western Cape Energy Consumption and CO_2 emissions database has not been updated, but new information should be sourced as part of the 2050 Emissions Pathway Analysis, which will be undertaken over the next two years.
[110] Western Cape Energy Consumption and CO_2 emissions database report (2015).
[111] GreenCape Market Intelligence Report 2014.

High level category	Indicator	Data 2012/13	Data 2015/16	Data 2018/19
Renewable energy	Total energy produced from Renewable sources by independent power producers	421.82 MW[112]	606 MW [113]	606 MW procured (June 2019)[114] 452 MW online (June 2019) 4 934 GWh generated (cumulative figure – June 2019) [115]
	Annual values of renewable energy projects financed by national and international funding sources	R 8 024 mill [116]	R 3.74 billion[117]	R7.2 billion[118]
Small Scale Embedded Generation	Number of Western Cape municipalities that have implemented small-scale embedded generation (SSEG) tariffs	4	13 municipalities have approved tariffs, but 19 allow SSEG	22 municipalities allow SSEG and 19 of these municipalities have tariffs in place (March 2020) [119]

6.1. GHG Emissions Associated with the Energy Sector

South Africa is the 37th largest economy in the world (and the 2nd biggest in Africa after Nigeria)[120] yet it is the 14th largest emitter of GHGs globally[121]. This is largely due to the country's energy intensive economy and dependence on fossil-fuel based energy sources. The majority of South Africa's electricity is generated by coal-fired power stations and most of the transport system relies on fossil-fuel based liquid fuels. In late 2019 and early 2020 South Africa, again, experienced significant loadshedding due to supply constraints, with the expectation that episodes of loadshedding will continue for the next 18 months (into the first quarter of 2021). There are several reasons for the supply constraints, with the continuous growth in the number of customers requiring electricity, lack of plant maintenance and unprecedented levels of power plant breakdowns being seen as key contributors.

The continued loadshedding has led to calls for increased uptake of renewable energy and a focus on allowing independent power producers to take some of the demand off Eskom and allow for an open market. In this respect, President Ramaphosa indicated in his 2020 State

[112] Green Economy indicator report 2015.
[113] Green Economy indicator report 2018
[114] IPP Office Q1 2019 – 2020 Overview
[115] IPP Office Q1 2019 – 2020 Overview [NOTE: the figure is understated as some of the generation figures were not received from the IPPs]
[116] Green Economy indicator report 2015.
[117] Green Economy indicator report 2018
[118] IPP Office Q1 2019/20 Overview
[119] GreenCape, March 2020.
[120] http://statisticstimes.com/economy/countries-by-projects-gdp.php Information taken from the International Monetary Fund World Economic Outlook (October 2019)
[121] Carbonbrief.org/the-carbon-brief-profile-south-africa

of the Nation address that emergency power will be procured from a variety of sources, including renewables, and that the contributions from small-scale embedded generation and renewable energy power plants will be facilitated[122]. This aligns well with the 2019 Integrated Resource Plan (see text box) which envisages a progressive shift away from carbon intense coal-based electricity supply – by 2030 it is expected that 49% of the installed power generation capacity [123] in the country will be considered low carbon (including nuclear), although the energy mix will still be dominated by fossil fuels. [124].

Box 6: Integrated Resource Plan (2019)

The Integrated Resource Plan (2019) was published in October 2019 after a very long delay and a number of shifts in Ministers and political priorities.

The IRP 2019 sets out 9 policy supply and demand-side decisions in the short term to minimise the risk of loadshedding and / or extensive use of diesel peaking plants.

- Undertake power purchase programme to acquire capacity
- Undertake technical and regulatory work for the 20 year extension of the life of the Koeberg Nuclear Power Plan beyond 2024
- Support Eskom to comply with minimum emissions standards
- Consolidate into a single team the various initiatives for a just transition for purposes of coherent policy development
- Retain the current annual build limit on renewables (wind and PV) until the finalisation of the just transition plan
- South Africa should not sterilise the development of its coal reserves for the purposes of power generation, but instead all new coal power plants must be based on high efficiency, low emissions technology
- Support the development of gas infrastructure and in addition to new gas to power capacity, convert all diesel-fired power plants to gas
- Commence preparation for a nuclear build programme to the extent of 2500 MW at a pace and scale that the country can afford, because it is a no-regret option in the long term.
- South Africa will participate in strategic power projects that enable the development of cross-boundary infrastructure needed for regional energy tracking.

The carbon-intense nature of the South African energy supply network has a major impact on the total national GHG emissions. The National GHG Inventory during 2000 – 2015[125] attributes 79.5% of national GHG emissions to the energy sector[126];. A similar proportional breakdown for the Western Cape is unfortunately not yet available. The knowledge gap will, however, be filled during 2020/21 as the WCG will be undertaking a 2050 Emissions Pathway Analysis. This study will include the development of a full emissions profile for the Western Cape, expanding on the energy consumption and carbon dioxide (CO_2) emissions database to include emissions from the waste, AFOLU and Industrial Process and Product Use (IPPU) sectors.

The WCG has to date concluded three energy consumption and CO_2 emissions data collection exercises in order to understand and track the emissions profile for the energy sector in the Western Cape. These were undertaken in 2012 (based on 2009 data), in 2015 (based on

[122] https://www.gov.za/speeches/president-cyril-ramaphosa-2020-state-nation-address-13-feb-2020-0000
[123] Installed capacity is projected maximum electricity load that a generator can support. This means that under ideal condition a certain amount can be generated, but this won't necessarily be the actual amount of electricity produced. In the case of renewables, the installed capacity is always higher than percentage contribution.
[124] Integrated Resource Plan (IRP2019), October 2019, Department of Energy
[125] The GHG National Inventory Report South Africa (2000 – 2015)
[126] The National GHG Inventory emissions proportions are: Energy (79.5%), Waste (4.1%), IPPU (7.7%) and AFOLU (4.1%) – making up 95% of total GHG emissions for the country.

2012 data) and in 2017 (based on 2015/16 data). There has been no update since the previous M&E report as the next full assessment will form part of the 2050 Emissions Pathway Analysis project.

It was previously reported that a comparison of the consumption and emission figures (Table 11) shows that although there was a decrease in energy consumption and associated emissions between 2009 and 2012/13, there was an increase for 2015/16, with the 2015/16 consumption figure also being slightly higher than in 2009.

Table 11. Sustainable energy indicators for the Western Cape

Key Sustainable energy indicator	Unit of measure	Provincial Value (2009)	Provincial Value 2012/13	Provincial Value 2015/16
Total Energy consumption	GJ	292 342 004	276 333 250	299 401 470
Total energy related GHG emissions	tCO_2e[127]	38 532 296	36 345 753	38 901 581
Energy consumption per capita	GJ/capita	64	46	48
GHG emissions per capita	tCO_2e/capita	8	6	6
Energy per GDP (R' mill)	GJ/GDP	1 428	679	792
GHG emissions per unit of GDP (R' mill)	tCO_2e/GDP	178	89	103

Figure 7 below shows the energy consumption and CO_2 emissions by sector for 2009, 2012/13 and 2015/2016. The largest proportion of the energy consumed in the province is in the transport sector with 54%, followed by industry at 29% for 2015/16. Across the province the residential sector is only responsible for 10% of energy consumption. This highlights that most of the energy efficiency activities should take place in the industrial and transport sectors, although many of the interventions for the residential and commercial sectors are generally considered to be 'low-hanging fruit'.

It is industry, however, and not the transport sector, that contributes the most to the provincial emissions profile at 36%, as it draws from coal-derived electricity as well as fairly large amounts of direct coal consumption. This is followed by the transport sector at 30% (Figure 7).

[127] The amount of carbon dioxide emission that would cause the same integrated radiative forcing, over a given time horizon, as an emitted amount of a GHG or a mixture of GHGs.

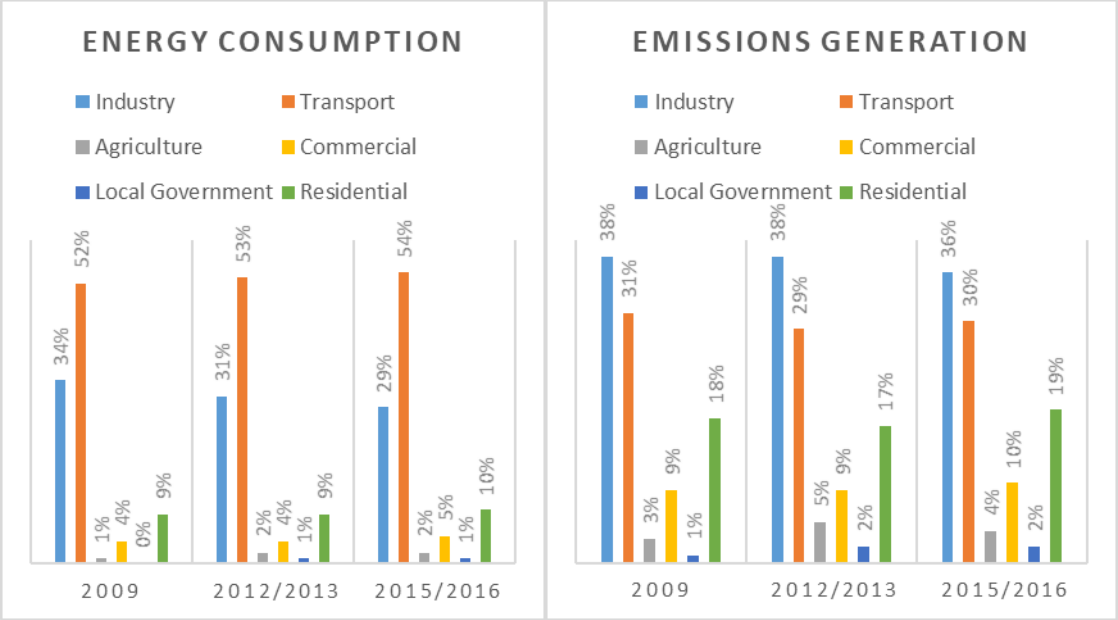

Figure 7 Energy consumption and CO2 emissions by sector for 2009, 2012/13 and 2015/2016

Electricity, diesel, petrol and coal dominate the mix of fuel consumed in the province, with some shifts in the proportional contribution from each fuel type. Coal consumption decreased from 22% in 2009 to 17% in 2015/2016 and the proportional consumption of petrol and diesel increased (there was a significant increase in the consumption of diesel between 2009 and 2015/16). However, there was a slight decrease of 1% in the consumption of Jet Fuel. There were no changes in consumption of other fuels such Paraffin, Liquified Petroleum Gas (LPG), Heavy Fuel Oil (HFO) and aviation gas between 2009 and 2015/2016 (Figure 8).

The 2009, 2012/13 and 2015/16 emission proportional breakdown are very similar, showing no significant changes between sectors except the increase of emissions from diesel - 8% in 2009 to 14% in 2015/16. Electricity is responsible for most of the emissions at 60% (up from 55% in 2009). This is followed by the liquid fuels, predominantly linked to the transport sector (petrol and diesel). Electricity is the largest producer of emissions in the Western Cape due to the coal-based electricity linked to the national grid. Electricity's contribution to emissions should decrease over time with the increase in renewable energy's contribution to the national energy mix. This trend should also manifest in primary coal for industry purposes and liquid fuels for transport as efficiency interventions in these sectors increase. This clearly highlights the sectors that need to be targeted in order to reduce emissions in the Western Cape.

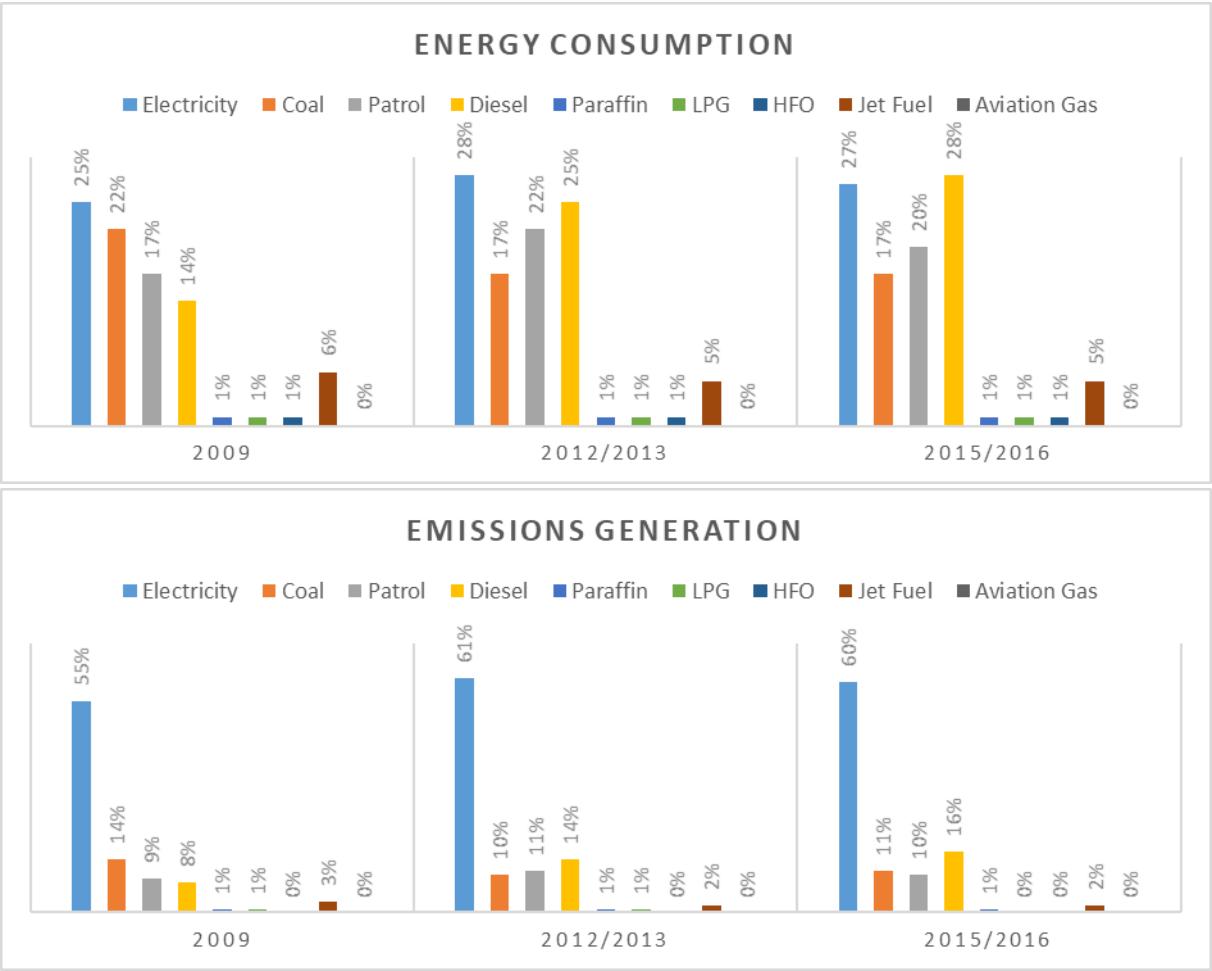

Figure 8 Energy consumption and CO_2 emissions by fuel for 2009, 2012/13 and 2015/2016

Box 7: 2050 Emissions Pathway Analysis

At the Global Climate Action Summit held in September 2018 in California, the Western Cape Government committed to undertake a 2050 Emissions Pathway Analysis as its initial contribution to the Under2Coalition. The 2050 Emissions Pathway Analysis will assist in setting short-, medium- and long-term emission reduction targets as well as identifying mitigation measures to achieve these targets.

The full emissions profile will cover the following sectors:

- Energy, including transport;
- IPPU
- Waste (including waste water)
- AFOLU

The exercise will be based on a methodology use by the Under2 Coalition for 2050 Emissions Pathways. The methodology starts with a government's long term GHG reduction goal and then works backwards to identify the technologies, infrastructure and investment that will be required to achieve it, as well as the costs, risks and trade-offs associated with different policy options.

This work will be undertaken over the next 2 years and will include the development of the first full GHG Inventory for the Western Cape.

6.2. Energy Efficiency

6.2.1. Western Cape Government

This indicator in the Western Cape is strongly focussed on WCG buildings. The Annual Property Efficiency Report[128] looks at a portion of the WCG property portfolio, with 38 buildings assessed in this edition of the report. The data (Figure 9) show that energy efficiency gains were consistent during the years 2014-2019. Despite the slight increase in energy consumption since 2017/18, WCG energy performance remains below a 5 year target of 154.4 kWh/m^2/pa.

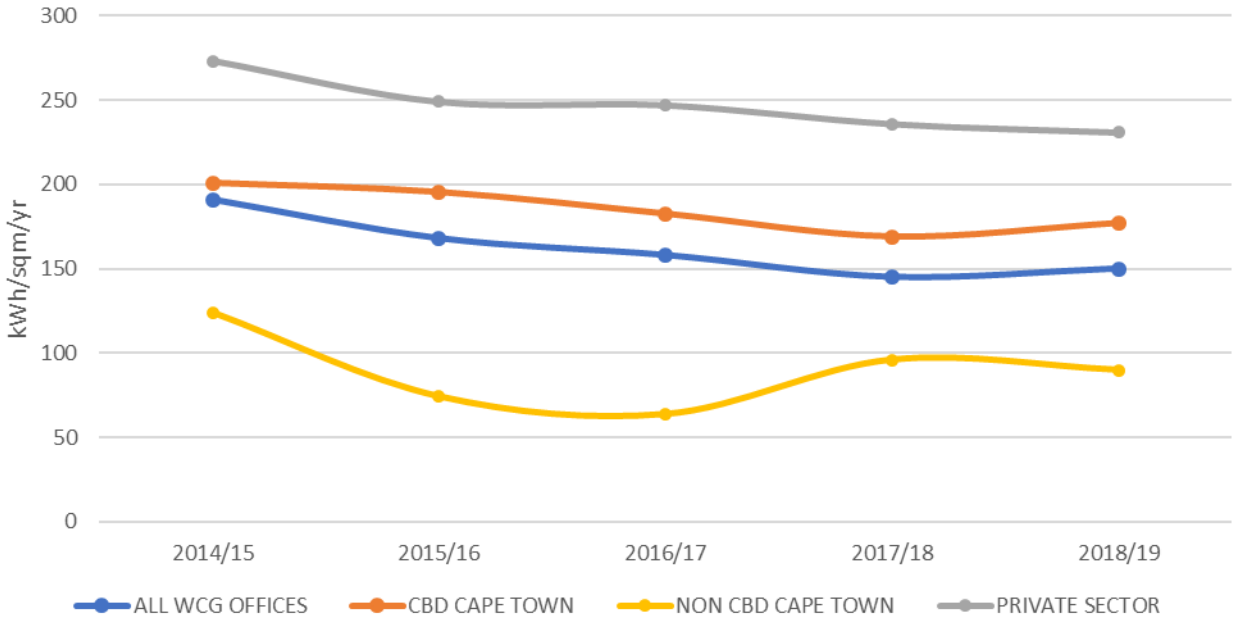

Figure 9: Energy consumption in WCG buildings, 2014/15 to 2018/19

The Department of Health has also been roll-out smart metering in its hospitals and together with the upgrading and retrofitting the older buildings are also working on behaviour changes in order to encourage resource efficiency. The Hospitals are currently seeing an approximately 11% saving against a 2014/15 baseline in terms of electricity consumption.

Box 8: Case Study – Remote Metering

The Department of Transport and Public Works (DTPW) remote metering project commenced in 2014 with a pilot of one building and 60 consumption meters. The pilot immediately yielded measurable benefits, resulting in a roll-out of 49 buildings within the WCG Portfolio, including 39 buildings of the Property Efficiency Report.

The ability to measure and monitor energy and water consumption 24/7 at 30-minute intervals allows the DTPW to effectively manage consumption in real time across the entire metered building portfolio. The systems alerts the DTPW to notable increased in consumption such as major leaks or burst pipes. This facilitates quick response at any time of the day and over weekends. This mitigates the risk of substantial losses, which are ultimately borne by taxpayers. More effective management of office costs makes more money available for other value adding WCG service delivery activities.

Data produced by remote meters enable the DTPW to raise awareness of building occupiers and WCG staff about their actual consumption of water and electricity and the importance of conserving our natural water and energy resources. During the recent drought in the Western Cape, a campaign was

[128] The 8th edition of the report was released in November 2019

launched to encourage WCG staff to save water at work and at home. Data from the remote metering system was used to provide weekly snapshots of water consumption in metered WCG buildings. This helped motivate staff to keep reducing their personal water consumption

The benefits to the Property Asset Management team are as follows:

- Auto-alert notifications when abnormal water flow is detected
- Bill comparison reports of consumption recorded in municipal bills and remote-metered consumption
- Tariff analysis reports to determine whether buildings are being billed according to the correct tariff
- Automated Electronic Power Controls for each monitored building
- Automated monthly portfolio and individual facility consumption reports for the attention of accounting officers and facility managers. The reports compare Individual and group building performance with industry benchmarks, the performance of the WCG-owned property portfolio with the leased portfolio, and the WCG City Centre portfolio with properties outside the City Centre.

6.2.2. Municipalities

Municipalities also play a key role in implementing energy efficiency through optimising their own operations and encouraging their consumers to implement energy efficiency interventions. The Department of Energy's (DoE) Energy Efficiency Demand Side Management (EEDSM) fund [through the Division of Revenue Act (DORA)] allows municipalities to access funds to retrofit building lighting, street lights and traffic lights, hot water systems, variable speed drive (VSD) motors for water systems, improved insulation and heat recovery. Table 12 shows the DORA allocations to municipalities for the period 2014/15 to 2020/21.

Table 12. Energy Efficiency and Demand Side Management Grant for Western Cape municipalities in 2014/15 to 2020/21 (Division of Revenue Bill, 2018)

Municipality	Allocation (R'000) 2014/2015	Allocation (R'000) 2015/2016	Allocation (R'000) 2016/2017	Allocation (R'000) 2017/2018	Allocation (R'000) 2018/2019	Allocation (R'000) 2019/2020	Allocation (R' 000) 2020/21
City of Cape Town	10 000	12 000	15 000	10 000	10 000	10 000	15 000
Swartland	10 000				3 000	5 000	5 000
Kannaland	4 000						
Hessequa	4 000						
Mossel Bay	4 000						
Beaufort West	4 000	8 000	3 000	6 000	5 024	5 065	
Stellenbosch		6 000	10 000	10 000	10 000	12 000	
Oudtshoorn		3 000	3 000	4 000			
Laingsburg		3 000	3 000	5 000			
George					7 000	5 000	5 000
Knysna					6 000	6 000	5 000
Cape Agulhas					5 000	5 000	5 000
Total:	**36 000**	**32 000**	**34 000**	**35 000**	**46 02**	**48 065**	**35 000**

6.3. Solar Water Heaters

The National Development Plan set a target of the installation of five (5) million SWHs in residential areas by 2030. This target has been in place since 2012, with the launch of the National Development Plan, and although several programmes have been initiated

(managed by Eskom and then Department of Energy), there has been limited success in reaching the target.

The Department of Mineral Resources and Energy (DMRE) is now rolling out a national SWH programme in order to achieve the target. SWH systems purchased by the DMRE are then installed in municipalities through either new pilot programmes or repair and replace programmes. Frameworks are signed with qualifying municipalities to facilitate installations. There has been a delay in the rollout of the installation, with no installations taking place since the 2018/19 financial year. There are seven municipalities in the Western Cape who have registered as part of the system, but to date no installations have taken place in the Western Cape.

6.4. Renewable Energy in the Western Cape

The Western Cape has attracted 606 Megawatt (MW) (9%) of the total national Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) procured capacity of 6.4 GW. The electrical energy that will become available from the investments in all the bid windows (BWs) will equate to roughly 8% of the Western Cape's own energy needs. REIPPPP projects in the Western Cape include 14 projects, consisting of Onshore Wind (8), photo-voltaic solar (PV) (5) and Biomass (1). 0.5 Gigawatt (GW) (15% of national total) electrical energy capacity is operational, with more than 4 934 GWh electricity generated since inception to the end 2019[129], thereby off-setting 2.6 million tonnes CO_2 emissions. Western Cape renewable energy projects from BW1 to 4, 1S2 and 2S2[130] will save a gross Eskom grid equivalent of 1.8 million tonnes CO_2 emissions per annum.

Table 13: Number and capacity of projects in Bid Window 1 – 4 of the REIPPPP in the Western Cape

	BW 1		BW 2		BW 3		BW 4		ALL	
Technology	**No. of Projects**	**Capacity (MW)**	**No. of Projects**	**Capacity (MW)**	**No. of Projects**	**Capacity (MW)**	**No. of Projects**	**Capacity (MW)**	**No. of Projects**	**Capacity MW(MW)**
Onshore Wind	4	102.4	2	226.32	0	0	2	139.66	8	468.38
PV	2	41	2	17.7	1	75	0	0	5	133.7
Biomass	1	5	0	0	0		0	0	1	5
TOTAL	**7**	**148.4**	**4**	**244.02**	**1**	**75**	**2**	**139.6**	**14**	**607.08**

Of the 14 renewable energy Independent Power Producers (IPPs) in the province, wind has the dominant share with eight IPPs or 77% of total provincial capacity (Figure 10). This is followed by five solar PV IPPs contributing 134 MW or 22% and one biomass IPP at 5 MW or 1% of total provincial capacity.

[129] Cumulative energy – figure is understated as figures not received from some of the IPPs
[130] Bid Windows 1S1 and 1S2 refer to a simplified application process created under the main bid windows to facilitate the development of small renewable energy projects of around 5MW.

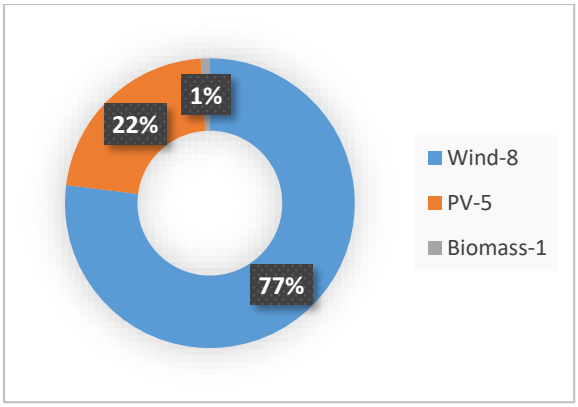

Figure 10 REIPP projects in the Western Cape by technology

The Western Cape has attracted 14% of the total wind capacity procured in BW1 to BW4, 1S2 and 2S2 under the REIPPPP in South Africa, contributing 0.47GW of the national total 3.37 GW wind power. Figure 11 indicates the locations and types of the various REIPPPP projects in the Western Cape.

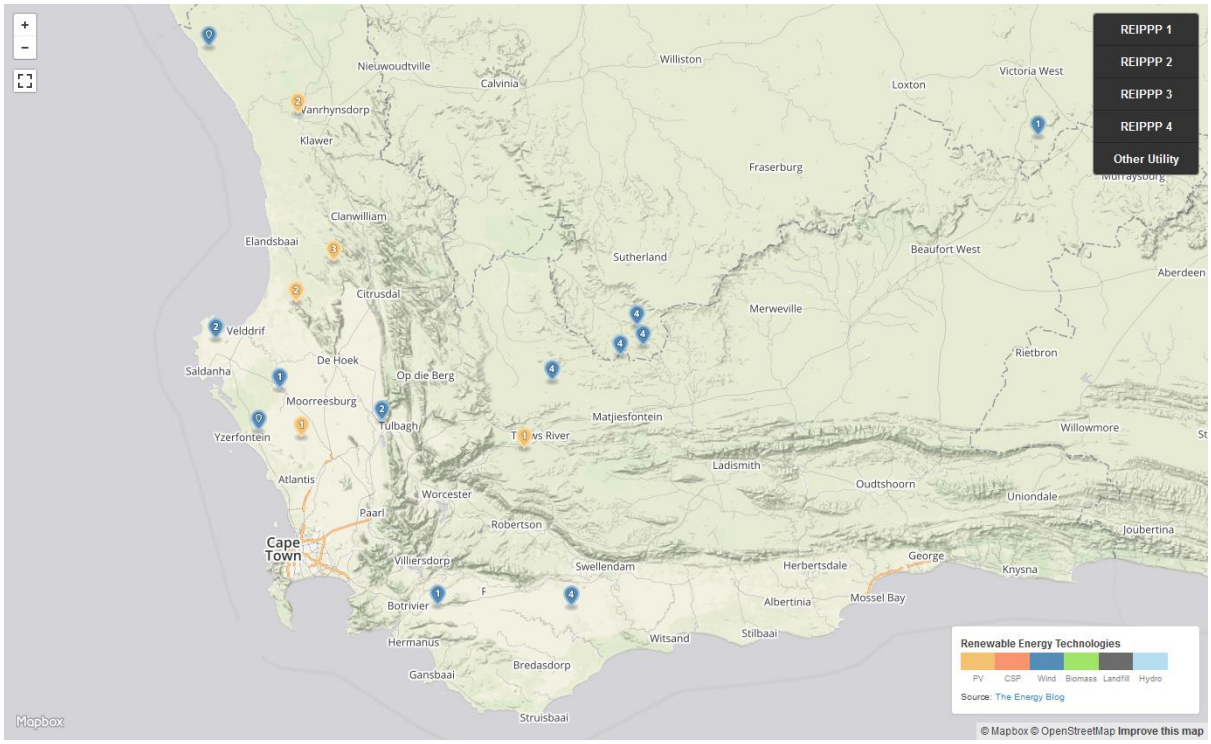

Figure 11 Location of the IPP projects within the province (image: energy.org.za)

6.5. Renewable Energy in Western Cape Government Buildings

Through the Provincial Energy Security Game Changer (see section below), the WCG aims to reduce dependence on Eskom generated electricity. The objective is for an effective 10% of the Western Cape's electricity needs to be generated from alternative sources of supply by 2020. In its capacity as custodian and manager of the WCGs immovable asset portfolio, the DTPW actively promotes the use of renewable energy in public buildings. The availability of abundant sunshine across South Africa means that installing solar energy plants is perfectly aligned with the objectives of the programme.

Approximately R53.3 million has been spent on the installation of rooftop solar PV systems at 17 WCG owned properties. At the end of 2019, consideration was being given to installing solar PV on at further four sites at the cost of R7.5 million. To date, 2.4 MW capacity of solar PV facilities have been installed.

The current cumulative energy savings for the initial phase of the project is estimated at more than R3.6 million, details of which are shown in the table below:

Table 14: Cumulative energy savings of the installation of rooftop solar PV systems at 17 WCG owned properties

Rooftop Solar PV – capacity, energy produced and cost saving			
Project / Building	Capacity (kW)	Energy Produced year 1 (MWh)	Energy Saving Year 1
9 Dorp Street	52	77	R 112 036
VSSC Athlone	109	172	R 118 234
27 Wale Street	16	23	R 33 669
Alfred Street Building – Library	76	110	R 105 029
Alfred Street Building – CMD	209	333	R 316 804
Karl Bremer Hospital	75	122	R 154 814
Khayelitsha Shared Services Centre	21	34	R 46 463
Revised GMT Building, Rusper Street, Maitland	72	119	R 116 381
Gouburn Building, 63 Voortrekker Road, Goodwood	22	35	R 49 835
Cape Teaching and Learning Institute (CTLI)	666	1 148	R751 017
Kromme Rhee, Stellenbosch	131	226	R 217 080
Gene Louw Building, Off Brackenfell Boulevard	54	98	R 106 768
Elsenburg Head Office Buildings, Stellenbosch	367	610	R 585 005
Dassen Island, Cape Town Nature	15	12	R 38 989
4 Dorp Street	29	44	R 68 905
York Park Building, George	120	168	R 222 974
Artscape	372	557	R 604 081
TOTAL	**2 405**	**3 888**	**R3 648 084**

6.6. Small-scale Embedded Generation

The Western Cape still has the greatest penetration of Small-Scale Embedded Generation (SSEG) rules, regulations and tariffs. The table below details which municipality allow SSEG within their municipality, which municipalities have feed-in tariffs (residential and commercial)

and which municipalities have approved policies and by-laws. The City of Cape Town, Drakenstein Municpality and Stellenbosch Municipality, also have wheeling tariffs in place.

Table 15: Western Cape municipalities SSEG update (March 2020)[131]

Municipality	Allow SSEG		SSEG Tariffs		SSEG by-laws / policies	
	Residential	Commercial	Residential	Commercial	Council Approved	Preliminary Version
Beaufort West	Y	Y	Y	Y	Y	
Bergrivier	Y	Y	N	N		Y
Bitou	Y	Y	Y	Y	Y	
Breede Valley	Y	Y	Y	Y		Y
Cape Agulhas	Y	Y	Y	Y	Y	
Cederberg	Y	Y	Y	Y	N	
City of Cape Town	Y	Y	Y	Y	Y	
Drakenstein	Y	Y	Y	Y	Y	
George	Y	Y	Y	Y	Y	
Hessequa	Y	Y	Y	Y	Y	
Kannaland	N	N	N	N	N	
Knysna	Y	Y	Y	Y	Y	
Laingsburg	N	N	N	N	N	
Langeberg	Y	Y	Y	Y	Y	
Matzikama	Y	Y	Y	Y	Y	
Mossel Bay	Y	Y	Y	Y	Y	
Oudtshoorn	Y	Y	Y	Y	Y	
Overstrand	Y	Y	Y	Y	Y	
Prince Albert	Y	Y	N	N	N	
Saldanha Bay	Y	Y	Y	Y	Y	
Stellenbosch	Y	Y	Y	Y	Y	
Swartland	N	Y	N	Y	Y	
Swellendam	N	N	N	N	N	
Theewaterskloof	Y	Y	Y	Y	Y	
Witzenberg	Y	Y	N	N		Y

6.7. Other Western Cape Government Responses: The Energy Security Game Changer

The security of energy supply is recognised as having a significant role in the development and resilience of modern economies. Energy security not only relies on the reliability of installed generation, transmission and distribution infrastructure, but increasingly also on the diversity of

[131] GreenCApe, March 2020

the energy mix of the region. The WCG and City of Cape Town identified the availability of quality, reliable and clean energy as a key strategic imperative in supporting continued economic and social development in the province. To this end, the Energy Security Game Changer sought to ensure the long term energy security through the availability of reliable diverse and low carbon energy to support economic and social growth in the Western Cape by 2020. The Energy Security Game Changer came to an end in March 2020 although a lot of the work will be continuing through the Department of Economic Development and Tourism.

Four strategies form the basis of the Energy Security Game Changer:

1. Enhanced uptake of rooftop PV: increase the contribution of rooftop PV to Western Cape electricity supply to 228 MW by 2020;
2. Reduced energy consumption in both public and private buildings: 30% reduction in energy consumption in provincial government buildings by 2020;
3. Enhanced load management: optimally manage the electricity grid in order to reduce peak demand;
4. The rollout of Independent Power Producers and Liquid Natural Gas: increases diversity of electricity supply in the Western Cape through IPPs by 2020.

Although a lot has been achieved through the programme, particularly in terms of efficiency in public buildings, several challenges were experienced during this period, including the need to focus on the impacts on the drought, which led to greater water efficiency in the province.

There were also several delays with the rollout of IPPs due to changes at a national level and shifting political priorities. The City of Cape Town is wanting to enter into Power Purchase Agreements with Independent Power Producers who are able to generate power from wind and solar resources. There has been no clarity on the matter with the City having filed court papers;

6.8. Opportunities, Gaps and Recommendations

- There is a strong drive in the Western Cape to support municipalities purchasing from Independent Power Producers, but to date permission has not been granted for this. There are mixed messages at a national level with some understanding the need for a diverse energy mix and the need for independent players in the renewable space, and others continuing to focus on coal and nuclear providing the majority of the electricity in the country. With continued loadshedding in the country, there is a call to relook at the energy picture and move forward with the vision given in the National Development Plan and the Integrated Resource Plan 2019.
- The Western Cape Government's commitment to the Under2 Coalition, through The Climate Group and the development of the 2050 Emissions Pathway for the province is an important opportunity. By undertaking this work and making the international commitment the WCG is joining many global regions and states in highlighting the role that local and regional governments have to play in responding to climate change and that it is not only the role of national government to direct actions and responses.
- Facilitating the implementation of the mitigation measures highlighted in the Western Cape Climate Change Mitigation Scenarios for the energy sector report across the sectors has still not taken place. This work will be included in the 2050 Emissions Pathway Analysis for the Western Cape, but the challenge in taking up the recommendations of this type of exercise remains.
- Energy consumption is characterised by diversity. There are some highly energy efficient office buildings within the WCG property estate but investigation into the

performance of the least efficient will undoubtedly uncover significant scope for improvement. As the number of buildings included in the sub-metering programme increasing, there will be greater opportunity for savings and investment in efficiency technologies and renewable energy.

- Data on energy consumption in buildings remains a challenge, although smart-metering is improving the situation in WCG buildings. This data is however limited to those that have been included in the smart metering programme and the quality of data outside this grouping is variable. This makes it difficult to successfully manage improvements in consumption.

7. Waste Minimisation and Management

Waste management is an important sector for climate change responses, as any inefficiencies in materials use and re-use (i.e. activities that generate waste) or improper waste disposal contribute to GHG emissions and impact negatively on the availability of resources.

The current priorities for addressing waste minimisation and management in the WCCCRS include:

1. Development of waste characterisation profiles for municipalities in the Western Cape;
2. Promotion of the waste economy and identification of opportunities to reduce waste going to landfill; and
3. Development of waste-to-energy generation opportunities for both municipal and private (industrial and commercial) waste systems.

7.1. Headline Climate Change Response Indicators

Table 16. Waste Indicators for the WCCCRS

High level category	2012	2015	2016	2017	2018[132]	2019
GHG emissions	2 348 249 tCO_2e (2009)					Data not available [133]
Municipal Solid Waste[134]	3 807 765 tonnes	2 922 787 tonnes	4 067 982 tonnes	3 602 979 tonnes	2 395 791 tonnes	
Waste diverted from landfill[134] (%)	9%	38.06 %	16.33 %	50 %	29%	

7.2. GHG Emissions Associated with the Waste Sector

The Integrated Waste Management Plan 2017-2022 (IWMP) has four strategic goals which inform the implementation plan. Each goal has detailed descriptions with individual objectives, indicators and activities. Goal 3, in particular, has strong links to the climate change programme.

Goal 3 of the IWMP focuses on achieving a low carbon economy and climate resilient world through the effective and efficient utilisation of resources. The planned activities under this goal contribute to reduced GHG emissions from the waste sector and include the development of guidelines for municipal Construction & Demolition waste management and on green waste. It also plans for engagement with and support to 'waste-preneurs'.

The ideal is to entrench a closed-loop system of materials usage, which harvests materials and embodied energy from the waste stream in an endless cycle – the so-called circular economy. Such a situation will avoid unnecessary detrimental impacts and emissions associated with

[132] 2018 State of Waste Report
[133] Waste-related emissions not available for 2015 – 2017. Extensive work is underway in terms of waste characterisation, and a provincial emissions inventory will be compiled in 2021/22; there is however currently not sufficient information available to provide an estimate of the waste-related emissions.
[134] Values are self-reported by municipalities to the online Integrated Pollutant and Waste Information System, and are subject to error

products made from virgin materials, and energy loss through landfilling of energy-dense materials.

The National GHG Inventory[135] (2000-2015) attributes 3.6% of national GHG emissions to the waste sector[136]. However, this only includes direct emissions of the waste sector, such as methane seepage from solid waste disposal facilities ('landfill gas') and wastewater treatment. Emissions, and costs to the environment, socio-economic well-being and the economy, associated with inefficient product use are not accounted for.

A full GHG profile should include emissions from the energy (including transport) sector, IPPU, AFOLU as well as waste. To date a full GHG inventory has not been completed for the Western Cape. Only an energy consumption and CO_2 database for the Western Cape has been completed every three years since 2012 and the first iteration of the database included an estimated emissions contribution for the waste sector.

The Western Cape Government will be undertaking a 2050 Emissions Pathway Analysis as part of its commitment to the Under2 Coalition. This will include the completion of full GHG Inventory for the Western Cape, which will include all the sectors noted above. This emissions inventory will be completed during 2021/22 to provide a more comprehensive emissions picture for the province.

The Western Cape Province's Waste Management Directorate is actively working towards reducing the impact of waste on GHG emissions, ensuring that it features in all policy documents and communication materials. For example, the 2018 Abattoir Waste Management Guideline[137] points out that certain methods of disposal contribute to the release of GHG, but that this can be avoided and turned into resource recovery processes – such as waste-to-energy facilities or further rendering as feed products. The Department also measures methane seepage at waste disposal facilities in the province. At present, limited seepage is present, with most facilities producing no measurable methane gas.

Box 9: Methane

Waste disposal facilities are one of the largest anthropogenic sources of methane (CH_4). Landfill methane is produced when organic materials are decomposed by bacteria under anaerobic conditions. Methane production varies greatly at each facility depending on site-specific characteristics such as waste quantities, composition, moisture content, landfill design, operating practices and climate. Unless captured first by a gas recovery system, methane generated by the disposal facility is emitted when it migrates through the landfill cover. During this process, the soil oxides approximately 10% of the methane generated and the remaining 90% is emitted. Methane is a powerful GHG with approximately 72 times as much global warming potential than CO_2 over a 20 year period.

Due to the significant production of methane from waste disposal facilities, it has become imperative to minimize the production of this gas from these facilities as methane is also a health and safety concern at waste facilities. In order to minimise the total methane produced at waste facilities, DEA&DP started a landfill gas monitoring project. The project includes a component of preliminary methane specific determination and aims to produce baseline data for landfill gas at waste disposal facilities. The results of the landfill gas monitoring are compiled in a Landfill Gas Report and communicated to the relevant municipalities.

[135] The National GHG Inventory emissions proportions are: Energy (79.5 %), The Industrial Processes and Product Use sector (7.7 %,) (IPPU, the Agriculture, Forestry and other Land use sector (AFOLU) (9.2% (gross emissions)) and the Waste sector (3.6%) – making up 100% of total GHG emissions for the country.

[136] International studies have, however, shown that this figure could be as high as 10% in some countries.

[137] https://www.westerncape.gov.za/eadp/files/atoms/files/Abattoir%20Waste%20Management%20Guide_A5%20Mini%20Guide_Web.pdf

Among the facilities tested during 2017, the Gwaing waste facility recorded the highest levels of methane (17.5% with a follow-up of 15 %) and the municipality has been requested to institute measures to control the seepage. Monitoring of sites in 2018 indicates that, as an average per facility, gas levels did not increase in 2018 compared to levels in 2017. Most facilities produced no measurable methane gas.

The information is assisting municipalities to implement mitigation measures or conduct additional studies on the methane levels at their facilities. The impact of the measures implemented can be seen from the difference in the monitoring results between 2016 and 2017.

7.3. Municipal Waste Generation

Waste generation in the province is tracked through self-reporting by municipalities on the Provincial online waste reporting platform, the Integrated Pollutant and Waste Information System (IPWIS). As seen in Table 16, the province typically disposes of between 3 and 4 million tonnes of waste per year – although currently (2018) the mass is sitting at 2 395 791 tonnes. The dramatic year-on-year changes are likely indicative of inconsistent data collection and the use of estimated values where data gaps are present, rather than an exact indication of the annual changes in tonnage of waste generated in the Western Cape. According to these numbers, however, the City of Cape Town generates approximately 45% of the solid waste in the Western Cape.

Table 17. Estimated waste generation in Western Cape District Municipalities (2010 - 2018)

	Estimated Mass (t) of WC general waste disposed of				
	2010	**2015**	**2016**	**2017**	**2018**
City of Cape Town	2 670 836	2 176 701	3 088 448	2 801 307	1 569 330
Cape Winelands	453 505	430 896	574 774	184 459	315 083
Garden Route	302 745	46 399	89 993	260 812	157 534
West Coast District	190 004	153 054	180 335	208 587	199 870
Overberg	151 618	110 157	131 034	142 742	148 617
Central Karoo	38 066	5 580	3 944	5 915	4 843
Total	**3 806 774**	**2 922 788**	**4 068 528**	**3 603 821**	**2 395 277**

Unfortunately, little can be deduced from the raw numbers as there are on-going concerns over the quality of waste information reported by municipalities. This is a concern, given the importance of the quality of waste information in waste management planning, especially as a guide for waste minimisation initiatives and implementation. Ongoing efforts have been and are made by the Department, to assist municipalities to report their waste quantities.

Furthermore, a characterisation of waste is required, not only for successful waste planning, but for understanding the GHG mitigation potential from this sector. The current understanding of the characteristics of waste in the different districts and Metro are shown in Figure 12, as determined for the Western Cape Waste Economy Business Case: Gap Analysis 2016. This needs to be updated on an on-going basis, in order to allow for proper GHG emissions calculations.

The Department runs a training programme for municipalities in respect of Waste Characterisation methods. During 2017, 2 training workshops were held, reaching seven municipalities. In 2018, training was conducted in the Drakenstein Municipality. Garden Route

District Municipality has conducted a waste characterisation study, with the Department conducting one for Elim, in the Cape Agulhas Municipality[138].

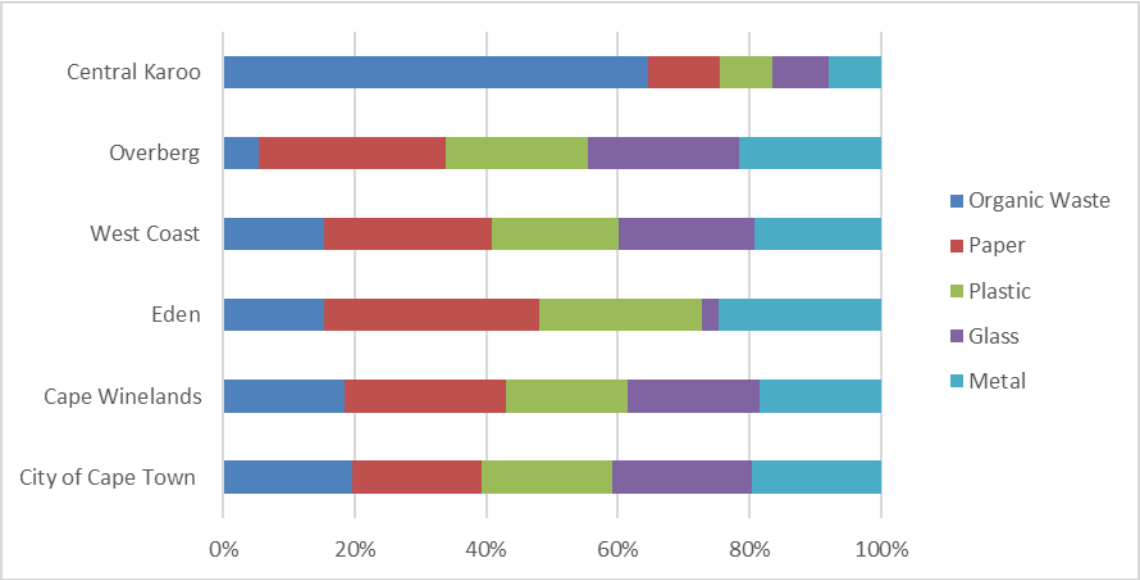

Figure 12. Waste stream analysis for the Western Cape for Metro and districts (2016)

To address the quality of waste information from municipalities, the Department provided municipal officials with training on the use of the IPWIS system. This includes both joint and individual engagements with municipalities or waste management entities. DEA&DP also developed a Waste Calculator which has assisted municipalities to document waste data. The capacity building efforts have led to increased reporting of waste information.

The DEA&DP Waste Directorate has also continued with the implementation of the waste data auditing process commenced with during 2017/2018. This has contributed to increasing the accuracy and quality of waste data recorded and submitted. However, the audits still indicate unsatisfactory waste data collection.

Total system planning, which involves considering a total waste system, and then developing the most appropriate mix of infrastructure and services to manage that waste stream, is an effective way of ensuring that waste management solutions are comprehensive, practical and encompass the wide variety of processes involved in each waste stream. It is therefore vital that municipalities conduct annual waste characterisation studies to determine waste streams and quantities.

7.4. Opportunities to Reduce Waste Going to Landfill

According to IPWIS data, the percentage of waste diverted from landfill has increased significantly from 2012 (9 %) to 2017 (50 %), but decreasing since (currently 29%) (Table 16). The fluctuating values indicate a measure of unreliability in the information submitted by municipalities.

DEA&DP prioritises the diversion of green waste from landfill as an option with significant benefits for reducing waste to landfills and reducing the methane emissions from organic waste. The target is to have 50% of organic waste being diverted from landfill by 2022 with a total ban on organics instituted by 2027. This will be confirmed in the 2019/20 Organic Waste

[138] Annual State of Waste Management Report Western Cape, 2018

Diversion Strategy due to be finalised. An important aspect of achieving this target would be to ensure that separation at source systems, coupled with the required infrastructure, are implemented by municipalities[139].

The department has completed a Guideline for the Management of Green Waste[140] in the Western Cape which addresses green waste generated within municipalities, in the forestry and agricultural sectors as well as the clearing of alien vegetation programmes. Also, a generic organic diversion plan has been developed to assist facilities in compiling their own customised plans.

Many of the municipalities in the Western Cape have embarked on waste minimisation initiatives that falls within the categories of waste avoidance, reduction and recycling. These initiatives include separation at source programmes, capacity building and awareness workshops, job creation programmes as well as buy-back and swop-shops projects[141].

Active support is provided by DEA&DP to municipal separation at source programmes. In 2019, a Guide to Separation of Waste at Source[142] was released, which describes different systems that can be implemented and how awareness, communication and the management of risk play an important part within the bigger system.

7.5. Promotion of a Western Cape Waste Economy

Waste has increasingly been receiving more attention due to its economic contribution and potential as well as waste-to-energy generation opportunities. In addition to the waste streams that are currently contributing to the economy, GreenCape has identified a total of 13 waste streams that can be explored though economic opportunities[143]. Tapping into the full economic potential of waste recycling would increase the waste from landfill diversion rate, positively impact the total GHG gas emissions produced, create job opportunities and secure investment in the province and the specific municipal areas. Creating an enabling environment for this growth remains a challenge but can be addressed through municipal partnerships with private enterprises, the creation of markets for waste products and the inclusion of waste pickers in formal plans[144].

Box 10: Support programme for small, very small and micro enterprises in the Western Cape

Recognising the important contribution from small businesses in the waste minimization landscape, the Western Cape government embarked on a support programme for small, very small and micro enterprises (SMMEs) during 2016/17. The programme contributes to reducing emissions from the waste sector through creating an enabling environment for SMMEs to play a long-term role in reducing the total waste going to landfills through waste minimization and recycling.

The pilot programme focussed the capacity development of 15 SMMEs in the province and creating an enabling environment for SMMEs that supports their role in the Green Economy of the province. The programme has since been extended to 10 small and micro waste enterprises in the Garden Route District Municipality for the 2017 financial year and a further 10 in the West Coast District for 2018.

[139] Annual State of Waste Management Report Western Cape, 2018
[140] Green Waste is defined as a subsection of organic waste which refers to organic biodegradable materials such as grass cuttings, leaves, soil, branches, and other woody waste generated from gardens and parks, trimmings from forestry and agriculture, and from the clearing of alien vegetation (Gregg Adams, DEA&DP: Waste Policy & Minimisation)
[141] Annual State of Waste Management Report Western Cape, 2018
[142] https://www.westerncape.gov.za/eadp/files/atoms/files/WCape%20Govt%20Municipal%20S%40S%20E-Guide_%2010%20-9%20-19Final.pdf
[143] GreenCape Waste MIR 2017
[144] Western Cape Government Provincial Treasury: Provincial Economic Review and Outlook 2017

The Western Cape Industrial Symbiosis Programme (WISP) is a free facilitation service that connects companies so that they can identify and realise the business opportunities enabled by sharing unused or residual resources (materials, energy, water, assets, logistics and expertise). WISP is funded by the City of Cape Town, with the programme run by GreenCape.

It is estimated that the programme has to date diverted 94 600 tonnes of waste from landfills which amounts to a reduction of 264 735 tonnes in CO_2e emissions. The financial benefits of the programme are calculated at R110 million in the form of additional revenue, cost savings (R36.1 million) and private investments (R20.5 million). More information on the achievements of WISP can be seen in Table 18 below.

Table 18: Aggregated list of verified outcomes of WISP

Key Performance Indicator	To Date (Feb 2020)
Waste Diversion	> 94,600 tonnes
Additional Revenue & Cost savings	> R 89.5 million
Private Investment	R20.5 million
Fossil GHG Savings	264,735 tonnes CO_2e (~ 32 * 2.2MW wind turbines)
Job Creation	34 temporary 69 permanent 194 economy-wide jobs

7.6. Municipal and Private Waste-to-Energy Generation Opportunities

The environmental thresholds for waste-to-energy projects triggering environmental authorisations are small and require multiple environmental authorisations. Twelve waste-to-energy facilities, which include anaerobic digesters, biogas, biomass fuel combustion and pyrolysis, have been licensed in the Western Cape, of which a number are in the agricultural sector.

Local municipalities Stellenbosch and Drakenstein located in the Cape Winelands district, are currently investigating the feasibility of waste-to-energy facilities. Stellenbosch municipality has undertaken a feasibility study into a waste-to-energy facility, while Drakenstein municipality has entered into a Public Private Partnership agreement with Interwaste to develop a waste-to-energy facility for the region. A concern for the proposed waste-to-energy facility in Drakenstein municipality is insufficient waste totals generated to make the facility financially viable[145].

The City of Cape Town's Department of Solid Waste Management launched a landfill gas flaring project at the Coastal Park and Bellville South landfills in March 2018. The gas extraction and flaring system reduces greenhouse gas emissions. In addition, the methane from the waste facility will be converted to energy that will be used for electricity generation. This will further reduce the emissions produced at the facility. The project was implemented via the United Nations Clean Development Mechanism (CDM), under the Kyoto Protocol. The mechanism allows developing countries to implement approved carbon offsetting projects which developed countries may invest in by purchasing "carbon credits". The City plans to develop a similar system at the Vissershok South landfill.

[145] Western Cape Integrated Waste Development Plan 2017 – 2022

7.7. Opportunities, Gaps and Recommendations

- There is a strong move towards considering waste as part of the circular economy, where resources and materials can be re-used and recycled, returned back to the economy and used again to create a closed-loop production system. To realise the potential of these so-called secondary raw materials, we have to remove the existing barriers to the trade, improve the waste management practices and guarantee high quality standards.
- There is a need to understand the role that solid waste plays in the GHG emission profiles for the Western Cape. Although this is a small proportion in comparison to the energy sector, there are a number of opportunities for this sector and every contribution that is made can add to emissions reductions.
- Growing reluctance from countries that used to import recyclable waste, such as China, means that the viability of local beneficiation is improving.
- Consistent, good quality data in order complete waste characterisation exercises is required in all municipalities.

8. Sustainable Transport

Not only is transport responsible for half the energy consumption and around 30% of the energy related GHG emissions of the Western Cape, it also plays a major role in the efficiency of urban areas and the quality of life of people at household level. It therefore forms an important part of the overall climate change response strategy of the province.

The current priorities for addressing sustainable transport in the WCCCRS , include:

- Promotion of public and non-motorised transport, including the development of appropriate infrastructure;
- Investigation of opportunities for alternative transport fuels, including biofuels;
- Awareness raising and behaviour change programmes and transport models; and
- Government vehicle fleet efficiency programmes.

8.1. Headline Climate Change Response Indicators

High Level Indicators	Indicator	2012/13	2015/16	2018/19
GHG emissions	GHG emissions associated with the transport sector	10 455 847 tCO_2e[146]	11 574 860 tCO_2e[147]	No updated data available
Public Transport	% of commuters who use public transport as main mode of transport	43% (2013)[148]	No updated data available	No updated data available
Non-motorised transport	% of commuters who use non-motorised transport (NMT) as main mode of transport	19% (2013)[148]	No updated data available	No updated data available
Integrated Public Transport Network	No of municipalities with Integrated Public Transport Networks (IPTNs)	2 (Cape Town and George)	2 (No new IPTNs)	2 (No new IPTNs)

8.2. GHG Emissions Associated with the Transport Sector

Although transportation is a key sector in the Western Cape economy, the sector is currently extremely inefficient from a cost, energy, emissions and lifestyle perspective (this is not unique among the South African provinces). The harmful effect that transport has on the environment through atmospheric emissions, habitat fragmentation and water contamination, as well as its socio-economic inadequacies, are of great concern. However, there lies a great opportunity in the potential of the sector for reducing GHG emissions (Figure 13). Along with a reduction in GHG emissions will come a concurrent reduction in noxious fumes, reducing the negative health impacts suffered by people exposed to the most concentrated transport related air pollution. The requirements for, and benefits of, diminished GHG emissions and improved air quality, coupled with potential limitation on the supply of fuel and promoting spatial transformation are therefore strong drivers promoting an energy-efficient transport system.

[146] Western Cape Energy Consumption and CO_2 emissions database (2012/13) (WCG:EADP, 2013)
[147] Western Cape Energy Consumption and CO_2 emissions database (2015/16) (WCG:EADP, 2018)
[148] Update of the Western Cape 2016/17 – 2020/21 Provincial Land Transport Framework (WCG: TPW, 2016).

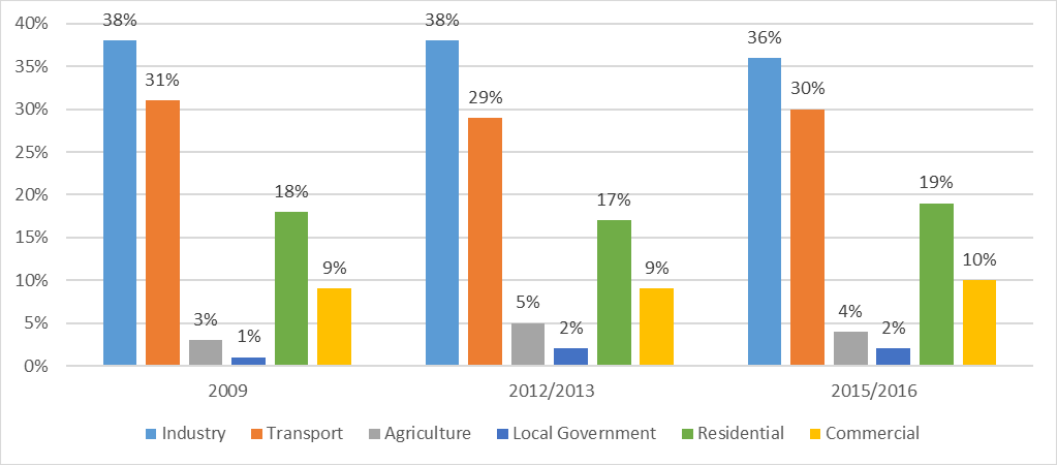

Figure 13: Emissions by Sector for the Western Cape – comparing 2009, 2012/13 and 2015/16

The transport sector is responsible for 30% of Western Cape energy related GHG emissions. At District level, however, it differs markedly between the Districts (Table 19).

Table 19: Energy consumption and emissions per district for the transport sector

	City of Cape Town	Cape Winelands	Overberg	Eden	Central Karoo	West Coast
Transport sector carbon emissions as % of district total	37%	16%	19%	39%	56%	10%
Transport sector energy consumed as % of district total	68%	38%	44%	68%	83%	12%

The variance between the Districts as shown in Table 19 is due to the differential role of transport in the various regions. National roads traversing a district's boundaries have a profound effect on energy consumption in the area, as can be seen for Central Karoo district, where 83% of energy consumed in the district and 56% of the energy related GHG emissions are ascribed to the Transport Sector[149]. This relates directly to the intensive use of the N1 and N12 national roads that run through this district, both of which carry substantial freight movement. Similarly, the land transport sector is also responsible for more than 50% of energy consumption in the Overberg and Eden districts, each of which has a national road that runs through the district. The liquid fuel use on these major transport routes is outside the management control of local municipalities and provinces.

Figure 14 presents the proportional consumption of energy by the transport sector across the City of Cape Town and the five districts in the Western Cape. It highlights the City of Cape Town as the largest consumer of energy in the transport sector. Seventy-two percent of energy consumed by the transport sector is consumed in the City of Cape Town. This is strongly linked

[149] The energy data for transport fuels as collected for the Western Cape Energy Consumption and CO_2 emissions database is based on fuel sales in a particular magisterial district (then converted into municipal boundaries). This, therefore, doesn't give an accurate reflection of the fuel consumption in the area, and in some areas this may skew the fuel use picture for a particular area, such as Central Karoo.

to the majority of Western Cape's population residing and working in the City of Cape Town as well as the economic contribution of the region.

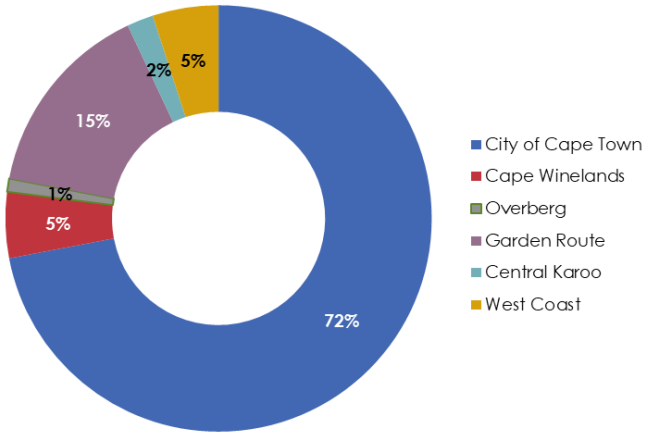

Figure 14: Percentage of provincial land transport energy used per district

8.3. Sustainability in Transport Strategy and Planning

At the centre of the province's aim to improve the sustainability of transportation in the Western Cape is the Provincial Sustainable Transport Programme (PSTP) of 2018. This programme replaces the Provincial Public Transport Institutional Framework (PPTIF), and envisages a transport system which facilitates equitable and safe access to opportunities; is affordable, supports a vibrant, inclusive economy; and limits impact on the environment. On a local level, the programme aims to support public transport and NMT, whilst at a provincial level it targets rail services, freight movement and transport information systems, among others. Fundamentally, the PSTP recognises that appropriate transport systems are key to improving people's access to opportunities and supporting efficient land use systems – thereby improving the resilience of households and communities. The PSTP has given rise to partnerships between the Western Cape DTPW and Stellenbosch and Overstrand Municipalities, and work has commenced on improving public transport and non-motorised transport in these areas. DTPW has provided technical support to these partners, including data collection, planning and implementation of sustainable transport initiatives. Further partnerships are being pursued.

The recently published 2019 Western Cape Freight Strategy aims to make freight transport safer, more efficient, more cost-effective and environmentally more sustainable. An important component of the strategy is to 'correct' the modal share, and shift suitable freight from road to rail in order to reduce the direct transport costs and externalities such as road accidents and road transport emissions.

8.4. Promotion of Public and Non-motorised Transport

A strategic goal of the Province is to create a spatially transformed province in which residents live in well connected, vibrant, climate resilient, and sustainable locations and move around efficiently on safe and affordable public transport[150]. This is especially important in priority non-Metro areas of the Western Cape, where the challenge lies in connecting dispersed settlements in an economically viable manner.

[150] Provincial Strategic Plan 2019-2024 (https://www.westerncape.gov.za/text/2020/February/western_cape_strategic_plan_2019-2024.pdf)

As is the case nationally, the Western Cape has experienced a large modal shift in passenger transport during the last two decades, but unfortunately detailed transport data is only available until 2013, which limits a more current understanding of trends. The existing data shows the share of NMT decreasing from 42% in 2003 to 19% in 2013, the share of minibus taxis increasing from 10% - 26% and that of private vehicles from 32% - 37%[151]. In the City of Cape Town, NMT only accounts for 9% of morning commuting transport[152]. From Table 20 it is also evident that private cars have become the dominant mode in most districts in 2013 apart from the Overberg, Central Karoo and Garden Route where NMT still plays a significant role.

Table 20: Household travel modal split (2013)[153]

	City of Cape Town	Cape Winelands	Overberg	West Coast	Garden Route	Central Karoo	Western Cape
Train	14%	5%	1%	2%	1%	2%	**11%**
Bus	8%	2%	4%	4%	5%	5%	**7%**
Bus Rapid Transit (BRT)	1%	0%	0%	0%	0%	0%	**0%**
Minibus Taxi	26%	21%	14%	24%	35%	35%	**26%**
Private Vehicle	37%	45%	47%	43%	26%	26%	**37%**
NMT	14%	27%	34%	27%	33%	33%	**19%**

Despite the increasing prevalence of private vehicles, motorised passenger transport in the Western Cape shifted from private to public transport between 2003 and 2013. According to the National Household Travel Survey (2013), 54% of the daily motorised transport trips across the Western Cape were via public transport mode (mainly minibus taxi) in 2013 as opposed to 45% in 2003 (Figure 15).

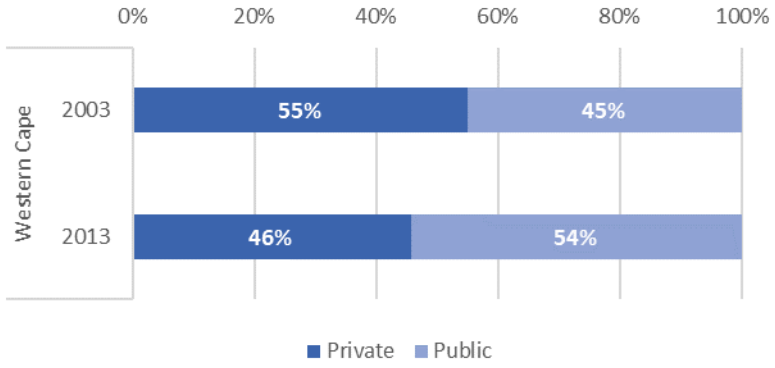

Figure 15: Private vs. public passenger motorised transport in the Western Cape, 2003 and 2013

Th shift to public transport is likely severely curtailed, however, by the rapid decline in the quality of passenger rail services in the City of Cape Town. The Passenger Rail Association of South Africa (PRASA) reports that there has been an approximately 75% drop in paying passenger

[151] Western Cape 2016/17 – 2020/21 Provincial Land Transport Framework
[152] City of Cape Town Comprehensive Integrated Transport Plan 2018 – 2023
[153] Western Cape 2016/17 – 2020/21 Provincial Land Transport Framework

numbers between 2014 and 2019[154] (Figure 16). This includes a 37% decline between 2017/18 and 2018/19, with reportedly only 32 operational trainsets[155] currently servicing a network that requires 88 sets[156]. This suggests that less than 150 000 passengers are currently serviced per day, in comparison to nearly 700 000 in 2012[157].

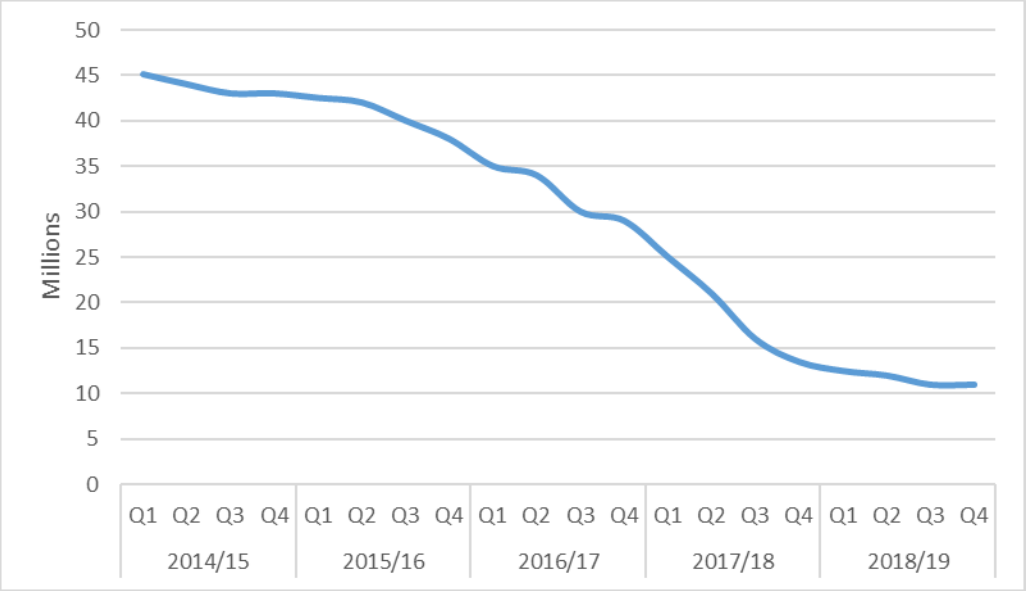

Figure 16: Trend in metrorail paying passenger trips in the Western Cape - 20114/15 to 2018/19

To date two municipalities have implemented Integrated Public Transport Networks (IPTNs) in the form of MyCiTi in the City of Cape Town (BRT based) and GoGeorge in George (Integrated Rapid Transit (IRT) based). MyCiTi is a bus rapid transit service with a feeder network which forms part of a greater Integrated Public Transport driven economic development strategy of the City of Cape Town that started in 2010. From Atlantis in the north to Hout Bay in the south, and from Mitchells Plain and Khayelitsha in the east to Sea Point in the west, there are currently 50 MyCiTi interconnected routes, serving many stations and stops. Further expansion into Mitchells Plain and Khayelitsha is due to come online in December 2023.

The George Integrated Public Transport Network, also known as GoGeorge, currently has 20 routes around George, with the next phase (Phase 4B) due to open in late March 2020. This will expand the operational footprint of the GoGeorge bus service to Conville, Parkdene, Ballotsview, Borcherds and Lawaaikamp. Eventually the entire George municipal area will be serviced with a network of routes that will ensure that the majority of the urban population of George will be within a 5-10 minute walk from a bus route. Routes will also be developed to serve the rural farming areas and link to the neighbouring towns of Knysna, Mossel Bay and Oudtshoorn.

Other non-metro transport projects are being pursued by the DTPW under the auspices of the PSTP. This includes a pilot project focussed on incremental and affordable improvement to the quality, efficiency and regulation of minibus taxi operations for the Overstrand Municipality.

[154] PRASA Annual Report, 2018/19
[155] https://www.iol.co.za/capetimes/news/western-cape-metrorail-left-with-only-32-operational-train-sets-after-another-blaze-41474104
[156] PRASA Annual Report, 2018/19
[157] City of Cape Town Comprehensive Integrated Transport Plan 2018 – 2023

Another primary objective of the province is to increase the role of NMT as a key transport mode, and together with the integration between NMT and public transport, is seen as vitally important. NMT should act as the feeder system to public transport, and the ease and convenience with which NMT users can access the public transport system will promote and enhance the utilisation of both modes at the same time. Non-motorised transport route facilities have been constructed in a number of urban and rural locations in the Province, some serving specific users (such as scholars) or purposes (such as access to public transport) and others providing for general mobility in urban and rural areas. It is a regulatory requirement for Integrated Transport Plans to include an NMT plan in the overall transport scheme, and hence all municipal entities have some level of NMT integration built into their planning. NMT improvements have been implemented in Stellenbosch and Overstrand, via the PSTP. Extensive NMT infrastructure exists in the City of Cape Town, but much more need to be done in support of the City's NMT aspirations. This includes the Cycling Strategy which sets a target of 8% of all trips by bike by 2030. The City of Cape Town Comprehensive Integrated Transport Plan 2018 – 2023 reports that since 2010, 206 km of dedicated cycle routes have been established, with an additional 234 km of routes shared between bicycles and pedestrians[158].

At the end of 2019 the DTPW appointed service providers to distribute bicycles as part of its PSTP. Between 50% and 72% of people in the Western Cape living outside the City of Cape Town rely on NMT, lifts, or public transport. The distribution of bicycles will help give effect to the PSTP's objective of improving mobility and enhancing access to transport to rural parts of the province, especially people living in poor and marginalised communities.

8.5. Investigation of Opportunities for Alternative Transport Fuels, Including Biofuels and Electric Vehicles

8.5.1. Biogas

The national Green Transport Strategy[159] sets a target of converting 5% of the public and national sector fleet by 2025 to cleaner alternative fuel, efficient technology vehicles (ideally powered by renewable energy), environmentally sustainable low carbon fuels and the use of renewable energy to provide electricity for transport.

Various studies by GreenCape have shown that there is a business case to be made for the use of organic resource materials for beneficiation into biogas once certain thresholds are reached in general fuel prices. Opportunities for biogas generation relate to different forms of waste and agricultural products suitable to the Western Cape. The City of Cape Town is also undertaking its own studies in this respect, with a focus on the potential extraction and use of bio-fuels from the City's Waste Water treatment works.

8.5.2. Electric Vehicles

Global uptake of electric vehicles (EVs) has quickened in the last few years, with global sales of electric vehicles estimated to have reached five million in 2019, up from one million in 2015[160]. Although the shift to EVs will not realise a reduction in the number of vehicles on the road, it may over time support some level of transport related emissions reduction through efficiency gains and fuel switches from fossil fuel based liquid fuels to electricity from

[158] City of Cape Town Comprehensive Integrated Transport Plan 2018 – 2023
[159] Green Transport Strategy (2018-2050), Department of Transport
[160] GreenCape, 2019: Electric Vehicles: Market Intelligence Report 2019

renewable sources. A concurrent benefit would be the elimination of local noxious gas emission, which will impact positively on human health (and resilience).

There are currently less than 700 EVs in total on South Africa's roads[161]. It is noteworthy that in contrast to worldwide sales, there was a decrease in sales in South Africa from 2015 onwards. Sales are also barely out of single digit numbers, as opposed to thousands and hundreds of thousands in other countries. This is indicative of a market that is still in its infancy but holds prospects should the right enabler be put in place to support its emergence and growth.

The Provincial Energy Security Game Changer established a Work Group to investigate electric vehicles in the Western Cape context and are working with the City of Cape Town and GreenCape on taking this work forward. The three areas of work that the Work Group will focus on include: electric vehicles and renewable energy, maximising the benefits of electric vehicles for the South African economy and facilitating the rapid uptake of electric vehicles through regulation and infrastructure rollout. This work has now been taken over by the provincial Department of Economic Development and Tourism's (DEDAT) Green Economy Chief Directorate.

The City of Cape Town has recognised that government stimulation will be required for the EV sector to grow in South Africa and the Western Cape. Their 2018 Fleet Management Strategy highlights that the incorporation of EVs in its Corporate fleets may reduce the City's carbon emission footprint and increase environmental awareness. The Strategy commits the City's fleets to a 2% shift of the current Internal Combustion Engine (ICE) fleet to zero emission vehicles by 2030. Accordingly, the City conducted cost-benefit assessments for the procurement of EVs for the City's fleets during 2019. Given the conditionally positive outcomes of the assessments, it is likely that the selection of EVs over ICE vehicles will commence in 2020/2021. Further investigations are also underway to explore the benefits of battery powered electric buses as an alternative fuel option for the MyCiTi fleet.

8.6. Awareness Raising and Behaviour Change Programmes and Transport Models

There are numerous *ad hoc* programmes underway to promote behaviour change around transport and to raise awareness about alternative transport modes, particularly to encourage commuters to shift to public transport.

The uptake of ride-sharing and carpooling apps, to a lesser extent, has had some impact on the transport sector, with these considered to be disruptive technologies in the transport space. Anecdotal evidence shows that people are giving up their private vehicles in favour of the ridesharing apps, but the negative impact of the technology has been felt. This includes strong opposition from the conventional metered taxi industry, and congestion in popular drop-off and collection points. It is not yet clear what impact this technology has had on energy consumption and associated emissions for road transport.

8.7. Government Vehicle Fleet Efficiency Programmes

The Transport Flagship Programme under the National Climate Change Response White Paper includes a Government Vehicle Efficiency Programme that will improve the efficiency of the government vehicle fleet by 2020. It encourages new efficient-vehicle technologies such as electric vehicles, by setting procurement objectives for acquiring such vehicles. The Western

[161] GreenCape, 2019: Electric Vehicles: Market Intelligence Report 2019

Cape Government Motor Transport service, falling under the administration of the DTPW, has thus far made a tentative commitment to conduct research and explore opportunities to introduce electric vehicles into its fleet in the near future[162].

8.8. Opportunities, Gaps and Recommendations

- There is a need to undertake a comprehensive and robust science-based climate change response strategy for the transport sector in the province, in order to fully understand and plan for the shift to a low carbon transport system as well as the impact that climate change is and will have on transport infrastructure and planning. Many good intentions are expressed in the various transport related plans and strategies, but few of these are informed by specific responses to climate change.
- A better understanding of the uptake of alternative fuels / new vehicle technologies is required in order to understand the mitigation potential for the transport sector. A lot of activities are taking place in the shift to more efficient public transport systems, but there are a number of opportunities for private vehicles, public fleets and freight in taking this work forward.
- Energy futures modelling undertaken in the City of Cape Town showed that the single biggest mitigation intervention for transport, particularly in the short term, would be increasing vehicle occupancy numbers as opposed to improved uptake of public transport and efficient vehicles. A better understanding of the interventions that will cause people to make this change is required in order to understand how to roll out a programme to encourage higher vehicle occupancies.
- An assessment of the mitigation measures identified for passenger and freight transport in the Western Cape Climate Change Mitigation Scenarios for the Energy Sector report is required. This can assist in identifying key activities that should be implemented in the short and medium term in order to reduce transport related emissions in the Western Cape. This includes looking at the immediate interventions that will facilitate changes over the long-term – such as increasing the penetration of electric mobility in anticipation of an increase in reliance on renewable energy.
- A better understanding of the freight sector is required to fully understand its role in the transport sector and its potential for mitigation of GHGs.
- In order to improve the sustainability of the province's transport system the province needs to facilitate a progressive model shift from road to rail and from private to public transport, in order to achieve sustainable mobility.

[162] Government Motor Transport Annual Report 2018/2019

9. Human Settlements

The vulnerability of human settlements to climate change is determined by the interplay of their sensitivity and exposure to environmental risks and changes, and the extent to which the adaptive capacity of affected communities and households is reduced by social vulnerability. Climatic changes are therefore likely to impact negatively on the quality and liveability of human settlements, unless measures are instituted to adapt to the risks and impacts that emanate from the altered climate regime.

In respect of the Human Settlements sector, the current WCCCRS M&E reporting focusses primarily on State subsidised settlements, due to that being a specific Provincial mandate. Priority areas for addressing Human Settlements in a changing climate include:

1. Mainstreaming climate change into human settlement developments;
2. Implementation of energy efficiency interventions in low income houses and communities; and
3. Improving the resilience and adaptive capacity of informal settlements.

9.1. Headline Climate Change Response Indicators

Table 21: Human Settlements Indicators for the WCCCRS[163]

High level category	Indicator	2015/16	2016/17	2017/18	2018/19	2019/20
Human Settlements	Percentage of State-subsidised houses built by the province that makes use of sustainable technologies in their designs	17.4%	16.8%	20.6%	14.2%	
Human Settlements	Number of State-subsidised houses built in the Province that comply with the updated[164] National Norms and Standards for the Construction of Stand Alone Residential Dwellings and Engineering Services (based on the requirements of SANS 10400 XA)	11 604 units	11 283 units	10 212 units	7 828 units	

9.2. Climate Change and Human Settlements

The nature and scale of human settlements not only play a determining role in the forcing of global climate change, but at the same time determine the resilience of people living in those settlements. The sustainability of construction materials, construction methods/technologies, water and energy usage, maintenance, associated transport modes, etc. will determine the carbon footprint of buildings during their lifetime.

Spatial inefficiencies and inequities inherited from the apartheid era and reinforced by post-apartheid planning and investment practices mean that most of the population of the province live in poorly located sprawling settlements, far from centres of economic opportunity. This exposes them to environmental hazards such as wind, fire, extreme heat and cold, as well as flooding, which will be exacerbated by climate change, and/or forces them

[163] Department of Human Settlements Annual Report, 2018/19 and Annual Performance Plan, 2019/20
[164] Note that since 2015/16, all units built by the Province comply with the Norms and Standards

spend too much energy and money on transport, thereby lowering their overall resilience and driving up GHG emissions. It is especially the lower-income component of the residential sector that is most vulnerable to climate change enhanced risks. This includes both informal settlements and to a lesser degree state-subsidised housing sectors.

Unfortunately, evidence indicates that the programme of providing State-subsidised housing has been unable to keep pace with a demand fuelled by immigration from other provinces and a challenging socio-economic context. The 2018 registered housing demand in the Western Cape was 571 979 units[165], up from 329 072 in 2011[166]. The housing demand is evidenced by the ever-growing informal settlements on the fringes of the City of Cape Town and other bigger towns in the province. The percentage of households classified as informal is also on the rise. According to surveys by Statistics South Africa, although the percentage of households classified as informal dropped from 18.2% in 2011 to 16.5% in 2016[167], the 2018 percentage was 25.31%[168] of households, of which the vast majority are in urban areas.

The impact which human settlement development has on the environment and resource use, coupled with the scale at which delivery is taking place, creates an opportunity and imperative to consider climate change. These considerations are relevant for all existing and planned low income and informal settlements, and should aim to improve the resilience, adaptive capacity, and resource dependency of settlements in urban areas.

The proposed Provincial Strategic Plan for 2019-2024 aims to address the challenges around this issue. Its 'Vision-Inspired Priority 4: Mobility and Spatial Transformation' seeks to create a spatially transformed province in which residents live in well connected, vibrant, climate resilient and sustainable locations, and move around efficiently on safe and affordable public transport.

9.3. Mainstreaming Climate Change into Human Settlement Developments

The PSP finds traction in the Western Cape Government Department of Human Settlements (WCDHS) Departmental Strategic Priorities for 2019-2024:

- Radical acceleration of housing opportunities delivery
- Radical implementation of innovative solutions
- Integrated approach to human settlements
- Revamping of the Breaking New Ground allocation model
- Revamping of the Finance Linked Individual Subsidy Programme model
- Affordable rental for youth

In line with the Departmental Strategic Objective/Priority: Radical Implementation of Innovative Solutions – the Department has undertaken a number of initiatives to mainstream and promote innovative outcomes in the construction of state subsidized housing in the Western Cape. The WCDHS has, and continues to, develop policies aimed at making service delivery more sustainable in the long term, focussing not only on financial sustainability, but also on social as well as environmental sustainability. These policies are increasingly explicitly including climate change response, as the current context prescribes it for any sustainable plan.

[165] Department of Human Settlements Annual Performance Plan, 2019/20.
[166] 2011 Census – Stats SA
[167] 2016 Community Survey – Stats SA
[168] 2018 Household Survey – Stats SA

It speaks to all three facets of sustainability:

- Financial losses related to maintaining and servicing settlements under a changing climate and especially during climate-related disaster events;
- the increased social sustainability that climate-proofed settlements offer residents; and
- the climate impacts of human settlement development and operations (e.g. the emissions from building and operating these settlements).

A variety of relevant policies and programmes have recently been developed, or are in development by the WCG, which will assist in setting the platform for a transitioning human settlements sector. These are captured in Table 22. It is important that the lessons learned from their application be used to improve policy directives and increase implementation success.

Table 22: Human settlement policies and programmes relevant to climate change response.

Policy, plan or programme	Description
PSDF specialist study on the municipal financial sustainability of current spatial growth patterns (2013)	The results from this study show that it is more financially sustainable for municipalities to pursue compact growth. A follow-up study was done using Mossel Bay Municipality as a case study (see below).
Western Cape Land Use Planning Act 2014 (Act 3 of 2014) (LUPA)	Replaces the Land Use Planning Ordinance, and is aligned with National Government's Spatial Planning and Land Use Management Act (Act 16 of 2013) (SPLUMA) Regulations. It introduces a new order for land use planning and attempts to ensure the effective integration of planning activities across the provincial and municipal governments. LUPA promotes the principles of densification and ensures that sustainability criteria are met.
Provincial Spatial Development Framework (PSDF) (2014)	The PSDF includes climate change as an issue to be addressed under the PSDF principle of *Sustainability and Resilience*, and also identifies it as one of the major future risk challenges the province will face. Various PSDF focus areas are linked to mitigation and adaptation. The PSDF is set for review in 2020.
Feasibility Study for Alternative and Sustainable Infrastructure and Services for Settlements (2015)	An investigation of the feasibility of alternative sustainable technologies currently on the market in settlement development. The outcomes indicated that in the long term it was financially more sustainable for municipalities to invest in more sustainable settlements using some of these alternative technologies instead of following a "business-as-usual" approach to settlement development.
Mossel Bay Growth Options Study (2015)[169]	This study included the non-financial impact of different growth footprints on biodiversity, ecosystem services, cultural landscape and agriculture, as well as social facilities and passenger transport; for all factors investigated the results indicate that compact growth is more sustainable than sprawling growth.
Western Cape Informal Settlement Strategic Framework (ISSF)(2016)	Focuses on i) how the current informal settlement upgrades can be enhanced; ii) what needs to be done differently and iii) what resources and expertise are required to shift from historical outdated planning methodologies to innovative, alternative and sustainable interventions for informal settlements. The 2030 vision incorporates climate resilience, stating that informal neighbourhoods will be "*able to withstand natural shocks and stresses, such as flooding and climate change*". Guiding principles include "*Plan for climate change, sustainability and resource efficiency*"

[169] DEADP. 2015. Mossel Bay Growth Options Study: A study on the municipal financial and non-financial impacts of sprawling vs. compact growth options. Final Report.

Policy, plan or programme	Description
Making better choices: green procurement in state-subsidised human settlements (2017)	Assists municipalities in, amongst others, i) following procurement processes for the development of housing that result in reduced levels of embodied carbon, ii) the development and housing that minimises exposure to environmental risks and hazards. This should result in developments that have a decreased climate risk. The WCDHS is in the process of developing an Implementation Programme for this policy.
Living Cape: A Western Cape Human Settlements Framework (2019)	This is an overall guide to human settlement development in the Western Cape in the short, medium and long term (up to 2040), and will combat urban fragmentation and sprawl as well as promoting more integrated and sustainable settlement development.
CSIR Green Book (2019)[170]	Similar to the Red Book, the Green Book has been developed by the CSIR to provide planning guidelines for adapting South African settlements to climate change. The target audience is primarily planners at a municipal level involved in spatial planning and land use management. Other disciplines such as disaster risk managers, engineers and environmentalists will also benefit from the guidelines.
WCDHS Water Crisis Policy Guidelines	These guidelines act as a guide for water saving measures on projects managed directly by the Department. In order to combat the impact of the drought and to build resilience the WCDHS now requires all successful bidders for Departmentally managed and contracted projects to submit a Water Demand Management Plan for approval, which focusses on interventions to make water use in settlements more sustainable. These include Technical Interventions relating to norms and standards and contractor activities, and Behavioural and Administrative Interventions which include consumer education activities, rain-water harvesting, contract management activities and other recommendations.
MoU with GBCSA to adopt and implement the IFC EDGE Tool within the province	The EDGE ("Excellence in Design for Greater Efficiencies") tool is an online platform, a green building standard and a certification system developed by the International Finance Corporation. The EDGE application helps to determine the most cost-effective options for sustainable building design within a local climate context. EDGE can be used for buildings of all vintages, including new construction, existing buildings and major retrofits. The objective in the province is to certify our projects with EDGE.
Green Procurement Implementation Programme	Policy guidelines to mainstream and promote green outcomes in the construction of state-subsidized housing – i.e. Green Procurement Implementation Guidelines.
Guidelines for the use of Sustainable Building Technologies (SBT) in buildings and infrastructure by the WCDHS	In light of quality concerns, issues pertaining to standardisation and regulation, future maintenance, beneficiary acceptance and high unit costs, and suspected damage to the environment, it has become imperative to develop guidelines that will guide the Department with the implementation of innovative/alternative building technologies.
Fire Safety Plan for Informal Settlements	The aim of the project is to devise a response plan that will improve fire safety/resilience in informal settlement.
Departmental Disaster Management Plan	The WCDHS is compiling a Departmental Disaster Management Plan in 2020, which will focus on fires, floods, droughts and climate change risks for the activities of the Department.

[170] https://greenbook.co.za/

9.4. Climate-resilient Technologies in State-subsidised Human Settlements Designs and Energy Efficiency in Low-income Settlements

In terms of incorporating alternative technologies into human settlement development, the WCDHS is continuously investigating and encouraging projects that will yield higher quality and more resource efficient settlements. The WCDHS has conducted a number of enumeration surveys in settlements in the Western Cape, which provide insight into vulnerability to climate change risk in these settlements.

The number of state-subsidised houses built in the province that makes use of climate-resilient technologies in the designs is measured under the WCDHS strategic departmental goal of promoting innovation and the Better Living concept – as "*the incorporation of sustainable technologies*" in housing developments. This is achieved by increasing sustainable resource use through exploring innovative technologies in construction, energy, water and sanitation, and promoting the use of sustainable building technologies to achieve the most energy and cost-effective development.

Table 23 shows the targets set by the WCDHS for the incorporation of sustainable building technologies into State-subsidised housing development for the 2015/16 – 2020/21 financial years, alongside the measured performance against the targets. All units constructed since the 2015/16 financial year comply with the updated National Norms and Standards for the Construction of Stand Alone Residential Dwellings and Engineering Services. These Norms and Standards were updated in 2014 through the incorporation of the requirements of the SANS 10400 XA standard for energy efficiency. Accordingly, inclusion of key passive design requirements from the SANS 10400 XA standard translates into an increased thermal performance for the standard 40m^2 house over the previous standards. Typically, the construction now includes ceilings, insulation, plastering, reduced window size, etc.

A subset of units further complies with more stringent sustainability requirements, meaning that sustainable technology initiatives in construction, energy, water, and sanitation were used in the overall design are not fully covered by existing standards in the National Building Regulations[171]. The aim is to promote the use of alternative building methods that will result in more energy efficient human settlements, culminating in environmental benefits and economic advantages to the beneficiaries. Notably, delivery of the improved standard units substantially exceeded targets since 2016/17.

Table 23: WCDHS performance in respect of the construction of sustainable State-subsidised houses

Financial year	Target number of houses constructed as per updated national norms and standards	Actual no. of housing units delivered	Target number of houses built using sustainable technology	Actual no. of housing units delivered
2015/16	10 240	11 604	3 240	2 023
2016/17	11 134	11 283	600	1 893
2017/18	11 094	10 212	600	2 288
2018/19	9 467	7 828	600	1 111
2019/20	9 723		1 000	
2020/21	9 800		1 000	
2021/22	9600		1 000	

[171] Department of Human Settlements Annual Report, 2018/19 and Annual Performance Plan, 2019/20

The Western Cape Department of Human Settlements has started using the International Finance Corporation's *Excellence in Design for Greater Efficiencies* (EDGE) tool in order to facilitate the implementation of alternative and climate-smart technologies in human settlements. This tool can be used to assess the cost impact on a housing project of including various climate-smart techniques and technologies in terms of reduction of energy consumption, water use, and embodied energy/carbon, and is specifically adapted to South African conditions with regard to climate, building regulations and utility costs[172].

The Department has received funding from the International Finance Corporation (IFC), a subsidiary of the World Bank, to finance the certification of the EDGE green rating standard in a pilot project of 500 houses. EDGE certification results in residential developments with the following benefits:

- They are at least 20% more energy efficient; use at least 20% less water and have at least 20% less embodied energy (energy of materials)- i.e. reduced utility costs for end-users
- They create a more comfortable and healthy home environment
- Green certified houses have a higher market value and sell better
- Banks are more inclined to mortgage or grant loans against green certified homes
- Construction is environmentally responsible

Ultimately, the aim is to have all state subsidized housing units EDGE certified. This is to be gradually implemented following the pilot phase mentioned above.

The Department is in the process of appointing a service provider to develop guidelines that will guide the Department with the implementation of innovative or SBTs in future. In addition, the Department will also undertake, as part of this project, a market readiness assessment to investigate to what extent the market is ready for supplying SBTs and which obstacles still need to be overcome.

With respect to 'active' sustainable technology interventions in housing – i.e. incorporation of mechanical or electrical systems that actively regulate resource use – the Western Cape has been able to add SWHs to a number of low-cost housing through means of a DANIDA funded project running between 2012 and 2018. This project has yielded 93 installed SWHs in Joe Slovo Phase 3, with 217 more ready for installation[173].

9.5. Improving Resilience and Adaptive Capacity in Informal Settlements

Improvement to the resilience and adaptive capacities of informal settlements are driven from a Provincial side via the ISSF developed by the WCDHS in 2016.

The purpose of the ISSF is to act as the foundation for effective prioritisation, planning, implementation and maintenance of interventions in informal settlements. This ISSF aims to simplify the concept of incremental upgrading and make it more practical to implement various solutions. A review of the design of the ISSF will be conducted in 2020, and a full evaluation of its implementation and impact in 2021. Importantly, the ISSF recognises the importance of 'soft' issues such as a cohesive and organised community, and a trust-based relationship between the community and the local authority.

The guidance from the ISSF is implemented in the Upgrading of Informal Settlements Programme (UISP) that aims to improve the living conditions of many people in informal

[172] https://www.gbcsa.org.za/residential-tools/edge/
[173] Department of Human Settlements Annual Report, 2018/19.

settlements and in backyards. The programme focusses on *in situ* upgrades of sites, with the objective of providing serviced sites with clean water, sanitation, roads and storm water drainage. Up to 2018/19, 6 687 such sites have been delivered[173]. Community dynamics, such as unrest, protests, labour demands, gangsterism and vandalism, have been cited as holding back delivery in past years, but the performance has improved more recently as delivery was accelerated.

Table 24: WCDHS performance in respect of the provision of serviced sites

	Financial year						
	2015/16	**2016/17**	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**
No. of UISP serviced sites delivered[174]	1 829	2 134	705	2 019			
UISP serviced sites target	2 939[175]	5 075[176]	2 222[177]	1 352	2 066	3 200	3 500

Further support to informal settlements is envisaged as a programme of capacity building amongst communities, NGOs and local government officials that will stimulate the application of resilience principles in the construction of informal dwellings. This is driven via the Better Living Challenge (BLC) project, which stimulates local innovative solutions, products, services and systems that can catalyse change and bring about improved living conditions.

The BLC is a project of the Craft and Design Institute (CDI) funded by the WCDHS and DEDAT. The current BLC 2 commenced in 2016. It explores ways of supporting incremental upgrades of homes within informal settlements, with a pilot programme providing builders in informal communities with training in improved construction methods. This programme has met with success in the City of Cape Town, and will now be expanded to the Swartland and Theewaterskloof Local Municipalities.

9.6. Opportunities, Gaps and Recommendations

- One of the gaps is that the current human settlement legislation does not explicitly consider climate change in its rollout; however, the development of resources such as the Green Book may help to fill this gap.
- A clearer understanding is required of risk to the sector and what climate resilience means for human settlements.
- Related to the above, is the need to identify ways to measure the state of vulnerability or resilience in settlements.
- Integration of climate change risk and vulnerability considerations into the ISSF update slated for 2020.
- There is a need for better understanding of how existing deficits in the provision for water, sanitation, drainage, electricity, tenure, healthcare, emergency services, schools and public transport affect climate resilience in vulnerable human settlements, and subsequently how these deficits can be overcome with climate-resilient policy, design and technologies.

[174] Department of Human Settlements Annual Performance Plan, 2019/20.
[175] Department of Human Settlements Annual Report, 2015/16
[176] Department of Human Settlements Annual Report, 2016/17
[177] Department of Human Settlements Annual Report, 2017/18

10. Biodiversity and Ecosystem Goods and Services

The current WCCCRS priority areas for addressing biodiversity and ecosystem goods and services in the Western Cape in a changing climate include:

1. Coordination, prioritisation, valuation, mapping, protection, and restoration of ecological infrastructure;
2. Landscape initiatives / biodiversity corridors and identification of requirements for climate change adaptation corridors;
3. Biodiversity stewardship; and
4. Mainstreaming of conservation planning into decision making.

Table 25. Biodiversity and Ecosystem Goods and Services Indicators for the WCCCRS

High level category	Indicator	2015/16	2017/18	2019/20
Biodiversity; Ecosystem Goods and Services	Percentage of protected and conservation areas that are also Climate Change Corridors (CCCs)	Less than 1%[178]	1.07%[179]	2.27 %[180]
EGS	Number of EGSs mapped and utilised in planning tools	9[181]	These tools have been incorporated into the 2017 Western Cape Biodiversity Spatial Plan Handbook. As part of the "cost surface" calculations, a layer of features important for climate change adaptation of biodiversity was utilised.	No update
Biodiversity	Integration of biodiversity priorities in municipal SDFs	Not adequately integrated: 34% Adequately integrated: 34%[182]	Not adequate: 10% Adequate: 0% Excellent:90%[184]	Not adequate: 7%[185] Adequate: 0% Excellent:93%[186]

[178] CapeNature, 2015. *CNC Reserves*. Western Cape Nature Conservation Board; CapeNature 2015. *Stewardship Sites - 2015 (Signed and Declared*). Western Cape Nature Conservation Board]; SANBI 2010. *Formal Protected Areas*. SANParks.
[179] CapeNature, 2017. *CNC Reserves*. Western Cape Nature Conservation Board; CapeNature 2017. *Stewardship Sites - 2017 (Signed and Declared)*. Western Cape Nature Conservation Board; SANBI 2011. *Formal Protected Areas*. SANParks.
[180] Therese Forsyth, CapeNature, January 2020, pers.Communication.(Categories of land parcels include CapeNature and SANParks Reserves, signed and declared stewardship contract nature reserves, Mountain Catchment Areas (MCAs) and Marine Protected Areas (MPAs).
[181] Genevieve Pierce, CapeNature, pers. Communication.
[182] Tracy Sampson, Biodiversity Sub-Directorate, DEADP, July 2017, pers. Communication
[184] Tracy Sampson, Biodiversity Sub-Directorate, DEADP, July 2017, pers. Communication
[185] Albert Ackhurst, Biodiversity, DEA&DP, January 2020, pers. Communication
[186] Tracy Sampson, Biodiversity Sub-Directorate, DEADP, July 2017, pers. Communication

High level category	Indicator	2015/16	2017/18	2019/20
		Excellently integrated: 31%[183]		
EGS	Number of wetlands rehabilitated per year	2013/14: 20 2014/15: 29 2015/16: 25[187]	2016/17: 32 2017/18: 34[187]	2018/19: 15[188]

Table 26. Additional High-level Biodiversity and EGS Indicators

High level category	Indicator	2015/16	2017/18	2018/19
Economic loss from ecosystem degradation	Estimated economic potential lost from ecosystem degradation per annum in the Western Cape	R4.5 billion[189]	No update	Data not yet available
Biodiversity	Percentage of the Western Cape's land that is under conservation management by CapeNature	2014/15: 6.81%[190] 2015/16: 6.91%[191]	2016/17: 7.45%[192] 2017/18: 6.37%[193]	6.40%[194]
Ecosystem Goods and Services	Percentage of wetland area in the Western Cape that falls within formally protected areas	8.8%[195]	9.9%[196]	14.66%[197]

[183] Albert Ackhurst, Biodiversity Sub-Directorate, DEADP, March 2016, pers. Communication.
[187] Heidi Nieuwoudt, SANBI, pers. communication.
[188] Heidi Muller nee Nieuwoudt, Working for Wetlands: Western and Northern Cape. Pers. Comm.
[189] WCG 2014. Western Cape Eco-Invest Project. Phase I: A Preliminary Assessment of Priorities and Opportunities for Mobilising Private Sector Investment in the Western Cape's Natural Capital.
[190] CapeNature Annual Report 2014/15.
[191] CapeNature Annual Report 2015/16
[192] CapeNature Annual Report 2016/17.
[193] CapeNature Annual Report 2017/2018.
[194] Therese Forsyth, CapeNature, pers. communication. NB: Data is based on METT areas for CapeNature-managed sites: reserves, island reserves, MPAs and stewardship sites.
[195] CapeNature, 2015. *CNC Reserves*. Western Cape Nature Conservation Board; CapeNature 2015. *Stewardship Sites - 2015 (Signed and Declared)*. Western Cape Nature Conservation Board]; SANBI, 2011. *NFEPA_Wetlands*. CSIR. Note that this dataset does not include estuaries.
[196] CapeNature, 2017. *CNC Reserves*. Western Cape Nature Conservation Board; CapeNature 2017. *Stewardship Sites - 2017 (Signed and Declared)*. Western Cape Nature Conservation Board; SANBI, 2011. *NFEPA_Wetlands*. CSIR (includes 2016 updates; note that this dataset does not include estuaries).
[197] Therese Forsyth, CapeNature, pers. communication. NB: Based on natural wetlands and estuaries from NFEPA wetlands layer (2011).

10.1. Climate Change, Biodiversity and Ecosystem Services

Climate change is one of the most important direct drivers of biodiversity loss and ecosystem service changes worldwide, and it may become the dominant direct driver of these changes by the end of the 21st century. The range of life forms forming biodiversity are adapted to the range of temperature and precipitation they normally experience with the distribution of ecosystems closely related to the distribution of climates. Any change in climate will profoundly influence the distribution of species and ecosystems. In addition to acting as a direct driver of biodiversity loss and habitat degradation, climate change multiplies other pressures on biodiversity, both exacerbating the effects of other pressures and altering the frequency, intensity and timing of events[198]. Despite climate change negatively impacting on people and ecosystems, healthy ecosystems can help people adapt to climate change[199]. As such it is important to monitor climate change impacts and get a better understanding around how ecosystem and society can adapt to it.

As stated in the introduction, climate forecast for South Africa projects an increase in temperature of up to 3°C within the interior and a decrease in the amount of rainfall in the westward-eastward direction by 2050 under the current emission trajectory. These changes in climate will profoundly influence distribution of biodiversity and ecosystems within the country. Direct impacts of such changes will include changes in habitat and species composition, habitat loss, increase in average temperature, increase in the frequency of extreme weather events and changes in ecosystem functioning. Indirect impacts that could be felt at a local level include loss of livelihood systems and economic losses. As reported in the SOEOR of 2018, the economic losses resulting from general ecosystem degradation have been calculated to amount to R4.5 billion per annum for the Western Cape[200]. The figure is likely to increase given the projected trend of climate change for the province.

Projections indicate that the Western Cape climate is likely to become warmer and drier, with less winter rainfall and more irregular and intense rainfall events[201]. This will have various consequences for the province's economy, ecological integrity and livelihoods including:

1. reduced water quantity and quality which will affect river flows and the state of wetlands and estuaries (see Water chapter);
2. Habitat fragmentation which could lead to species losses in the Cape Floristic Region as well as for other biomes that occur in the Western Cape;
3. Prolonged (perhaps even continuous) fire and flooding seasons and intensity (see Climate Risk Management);
4. Increase in the spread of invasive alien plants resulting in reduced water availability and increased fire intensity. The NBA 2018 presents that woody plant invasions in the province's mountain catchment areas directly threaten Fynbos biodiversity and disrupt hydrological processes that underpin water delivery to agricultural and

[198] South African National Biodiversity Institute (SANBI). 2019. National Biodiversity Assessment 2018: The status of South Africa's ecosystems and biodiversity. Synthesis Report. South African National Biodiversity Institute, an entity of the Department of Environment, Forestry and Fisheries, Pretoria.
[199] ibid
[200] WCG 2014. Western Cape Eco-Invest Project. Phase I: A Preliminary Assessment of Priorities and Opportunities for Mobilising Private Sector Investment in the Western Cape's Natural Capital.
[201] Climate Systems Analysis Group (CSAG). 2017. Provincial Plans Phase Three: Support the review of Provincial Climate Change Response Strategies and the Development of Action Plans. Report for the Western Cape Government, Cape Town. South Africa

urban areas[202]. The uncontrolled spread of invasive alien vegetation is likely to take place at high altitudes and inaccessible catchments threatening to reduce mean annual run-off in the catchments.

5. Increased danger to coastal towns due to sea level rise and coastal erosion (see Coastal and Estuary Management chapter);
6. Development of informal settlements in unsafe areas such as the wild land and urban interfaces without implementing the necessary risk reduction measures; and
7. impacts on economic sectors such as fishing, forestry, agriculture, insurance, banking, tourism, infrastructure and construction[203].

The 2018 edition of the SOEOR for the Western Cape also showed that the overall biodiversity and ecosystem health of the province was declining. The report stated that 14 additional ecosystems qualified for the national listing as threatened, an upward increase in number from the number of threatened ecosystems gazetted in 2011. This continued loss of natural habitat, particularly in Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs), undermines not only the rich natural heritage of the Western Cape, but people's livelihoods and quality of life, water security, and the society's resilience in the face of a changing climate[204].

Information presented in the 2018 SOEOR also confirmed findings from The Western Cape State of Biodiversity report which was published by CapeNature in 2017. The report had presented the following in relation to climate change: i) land use change is still threatening biodiversity areas particularly Critical Biodiversity Areas; ii) due to the uncertainty around climate change projections, the exact impacts of climate change on biodiversity remain largely unknown; iii) disasters such as fires and drought are impacting on conservation budgets negatively; and iv) CapeNature has the potential to increase the weather monitoring system and has subsequently done so through setting up of addition of several new weather stations in the province.

10.2. Western Cape Land that is Under Conservation Management by CapeNature

Whilst there is a declining state of biodiversity, much is being done to turn the tide on this. One of the ways this is being done is through increasing the conservation estate[205], as well as restoring and rehabilitating key ecosystems [including wetlands (covered later in this section) and rivers (see Water chapter)]. In the last few years there has been an increase in the percentage of land under conservation management (Figure 17) in line with targets set by CapeNature.

[202] South African National Biodiversity Institute (SANBI). 2019. National Biodiversity Assessment 2018: The status of South Africa's ecosystems and biodiversity. Synthesis Report. South African National Biodiversity Institute, an entity of the Department of Environment, Forestry and Fisheries, Pretoria.
[203] Western Cape Protected Area Expansion Strategy: 2015 – 2020. 2015. Compiled by Maree, K.S., Pence, G.Q.K. and Purnell, K. 2015. Unpublished report. Produced by CapeNature. Cape Town, South Africa.
[204] WCG 2018. State of Environment Outlook Report for the Western Cape. Environmental Outlook
[205] The conservation estate referred to in CapeNature's strategic documents. This is defined as all sites declared by Government Gazette and/or formal agreement under NEM:PAA, (new state land and contract nature reserves, as well as contractual agreements, but not voluntary stewardship sites).

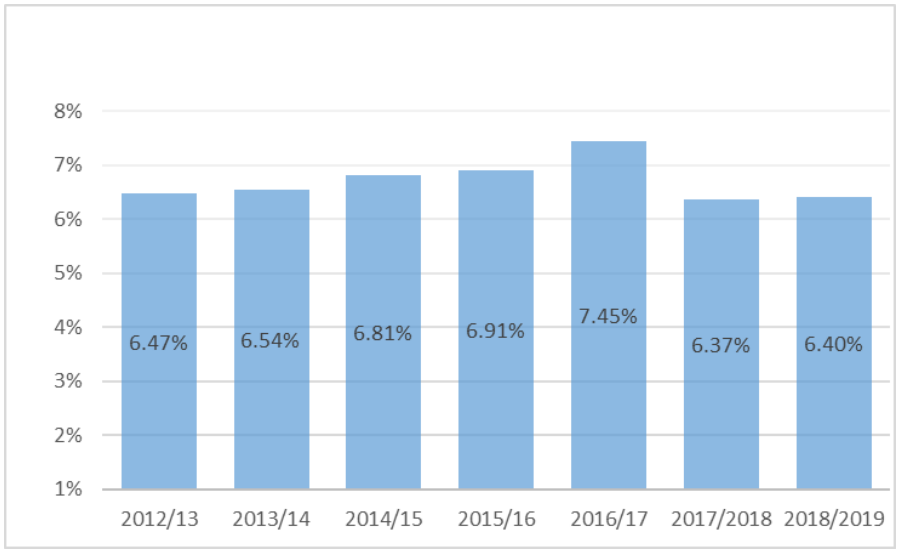

Figure 17: Percentage of land in the Western Cape that is under conservation management by CapeNature (CapeNature Annual Reports: 2012/13; 2013/14; 2014/15; 2015/16; 2016/17, 2017/2019 and 2018/2019)

However, during the 2017/18 reporting period, a number of substantial adjustments were made to the boundaries of the 31 provincial nature reserve clusters as necessitated by the Surveyor General's notices and adjustments to the cadastral boundaries (land parcels) of these nature reserves. The exercise resulted in the need to reduce the 2017/18 hectares contained in the conservation estate to an adjusted baseline of 974 866 hectares for the ensuing reporting period hence the noted decrease in percentage of area under conservation management by CapeNature on the graph.

10.3. Climate Change Corridors that fall within Conserved Areas

Corridors act as passages for plants, animals, insects, birds to move from one region to the next. In light of climate change, they also play a vital role in allowing species to move from a warmer to a cooler region, and vice versa. Establishment of climate change corridors was identified as a strategy to reduce the impacts of threats to biodiversity and EGS from climate change in the Western Cape. These corridors were designed to continuously contribute towards improving protection of the climate change corridors and refugia within the province. These corridors were taken into account when designing the Province's Protected Area Expansion Strategy[206]. CapeNature undertook the initial work of identifying these corridors with support from The Table Mountain Fund (TMF[207]).

Several landscape level initiatives are being implemented across the province with the aim of improving protection and sustainable land management within these corridors so that they maintain their function. Relevant initiatives include:

1. Biosphere Reserves[208].

[206] Western Cape Protected Area Expansion Strategy. 2016
[207] Pence, G.Q.K. 2009. Climate Adaptation Scenarios for the Cape Floristic Region: Technical Report.
[208] Which represents the five biosphere reserves: Gouritz Cluster, Cape Winelands, Kogelberg, Garden Route and Cape West Coast.

2. The Freshwater Forum which is a convening platform for the catchment based local network platforms across the province. The Forum is coordinated by the Biodiversity Directorate.
3. Landscape Initiatives coordinated or supported by CapeNature and represented at the CAPE Implementation Committee[209].

To measure whether the conservation status of these targeted areas is increasing, the percentage area of protected and conservation areas that constitute climate change corridors in the province was compared with the most up to date information for areas conserved by CapeNature and SANParks; i.e. calculate the area of climate change corridors as identified in the 2017 Western Cape Biodiversity Spatial Plan that intersect the with conservation and protected areas as identified in the South Africa Protected Area Database (SAPAD) and South Africa Conservation Area Database (SACAD). Areas of intersection are represented in red in the map (Figure 18).

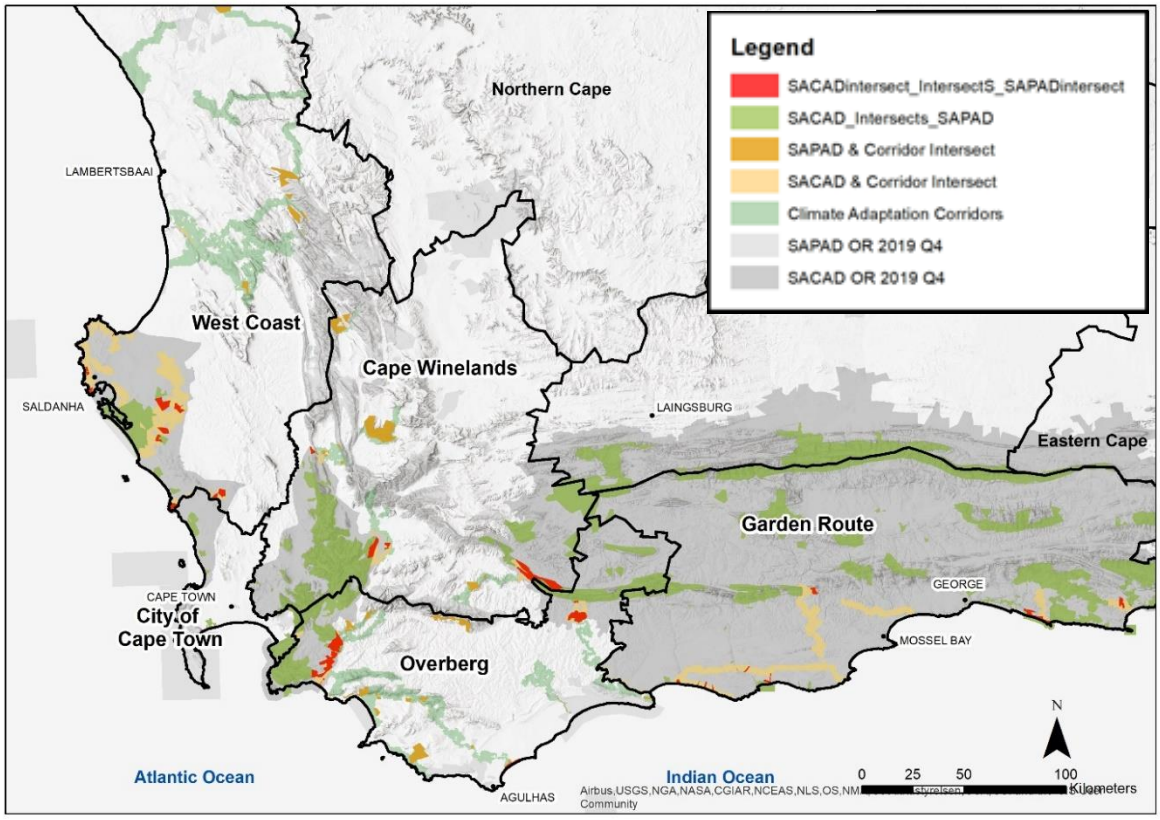

Figure 18:Distribution of protected areas, conservation areas and the intersect with climate change corridors in the Western Cape[210]

Currently less than 1% of formally protected areas is also climate corridor areas[211], or alternatively, 17.5% of the designated CCCs are formally protected. Additional portions that

[209] Includes the Agulhas Biodiversity Initiative (ABI), The Greater Cederberg Biodiversity Corridor (GCBC), Upper Breede Collaborative Extension Group (UBCEG), Garden Route Environmental Forum (GREF), and Addo-to-Eden Corridor.

[210] SACAD is South Africa Conservation Areas Database, SAPAD is South Africa Protected Area Database and Climate Change Corridors are based on the Provincial Biodiversity Spatial Plan

[211] Protected areas used in this analysis include areas that fall within CapeNature's conservation estate [CapeNature 2015. *CNC Reserves*. Western Cape Nature Conservation Board; CapeNature 2015. *Stewardship Sites - 2015 (Signed and Declared)*. Western Cape Nature Conservation Board], as well as national nature reserves (SANBI 2010. *Formal Protected Areas*. SANParks).

do not currently enjoy formal protection do fall within areas that are conserved by virtue of their inaccessibility (e.g. mountainous areas) or conservation importance to other sectors (e.g. strategic water source areas). Despite this, it is vitally important to formalise the protection of these 'informally' protected areas, as well as affording protection to the currently unprotected portions of those corridors.

10.4. Ecological Infrastructure and Climate Change

Ecological infrastructure is the nature-based equivalence of the built infrastructure and provides vital services that underpin social development and economic activities. Examples of ecological infrastructure include healthy mountain catchments, wetlands and water courses, coastal dunes and nodes. Ecological infrastructure provides services such as flood attenuation, water purification, drought management, biodiversity conservation and regulating weather and climate patterns. Climate change projections for the Province indicate an increase in air temperatures, a decrease in rainfall and an increase in the periods between rainfall events[212] and this will likely lead to hotter and dryer conditions that increase the risk of wildfires in terms of both number and duration[213]. This is particularly problematic in sensitive ecological infrastructure such as peatlands and wetlands, especially if these areas are disturbed by factors such as the spread of IAPs and/or inappropriate urban development. In efforts to curb the decline in the state of biodiversity in the Western Cape, the 2017 Biodiversity Spatial Plan generated a spatial representation of how ecological infrastructure in the province could contribute towards adapting to effects of climate change. This was achieved through integrating:

- Areas of climate change resilience
- Areas of intact ecosystems
- Ecological corridors that facilitate movement of species as they respond to the changing environment

These climate change adaptation features were integrated into a single climate change surface layer that was used as a "cost" in the spatial analysis. As a result, climate change adaptation and promoting resilience of ecological infrastructure were keys factors in determining and delineating CBAs and ESAs for the provincial-wide Biodiversity Spatial Plan.

10.5. Biodiversity Mainstreaming

10.5.1. Ecosystem Goods and Services (EGS) Mapped and Utilised in Planning Tools

In developing the abovementioned 2017 Western Cape Biodiversity Spatial Plan, CapeNature also used a set of biodiversity planning tools - prioritising the role of ecological infrastructure (through which EGS flow) in contributing to the socio-economic development of the province. Since EGS are rarely included directly in planning tools, these types of tools were used as a proxy indicator for planning tools that include EGS. These tools are:

1. Important water source areas [combination of Strategic Water Source Areas and High Yield Catchments, as per NFEPA];
2. High groundwater recharge areas (NFEPA);

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[212] Engelbrecht, F. A., Landman, W.A. Engelbrecht, C.J., Landman, S., Bopape, M.M., Roux, B., McGregor J.L. & Thatcher, M. 2011. Multi-scale climate modelling over Southern Africa using a variable-resolution global model. *Water SA*. **37**: 647–658. Available: http://www.scielo.org.za/scielo.php?script=sci_arttext&pid=S1816-79502011000500006. [4 November 2019].

[213] Forsyth, G. & Le Maitre, D. 2019. *Green Book – The impact of climate change on wildfires. Technical Report.* CSIR Report: CSIR/NRE/ECOS/ER/2019/0003/C. Pretoria: Council for Scientific and Industrial Research (CSIR).

3. Climate change adaptation corridors;
4. Upland-lowland interfaces;
5. Estuarine functional areas;
6. Wetland clusters (NFEPA);
7. Ecosystem-based adaptation areas [as per the National Biodiversity Assessment (NBA 2011];
8. Riparian functional areas; and
9. Coastal corridors, which include: Fore dunes (specific value/service of providing physical buffering against sea storm surges).

These tools have now been incorporated into the Western Cape Biodiversity Spatial Plan, which has a handbook to support land use planning decision making. The Biodiversity Spatial Plan as well as the Provincial Biodiversity Strategy and Action Plan will be used by DEA&DP and CapeNature when commenting on development applications or environmental impact assessments (EIAs), and will be incorporated in spatial development tools through the classification of specific areas of high ecological importance.

10.5.2. Integration of Biodiversity Priorities in Municipal SDFs

An additional planning tool is the integration of biodiversity and ecosystem priorities into municipal SDFs. SDFs are included in IDPs, and DEA&DP annually assesses these documents to ensure that they include the necessary biodiversity planning and considerations. Figure 19 illustrates the DEA&DP assessment outcomes for the 30 Local Municipalities in the province[214]. The assessment on how well municipalities integrate biodiversity priorities in the SDF is done on approximately a five-year interval by the Biodiversity component of DEA&DP, which matches the SDF review cycle. The integration of biodiversity into SDFs is improving with time. From the assessments, the Western Cape has experienced an increase in the number of municipalities that consider and prioritise biodiversity in their land-use decision making processes as shown in the pie charts in Figure 19.

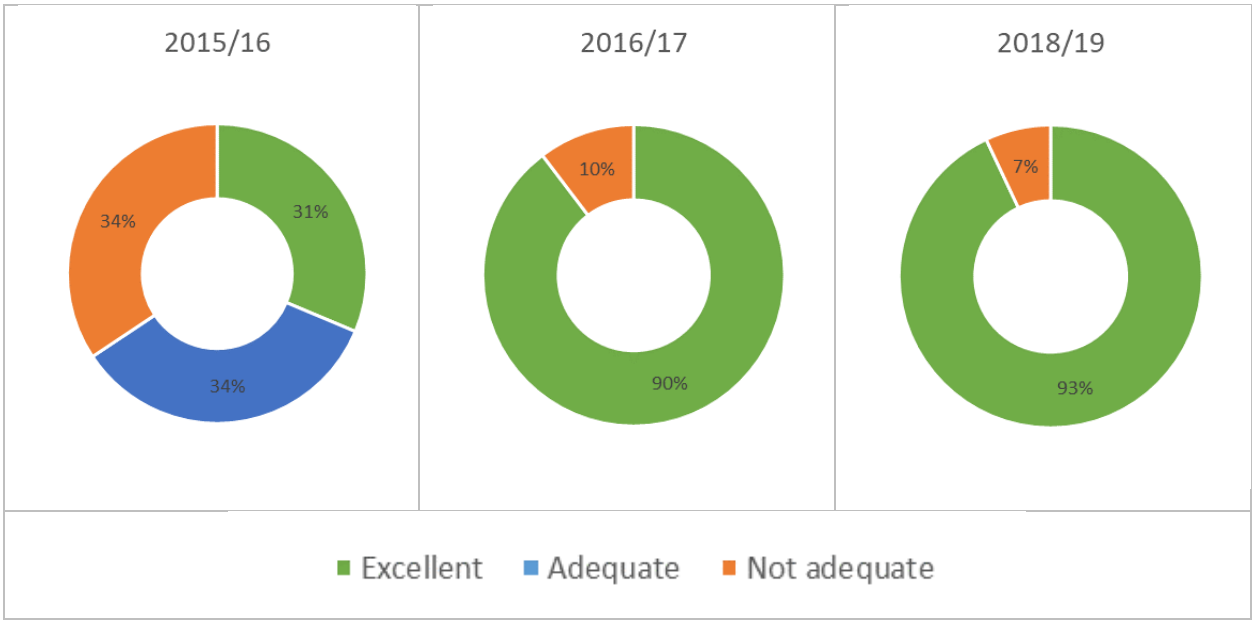

Figure 19: Degree to which biodiversity priorities were integrated into Western Cape Municipal Spatial Development Frameworks

[214] The City of Cape Town was excluded from this analysis.

10.5.3. Additional Tools to Ensure Biodiversity Supports Climate Resilience

Following on from the publication of the National Biodiversity Strategy and Action Plan (NBSAP) the WCG finalised a Provincial Biodiversity Strategy and Action Plan[215] (PBSAP) in 2017. PBSAP is a high-level long-term plan that governs biodiversity management in the Western Cape. The PBSAP has seven core strategic objectives, of which the first two speak strongly to climate change and Ecosystem-based Adaptation:

i) conservation and effective management of biodiversity contributes to a resilient and inclusive Western Cape economy;
ii) partner sectors contribute to achieving biodiversity conservation targets through mainstreaming biodiversity into policies, strategies, plans, practices and projects.

The PBSAP therefore aims to protect the diversity of ecosystems, habitats, populations, species and genetic diversity. There are several indicators that are monitored and used to report progress on implementation of the PBSAP annually. One of the key indicators in the PBSAP speaks of the need for an Ecological Infrastructure Investment Framework (EIIF).

The EIIF is a framework to guide decision makers from both the public and private sector in making choices around where – and how – to invest in order to promote the resilience of the Western Cape's ecological infrastructure. The process to develop the framework was initiated in 2019 and has a strong focus on fostering a multi-sectoral and multi-stakeholder approach to managing ecological infrastructure in the province. The framework provides a point of departure for further exploration and planning by investors in the context relevant to their proposal (e.g. time, spatial and institutional context of the investor, as well as the proposed investment). Implementation of the EIIF serves to present a "low to no risk" resilience strategy with significant co-benefits to ecosystems, people and the economy of the Western Cape. The Framework also identifies sustainable finance mechanisms to fund activities such as clearing of alien invasive vegetation species, rehabilitation of wetlands and catchment systems all of which contribute towards reducing the vulnerability of Western Cape to environmental shocks such as droughts, fires and floods and thus increasing the Western Cape's natural systems, resilience to climate change impacts.

10.5.4. Wetland rehabilitation

The EIIF initiative advocates, *inter alia*, investing in maintaining and restoring ecosystem services such as those provided by wetlands. In the Western Cape wetland rehabilitation is often done by the Working for Wetlands programme. Table 27 gives an indication of how many wetlands were rehabilitated in the Western Cape over the last four financial years by this programme[216].The budget allocated for wetland rehabilitation works in 3-year cycles and the decrease experienced in the 2018/2019 could be attributed towards beginning of a new 3-year cycle of contracts that needed to be signed resulting in not all projects being operational. The Working for Wetlands programme has been implemented with support from other government departments such as the Department of Agriculture through the LandCare Programme; and in 2019 the Western Cape Government also actively participated in rehabilitation of wetlands in the Cape Winelands District Municipality.

215 The Provincial Biodiversity Strategy and Action Plan: 2015 to 2025.
216 It should be noted that there are other programmes that focus on wetlands in the Western Cape; in this case Working for Wetlands numbers are readily available.

Table 27. Number of wetlands rehabilitated in the Western Cape, 2013 – 2019[217]

Year	Number of wetlands rehabilitated
2013/14	20
2014/15	29
2015/16	25
2016/17	32
2017/18	34
2018/19	15

10.5.5. Collaborative governance for climate resilience

The Greater Cape Town Water Fund was launched in 2019 with a focus of bringing together private and public-sector stakeholders – alongside local communities – around the common goal of promoting restoration of the surface water catchments and aquifers that supply water to Cape Town. In addition, the water fund will stimulate funding and implementation of catchment restoration efforts and, in the process, create jobs and momentum to protect globally important biodiversity while also building more resilient communities in the face of climate change.

Climate change responses that relate to improving the ability of biodiversity and EGS to lend our society the resilience to respond to climate change have been quite well addressed in the Western Cape to date. What needs further maturing is the use of ecosystems and biodiversity as buffers and in providing resilience to built infrastructure, towns, settlements, agriculture and key resources (water, food, energy, transport etc.) while also continuously enhancing coordination efforts in managing biodiversity and ecosystem goods and services in the province.

10.6. Opportunities, Gaps and Recommendations

- Better data sharing is needed between government entities such as DEA&DP, SANBI and CapeNature, as well as between government and the private sector, to facilitate the tracking of biodiversity and EGS-related indicators.
- Due to the wide range of stakeholders and entities involved in alien clearing, finding comprehensive information on the numbers/hectares of aliens cleared is problematic. (Alien invasive vegetation is covered in this report under the water chapter).
- Informally protected areas are hard to track, as the data is often patchy or outdated.
- There is a need to set fact-based climate change targets for this focus area.
- The data indicates that only very small areas of the climate change corridors are protected – there is therefore a big need to expand the conservation estate within these corridors.
- Local community stewardship over corridors and unprotected areas should be promoted.

[217] H. Nieuwoudt, SANBI, pers. Communication.

11. Coastal and Estuary Management

Through its natural resource value, the coastline of the Western Cape is closely linked to the economic prosperity of the province. The climatic changes projected for the province are, however, likely to increase the vulnerability of the coastline itself, in terms of coastal erosion and ecosystem health, but also of the people within the coastal zone in the form of impacts on livelihoods dependent on coastal resources.

The current WCCCRS priority areas for preserving coastal specific biodiversity and ecosystem goods and services in the Western Cape in a changing climate include:

1. Establishment of coastal risk overlays and coastal management lines;
2. Researching best practice regarding responding to repeated coastal inundation in high risk areas;
3. Protecting and rehabilitating existing dune fields as coastal buffers / ecological infrastructure;
4. Monitor possible linkages between climate change and the fisheries industry;
5. Ensuring Estuary Management Plans take cognisance of climate change

11.1. Headline Climate Change Response Indicators

Table 28. Coastal & Estuary Management Indicators for the WCCCRS

High level category	Indicator	State	2015/16	2017/18	2019/20
Coastal Management	Coastal municipalities using coastal management lines and coastal risk overlays in development planning	% of coastline with coastal management lines determined	64%	100%	100%
		% of coastline with coastal risk overlays determined	64%	100%	100%
		% of coastline with coastal management lines and coastal risk overlays endorsed by MEC	0%	0%	0%
		% of coastline with coastal Management lines and coastal risk overlays incorporated into municipal zoning schemes	0%	0%	10% (Overstrand)
Estuary Management	Number of Estuary Management Plans (EMPs) that adequately include climate change (CC) risks and responses	CC not mentioned at all	3	New and revised EMPs being compiled for the main estuaries in the province	N/A
		CC mentioned briefly	4		N/A
		Potential impacts of CC on estuary discussed	5		33 estuaries
		Management actions in response to CC identified (excluding research and monitoring)	4		33 estuaries

Table 29. Additional High-Level Coastal & Estuary Indicators

High level category	Indicator	State (NBA 2018 category)	2015/6 NBA 2011[218]	2017/18 State of Biodiversity 2017[219]	2019/20 NBA 2018[220]
Estuary Management	State of estuaries (Present Ecological State)	Natural / Near Natural (A-B)	41%	39%	37%
		Moderately Modified (C)	20%	23%	22%
		Heavily Modified (D)	19%	22%	22%
		Severely to Critically Modified (E-F)	20%	16%	19%
Coastal Management	% of Western Cape coastline protected by Marine Protected Areas (MPAs)		21.2%	21.2%	21.2% 9 offshore MPAs were declared off the Western Cape coastline

11.2. Climate Change and the Coast

Climate change will increase the likelihood of disasters in coastal areas, directly due to rising sea levels and increasing temperatures (land and sea), but also indirectly in terms of increased social, economic and ecological vulnerabilities.

According to the 2014 National Coastal Management Programme (NCMP) and the 2018 Western Cape State of the Coast report[221], climate change results in environmental changes in the coastal zone such as:

- Changes in ocean circulation patterns;
- Sea level rise and increased storminess;
- Changes in temperatures from both the land and sea;
- Changes in precipitation and runoff;
- Changes in pH (referred to as ocean acidification; and
- Changes in wind regimes.

[218] Van Niekerk, L. and Turpie, J.K. (eds) 2012. South African National Biodiversity Assessment 2011: Technical Report. Volume 3: Estuary Component. CSIR Report Number CSIR/NRE/ECOS/ER/2011/0045/B. Council for Scientific and Industrial Research, Stellenbosch.
[219] Van Niekerk, L. (2017). Estuaries. In: Turner, A.A. (ed.) Western Cape State of Biodiversity 2017. CapeNature Scientific Services, Stellenbosch, ISBN: 978-0-621-45962-3.
[220] Van Niekerk, L., Adams, J.B., Lamberth, S.J., MacKay, C.F., Taljaard, S., Turpie, J.K., Weerts S.P. & Raimondo, D.C. (2019) (eds). South African National Biodiversity Assessment 2018: Technical Report. Volume 3: Estuarine Realm. CSIR report number CSIR/SPLA/EM/EXP/2019/0062/A. South African National Biodiversity Institute, Pretoria. Report Number: SANBI/NAT/NBA2018/2019/Vol3/A. http://hdl.handle.net/20.500.12143/6373 (Unproofed version)
[221][221] DEA&DP (2018). State of the Coast Western Cape: A Review of the State of the Coastal Zone in the Western Cape. Western Cape Department of Environmental Affairs and Development Planning.

The above-mentioned changes are likely to translate into economic losses; for example, Cartwright (2008)[222] estimated that storm surges enhanced by sea level rise could cost the City of Cape Town between R5 billion to R20 billion in the next 25 years. Similarly, the LTAS study by the erstwhile DEA estimated the associated loss of property and tourism for the entire country by 2100 to be between R211,5 billion and R385.5 billion (in 2010 prices)[223].

It is therefore important that climate change, and particularly the above-mentioned effects, be integrated into ocean and coastal spatial planning. As part of this, the Department of Environment, Forestry and Fisheries is working on defining conditions of use for the coastal zone, which includes a national coastal risk and vulnerability assessment. These conditions of use will provide guidance for mitigation and adaptation to climate change in the coastal zone (DEA: Oceans and coasts, in progress)[224].

The NCMP identified nine key priorities for coastal management in South Africa, of which priority one is "*Effective planning for coastal vulnerability to global change (including climate change)*". The programme also indicated that national government was in the process of preparing a coastal hazard zone index and demarcate coastal hazard zones (including impacts from climate change) by March 2015. This has not been concluded.

The WCG is responding to the need for responsible coastal and estuary management in several ways.

The 2016 **Western Cape Coastal Management Programme** (CMP) replaced the 2004 Western Cape Coastal Management Plan. Along with guiding coastal management in the Western Cape, the CMP focuses on growing the blue and green economies[225] through unlocking the economic potential of our coastal assets. It will contribute directly to enabling a resilient, sustainable, quality and inclusive living environment through improved coastal spatial and development planning, access, protection and Local Government support.

Of the nine Priority Areas of the CMP, Priority Area 4 focusses on "*climate change, dynamic coastal processes and building resilient communities*", with the goal of promoting resilience to the effects of dynamic coastal processes, environmental hazards and natural disasters. Some of the outputs of this priority area include a coastal vulnerability analysis for the Western Cape, a Western Cape Coastal Regional Plan (with responses to increase coastal resilience), and a Provincial Coastal Protocol for assessment and response for coastal vulnerability, risk and damage.

The Programme also has a priority area dedicated to Estuary Management. This focusses on the requirements of the National Estuarine Management Protocol (NEMP), with the goal of co-ordinating and integrating estuarine management to optimise the ecological, social and economic value of these systems on an equitable and sustainable basis. It finds application in the form of the Provincial Estuarine Management Framework and Implementation Strategy which in turn forms part of a dedicated Provincial Estuarine Management Programme. As per

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[222] Cartwright, A., Brundrit, G. B. and Fairhurst, L. (2008). Global climate change and adaptation – A sea-level rise risk assessment. Phase four: Adaptation and risk mitigation measures for the City of Cape Town. Prepared for the City of Cape Town by LaquaR Consultants CC, 42 pp.

[223] DEA (Department of Environmental Affairs), 2013. Long-Term Adaptation Scenarios Flagship Research Programme (LTAS) for South Africa: Summary for Policy-Makers. Online: https://www.environment.gov.za/sites/default/files/docs/summary_policymakers_bookV3.pdf

[224] National Coastal Management Programme (2014).

[225] The 'blue economy' is a term in economics relating to the exploitation and preservation of the marine environment, whereas the 'green economy' is defined as low carbon, resource efficient and socially inclusive economic activities.

the NEMP, climate change is a mandatory consideration during the compilation of Estuarine Management Plans.

Adoption of Estuary Management Plans by the Responsible Management Authorities for all major estuaries is underway, and implementation of priority actions is currently being undertaken in a number of estuaries. Floodline determinations have been undertaken for the Breede and Keurbooms-Bitou estuaries and are currently underway for the Great Brak and Little/Klein Brak estuaries. These floodline projects have included climate change aspects as part of the methodology and have determined "current" and "future" floodlines. The aim of these floodline determinations is to ensure that development is not placed in areas where inundation is likely.

11.3. State of the Coast

The provincial SOEORs published in 2013 and 2018 each includes a chapter on oceans and coasts. In these reports, the Province tracks the state of the ocean and coastal areas using key indicators. Both the 2013 and 2018 reports concluded that the quality of South Africa's oceans and coasts are declining due to environmental impacts and that access to information and data around coastal indicators is imperative for effectively addressing this decline.

In 2018, the Western Cape Government launched the first State of the Coast Report (SoCR)[226]. The report describes the condition of the biophysical, socio-economic and institutional issues as they relate to the coastal zone. As the first in the series, the 2018 SoCR serves as a baseline which will be used in assessing changes to the coast over time; some of which will be attributed to the impacts of prevailing and projected climate change manifestations on the coastline.

Climate change is recognised as a pressure on coastal systems, driving biome shifts and related effects on species population numbers and distribution, and affecting the natural balance and functioning of typically highly sensitive coastal ecosystems. The effects of these shifts on the coast are yet to be quantified, but will include:

- Change in ecological balance due to differences in species resilience
- Impacts from changed and unpredictable freshwater flow regimes
- Temperature and desiccation related die-offs
- Coastal erosion and dune destabilisation

General loss of natural habitat and species, especially in critical biodiversity and ecological support areas, affects the delivery of ecosystem services and compromises the coastal environment's resilience to climate change. This contributes to a 'Declining' outlook for coastal biodiversity and 'High Concern' outlook for coastal resource use. Estuarine systems are considered to be of 'High Concern', due to the expected pressures of altered runoff regimes (lower runoff total but higher intensities) and the threat of coastal erosion and flooding that increases the risk to human settlements around estuaries.

In terms of coastal vulnerability, the SoCR indicates an 'Improving' outlook, mostly due to improved responses, although the assessment is severely constrained by data availability. There are improvements recorded in terms of coastal risk management and Disaster Risk Management budgets, but it is not clear whether implementation of development management responses is keeping up with changes in environmental parameters such as sea level rise, biome shifts etc.

[226][226] DEA&DP (2018). State of the Coast Western Cape: A Review of the State of the Coastal Zone in the Western Cape. Western Cape Department of Environmental Affairs and Development Planning.

Figure 20 indicates the number of the extreme weather occurrences in the Western Cape recorded from 2013 until 2018, as reported on in the SoCR. The figure indicates that the most commonly reported extreme weather event is reduced visibility due to misty conditions around the province (although this is not only for coastal areas). It is also interesting to note that the number of recorded swells over 4 m has shown an increase over the 2013/2014 to 2017/2018 period. If this trend continues, there will be an increased risk to infrastructure located close to the shoreline.

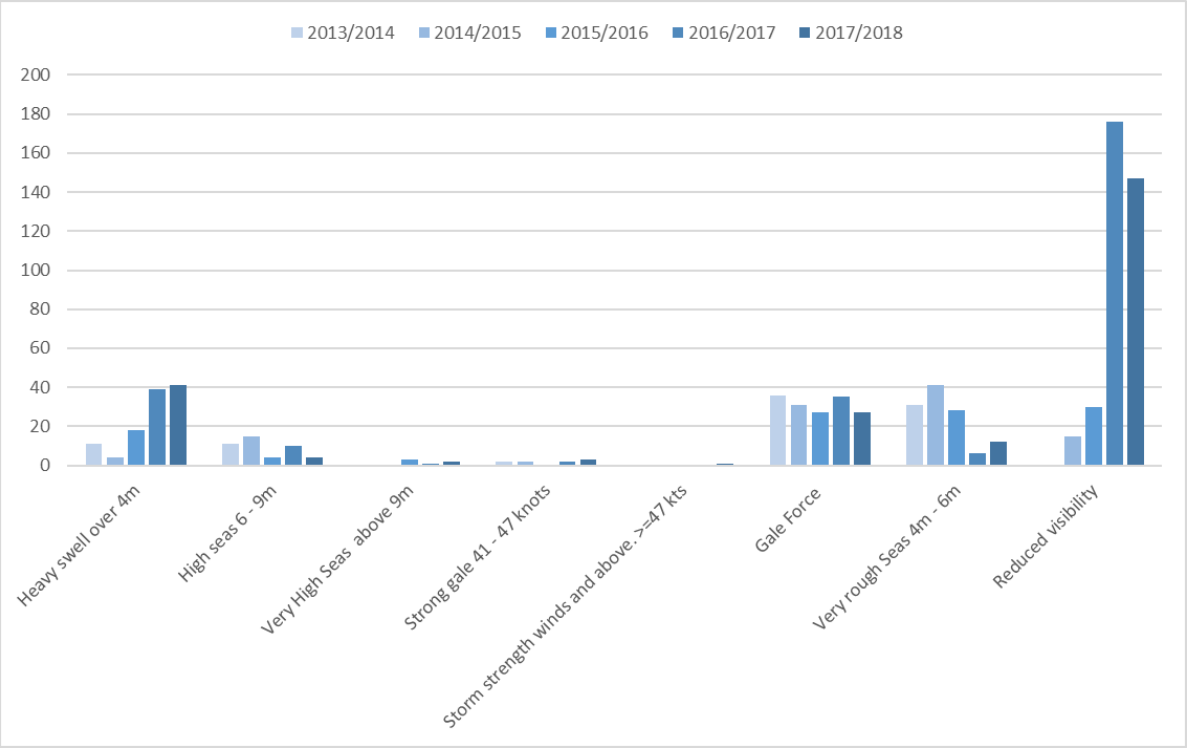

Figure 20: Number of extreme weather events in the Western Cape 2013-2018 (Source: WeatherSA)

11.4. State of Estuaries

Although climate change is not often mentioned as a direct threat to estuaries, there are in fact many climate change impacts which may affect estuaries significantly. These include reduced/increased freshwater inflow, sea level rise, increased/reduced storm frequency and decreased rainfall. These changes may result in reductions in estuarine nursery habitat, or cause changes in how often mouths open. Longer periods of drought and intense flooding events will also affect salinity levels and ecological functioning of estuaries.

As healthy estuaries are more resilient to the effects of climate change, the state of estuaries is considered to be an important indicator that we can use to track our climate change adaptation response. The most consistent data on the state of estuaries are found in the National Biodiversity Assessment conducted periodically by SANBI. The 2011[227] and 2018[228]

[227] Van Niekerk, L. and Turpie, J.K. (eds) 2012. South African National Biodiversity Assessment 2011: Technical Report. Volume 3: Estuary Component. CSIR Report Number CSIR/NRE/ECOS/ER/2011/0045/B. Council for Scientific and Industrial Research, Stellenbosch.

[228] Van Niekerk, L., Adams, J.B., Lamberth, S.J., MacKay, C.F., Taljaard, S., Turpie, J.K., Weerts S.P. & Raimondo, D.C. (2019) (eds). South African National Biodiversity Assessment 2018: Technical Report. Volume 3: Estuarine Realm. CSIR report number CSIR/SPLA/EM/EXP/2019/0062/A. South African National Biodiversity Institute, Pretoria. Report Number: SANBI/NAT/NBA2018/2019/Vol3/A. http://hdl.handle.net/20.500.12143/6373 (Unproofed version)

editions both categorised estuaries in terms of their Present Ecological State (PES), which makes it possible to compare the systems over time. An additional, similar assessment is found in the 2017 Western Cape State of Biodiversity Report[229]. A comparison of the outcomes of the three assessments is provided in Figure 21. Although there is improvement in the percentage of estuaries in the lowest category (critically modified), there is also a decline in the percentage of estuaries considered as being in an excellent condition (natural or near natural).

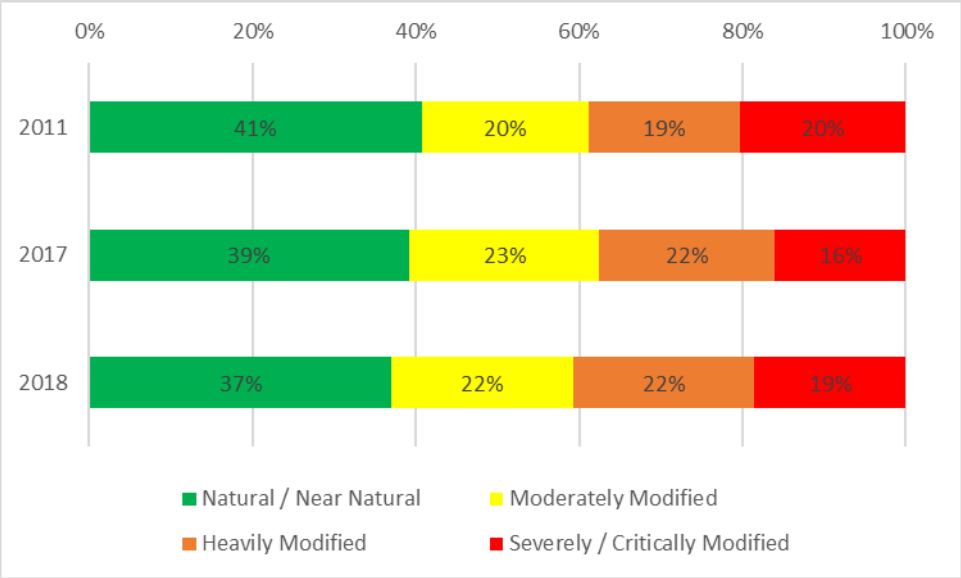

Figure 21. Percentage of the Western Cape estuaries classified under the various ecological rating categories (NBA 2011, WC SoB 2017 and NBA 2018).

Of the 56 estuaries in the province, one estuary has an approved Estuarine Management Plan (EMP), and 32 currently have draft EMPs that are awaiting final approval (these are being implemented in the interim). The new or revised EMPs were developed as part of the Provincial Estuarine Management Framework and Implementation Strategy project that ran from 2015 to 2019, and cover most major estuaries in the province except for Langebaan lagoon. Langebaan is a particularly complex system, uniquely classified in the 2018 NBA as an estuarine lagoon. As Responsible Management Authority, SANParks will need to develop the Langebaan EMP as per the NEMP.

Whereas a review[230] by the erstwhile DEA found that most of the pre-2014 EMPs did not address climate change or sea level rise, the current set of EMPs explicitly considers the effects of climate change in the estuarine condition assessments and management plans.

In addition to the EMPs, mouth management plans have been compiled for 10 estuaries, detailing the considerations for potential artificial manipulation of estuary mouths. Floodline modelling have also been conducted for the Breede and Keurbooms-Bitou river estuaries, and is currently underway for the Great Brak and Little/Klein Brak estuaries, further informing risk-averse development planning in the estuaries.

[229] Van Niekerk, L. (2017). Estuaries. In: Turner, A.A. (ed.) Western Cape State of Biodiversity 2017. CapeNature Scientific Services, Stellenbosch, ISBN: 978-0-621-45962-3.
[230] Department of Environmental Affairs (2014) National Estuarine Management Protocol. Review of Existing Estuarine Management Plans 2007-2014. Cape Town.

11.5. Sea Level Rise, Storm Surges and Coastal Flooding

The coast is inherently vulnerable to storm surges and heavy rainfall events, and this risk will escalate as sea levels rise. Low-lying coastal development, in particular, is at risk. The impacts have been evident in locations where coastal erosion is present, such as around the City of Cape Town. In the last few years, some coastal businesses and infrastructure have been inundated on a regular basis, causing repeated damage and necessitating coastal defence works[231]. High intensity storms and high water events also have the potential to impact on estuarine, inshore and offshore fisheries[232].

The City of Cape Town is in the process of setting up a monitoring programme to track what combinations of environmental conditions lead to damage to infrastructure (such as swell direction and height, wind speed and direction, etc.). This should in future give an indication of which climate change related factors have the potential to threaten critical infrastructure.

Response to the risks emanating from climatic factors – specifically sea level rise and the associated coastal erosion and inundation, as well as changed estuarine dynamics – requires careful management of coastal development and a focus on maintaining the resilience of coastal ecosystems. Current response programmes include the formalisation of coastal management lines and coastal risk overlays (see section below) and the inclusion of climate risks in Disaster Risk Management plans. There is active engagement between the Provincial Disaster Management Centre (PDMC) and officials from the DEA&DP Chief Directorates for Environmental Sustainability, Development Planning and Environmental Quality on the matter of climate vulnerability.

At municipal level there is evidence of a balance being struck between coastal defences and development retreat. By way of example, the City of Cape Town is rehabilitating a minor portion of the heavily eroded Fisherman's Lane at the Strandfontein Pavilion node, as part of an overall plan to relocate some of the facilities to behind the foredune. The City is currently in the final phases of an engineering assessment to test the pragmatism, financial feasibility and political appetite for a 'retreat' vs 'hold the line' approach at a test location along the City's coastline. Another example of managed retreat is the Suiderkruis parking area in Grootbrak, where the existing beach parking is being moved inland so that the dune buffer can be reinstated.

In many instances though, municipal finances are too limited to protect or repair coastal infrastructure and facilities, and a *de facto* 'retreat' approach is adopted. In Struisbaai, for example, a decision was taken to abandon attempts at protecting the beachfront restaurant, and rather remove the sea-battered structure completely. Such approaches are typical where low value properties such as caravan and camping areas are exposed to erosive forces – such as at Leentjiesklip in Langebaan.

The City of Cape Town relies on stakeholder involvement to find universally acceptable resolutions for erosion-related issues along the coastline. In this regard the City has established the Milnerton Coastal Erosion Response Forum with the idea to meet with ratepayers and promote a 'co-governance' approach to the issues along the Milnerton coastline. The Forum is tasked with the formulation of a Milnerton Coastal Erosion Response Protocol.

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[231] https://www.timeslive.co.za/news/south-africa/2019-08-30-rising-sea-levels-are-causing-problems-for-cape-town/
[232] Department of Environmental Affairs. 2013. Long-Term Adaptation Scenarios Flagship Research Programme (LTAS) for South Africa. Summary for Policy-Makers. Pretoria, South Africa.

11.6. Coastal Management Lines and Coastal Risk Overlays

Between 2011 and 2017, the WCG commissioned a series of studies to determine coastal setback / management lines (CMLs) for all District Municipalities in the Western Cape, based on sea level rise and erosion risk assessments. Combined, these studies offer an overview of sea level rise science and literature for South Africa and the Western Cape, a sea level rise and flood inundation Geographic Information System (GIS) model for the coastline, as well as a sea level rise and flooding hazard risk assessment for the Districts of the Western Cape.

The DEA&DP studies to determine coastal setback / management were driven by the need to align coastal development planning with coastal risks and hazards. As of 2017, all coastal Districts (14 Local Municipalities) have had coastal management lines and associated coastal risk overlays determined, and since 2008 the City of Cape Town has delineated similar lines and zones to form part of their by-law scheme. For the Districts, the demarcation of coastal risk includes modelling of 20, 50 and 100 year erosion projections for sandy shores and wave overtopping and inundation risk on rocky shores. The risk analysis by the City of Cape Town focussed on certain risk (inundation by surging seas) scenarios.

So far none of these have been adopted by the MEC: Local Government, Environmental Affairs and Development Planning; however, the process for adoption has been initiated, commencing with the City of Cape Town. Until the coastal management lines and coastal risk overlays have been adopted the municipalities may use them to inform their development decisions, but they are not necessarily compelled to do so. DEA&DP is embarking on a 3 year process of assisting municipalities in incorporating CMLs and risk overlays into municipal zoning schemes, to ensure that the CML provisions can be implemented once endorsed by the MEC.

The formalising of the coastal management lines for the City of Cape town forms an integral part of the process of adopting a Coastal By-law in the City. This by-law is currently undergoing Public Participation and should be completed in the first half of 2020. Provisions within the by-law address sea level rise and storm surge induced coastal pressures.

Ultimately, the City of Cape Town Coastal Management Policy will need to be revised to enable the City to enforce conditions of development and address liability issues in areas of known coastal risk. This process has commenced, but is yet to proceed to public involvement.

11.7. Protecting and Rehabilitating Existing Dune Fields as Coastal Buffers / Ecological Infrastructure

In a number of areas along the coast, potentially unstable dune areas represent an ecological buffer along the shoreline. These areas protect the coast, and coastal developments, from wind, erosion, extreme storm action and wind-blown sand. Destabilisation of these dune fields is possible through inappropriate human activities or due to changing climatic conditions. Destabilisation will mean mobilisation of the sand currently being held fast by vegetation, and the loss of the barrier function.

Dune fields are typically identified in spatial biodiversity planning as sensitive coastal vegetation, worthy of protection. The recognised sensitivity and ecological value should therefore be protected through adherence to biodiversity plans and the risk assessments conducted as part of the Coastal Management Lines planning.

Dune rehabilitation work is taking place in Stilbaai and Witsand in Hessequa municipality, at Twee Kuilen beach in Mossel Bay, as well as in Langebaan on the West Coast. In the City of Cape Town, numerous ecosystem-based adaptation projects are present along the coastline - notably dune restoration in Hout Bay, Felur Park, Kommetjie and Table View. The City is also

looking at feasible public-private sector financial models in partnership with the C40 Cities group[233] for coastal adaptation projects.

11.8. Marine Protected Areas

Both the Western Cape Protected Area Expansion Strategy (PAES 2016) and the WC CMP support the expansion of Marine Protected Areas (MPAs) in the Western Cape as part of Operation Phakisa[234], with the expansion and effective management of a system of coastal protected areas being one of the goals of Priority Area 6 (*Natural and cultural resource management*) of the WC CMP.

As of 2015, 369 km (or 21.2%) of the Western Cape's 1 742 km coastline is protected by MPAs. This includes the coastlines of islands that fall within MPAs, but excludes some Marine Nature Reserves that still need to be added[235]. 22 additional MPAs were proclaimed by the National Minister responsible for environmental affairs in 2019; however, the nine located off the Western Cape coastline are offshore, except for Robben Island MPA which surrounds an inshore island.

An area of emerging interest is the fisheries sector, as climate change is likely to affect the productivity and diversity of South Africa's fisheries. Anecdotal evidence points to stronger wind and warmer waters as having detrimental impacts on fishing livelihoods[236]. Already rendered marginal due to overfishing, small-scale fisheries are likely to become increasingly vulnerable.

Increased pressure on estuarine health is likely to further affect fish populations, as many marine fish depend on estuaries for at least part of their life cycle. The inability of estuaries to function normally, due to impacts such as reduced freshwater inflow, altered breaching regimes or increased water temperatures will have serious impacts on fish recruitment as well as on marine and coastal tourism.

11.9. Opportunities, Gaps and Recommendations

- Case studies and cost benefit analyses on optimal approaches to coastal protection should be developed for the Western Cape.
- Fact-based climate change targets for this Focus Area need to be set out.
- A better understanding of the fisheries sector, and the impact of climate change on this sector in the Western Cape is required.
- There are sometimes issues around how regularly datasets are updated – e.g. the fact that the state of estuaries will only be updated every 7 years means that new data will only be available with every third climate change response monitoring report.
- Monitoring standards need to be implemented for estuaries, possibly through the incorporation of a monitoring and evaluation component in all EMPs. Thus, the state of each estuary should be monitored on a regular basis.
- Use of new technologies for coastal monitoring.

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[233] C40 is a network of the world's megacities committed to addressing climate change. C40 supports cities to collaborate effectively, share knowledge and drive meaningful, measurable and sustainable action on climate change. See https://www.c40.org/about

[234] Operation Phakisa is an initiative of the South African government designed to fast track the implementation of solutions on critical development issues, including the marine and coastal economies. https://www.operationphakisa.gov.za/pages/home.aspx

[235] H.F. Verwoerd Marine Reserve (Betty's Bay), Millers Point Nature Reserve (Simon's Town), Knysna National Lake Area and marine reserves that for part of national parks (West Coast National Park, Wilderness National Park and Tsitsikamma National Park).

[236] https://www.wwf.org.za/our_news/blog/theres_no_catch__its_climate_change_.cfm

12. Healthy Communities

The current WCCCRS covers the following in this focus area of Healthy Communities:

1. Monitoring health trends in relation to climate trends, including the linkages between human health and climate change in the Western Cape context.

[Infrastructure and energy efficiency in public buildings, which includes hospitals and clinics is covered under the Energy section]

There is currently no specific indicator for tracking climate change and health research in the Western Cape context, because the area of research is particularly new, and because, until recently, there has yet to be a concerted effort to analyse the broader research that might be underway. In 2017 the WCG Climate Change Directorate put out a call through CHEC to have a literature review conducted of climate change impacts on health in the Western Cape. Findings indicate that a key concern is climate change will increase the current burden of disease. There are however still many unknowns, and suggested areas of research include: mental health, urban health, allergies and respiratory health, water and food-borne diseases, injuries, infectious disease, chronic disease, malnutrition, reproductive health and cancer (specifically related to sun and air pollution).

Box 11. The Global Picture

Summary taken from the 2019 report of the Lancet Countdown on Health and Climate Change - Ensuring the Health of a Child Born Today is not Defined by a Changing Climate[237]

A child born today will experience a world that is more than four degrees warmer than the pre-industrial average, with climate change impacting human health from infancy and adolescence to adulthood and old age. Across the world, children are among the worst affected by climate change. Downward trends in global yield potential for all major crops tracked since 1960 threaten food production and food security, with infants often the worst affected by the potentially permanent effects of undernutrition. Children are among the most susceptible to diarrhoeal disease. Since an early 1980s baseline, the number of days suitable for Vibrio[238] has doubled, and global suitability for coastal Vibrio cholerae has increased by 9.9%. Through adolescence and beyond, air pollution—principally driven by fossil fuels, and exacerbated by climate change—damages the heart, lungs, and every other vital organ. These effects accumulate over time, and into adulthood, with global deaths attributable to ambient fine particulate matter (PM2·5) remaining at 2.9 million in 2016 and total global air pollution deaths reaching 7 million.

Later in life, families and livelihoods are put at risk from increases in the frequency and severity of extreme weather conditions, with women among the most vulnerable across a range of social and cultural contexts. Globally, 77% of countries experienced an increase in daily population exposure to wildfires from 2001–14 to 2015–18.

Temperature rise and heatwaves are increasingly limiting the labour capacity of various populations. In 2018, 133·6 billion potential work hours were lost globally, 45 billion more than the 2000 baseline, and southern areas of the USA lost 15–20% of potential daylight work hours during the hottest month of 2018. Populations aged 65 years and older are particularly vulnerable to the health effects of climate change, and especially to extremes of heat. From 1990 to 2018, populations in every region have become more vulnerable to heat and heatwaves, with Europe and the Eastern Mediterranean remaining the most vulnerable (indicator 1.1.1). In 2018, these vulnerable populations experienced 220 million heatwave exposures globally, breaking the previous record of 209 million set in 2015 (indicator 1.1.3).

A business as usual trajectory will result in a fundamentally altered world, with the indicators described providing a glimpse of the implications of this pathway. The life of every child born today will be

[237] https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(19)32596-6/fulltext
[238] A pathogen responsible for part of the burden of diarrhoeal disease

profoundly affected by climate change. Without accelerated intervention, this new era will come to define the health of people at every stage of their lives.

Table 30. Health Indicators for the WCCCRS

High level category	Indicator	2015/16	2017/18	2019/20
Provincial hospitals uptake of greening	Number of provincial hospitals that have joined the Global Green and Healthy Hospitals Network (GGHHN)	2015: 6 (out of 52)	2018: 8[239]	2020: 10[240]

Table 31. Additional High-Level Health Indicators

High level category	Indicator	2012	2015/16	2017/18	2019/20
Household Food Security	% households with measure of food insecurity	21.3%[241]	2013: 22.7%[242]	2014: 25.5%[243]	2016[244]: 13.6%[245]
Household Sanitation	% households with access to sanitation	95.6%[241]	2013: 94.8%[242]	2014: 94.6%[243]	2016: 94.2%[246]

12.1. Climate Change and Health

The Health sector is increasingly gaining more prominence in dialogues and research on the impacts of climate change globally. This includes a variety of concerning trends including inter alia: i) the links between climate change and potential outbreaks of diseases such as Ebola Virus Disease (EVD), Zika Virus, and coronavirus disease 2019 (COVID-19) most recently; ii) links potential between decreasing immunity to viruses and fungi[247]; iii) link between climate change and malnutrition; iv) increasing incidence and occurrence of disease such as Cholera related both to changing climate and decline in infrastructure and ability to cope with increasing urban populations; and v) the unknown psychological impacts of climate change on human mental wellbeing – now being termed eco-anxiety and climate-grief.

The Western Cape does have in a number of instances progressive performing health statistics. For example: i) life expectancy at birth is 69 years, 71 years for women and 66 years for men, which is above the figures for the country as a whole[248]; ii) the 2015 infant mortality rate is 23[249]

[239] https://www.greenhospitals.net/members/?lang=en. Date of access: 30 November 2017. [Mitchells Plain Hospital, Khayelitsha Hospital, Valkenberg Hospital, Victoria Hospital, Groote Schuur Hospital, Worcester Hospital, George Hospital, Mowbray Maternity Hospital]
[240] In addition to the 2018 list, Du Noon CHC and Lentegeur Psychiatric Hospital.
[241] Western Cape Government Green Economy Report 2014.
[242] Western Cape Government Green Economy Report 2015.
[243] Western Cape Government Green Economy Report 2016.
[244] The previous data input for this variable was reviewed and updated to reflect the GHS (revised 2017) and comparison with previous publications might not be possible.
[245] Western Cape Government Green Economy Report 2018
[246] Western Cape Government Green Economy Report 2018
[247] https://time.com/5779156/wuhan-coronavirus-climate-change/
[248] Mid-year population estimates 2019, Statistical Release P0302, Statistics South Africa 2019
[249] Western Cape Department of Health, Statistics South Africa data, own calculations

compared to 27 nationally; and iii) the in-facility maternal mortality ratio is 68 as compared to 134 for South Africa[250]. However, the Western Cape does already have large vulnerable communities with a high underlying disease burden (i.e. HIV/AIDS (estimated prevalence of 10% in age 15 -49 years in 2018[251]) and Tuberculosis (the highest in the country with 832[252] cases per 100,000 in 2018). Climate related hazards such as extreme events characterised by floods and high winds, heat waves and cold snaps will result in impacts such as heat stress, an increase in incidence of communicable diseases, and potential range expansion of disease vectors.

The biggest impact is likely to be on the poor, environmental migrants, vulnerable children, the frail and the elderly.

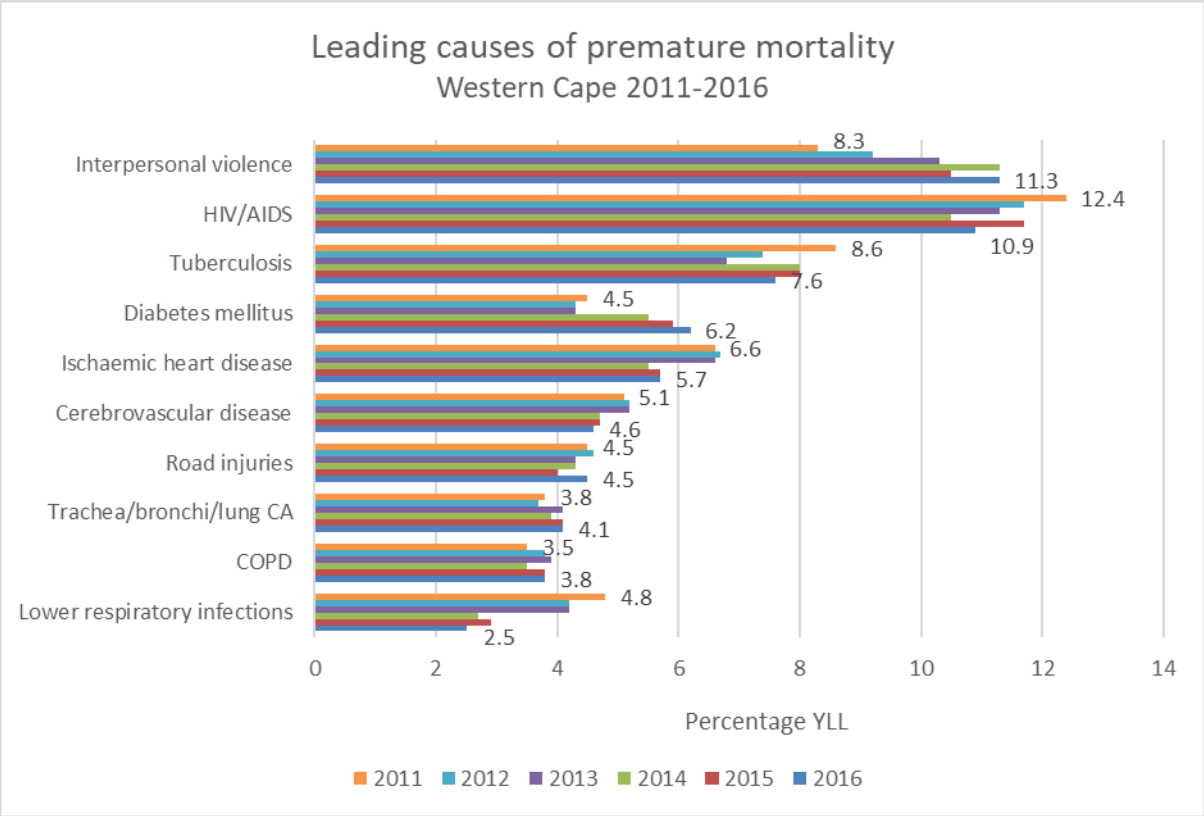

Figure 22. Leading causes of death, measured in years of potential life lost (YLL), for all persons in Western Cape, 2011 – 2016 ranked in order of percent contribution to YLL in 2016 [No update on this graph since the 2016/16 report]

A large contributing factor to increased resilience in health and the ability to cope with climate impacts is related to the underlying vulnerability and state of health services infrastructure, community infrastructure such as clean water and sanitation and access to facilities, health and medical staff. The baseline resilience of the Western Cape is relatively high compared to the rest of South Africa; although with increasing population sizes particularly in lower income groups do result in an ongoing backlog of service delivery. The recent ongoing drought of 2015-2020 indicated that large scale climate related events can and are likely to overcome

[250] Saving Mothers 2014-2016: Seventh triennial report on confidential enquiries into maternal deaths in South Africa, 2018
[251] Thembisa HIV and demographic model, 4.2 (www.thembisa.org)
[252] Western Cape Burden of disease rapid review update 2019, Davies et al (55 946 TB cases in 2018)

general resilience, and create health risks as a result of limited and decreasing water supplies, and associated sanitation levels.

The current focus on health care, emergency health response and preparedness in the Western Cape to climate change risks is still in a research and preparation phase. There is currently a low awareness of impacts of climate change on inter alia: infectious diseases, violence and injury, mental health, chronic diseases, malnutrition, women's and reproductive health, child health, and occupational health. This includes impacts such as heat stress, and extreme events directly on human health and well-being (including psychological impacts). Furthermore, to date there is limited preparation and planning in place to knock-on impacts via specific vector pathways.

In South Africa, there is a National Climate Change and Health Adaptation Plan 2012 -2016 which has started to guide the needs and responses of the health sector. Other key strategic research policy focused initiatives in South Africa have also contributed to the evidence base for health, such as the focus on 'Climate Change and Human Health' in Phase 1 of the national Long Term Adaptation Scenarios. This key piece of work has also identified that monitoring of health trends in relation to climate trends is the critical action required across the country. Within the Western Cape, the HealthCare 2030 Strategy guides the Health sector (See Box 12). There is currently no climate change response plan in place for Health in the Western Cape (this would ideally include specific hazard response plans: such as heatwaves, cold snaps, severe storms, flooding etc.). However, there is a Climate Change Adaptation Plan of Action (CAPA) for the health sector in the City of Cape Town which was drafted in September 2011, following a series of workshops and interviews with key informants across the City[253]. The WCG: Department of Health has recently become a member of the Global Green and Healthy Hospitals Network (GGHHN) and is a signatory to the Kolkata Call to Action[254].

Box 12. The WC HealthCare 2030 Strategy

The health service needs to be in a state of readiness to address the public health consequences of climate change. This will include improved surveillance and disease outbreak management capacity, better disaster management and rescue responsiveness in collaboration with other departments and strengthened emergency services within health.

The department will put in place tools to measure its own contribution to GHG emissions, set targets and implement cost-effective mitigation measures to systematically reduce its GHG contributions. This will include a range of interventions from better infrastructure design to more environmentally friendly operational policies such as the Green Procurement Policy of the WCG. The four focus mitigation areas are currently water usage, electricity consumption, waste management and distances travelled.

The department has created a climate change committee, convened by a senior manager, to systematically start to address both the mitigation and adaptation aspects. Work is currently in its infancy. Disaster preparedness in the department is being systematically supported by the emergency medical services. The committee will also be the liaison point for engaging with other sectors and spheres of government in this regard.

Khayelitsha and Lentegeur hospitals have been identified as flagship projects as part of the Premier's 100% Green campaign. Local initiatives by institutions in the department are being encouraged and the expertise, technical knowledge and research within the Higher Education Institutions (HEIs) are being harnessed by the department.

[253] City of Cape Town, 2011
[254] https://www.wfpha.org/images/events/150216_Kolkata_Call_to_Action_FINAL.pdf

Various coordinating initiatives are underway and in development, for example, there is a National Climate Change & Health Steering Committee. Institutionally the WCG: Department of Health established a Western Cape Climate Change and Health Committee, however in 2018 this stopped being held, its future status remains unclear. It included both internal and external stakeholders and included ongoing guidance and consistent support from the WCG: DEA&DP Climate Change Directorate. The committee focused on both climate change mitigation and adaptation issues related to health, with an increasing focus towards adaptation and resilience. Key collaborations and partnerships are critical for health and climate change, such as enhancing partnerships with national structures, such as the Epidemiology and Surveillance Directorate under the WCG: Health to monitor these trends in the Western Cape.

Whilst the research required on climate change and health impacts in the Western Cape is in its nascent stages, there are some research projects and programmes underway that will continue to provide a sound basis upon which to build our knowledge.

12.2. Opportunities, Gaps and Recommendations

- Develop a Climate Change Response Plan for the Health sector in the Western Cape aligned with the national responses.
- Future iterations of the WCCCRS and Implementation Plan will enhance the health focus, and in synergy with this more sophisticated groups of indicators might be tracked. Indicators may need to be linked across sectors, e.g. days of absenteeism from schools may provide data for diseases, but this will require tight coordination across multiple levels.
- Collaborate across sectors for specific groups of vulnerable people who will be impacted by specific climate change impacts. For example, for occupational health of agriworkers who work outdoors may require specific plans for coping with heat waves, as has been identified in the Agriculture response strategy.
- Co-ordinate integrated plans and health surveillance with the Western Cape Disaster Management Centre.
- Continue to partner with research organisations and entities to undertake critical research and surveillance and monitoring as identified in the Health Climate Change Response Plan. This could include a range of specific interlinked data collection activities at different levels (from clinic to provincial hospital). It should include the development of burden of disease indicators in order to monitor the impact of climate change and should also enhance systems developed to report on the impact of climate related extreme events on health.

ANNEX 1: LIST OF CONTRIBUTING STAKEHOLDERS TO THIS REPORT

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WCG: Economic Development and Tourism	Cabral Wicht
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