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CONTENTS

ACRONYMS X

FOREWORD XIII

CHAPTER 1:
INTRODUCTION 15

CHAPTER 2:
AIR QUALITY MANAGEMENT AND CLIMATE CHANGE: LEGISLATIVE AND POLICY DEVELOPMENTS 23

CHAPTER 3:
DEVELOPING THE 2ND GENERATION AIR QUALITY MANAGEMENT PLAN (AQMP) 39

CHAPTER 4:
OVERVIEW OF THE WESTERN CAPE 43

CHAPTER 5:
GOVERNANCE: AIR QUALITY MANAGEMENT PLANNING 61

CHAPTER 6:
GOVERNANCE: AIR QUALITY OFFICERS FORUMS 69

CHAPTER 7:
AMBIENT AIR QUALITY MONITORING 81

CHAPTER 8:
AIR QUALITY COMPLIANCE AND ENFORCEMENT 139

CHAPTER 9:
EMISSIONS INVENTORIES 151

CHAPTER 10:
GAPS AND RECOMMENDATIONS 171

CHAPTER 11:
REFERENCES 178

LIST OF FIGURES

FIGURE 4-1: LOCALITY MAP DEPICTING THE WESTERN CAPE PROVINCE, INDICATING THE FIVE DISTRICTS AND THE CITY OF CAPE TOWN METROPOLITAN MUNICIPALITY **43**

FIGURE 4-2: WESTERN CAPE PROVINCE POPULATION DISTRIBUTION 2014 (PT, 2015a) **44**

FIGURE 4-3: THE SIX METEOROLOGICAL ZONES IN THE CITY OF CAPE TOWN. THE SHADING DEMONSTRATES THE TERRAIN HEIGHT IN METRES ABOVE SEA LEVEL (DEA&DP, 2009) **46**

FIGURE 4-4: SECTORAL CONTRIBUTION IN THE CITY OF CAPE TOWN (CCT, 2013/2014) . . . **47**

FIGURE 4-5: SECTORAL COMPOSITION OF THE CENTRAL KAROO DISTRICT 2013 (PT, 2015b) **48**

FIGURE 4-6: SECTORAL COMPOSITION OF THE WEST COAST DISTRICT MUNICIPALITY 2013 (PT, 2015b) **49**

FIGURE 4-7: SECTORAL COMPOSITION OF THE EDEN DISTRICT MUNICIPALITY 2013 (PT, 2015b) **50**

FIGURE 4-8: SECTORAL COMPOSITION OF THE CAPE WINELANDS DISTRICT MUNICIPALITY 2013 (PT, 2015b) **51**

FIGURE 4-9: SECTORAL COMPOSITION OF THE OVERBERG DISTRICT MUNICIPALITY 2013 (PT, 2015b). **52**

FIGURE 4-10: CONTRIBUTION BY SECTOR TO THE WESTERN CAPE ECONOMY 2012 (DEA&DP, 2013a) **53**

FIGURE 4-11: ENERGY USE PER DISTRICT (DEA&DP, 2013a) **53**

FIGURE 7-1: LOCATIONS OF THE AMBIENT AIR QUALITY MONITORING STATIONS OPERATED IN THE DEA&DP's AMBIENT AIR QUALITY MONITORING NETWORK **87**

FIGURE 7-2: AERIAL IMAGE OF THE AMBIENT AIR QUALITY MONITORING STATION AT ST. HELENA BAY **88**

FIGURE 7-3: LONG TERM CO_2 MEASUREMENTS AT ST HELENA BAY (2012 – 2015) **89**

FIGURE 7-4: LONG TERM H_2S AT ST. HELENA BAY (2011 – 2015) **89**

FIGURE 7-5: H_2S CONCENTRATION IN RELATION TO WIND DIRECTION AT ST HELENA BAY MONITORING STATION (2013 – 2015) **90**

FIGURE 7-6: ST HELENA BAY WIND ROSE FOR 2014 . . . . . **90**

FIGURE 7-7: ST HELENA BAY WIND ROSE FOR 2015 . . . . . **90**

FIGURE 7-8: AERIAL IMAGE OF THE MALMESBURY AMBIENT AIR QUALITY MONITORING STATION **91**

FIGURE 7-9: LONG TERM O_3 MEASUREMENTS AT MALMESBURY (2010 – 2015) **92**

FIGURE 7-10: LONG TERM NO_2 MEASUREMENTS AT MALMESBURY (2010 – 2015) **92**

FIGURE 7-11: LONG TERM SO_2 MEASUREMENTS AT MALMESBURY (2010 – 2015) **93**

FIGURE 7-12: LONG TERM PM_{10} MEASUREMENTS AT MALMESBURY (2010 – 2015 . . . . . **93**

FIGURE 7-13: LONG TERM CO AT MALMESBURY (2010 – 2015) **94**

FIGURE 7-14: ANNUAL WIND ROSE FOR MALMESBURY 2011 . . . . . **94**

FIGURE 7-15: ANNUAL WIND ROSE FOR MALMESBURY 2012 . . . . . **94**

FIGURE 7-16: ANNUAL WIND ROSE FOR MALMESBURY 2013 . . . . . **95**

FIGURE 7-17: ANNUAL WIND ROSE FOR MALMESBURY 2014 . . . . . **95**

FIGURE 7-18: AERIAL IMAGE OF THE VISSERSHOK AMBIENT AIR QUALITY MONITORING STATION **95**
FIGURE 7-19: LONG TERM CO MEASUREMENTS AT VISSERSHOK (2012 - 2015) **96**
FIGURE 7-20: LONG TERM O_3 MEASUREMENTS AT VISSERSHOK (2012 - 2015) **96**
FIGURE 7-21: LONG TERM NO_2 MEASUREMENTS AT VISSERSHOK (2012 - 2015) **97**
FIGURE 7-22: LONG TERM PM_{10} MEASUREMENTS AT VISSERSHOK (2012 - 2015) **97**
FIGURE 7-23: VISSERSHOK WIND ROSE FOR 2012 . . . . . **98**
FIGURE 7-24: VISSERSHOK WIND ROSE FOR 2013 . . . . . **98**
FIGURE 7-25: VISSERSHOK WIND ROSE FOR 2014 . . . . . **98**
FIGURE 7-26: VISSERSHOK WIND ROSE FOR 2015 . . . . . **98**
FIGURE 7-27: AERIAL IMAGE OF THE KHAYELITSHA AIR QUALITY MONITORING STATION . . . **99**
FIGURE 7-28: LONG TERM DAILY MAXIMUM 8-HR MEAN CO MEASUREMENTS AT KHAYELITSHA (2012 – 2015) **100**
FIGURE 7-29: LONG TERM DAILY MAXIMUM 8-HR O_3 MEASUREMENTS AT KHAYELITSHA (2012 – 2015) **100**
FIGURE 7-30: LONG TERM DAILY MAXIMUM HOURLY MEAN NO_2 MEASUREMENTS AT KHAYELITSHA (2012 – 2015) **101**
FIGURE 7-31: LONG TERM DAILY MEAN SO_2 MEASUREMENTS AT KHAYELITSHA (2012 – 2015) **101**
FIGURE 7-32: LONG TERM MEAN CO_2 MEASUREMENTS AT KHAYELITSHA (2012 – 2015) . . . **102**
FIGURE 7-33: LONG TERM PM_{10} MEASUREMENTS AT KHAYELITSHA (2012 – 2015) **102**
FIGURE 7-34: KHAYELITSHA WIND ROSE FOR 2012 . . . . . **103**
FIGURE 7-35 KHAYELITSHA WIND ROSE FOR 2013 . . . . . **103**
FIGURE 7-36: AERIAL IMAGE OF THE STELLENBOSCH AIR QUALITY MONITORING STATION **103**
FIGURE 7-37: LONG TERM O_3 MEASUREMENTS AT STELLENBOSCH (2011- 2015) **104**
FIGURE 7-38: LONG TERM CO MEASUREMENTS AT STELLENBOSCH (2011 - 2015) **104**
FIGURE 7-39: LONG TERM PM_{10} MEASUREMENTS AT STELLENBOSCH (2011 - 2015) **105**
FIGURE 7-40: LONG TERM DAILY MEAN SO_2 MEASUREMENTS AT STELLENBOSCH (2011 - 2015) **105**
FIGURE 7-41: ANNUAL WIND ROSE FOR STELLENBOSCH 2014 . . . . . **106**
FIGURE 7-42: ANNUAL WIND ROSE FOR STELLENBOSCH 2015 . . . . . **106**
FIGURE 7-43: AERIAL IMAGE OF WORCESTER AMBIENT AIR QUALITY MONITORING STATION **106**
FIGURE 7-44: LONG TERM CO MEASUREMENTS AT WORCESTER (2011 - 2015) **107**
FIGURE 7-45: LONG TERM O_3 MEASUREMENTS AT WORCESTER (2009 - 2015) **107**
FIGURE 7-46: LONG TERM PM_{10} MEASUREMENTS AT WORCESTER (2009 - 2015) **108**
FIGURE 7-47: LONG TERM SO_2 MEASUREMENTS AT WORCESTER (2009 - 2015) **108**
FIGURE 7-48: ANNUAL WIND ROSE FOR WORCESTER 2009 . . . . . **109**
FIGURE 7-49: ANNUAL WIND ROSE FOR WORCESTER 2010 . . . . . **109**
FIGURE 7-50: ANNUAL WIND ROSE FOR WORCESTER 2015 . . . . . **109**
FIGURE 7-51: AERIAL IMAGE OF OUDTSHOORN AMBIENT AIR QUALITY MONITORING STATION **109**

FIGURE 7-52: LONG TERM H_2S MEASUREMENTS AT OUDTSHOORN (2011 - 2015) **110**
FIGURE 7-53: ANNUAL WIND ROSE FOR OUDTSHOORN 2011 . . . . . **110**
FIGURE 7-54: ANNUAL WIND ROSE FOR OUDTSHOORN 2013 . . . . . **110**
FIGURE 7-55: ANNUAL WIND ROSE FOR OUDTSHOORN 2014 . . . . . **111**
FIGURE 7-56: AERIAL IMAGE OF GEORGE AMBIENT AIR QUALITY MONITORING STATION . **111**
FIGURE 7-57: LONG TERM CO MEASUREMENTS AT GEORGE (2010 - 2015) **112**
FIGURE 7-58: LONG TERM O_3 MEASUREMENTS AT GEORGE (2010 - 2015) **112**
FIGURE 7-59: LONG TERM NO_2 MEASUREMENTS AT GEORGE (2010 - 2015) **113**
FIGURE 7-60: LONG TERM SO_2 MEASUREMENTS AT GEORGE (2010 - 2015) **113**
FIGURE 7-61: LONG TERM PM_{10} MEASUREMENTS AT GEORGE (2010 - 2015) **114**
FIGURE 7-62: ANNUAL WIND ROSE FOR GEORGE 2010 . . . . . **114**
FIGURE 7-63: ANNUAL WIND ROSE FOR GEORGE 2011 . . . . . **114**
FIGURE 7-64: ANNUAL WIND ROSE FOR GEORGE 2015 . . . . . **114**
FIGURE 7-65: AERIAL IMAGE OF DANA BAY AMBIENT AIR QUALITY MONITORING STATION **115**
FIGURE 7-66: LONG TERM H_2S MEASUREMENTS AT DANA BAY (2011 - 2015) **115**
FIGURE 7-67: AERIAL IMAGE OF HOUT BAY AMBIENT AIR QUALITY MONITORING STATION **116**
FIGURE 7-68: LONG TERM H_2S MEASUREMENTS AT HOUT BAY (2014 - 2015) **116**
FIGURE 7-69: ANNUAL WIND ROSE FOR HOUT BAY 2014 . . . . . **117**
FIGURE 7-70: ANNUAL WIND ROSE FOR HOUT BAY 2015 . . . . . **117**
FIGURE 7-71: AERIAL IMAGE OF HERMANUS AMBIENT AIR QUALITY STATION **117**
FIGURE 7-72: LONG TERM O_3 MEASUREMENTS FOR HERMANUS (2014 - 2015) **118**
FIGURE 7-73: LONG TERM CO MEASUREMENTS FOR HERMANUS (2014 - 2015) **118**
FIGURE 7-74: ANNUAL WIND ROSE FOR HERMANUS 2014 . . . . . **119**
FIGURE 7-75: ANNUAL WIND ROSE FOR HERMANUS 2015 . . . . . **119**
FIGURE 7-76: AERIAL IMAGE OF SALDANHA BAY MUNICIPAL AIR QUALITY AND DUST MONITORING LOCATIONS **119**
FIGURE 7-77: DAILY MEAN $PM_{2.5}$ MEASUREMENTS AT SALDANHA BAY (2015) **120**
FIGURE 7-78: DAILY MAXIMUM HOURLY NO_2 MEASUREMENTS AT SALDANHA BAY (2015) **121**
FIGURE 7-79: DAILY MAXIMUM 8-HR MEAN O_3 MEASUREMENTS AT SALDANHA BAY (2015) **121**
FIGURE 7-80: DAILY MAXIMUM SO_2 MEASUREMENTS AT SALDANHA BAY (2015) **122**
FIGURE 7-81: DAILY MEAN PM_{10} MEASUREMENTS AT SALDANHA BAY (2015) **122**
FIGURE 7-82: THE CITY OF CAPE TOWN MUNICIPAL AMBIENT AIR QUALITY MONITORING NETWORK **123**
FIGURE 7-83: DAILY MEAN SO_2 MEASUREMENTS FOR BOTHASIG (2011 – 2015) **123**
FIGURE 7-84: DAILY MAXIMUM HOURLY MEAN NO_2 MEASUREMENTS FOR BOTHASIG (2011 – 2015) **125**
FIGURE 7-85: DAILY MEAN PM_{10} MEASUREMENTS FOR THE FORESHORE (2011- 2015) **126**
FIGURE 7-86: DAILY MEAN SO_2 MEASUREMENTS FOR GOODWOOD (2011 – 2015) **127**
FIGURE 7-87: DAILY MEAN NO_2 MEASUREMENTS FOR GOODWOOD (2011 – 2015) **127**
FIGURE 7-88: DAILY MEAN PM_{10} MEASUREMENTS FOR GOODWOOD (2011 – 2015) **128**
FIGURE 7-89: DAILY MEAN NO_2 CONCENTRATIONS FOR KHAYELITSHA (2011 – 2015) **129**

FIGURE 7-90: DAILY MEAN PM_{10} CONCENTRATIONS FOR KHAYELITSHA (2011 – 2015) **129**
FIGURE 7-91: DAILY MEAN SO_2 CONCENTRATIONS FOR TABLEVIEW (2011 – 2015) **130**
FIGURE 7-92: DAILY MEAN NO_2 CONCENTRATIONS FOR TABLEVIEW (2011 – 2015) **130**
FIGURE 7-93: DAILY MEAN PM_{10} CONCENTRATIONS FOR TABLEVIEW (2011 – 2015) **131**
FIGURE 7-94: DAILY MAXIMUM HOURLY MEAN NO_2 CONCENTRATIONS FOR WALLACEDENE (2011 – 2015) **132**
FIGURE 7-95: DAILY MEAN PM_{10} CONCENTRATIONS FOR WALLACEDENE (2011 – 2015) .. **132**
FIGURE 7-96: DAILY MEAN SO_2 CONCENTRATIONS FOR PLATTEKLOOF (2013 – 2015) **133**
FIGURE 7-97: DAILY NO_2 CONCENTRATIONS FOR PLATTEKLOOF (2013 – 2015) **133**
FIGURE 7-98: DAILY MEAN O_3 CONCENTRATIONS FOR PLATTEKLOOF (2014 – 2015) **134**
FIGURE 7-99: DAILY MEAN SO_2 CONCENTRATIONS FOR BELLVILLE-SOUTH (2011 – 2015) .. **134**
FIGURE 7-100: DAILY MEAN PM_{10} CONCENTRATIONS FOR BELLVILLE-SOUTH (2011 – 2015) **135**
FIGURE 7-101: DAILY MEAN NO_2 CONCENTRATIONS FOR CITY HALL (2011 – 2015) **135**
FIGURE 7-102: DAILY MEAN CO CONCENTRATIONS FOR CITY HALL (2011 – 2015) **136**
FIGURE 7-103: DAILY MEAN SO_2 CONCENTRATIONS FOR ATLANTIS (2011 – 2015) **136**
FIGURE 7-104: DAILY MEAN NO_2 MEASUREMENTS FOR ATLANTIS (2011 – 2015) **137**
FIGURE 8-1: TOTAL COMPLAINTS RECEIVED BY THE EDEN DISTRICT (2010 2015) **144**
FIGURE 8-2: TOTAL COMPLAINTS RECEIVED BY THE WEST COAST DISTRICT MUNICIPALITY (2010 – 2015) **145**
FIGURE 8-3: TOTAL COMPLAINTS RECEIVED BY THE CAPE WINELANDS DISTRICT MUNICIPALITY (2010 – 2015) **146**
FIGURE 8-4: TOTAL COMPLAINTS RECEIVED BY THE CENTRAL KAROO DISTRICT MUNICIPALITY (2010 – 2015) **147**
FIGURE 8-5: TOTAL COMPLAINTS RECEIVED BY THE OVERBERG DISTRICT MUNICIPALITY (2010 – 2015) **147**
FIGURE 8-6: TOTAL ANNUAL COMPLAINTS RECEIVED BY THE CITY OF CAPE TOWN (2010 – 2015) **148**
FIGURE 9-1: THE LOCATION OF AIRPORTS AND SEAPORTS IN THE WESTERN CAPE **155**
FIGURE 9-2: AIR QUALITY MODELING POINT SOURCE DOMAINS IN THE WESTERN CAPE . **156**
FIGURE 9-3: PROPOSED MODELING OPTION A **157**
FIGURE 9-4: PROPOSED MODELING OPTION B **157**
FIGURE 9-5: ESTIMATED PM_{10} EMISSIONS PER SECTION 21 LISTED ACTIVITY CATEGORY (%) **160**
FIGURE 9-6: ESTIMATED SO_2 EMISSIONS PER SECTION 21 LISTED ACTIVITY CATEGORY (%) **160**
FIGURE 9-7: ESTIMATED NO_x EMISSIONS PER SECTION 21 LISTED ACTIVITY CATEGORY (%) **160**
FIGURE 9-8: ESTIMATED CO EMISSIONS PER SECTION 21 LISTED ACTIVITY CATEGORY (%) **161**
FIGURE 9-9: ESTIMATED VOC EMISSIONS PER SECTION 21 LISTED ACTIVITY CATEGORY (%) **161**
FIGURE 9-10: ESTIMATED PM_{10} EMISSIONS PER SECTION 21 LISTED ACTIVITY CATEGORY (%) **162**

FIGURE 9-11: ESTIMATED SO_2 EMISSIONS PER SECTION 21 LISTED ACTIVITY CATEGORY (%) **162**
FIGURE 9-12: ESTIMATED NO_x EMISSIONS PER SECTION 21 LISTED ACTIVITY CATEGORY (%) **163**
FIGURE 9-13: ESTIMATED CO EMISSIONS PER SECTION 21 LISTED ACTIVITY CATEGORY (%) **163**
FIGURE 9-14: ESTIMATED VOC EMISSIONS PER SECTION 21 LISTED ACTIVITY CATEGORY (%) **163**
FIGURE 9-15: ESTIMATED PM_{10} EMISSIONS PER SECTION 21 LISTED ACTIVITY CATEGORY (%) **164**
FIGURE 9-16: ESTIMATED SO_2 EMISSIONS PER SECTION 21 LISTED ACTIVITY CATEGORY (%) **164**
FIGURE 9-17: ESTIMATED NO_x EMISSIONS PER SECTION 21 LISTED ACTIVITY CATEGORY (%) **165**
FIGURE 9-18: ESTIMATED CO EMISSIONS PER SECTION 21 LISTED ACTIVITY CATEGORY (%) **165**
FIGURE 9-19: ESTIMATED VOC EMISSIONS PER SECTION 21 LISTED ACTIVITY CATEGORY (%) **165**
FIGURE 9-20: ESTIMATED PM_{10} EMISSIONS PER SECTION 21 LISTED ACTIVITY CATEGORY (%) **166**
FIGURE 9-21: ESTIMATED SO_2 EMISSIONS PER SECTION 21 LISTED ACTIVITY CATEGORY (%) **166**
FIGURE 9-22: ESTIMATED NO_x EMISSIONS PER SECTION 21 LISTED ACTIVITY CATEGORY (%) **167**
FIGURE 9-23: ESTIMATED CO EMISSIONS PER SECTION 21 LISTED ACTIVITY CATEGORY (%) **167**
FIGURE 9-24: ESTIMATED VOC EMISSIONS PER SECTION 21 LISTED ACTIVITY CATEGORY (%) **167**

LIST OF TABLES

TABLE 2-1: LEGISLATIVE REFORM IN TERMS OF THE NEMA **24**

TABLE 2-2: LEGISLATIVE DEVELOPMENTS TOWARDS THE FULL IMPLEMENTATION OF NEM: AQA **25**

TABLE 2-3: REGULATIONS PROMULGATED IN TERMS OF NEM: AQA DURING 2009 -2016 **26**

TABLE 2-4: REGULATORY DEVELOPMENTS IN RESPECT OF CLIMATE CHANGE AND AIR QUALITY MANAGEMENT, PUBLISHED FOR COMMENT IN TERMS OF THE NEM: AQA **28**

TABLE 2-5: LEGISLATIVE AND POLICY DEVELOPMENTS TO ADDRESS CLIMATE CHANGE . **30**

TABLE 3-1A: PHASE 1 PUBLIC PARTICIPATION PROCESS HELD DURING SEPTEMBER 2015 . . **40**

TABLE 3-1B: PHASE 2 PUBLIC PARTICIPATION PROCESS HELD DURING AUGUST 2016 . . . . . **40**

TABLE 5-1: STATUS OF AQMPs AND DESIGNATED AQOs IN THE MUNICIPALITIES OF THE WESTERN CAPE. **63**

TABLE 5-2: THE STATUS OF EDMs AQMP IMPLEMENTATION **65**

TABLE 6-1: AIR QUALITY OFFICER AND NOISE CONTROL FORUMS HELD DURING THE PERIOD 2010 – 2015 . . . . . **70**

TABLE 6-2: LOCATIONS PROPOSED BY THE HRA NEEDS ANALYSIS **73**

TABLE 6-3: LIST OF MUNICIPAL BY-LAWS PROMULGATED, IN RESPECT OF AIR QUALITY MANAGEMENT IN THE WESTERN CAPE **78**

TABLE 7-1: STANDARD AND GUIDELINES FOR POLLUTANTS MONITORED IN THE WESTERN CAPE **82**

TABLE 7-2: NATIONAL STANDARDS FOR DUST FALLOUT (DEA, 2013) **82**

TABLE 7-3: SUMMARY OF THE SOURCES, HEALTH AND ENVIRONMENTAL EFFECTS OF POLLUTANTS (DEA&DP, 2009) **83**

TABLE 7-4: THE AMBIENT AIR QUALITY MONITORING NETWORKS IN THE WESTERN CAPE . **85**

TABLE 7-5: LIST OF PARAMETERS MONITORED AT THE AIR QUALITY MONITORING STATIONS **87**

TABLE 7-6: EDM PASSIVE SAMPLING FOR SO_2, NO_2, H_2S AND BTEX **137**

TABLE 8-1: SUMMARY OF THE AELs AND PAELs ISSUED BY LICENSING AUTHORITIES IN THE WESTERN CAPE DURING 2010 – 2015 . . . . . **140**

TABLE 8-2: NUMBER OF FACILITIES IN THE WESTERN CAPE, AS REGISTERED ON THE NAEIS. **141**

TABLE 8-3: SUMMARY OF THE AEL COMPLIANCE INSPECTION PROGRAMME UNDERTAKENIN THE WESTERN CAPE SINCE 2013 . . . . . **142**

TABLE 8-4: SUMMARY OF INTER-GOVERNMENTAL TASK TEAMS FORMED IN THE WESTERN CAPE **143**

TABLE 9-1: LOCATION OF ALL PORTS IN THE WESTERN CAPE **154**

TABLE 9-2: NUMBER OF SHIPPING VESSELS ENTERING THE PORTS OF CAPE TOWN, MOSSEL BAY AND SALDANHA BAY **154**

TABLE 9-3: ESTIMATED EMISSIONS FROM SECTION 21 LISTED ACTIVITIES IN THE WESTERN CAPE (KG /ANNUM) **159**

TABLE 9-4: ESTIMATED EMISSIONS FROM UNLISTED ACTIVITIES IN THE WESTERN CAPE (KG / ANNUM) **159**

ACRONYMS

ACSA	Airports Company South Africa
AEL	Atmospheric Emission Licence
APPA	Atmospheric Pollution Prevention Act (No. 45 of 1965)
AQMP	Air Quality Management Plan
AQM	Air Quality Management
AQO	Air Quality Officer
AQOF	Air Quality Officer's Forum
CCT	City of Cape Town
CDM	Clean Development Mechanism
CKDM	Central Karoo District Municipality
CH_4	Methane
COP	Conference of the Parties
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CWDM	Cape Winelands District Municipality
D: AQM	Directorate: Air Quality Management
DEROs	Desired Emission Reduction Outcomes
DoE	Department of Energy
DEA	Department of Environmental Affairs
DEA&DP	Department of Environmental Affairs and Development Planning
DM	District Municipality
DNA	Designated National Authority
DTI	Department of Trade and Industry
DoT	Department of Transport
EDM	Eden District Municipality
EIA	Environmental Impact Assessment
EMI	Environmental Management Inspector
GHG	Greenhouse Gas
GN	Government Notice
HRA	Health Risk Assessment
IDP	Integrated Development Plan
IDZ	Industrial Development Zone
IGTT	Inter-Governmental Task Team
IPCC	Inter-Governmental Panel on Climate Change

IRP	Integrated Resource Plan
LM	Local Municipality
MEC	Member of the Executive Council
NAEIS	National Atmospheric Emissions Inventory System
NEMA	National Environmental Management Act (No. 107 of 1998)
NEM: AQA	National Environmental Management: Air Quality Act (No. 39 of 2004)
NEM: AQAA	National Environmental Management: Air Quality Amendment Act
NEM: WA	National Environmental Management: Waste Act, 2008 (No. 59 of 2008)
NERSA	National Energy Regulator of South Africa
N_2O	Nitrous Oxide
NO_2	Nitrogen Dioxide
ODM	Overberg District Municipality
PAEL	Provisional Atmospheric Emission Licence
PERO	Provincial Economic Review and Outlook
PM	Particulate Matter
PM_{10}	Particulate matter with an aerodynamic diameter of 10µm and smaller
$PM_{2.5}$	Particulate matter with an aerodynamic diameter of 2.5µm and smaller
PPP	Public Participation Process
REIPPP	Renewable Energy Independent Power Producers Procurement Programme
SAAELIP	South African Atmospheric Emission Licensing and Inventory Portal
SAAQIS	South African Air Quality Information System
SANEDI	South African National Energy Development Institute
SBIDZ	Saldanha Bay Industrial Development Zone
SEA	Strategic Environmental Assessment
SEMA	Specific Environmental Management Act
SNAEL	System for National Atmospheric Emission Licensing
SO_2	Sulphur Dioxide
StatsSA	Statistics South Africa
UNFCCC	United Nations Framework Convention on Climate Change
US EPA	United States Environmental Protection Agency
VOCs	Volatile Organic Compounds
WCDM	West Coast District Municipality

Photograph by: S. Benson

FOREWORD

It has been 12 years since the promulgation of the National Environmental Management: Air Quality Act (Act 39 of 2004; "the Act"). Of these, the past five years have probably been the most dynamic in that a host of legislative reform has seen air quality management in the country develop from an "infant" into an "adolescent". The full implementation of the Act came into effect on 01 April 2010 when the Atmospheric Pollution Prevention Act (Act 45 of 1965) was repealed on 31 March 2010. Undoubtedly the most significant shift has been that Provinces, as well as District and Metropolitan Municipalities became Licensing Authorities for Section 21 Listed Activities of the Act. Thus, the function of atmospheric emission licensing was devolved from National Government, with the latter licensing only certain activities in the country.

Authorities in the Western Cape have embraced the changes to the legislation and have been implementing the atmospheric emission licensing system, as well as all air quality management functions mandated. At present, a total of 43 Provisional Atmospheric Emission Licences and 73 final Atmospheric Emission Licences are being regulated by the Licensing Authorities in the Western Cape. Moreover, the Province has seen a total of 12 Municipal by-laws published so that Municipalities can further regulate air quality in the regions. In addition, the DEA&DP has published the Western Cape Noise Control Regulation on 20 June 2013 (P.N. 200/2013), which have largely assisted our Municipalities to regulate and manage noise pollution in their areas.

Municipalities have adopted their Air Quality Management Plans and have designated Air Quality Officers to ensure that air quality in the regions is managed effectively and efficiently so that we can continue to breathe good quality air in the Province. The Air Quality Officers have done a tremendous job in terms of regulating the licensed facilities, and have undertaken various compliance monitoring inspections to ensure that facilities continue to uphold their licence conditions. Disturbance and nuisance matters, as it relates to air quality, have also been investigated and have been resolved effectively in the regions. Of course, there are complex air quality concerns that require long-term solutions; our authorities continue to engage with the public and licence holders where such complex air quality matters exist.

It is also important to note that air quality and climate change are integrally linked. It has been anticipated that air quality in many parts of the world will worsen due to climate change, and the severity of the matter has been aptly reported in The 2015 Lancet Commission on Health and Climate Change as, "climate change and air pollution make a dangerous pair". Not only our industries, but also our communities should play their part in reducing air pollution and hence indirectly reduce the effects of climate change.

This Report is the culmination of five years of implementing the 1st Generation Western Cape Air Quality Management Plan, which I endorsed during my first few months at the Department. It gives me great pleasure to report on the progress made in terms of implementing the Plan during the past five years, during 2010 – 2015. The Report provides an overview of the state of air quality management in the Western Cape currently, and also provides input towards the development of the 2nd Generation Western Cape Air Quality Management Plan. Good progress has been made; however, I call upon your continued interest in the environment and to alert the Air Quality Officers should air quality-related non-compliances be perceived to take place in your area. Together, we can do better to ensure that the air that we breathe remains good in the Western Cape, for our generation and future generations.

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1. INTRODUCTION

1.1 BACKGROUND

The rapid development of heavy industry in South Africa during the 1950's to 1960's resulted in a rapid increase in atmospheric emissions and air pollution, with a concomitant reduction of ambient air quality in the urban and industrial areas of the country. During this time, air quality management in South Africa was informed and regulated by the Atmospheric Pollution Prevention Act (Act No, 45 of 1965; APPA; DEA, 1965). However, by the 1990s it became clear that a more modern approach to air quality regulation was required.

A new dawn in air quality management saw the development of a draft Air Quality Bill, which was initiated during 2001, and the subsequent promulgation of the National Environmental Management: Air Quality Act (Act No. 39 of 2004; DEA, 2004), hereafter referred to as "the NEM: AQA". The promulgation of the NEM: AQA marked a turning point in the approach to air pollution control and governance in South Africa. The focus shifted from source control to the management of air pollutant levels in the ambient environment. The philosophy of "air quality management" as it stands today was introduced and is in line with international policy developments and the environmental right, viz. Section 24 of the Constitution (Act No. 108 of 1996; RSA, 1996). The NEM: AQA defined air quality that is not harmful to health and well-being through the promulgation of the National Ambient Air Quality Standards (DEA, 2009) and provides the regulatory tools and mandates for government to deliver the desired outcome.

The full implementation of the NEM: AQA came into effect on 01 April 2010, when the APPA was repealed on 31 March 2010. Section 36 of the NEM: AQA is probably the most significant shift from the APPA, in that Provinces, as well as the Metropolitan and District Municipalities became the Licensing Authorities for Section 21 Listed Activities, promulgated under the NEM: AQA. As such, the function of atmospheric emission licensing was devolved from the National Department of Environmental Affairs to the Provinces and Municipalities.

The Western Cape has embraced the changes to the legislation and endeavoured to fully implement the roles and responsibilities of air quality management, as assigned to it through the NEM: AQA and as spelt out in the National Air Quality Management Framework 2007, as amended in 2012 (DEA, 2007; 2013). It has been 12 years since the promulgation of the NEM: AQA, and six years since its full implementation. This has seen air quality management in South Africa developing from an "infant" into an "adolescent". With the full implementation of the NEM: AQA, it became clear that various regulations and policies were required to further advance the management of air quality in the country. Various regulations and policies have been developed, while various amendments to the NEM: AQA have been made over the past six years. Some of the recent amendments to the NEM: AQA has mandated the National DEA to once again become a Licensing Authority for specific Atmospheric Emission Licence (AEL) applications in the country (see Chapter 2). The new regulatory and policy developments in respect of the NEM: AQA places South Africa and the Provinces on a good trajectory towards managing air quality to ensure the health and well-being of the citizens of the country and our environment.

1.2 UNDERSTANDING THE LINKAGE BETWEEN AIR QUALITY AND CLIMATE CHANGE

Concerned with the implications of global climate change, several governments came together in 1988 and formed the Intergovernmental Panel on Climate Change (IPCC). This led to an international treaty, the United Nations Framework Convention on Climate Change (UNFCCC), as a framework for international co-operation to combat climate change by limiting average global temperature increases and the resulting climate change, and coping with impacts that were, by then, inevitable. The stated objective of the UNFCCC is to achieve stabilisation of the concentrations of GHG in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system (https://www.ipcc.ch/organization/organization.shtml).

The governments that have ratified the UNFCCC – known as Parties to the Convention – have met annually as the Conference of the Parties (COP) since 1995 to take stock of their progress, monitor the implementation of their obligations and continue talks on how best to tackle climate change. By 1995, countries launched negotiations to strengthen the global response to climate change, and, two years later, adopted the Kyoto Protocol. The Kyoto Protocol legally binds Parties that have signed it, to the emission reduction targets. The Protocol's first commitment period started in 2008 and ended in 2012. The second commitment period began on 1 January 2013 and will end in 2020. There are now 197 Parties to the Convention and 192 Parties to the Kyoto Protocol.

The South African government ratified the UNFCCC in August 1997. It was soon recognised that the commitments set out in the UNFCCC were inadequate for achieving its ultimate objective and this led to the adoption of the Kyoto Protocol in 1997, after much international negotiation. The need for a national climate change policy for South Africa was identified as an urgent requirement during the preparations for the ratification of the UNFCCC in 1997.

South Africa has developed a National Climate Change Response White Paper (DEA, 2011) that outlines the country's response to climate change. It provides that South Africa will build its climate resilience, its economy and its people and manage the transition to a climate-resilient, equitable and internationally competitive lower carbon economy and society, and the country will:

- "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
- 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. "

(DEA, 2011)

In this regard, the White Paper provides that South Africa will implement the following strategic priorities in order to achieve its climate change response objective –

- "**Risk reduction and management** – prioritise near-term adaptation interventions that address immediate and observed threats to the economy, ecosystem services and the health and well-being of South Africans while researching and developing short-, medium- and longer-term climate resilience, risk and vulnerability management policies and measures.

- **Mitigation actions with significant outcomes** – prioritise cost effective and beneficial mitigation policies, measures and interventions that significantly contribute to the country's deviation from the GHG emission "business as usual trajectory" as measured against a benchmark "peak, plateau and decline" GHG emission trajectory where GHG emissions peak between 2020 and 2025, plateau for approximately a decade and begin declining in absolute terms thereafter.
- **Sectoral responses** – prioritise, in accordance with the provisions of this policy, the requirement for all key actors, organisations or participants in relevant sectors or sub-sectors to prepare, submit, implement, monitor and report the implementation of detailed climate change response strategies and action plans that clearly articulate their roles, responsibilities, policies, measures, and interventions or actions to contribute to the achievement of the National Climate Change Response Objective in a measurable way.
- **Policy and regulatory alignment** – firstly, prioritise interventions already envisaged by national policies, legislation or strategies that have climate change co-benefits, particularly those that also contribute towards the national priorities of job creation, poverty alleviation or have other positive socioeconomic benefits. Secondly, review existing national policies, legislation or strategies, with a view to optimising and maximising the climate change co-benefits of their interventions. Thirdly, integrate into the relevant existing or new policies, legislation or strategies those climate change response interventions that stimulate new economic activities as well as those that improve the efficiency and competitive advantage of existing activities.
- **Integrated planning** – prioritise the mainstreaming of climate change considerations and responses into all relevant sector, national, provincial and local planning regimes such as, but not limited to, the Industrial Policy Action Plan, Integrated Resource Plan for Electricity Generation, Provincial Growth and Development Plans, and Integrated Development Plans.
- **Informed decision-making and planning** – prioritise research, systemic observation, knowledge generation, information management and early warning systems that increase our ability to measure and predict climate change and the implications of its adverse effects on the economy, society and the environment.
- **Technology research, development and innovation** – prioritise cooperation and the promotion of research, investment in and/or acquisition of adaptation, lower-carbon and energy-efficient technologies, practices and processes for employment by existing or new sectors or sub-sectors.
- **Facilitated behaviour change** – prioritise the use of incentives and disincentives, including regulatory, economic and fiscal measures, to promote behaviour change towards a lower-carbon society and economy.
- **Behaviour change through choice** – prioritise education, training and public awareness programmes to build the general public's awareness of climate change so as to empower all South Africans to make informed choices that contribute to an economy and society that is resilient to climate change.
- **Resource mobilisation** – prioritise the development of comprehensive resource and investment mobilisation strategies, capacities, mechanisms or instruments that support and enable implementation of climate change responses at the scale required, including, but not limited to, public and private financial resources, incentives, non-market and market-based instruments, technical cooperation and partnership agreements, and technology transfers at domestic, sub-regional, regional, and international levels."

(DEA, 2011)

The South African government acceded to the Kyoto Protocol in July 2002. At the UNFCCC's COP15 negotiations in December 2009, South Africa announced its voluntary commitment to reduce its GHG emissions. This commitment is reflected in the Copenhagen Accord made by the Parties to the Convention and the Kyoto Protocol and provides political direction to international climate change negotiations. South Africa therefore committed to take nationally appropriate CO2 mitigation action to enable the following:

- a 34% deviation below the "Business-as-Usual" emissions growth trajectory by 2020; and
- a 42% deviation below the "Business-as-Usual" emission growth trajectory by 2025.

In addition, based on the UNFCCC, the Government's Long Term Mitigation Scenario focus is on the reduction of GHG emissions in South Africa, which would see the growth of carbon emissions peak (up to 2020), plateau (between 2020–2030) and decline (from 2035).

South Africa committed to the 'Paris Agreement' on 12 December 2015 at the UNFCCC's 21st COP (i.e. COP21). The key commitment made by all nations is to hold 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 rise in the average global temperature was found to be primarily due to the increased concentration of GHGs in the atmosphere. To ensure that the increase in the global average temperature is kept below 2°C above pre-industrial levels, targets to reduce GHG emissions will need to be formalised.

It has been anticipated that air quality in many parts of the world will worsen due to climate change, and hence worsen the impact on public health (US EPA, 2009). It has been reported that "air pollution is among the most serious of indirect health effects of climate change" and that "climate change and air pollution make a dangerous pair" (Lancet, 2015). It was reported that the concoction of priority pollutants and greenhouse gases (GHGs) such as carbon dioxide (CO_2), methane (CH_4), volatile organic carbon compounds (VOCs), nitrous oxide (N_2O), particulate matter (PM), make for a dangerous interaction that potentially impact human health and the environment (Lancet, 2015).

An increase in ozone-depleting substances and GHG emissions has a direct effect on air quality. At the national government level, the Department of Environmental Affairs (DEA) is mandated with both air quality management and climate change matters, with two distinct branches, viz. Air Quality Management and Climate Change, developing and implementing legislation in this regard. In the Western Cape, the Western Cape Government, through the Department of Environmental Affairs and Development Planning (DEA&DP), both implements systems and provides an oversight role with respect to air quality management and climate change in the Province. Within the DEA&DP, the Directorate: Air Quality Management is responsible for air quality management, which includes air quality planning, monitoring and regulatory services; while the Directorate: Climate Change facilitates and enables the implementation of climate change mitigation and adaptation responses. Both Directorates have recognised the strong linkage between air quality management and climate change and works co-operatively to achieve air quality and climate change targets in an integrated manner. The local sphere of government in the Province (i.e. 30 municipalities) is tasked with air quality management and climate change matters through the NEM: AQA and the Municipal Systems Act (Act No. 32 of 2000).

At national level, significant strides have been made towards integrating air quality and climate change at a national level, with the National DEA actively developing legislation and policy towards implementing actions to mitigate and to a certain degree, adapt to climate change linked to air quality management. In April 2016, the DEA, together with the various Provinces in the country undertook to form a task team to expand on the legislative and policy developments to integrate air quality management and climate change. Various role players from different departments and spheres of government are actively engaging to

seek an overall strategic approach to respond to climate change in South Africa. The forum seeks to employ a wide range of adaptation and mitigation approaches, policies, measures, and programmes, while taking cognisance of the fact that all such interventions and actions positively influences the management of air quality in the country. In doing so, short- and long-term goals are being developed as it relates to regulations and policy to mitigate and adapt to climate change, while managing air quality in the country.

1.3 THE WESTERN CAPE AIR QUALITY MANAGEMENT PLAN – 2010

Section 15(1) of the NEM: AQA requires that Provinces and Municipalities develop Air Quality Management Plans (AQMPs) to manage air quality in their regions. In order for it to be effective, the AQMP needs to be reviewed every 5 years to establish whether the identified air quality management goals and targets have been effectively implemented and whether they were still valid in terms of new developments and economic growth, where implemented.

In accordance with the requirements of Section 15(1) of the NEM: AQA, the DEA&DP has developed the Western Cape Air Quality Management Plan, which was adopted in 2010 (henceforth referred to as "AQMP2010"; DEA&DP, 2010a), with the following:

VISION: "Clean and healthy air for all in the Western Cape"

MISSION: "To ensure the effective and consistent implementation of sustainable air quality management practices, by all spheres of government, relevant stakeholders and civil society to progressively achieve and efficiently maintain clean and healthy air in the Western Cape"

Four goals of the AQMP2010 supported the Vision and Mission, with each goal addressing the different aspects of the vision and are underpinned by objectives to achieve them. These are:

- **GOAL 1: To ensure effective and consistent Air Quality Management**
  This goal aimed to address the establishment of the necessary institutional arrangements, i.e. the development and maintenance of the varied systems, skills and capacity for effective air quality management.

- **GOAL 2: To continually engage with stakeholders to raise awareness with respect to air quality**
  This goal aimed to improve the awareness of air quality management in the Western Cape, through awareness raising and education campaigns. It involved the dissemination of information and capacity building of stakeholders from communities and industrial sectors.

- **GOAL 3: To ensure effective and consistent compliance monitoring and enforcement**
  This goal aimed to improve and standardise compliance monitoring and enforcement in the Western Cape, and to ensure that ambient air quality standards for the protection of health are attained and continually met.

- **GOAL 4: To support climate change protection programmes, including promoting the reduction of greenhouse gas emissions**
  This goal aimed to introduce the co-benefits philosophy between AQM and climate change interventions. It further aimed to accelerate the reduction of greenhouse gas emissions and ozone depleting substances in-line with national and international targets.

The goals and objectives were further defined in a detailed Implementation Plan, which included targets, activities, timeframes, responsibilities, sources of funding and estimated costs. The timeframes were described as short, medium, long-term or continuous; and responsibilities encompassed a broad range of stakeholders, including National, Provincial and Local environmental authorities, as well as other sectors of government, industry, business, agriculture, non-governmental organisations, and civil society.

Further to the goals and objectives, an AQMP Steering Committee and three Working Groups were established as the primary mechanism to drive the AQMP2010 implementation, as a means to direct the activities and involve all necessary stakeholders.

The Working Groups had the following areas of work assigned, respectively:

- **WORKING GROUP 1:** Air Quality Management and Climate Change
  Area of work: governance, management with respect to air quality, climate change, town and regional planning and transport planning.
- **WORKING GROUP 2:** Air Quality Awareness Raising Working Group
  Area of work: information management on air quality and climate change.
- **WORKING GROUP 3:** Compliance Monitoring and Enforcement Working Group
  Area of work: technical/control and legal.

The AQMP2010 took into account the roles and responsibilities of the different spheres of government, as well as other stakeholders for air quality management in the Province, as outlined in the 2007 National Framework for Air Quality Management in South Africa (DEA, 2007). The roles and responsibilities for the three spheres of government, which promotes co-operative governance were taken into account in the AQMP2010. In this regard, the DEA&DP both implements systems and provides an oversight role in the Province with respect to air quality management.

Therefore, following five years of its implementation, the DEA&DP has embarked on a review of the Western Cape AQMP2010 to, amongst others:

- assess progress made in air quality management in the Province;
- establish whether the identified goals and targets have been effectively implemented;
- establish whether the goals and targets were still valid in terms of new developments and economic growth in the Province; and
- identify potential air quality risks and interventions that can be translated into new goals and objectives, where required.

This Status Quo Report provides an overview of the progress made towards implementing air quality management in South Africa and the Western Cape.

1.4 ORGANISATION OF THE REPORT

- **CHAPTER 1: Introduction**
  Chapter one provides a background to the challenges of air quality and climate change.

- **CHAPTER 2: Air Quality Management and Climate Change**
  Chapter two explains the legislative and policy developments in respect of air quality management and climate change in South Africa.

- **CHAPTER 3: Developing the 2nd Generation Air Quality Management Plan (AQMP)**
  Chapter three provides an overview of the Public Participation Process Workshops, which the DEA&DP has conducted as part of the review of the Western Cape AQMP2010.

- **CHAPTER 4: Overview of the Western Cape**
  Chapter four provides an overview of the Province's meteorological conditions, population distribution and economic distribution as these either impact on the dynamics of air flow in the region, or are linked to activities that could contribute to anthropogenic air pollution emissions.

- **CHAPTER 5: Governance: Air Quality Management Planning**
  This chapter summarises the progress made during the implementation of the Provincial AQMP2010 and those of the Municipal AQMPs, where adopted.

- **CHAPTER 6: Governance: Air Quality Officer's Forums**
  This chapter provides a summary of the Western Cape Provincial Air Quality Officer's Forums conducted on a quarterly basis.

- **CHAPTER 7: Air Quality Monitoring**
  This chapter provides an overview of the Western Cape Ambient Air Quality Monitoring Network (DEA&DP), the City of Cape Town's and the Saldanha Bay Local Municipality's Ambient Air Quality Monitoring Network, as well as passive sampling undertaken by the Eden District Municipality.

- **CHAPTER 8: Air Quality Compliance and Enforcement**
  Chapter eight provides an overview on atmospheric emission licensing, compliance inspections and complaints handling conducted by air quality officials in the Western Cape.

- **CHAPTER 9: Emissions Inventories**
  Chapter nine provides an overview of the Western Cape Air Pollutant and Greenhouse Gas Inventory for point, non-point and mobile sources, as well as the National Atmospheric Emissions Inventory System (NAEIS).

- **CHAPTER 10: Gaps and Recommendations**
  This chapter identifies the gaps and recommendations to be made in terms of managing air quality in the Western Cape. The recommendations will be addressed in the 2nd Generation Western Cape AQMP.

- **CHAPTER 11: References**
  This chapter provides the references used in developing this Report.

Photograph by: C. Frazenburg

2. AIR QUALITY MANAGEMENT AND CLIMATE CHANGE: LEGISLATIVE AND POLICY DEVELOPMENTS

2.1 LEGISLATIVE AND POLICY DEVELOPMENTS: AIR QUALITY MANAGEMENT

Since the promulgation of the NEM: AQA, various legislative reform and policy developments on how air quality is to be managed in the South Africa have been developed. This Chapter provides an overview of the legislative reform and policy developments that have taken place since the promulgation of the NEM: AQA, towards ensuring that South Africa's obligations in respect of air quality management and international agreements on climate change are met.

2.1.1 ATMOSPHERIC POLLUTION PREVENTION ACT (ACT NO. 45 OF 1965)

The management of air quality in South Africa was governed by the Atmospheric Pollution Prevention Act (Act No. 45 of 1965; APPA) during 1965 – 2004. During this time, the management of air quality focused on industrial pollution, with the APPA using a traditional "command and control" approach with respect to emissions permitting for industries, where identified as significant sources of air pollution. Although the APPA controlled gross emissions of air pollution, it did not ensure effective and efficient protection of air quality. The APPA was later repealed as part of the National Environment Laws Amendment Act (Act No. 44 of 2008; See Section 2.1.2).

2.1.2 NATIONAL ENVIRONMENTAL MANAGEMENT ACT (ACT NO. 107 OF 1998)

The National Environmental Management Act (Act No. 107 of 1998; NEMA) seeks to promote the protection of the environment and its resources for the benefit of present and future generations through reasonable legislative and other measures that prevent pollution and ecological degradation, promote conservation, and secure ecologically sustainable development and use of natural resources, while promoting justifiable economic and social development, as stated in Section 24 of the Constitution.

Table 2-1 shows the recent amendments made, as it relates to air quality management and as promulgated in terms of the NEMA.

TABLE 2-1: LEGISLATIVE REFORM IN TERMS OF THE NEMA

LEGISLATION	COMMENCEMENT DATE	DESCRIPTION OF AMENDMENTS
National Environment Laws Amendment Act (No. 44 of 2008); G.N. 31685, Notice No. 1318 [Proc. No. 902, G.N. 32563].	11 September 2009	Amendments made provided for the following legislation were to be repealed in terms of Section 60 of the NEM:AQA: • Atmospheric Pollution Prevention Act (Act No. 45 of 1965); • Atmospheric Pollution Prevention Amendment Act (Act No. 17 of 1973); • Atmospheric Pollution Prevention Amendment Act (Act No. 21 of 1981); and • Atmospheric Pollution Prevention Amendment Act (Act No. 15 of 1985).
National Environment Laws Amendment Act (No. 14 of 2009); G.N. 32267, Notice No. 617. [Proc. No.65, G.N. 32580].	18 September 2009	Amendments to Section 45 of NEM: AQA were introduced in terms of the payment and cost of the prescribed processing fee during the review of the Provisional AEL and AELs; • Amendments to Section 49 of the NEM: AQA, by including "a juristic person" in terms of the criteria for fit and proper persons. • Amendments to Section 52 of the NEM: AQA, as it relates to penalties associated with offences.
The National Environmental Management Laws Amendment Act (No. 14 of 2013); G.N. 36703, Notice No. 530	24 July 2013	Amendment of Section 55 of the NEM: AQA as to align the penalties with other specific environmental management Acts.
The National Environmental Management Laws Second Amendment Act (No. 30 of 2013); G.N. 1019, Notice No. 37170.	18 December 2013	Amendments to Section 36 of the NEM: AQA provide that the Minister is the licensing authority if: • the listed activity forms part of a matter declared as a national priority in terms of a Cabinet decision and notice referred to in section 24C(2B) of the NEMA (1998); • the listed activity relates to the activities listed in terms of section 24(2) of the NEMA, 1998, or in terms of section 19(1) of the NEM: WA, 2008, or the Minister has been identified as the competent authority; or • the listed activity relates to a prospecting, mining, exploration or production activity as contemplated in the MPRDA, 2002, in the area for which the right has been applied for, and the Minister responsible for mineral resources has been identified as the competent authority in terms of section 24C of NEMA, 1998.

2.1.3 NATIONAL ENVIRONMENTAL MANAGEMENT: AIR QUALITY ACT (ACT NO. 39 OF 2004)

The National Environmental Management: Air Quality Act (Act No. 39 of 2004; NEM: AQA) is a Specific Environmental Management Act (SEMA), promulgated on 24 February 2005 under the NEMA, to address air quality management in the country. This was followed by the publication of Government Gazette Notice No. R 898 in the Government Gazette, dated 09 September 2005, in which the Minister, in terms of section 64(1), read with section 64(2), declared that the NEM: AQA will become effective on 11 September 2005.

As sections 21, 22, 36 to 49, 51(1)(e), 51(1)(f), 51(3), 60 and 61, had not commenced at the time, the APPA was not repealed, and was declared a SEMA on. 11 September 2009. The APPA was repealed in its entirety on 31 March 2010; with the full implementation of the NEM: AQA on 01 April 2010.

There has been a major paradigm shift with the NEM: AQA, as opposed to APPA, in terms of air quality management and monitoring within the country. The NEM: AQA provides for "*the protection of the environment by providing reasonable measures for the protection and enhancement of the quality of air in the Republic; the prevention of air pollution and ecological degradation; and securing ecologically sustainable development while promoting justifiable economic and social development; and to give effect to section 24(b) of the Constitution in order to enhance the quality of ambient air for the sake of securing an environment that is not harmful to the health and well-being of people*" (DEA, 2004).

Further, the NEM: AQA recognised Provincial environmental departments as the lead agents for environmental management, as it relates to air quality management. As such, Provincial environmental departments must provide, where necessary, provincial norms and standards to ensure coordinated, integrated and cohesive air quality governance in the Province.

The NEM: AQA is an objectives or outcomes-based approach that took the Constitution of the South Africa as its departure point and provides regulatory tools and mandates for government to deliver the desired outcome in terms of air quality management.

Table 2-2 shows the legislative developments that have been made towards the full commencement of the NEM: AQA.

TABLE 2-2: LEGISLATIVE DEVELOPMENTS TOWARDS THE FULL IMPLEMENTATION OF NEM: AQA

LEGISLATION	COMMENCEMENT DATE	DESCRIPTION OF AMENDMENTS
National Environmental Management: Air Quality Act commencement date of Sections 21, 22, 36 to 49, 51(1)(e), 51(1)(f), 51(3), 60 and 61 of the original Act 39 for 2004	01 April 2010 (GN. 33041)	• The atmospheric emission licensing system was fully implemented, resulting in the District and Metropolitan Municipalities, as well as Provinces taking on the responsibility of Licensing Authority for all Section 21 Listed Activities.
National Environmental Management: Air Quality Amendment Act 20 of 2014	19 May 2014 (GN. 37666)	• The amendments made to the NEM: AQA make provision for the National Minister to be a Licensing Authority for additional activities, in terms of Section 36(5) and related.

In terms of implementing the NEM: AQA, Section 7 requires the Minister to establish a National Framework for Air Quality Management. In this regard, the National Department of Environmental Affairs established the 2007 National Framework for Air Quality Management (DEA, 2007) in order to ensure the efficient and effective implementation of the NEM: AQA throughout the country. The Framework was reviewed following five years of implementation of the NEM: AQA, through a consultative and preparatory process. The review indicated that major achievements have been made in implementing the NEM: AQA, which includes the following:

- declaration of national priority areas;
- development of air quality management plans and designation of air quality officers to improve and maintain air quality in provinces and municipalities; and
- full implementation of the licensing system across the country.

The 2012 National Framework for Air Quality Management commenced on 29 November 2013, and its purpose is to achieve the objectives of the NEM: AQA, through medium- to long-term plans that promote holistic and integrated air quality management through pollution prevention and minimisation at source, and through impact management with respect to the receiving environment from local scale to international issues (DEA, 2013).

The Framework provides norms and standards for all technical aspects of air quality management in South Africa. Table 2-3 provides a summary of the regulations promulgated under the NEM: AQA, to date.

TABLE 2-3: REGULATIONS PROMULGATED IN TERMS OF NEM: AQA DURING 2009 – 2016

LEGISLATION	COMMENCEMENT DATE	DESCRIPTION / PURPOSE
National Ambient Air Quality Standards	24 December 2009 (GN. 1210 of Gazette No. 32816)	The notice provides for the assessment of ambient air quality standards in terms of section 5.2.1.3. for the National Framework for Air Quality Management in South Africa, as it pertains to the following pollutants: sulphur dioxide, nitrogen dioxide, particulate matter, ozone, benzene, lead, and carbon monoxide.
List of Activities which Result in Atmospheric Emissions which have or may have a Significant Detrimental Effect on the Environment, including Health, Social Conditions, Economic Conditions, Ecological Conditions or Cultural Heritage	01 April 2010 (GN 248 of Gazette No. 33064)	The regulations make provision for minimum emission standards to apply to both permanently operated plants and for experimental (pilot) plants with a design capacity to the one of a listed activity, as it is applicable under normal working conditions.
National Ambient Air Quality Standard for Particulate Matter with Aerodynamic Diameter less than 2.5 micron metres ($PM_{2.5}$)	29 June 2012 (GN 486 of Gazette No. 35463)	The regulations make provision for the regulating of particulate matter of aerodynamic diameter less than 2.5 micron metres ($PM_{2.5}$).
National Dust Control Regulations	01 November 2013 (GN 827 of Gazette No. 36974)	The regulations are to prescribe general measures for the control of dust in all areas.
Declaration of a small boiler as a controlled emitter and establishment of emission standards	01 November 2013 (GN 831 of Gazette No. 36973)	The regulations are to regulate the emissions and requirements as set out for any small boiler under normal operating conditions subject to the provisions for start-up, soot-blowing and incidences of abnormal conditions.

LEGISLATION	COMMENCEMENT DATE	DESCRIPTION / PURPOSE
Regulations Prescribing the Format of the Atmospheric Impact Report	02 April 2015 (GN 747, as amended by GNR 284)	The regulations make provision for any person required to submit an atmospheric impact report in terms of section 30 of the NEM: AQA 2004 to do so in the prescribed format.
National Atmospheric Emission Reporting Regulations	02 April 2015 (GN 283)	The regulations are for the reporting of data on sources of atmospheric emissions to National Atmospheric Emissions Inventory System (NAEIS) and compilation of atmospheric emission inventories.
Amendments to the List of Activities which Result in Atmospheric Emissions which have or may have a Significant Detrimental Effect on the Environment, including Health, Social Conditions, Economic Conditions, Ecological Conditions or Cultural Heritage	12 June 2015 (GN 551 of Gazette 38863)	The regulations make provision for additional requirements in terms of when waste ceases to be waste as per section 1 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008), as amended. Further amendments were made to the following listed activities: • Sub-category 2.1 (Combustion installations) • Subcategory 3.4 (Char, Charcoal and Carbon Black Production) • Subcategory 4.3 (Primary Aluminium Production) • Subcategory 5.3: Clamp Kilns for Brick Production
Declaration of Small-scale Char And Small-scale Charcoal Plants as Controlled Emitters and Establishment of Emission Standards	18 September 2015 (GN. 602 of Gazette No. 39220)	The regulations make provision for small-scale char and small-scale charcoal plants as controlled emitters and establishment of emission standards (production capacity smaller than 20 tons per month).
Regulations Prescribing the Atmospheric Emission Licence Processing Fee	11 March 2016 (GN. 250 of Gazette No. 39805)	The regulations make provision for an applicant of an AEL to pay the prescribed processing fees, as indicated in the Annexure A, before or on the date of the submission of the application or as directed by the licensing authority.
Regulations for the Procedure and Criteria to be followed in the Determination of an Administrative Fine in terms of section 22a of the Act	18 March 2016 (GN. 332 of Gazette 39833)	The regulations provide for the determination of administrative fine, as well as for an applicant to pay the applicable AEL processing fee as stipulated. The regulations make provision for the payment of an administrative fee, in addition to the administrative fee payable in terms of section 24G of NEMA
Air Quality Offsets Guideline	18 March 2016 (GN. 333 of Gazette No. 39833)	The regulations make provision for guidance on situations under which offsets can be applied during the implementation of the atmospheric emission licensing system stipulated in Chapter 5 of NEM: AQA. Also provides guidance in terms of principles that should be adhered to in recommending and implementing offsets as well as the responsibilities of the different role players.

Note: 2016 is included to illustrate current developments.

More recently, the DEA has published draft regulations in terms of the NEM: AQA that directly addresses both the management of air quality and climate change matters. Table 2-4 provides a summary of the regulations gazetted and that have been gazetted for comment, in respect of air quality management and climate change.

The National DEA is in the process of developing a National GHG Inventory System, which will ensure that data related to climate change is managed in a consistent, transparent and accurate manner for both internal and external reporting.

The promulgation of the proposed regulations listed in Table 2-4 would require a system for reporting. Such a tool exists in the form of the National Atmospheric Emissions Inventory System (NAEIS); however, it would require that the NAEIS be updated to accommodate for the reporting of GHGs in the required format. The NAEIS can play a major role in managing the reporting and processing of data for the inventory. See Chapters 8 and 9 for more information in respect of NAEIS.

As with all new legislation and policies, the next few years will see air quality management developing from an "adolescent" into an "adult", with strict compliance and enforcement required to ensure that air quality is managed effectively and efficiently in the country.

TABLE 2-4: REGULATORY DEVELOPMENTS IN RESPECT OF CLIMATE CHANGE AND AIR QUALITY MANAGEMENT, PUBLISHED FOR COMMENT IN TERMS OF THE NEM: AQA

LEGISLATION	DATE PUBLISHED FOR COMMENT	DESCRIPTION OF AMENDMENTS
National Pollution Prevention Plans Regulations	08 January 2016 (GN. 5 of Gazette No. 39578)	The regulations intend to provide for a tool for authorities to obtain information pertaining to greenhouse gases. The regulations stipulate that companies conducting particular processes that emit greenhouse gases directly into the atmosphere must prepare, submit and implement a pollution prevention plan in respect of the greenhouse gases.
Declaration of Greenhouse Gases as Priority Air Pollutants	08 January 2016 (GN. 6 of Gazette No. 39578)	The notice intends to declare greenhouse gases as priority air pollutants. The notice stipulates that people conducting certain listed production processes which result in the emission of greenhouse gases that are listed as priority air pollutants must prepare and submit a pollution prevention plan.
Draft National Greenhouse Gas Emission Reporting Regulations	07 June 2016 (GN. 336 of Gazette No. 40054)	The regulations intend to provide for the reporting of greenhouse gases. The regulations will make the reporting of greenhouse gases mandatory, and allow for data that could be more accurate and reliable.

2.2 LEGISLATIVE AND POLICY DEVELOPMENTS: CLIMATE CHANGE

South Africa is obligated to reduce emissions under the UNFCCC. According to the provisions of the UNFCCC and the Kyoto Protocol (DEA, 2013), South Africa must:

- Prepare and periodically update a national inventory on greenhouse gas emissions and sinks;
- Formulate and implement national and, where appropriate, regional programmes to mitigate climate change and facilitate adequate adaptation to climate change; and
- Promote and cooperate in the development, application and diffusion of technologies, practices and processes that control, reduce or prevent anthropogenic emissions of greenhouse gases.

The National Climate Change Response White Paper requires the management of any response measures generated by our action as well as being able to respond to the response measures of other coutnries that have negative consequences for our country (DEA, 2011). In terms of air quality, it provides that South Africa will integrate climate change considerations into health sector plans to:

- "reduce the incidence of respiratory diseases and improve air quality through reducing ambient PM, O_3 and SO_2 concentrations by legislative and other measures to ensure full compliance with the National Ambient Air Quality Standards by 2020. In this regard, the use of legislative and other measures that also have the co-benefit of reducing GHG emissions will be prioritised. Progress on this will be published on the South African Air Quality Information System (SAAQIS)."

All spheres of government need to respond to climate change, and therefore also indirectly manage air quality. The following regulatory reform and policy development at both national and provincial levels contribute towards South Africa meeting its emission reduction obligations under the Kyoto Protocol and the Paris Agreement.

2.2.1 NATIONAL LEGISLATIVE AND POLICY DEVELOPMENTS

South Africa has shown its commitment to the Kyoto Protocol and the Paris Agreement. As such, the following national government departments have been tasked with developing climate change strategies and policies, either directly or indirectly, and promoting renewable energy (Tucker and Khanye, 2015):

- The Department of Energy (DoE) and National Treasury have presently taken the lead in fulfilling South Africa's objectives of increasing renewable energy generation, through the Renewable Energy Independent Power Producers Procurement Programme (REIPPP Programme). The DoE and its branches are also responsible for energy efficiency, energy planning (including renewable energy) and capital grants to renewable energy projects.
- The Designated National Authority (DNA) at the Department of Energy regulates the Clean Development Mechanism (CDM) applications, including evaluating and approving the operation of CDM projects and the promotion of investment in CDM projects.
- In terms of the National Energy Act (Act No. 34 of 2008), the South African National Energy Development Institute (SANEDI) has been created as a successor to the South African National Energy Research Institute and the National Energy Efficiency Agency. The SANEDI's functions include directing, monitoring and conducting applied energy research and development, demonstration and development as well as undertaking specific measures to promote the uptake of Green Energy and Energy Efficiency in South Africa.
- The South African Tradeable Renewable Energy Certificate Issuing Body (SATIB), formed by the South African National Tradeable Renewable Energy Certificate Team, under the DoE.
- The National Energy Regulator of South Africa (NERSA) regulates electricity and issues licences to renewable energy producers supplying to the electricity grid.

A number of policy and legislative instruments have also been developed as it relates to emission limits and tax incentives to reduce carbon emissions. Table 2-5 provides a summary of the legislative and policy developments in South Africa to formally address climate change, and thereby also indirectly the management of air quality in the country.

TABLE 2-5: LEGISLATIVE AND POLICY DEVELOPMENTS TO ADDRESS CLIMATE CHANGE

LEGISLATION	DATE PUBLISHED FOR COMMENT / COMMENCEMENT	DESCRIPTION OF AMENDMENTS
National Climate Change Response White Paper	19 October 2011	The White Paper presented the 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. The overall approach will include: • adopting a 'carbon budget approach' to provide for flexibility and least-cost mechanisms for companies in each 'relevant sector and/or sub-sectors'; • where appropriate, translating carbon budgets into company-level desired emission reduction outcomes; • requiring companies and economic sectors or sub-sectors for which desired emission reduction outcomes have been established to prepare and submit mitigation plans, setting out how they intend to achieve the desired emission reductions; and • deploying a range of economic instruments to support the system of desired emission reduction outcomes.
Draft Carbon Tax Bill	02 November 2015	The Bill provided the detailed and revised carbon tax design features as per the Carbon Tax Policy Paper of 2013, and took into consideration the Budget 2014 and Carbon Offsets Paper of 2014. The Bill requires processes, such as fossil fuel combustion, coal mining, oil and gas extraction, industrial processes, and processes resulting in product use emissions to pay a tax for their carbon dioxide emissions. It is envisaged that this Bill will come into effect on 1 January 2017.
Draft Regulations on the Carbon Offset	20 June 2016	The Regulation was published in terms of Sections 13 and 20 (b) of the Draft Carbon Tax Bill and sets out the procedure for the use of carbon offsets by taxpayers to reduce their carbon tax liability. The Regulations calls for a registry to be developed to avoid duplication in counting emission reductions and to ensure credibility of the scheme.

Aside from the above, the National departments have developed the following instruments to further address climate change:

- **DESIRED EMISSION REDUCTION OUTCOMES**
  The DEA has developed the Desired Emission Reduction Outcomes (DEROs), which are referenced in the National Climate Change Response White Paper (DEA, 2011) as one of the key elements for the implementation of South Africa's long-term climate mitigation goal. The DEROs are defined for the short, medium and long term, on a five-year cycle, allowing for flexibility in the development of the overall mitigation system, national and sectoral policy, and the incorporation of updated information on emissions, technology opportunities and costs and other relevant information.

The DEROs are intended for the implementation of policies and measures intended to meet South Africa's long-term climate mitigation goals and serves a roadmap to a low-carbon future. As the DEA has recently initiated the development of a comprehensive GHG mitigation system, inclusive of a carbon budget system, the DEROs will be developed in phases.

Phase 1 of the DEROs will be limited in its application to the short and medium term, to test the system and its initial methodology, and to inform a far more comprehensive system, which will include a rigorous compliance system. Over the intervening five-year period to 2020, the reporting, monitoring and evaluation systems will be implemented, and the coverage and extent of the DEROs will be extended to cover all time periods accordingly. While it is envisaged that there will be a closer relationship between the carbon budgets and the DEROs in the longer term, the Phase 1 allocation of carbon budgets will not be related to the applicable short-term DEROs.

- **INTEGRATED RESOURCE PLAN**

  The National DEA very recently gazetted the following notice to address its international commitments made in terms of the UNFCCC:

  - Identification of the Minister as Competent Authority for the Consideration and Processing of Environmental Authorisations and Amendments thereto for Activities related to the Integrated Resource Plan (GN. 779 of Gazette No. 40110), with a commencement date of 01 July 2016.

  The notice provides for identification of the competent authority for environmental authorisation applications in respect of activities indentified in terms of section 24(2) of NEMA, which relates to the Integrated Resource Plan. Further, it provides that all pending applications on the date of publication of this notice in the Gazette must be submitted to the Minister of Environmental Affairs for finalisation. This notice has significant implications for the Licensing Authorities of Section 21 Listed Activities of the NEM: AQA, as well as all climate change policies, at both Provincial and Municipal levels.

  The Integrated Resource Plan 2010 – 2030 for South Africa (IRP 2010 – 2030) promulgated in 2011 by the Department of Energy, laid out the proposed generation new build fleet for South Africa for the period 2010 – 2030 (DoE, 2011). The IRP 2010 – 2030 makes provision for a Revised Balanced Scenario, which includes the following:

  - Nuclear fleet (9.6 GW);
  - Coal (6.3 GW);
  - Renewables (11.4 GW); and
  - Other energy generation sources (11.0 GW).

  The IRP2010-2013 is currently being updated, following which it will be presented to the Energy Portfolio Committee. It is therefore imperative for the Local and Provincial spheres of government to be part of the environmental authorisation process for all Section 21 Listed Activities of the NEM: AQA, as it relates to the IRP2010 – 2030.

  Further to the above proposed regulations and notice, it is important that domestic and international reporting requirements be understood in order to fully integrate air quality management and climate change. It is imperative that the various spheres of government and relevant departments understand their roles and responsibilities in the air quality and climate change arena. The implications are that a single reporting system that supports/adapts to policy making and is robust enough to meet domestic and international reporting obligations, is required. The National Atmospheric Emission Inventory System (NAEIS; See Chapter 8) is a likely avenue that can be adapted to meet future reporting requirements in terms of the determination of carbon tax, carbon budgets and carbon offsets. Climate change and its measures to address it are transversal. As such, a concerted effort must be made to avoid the duplication of reporting in terms of implementing any intervention in respect of climate change.

The above legislative reform and policy developments contributes to the Green Economy, which refers to two interlinked developmental outcomes for the South African economy:

- Growing economic activity (which leads to investment, jobs and competitiveness) in the green industry sector; and
- A shift in the economy as a whole towards cleaner industries and sectors with a low environmental impact compared to its socio-economic impact.

It is envisaged that the Green Economy will be able to create "green" jobs, ensure real sustainable economic growth and prevent environmental pollution, global warming, resource depletion and environmental degradation. It is a growing economic development model based on the knowledge that aims to address the interdependence of economic growth and natural ecosystems and the adverse impact economic activities can have on the environment.

2.2.2 PROVINCIAL POLICY DEVELOPMENTS

Climate Change has been identified as a policy priority of the Western Cape Government. As such, the following policy developments and initiatives have been implemented to address climate change, and indirectly manage air quality in the Province. A summary of the policy developments and initiatives that have been developed in the Western Cape is provided below.

- **2014 WESTERN CAPE CLIMATE CHANGE RESPONSE STRATEGY**

  The Western Cape Climate Change Response Strategy was approved and adopted by the Western Cape Government in 2014. The Strategy provides a coordinated response to climate change and aims to guide the implementation of innovative projects that combined a low carbon development trajectory with increased climate resilience, enhancement of ecosystems and the services they provide, as well as economic stability and growth. The following nine focus areas are highlighted in the Strategy:

  - 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.

The Strategy will be updated in 2017/18 and this update will include a review of the focus areas, as well as the priority programmes.

- **2014 WESTERN CAPE CLIMATE CHANGE RESPONSE IMPLEMENTATION FRAMEWORK**

  The Western Cape Climate Change Response Implementation Framework was published in August 2014. The Framework outlines each focus area in order to identify impact potential or benefit for priority programmes and to discuss the opportunities for and barriers to the implementation of priority programmes, as identified in the Western Cape Climate Change Response Strategy. The impact potential or benefits were used to finalise a set of indicators that could be used to contribute to the national Climate Change Monitoring and Evaluation Report, which is scheduled for publication in 2017/2018.

  It is clear that air quality plays a major role in adapting to and mitigating climate change. With the ever-increasing linkages between the two arenas, it is evident that key role players remain in communication. A need for clear and precise policy and legislative guidance is essential to the implementation of strategies toward climate change mitigation, which will inevitably determine the effectiveness of strategies inaugurated. Further, informed

decision-making is fundamental to good governance and is critical towards continuous improvements in climate change and air quality management, as well as streamlining of legislation.

Continued efforts to reduce air pollution and GHG emissions are essential, as these pose serious risks to both human health and the environment. Moreover, air pollution and climate change influence each other through complex interactions in the atmosphere. Increasing levels of GHGs alter the energy balance between the atmosphere and the Earth's surface which, in turn, can lead to temperature changes that alter the chemical composition of the atmosphere (Law, 2010). Direct emissions of air pollutants (e.g. black carbon) or those formed from emissions such as sulphate and ozone can also influence this energy balance. Thus, climate change and air quality management have significant consequences for each other. The implementation of legislation and policies relating to the management of air quality and climate change can provide mutual benefits that contribute towards maintaining good, clean air, while also reducing global warming.

2.3 ALIGNMENT OF AIR QUALITY MANAGEMENT AND CLIMATE CHANGE WITH OTHER EXISTING NATIONAL AND PROVINCIAL PLANS AND STRATEGIES

Applicable existing plans and strategies exist at the National and Provincial levels. A synopsis is provided below in respect of the key matters of relevance to air quality management and climate change in the Province.

2.3.1 NATIONAL MATTERS OF RELEVANCE TO THE WESTERN CAPE 2ND GENERATION AQMP

2030 NATIONAL DEVELOPMENT PLAN	20 YEAR PLAN
Objectives and actions ● Economy and employment ● Economic Infrastructure ● Environmental sustainability and resilience ● An integrated and inclusive rural economy ● Positioning South Africa in the region and the world ● Building a capable and developmental state ● National building and social cohesion ● Improving education, training and innovation ● Social protection	

2020 NEW GROWTH PATH	10 YEAR PLAN
Job Drivers ● Infrastructure ● Spatial Development ● Main economic sectors ● Seizing the potential of new economies ● Investing in social capital and public services	
Job Sector ● Green Economy	

OUTCOME 10 DELIVERY AGREEMENT	5 YEAR PLAN
Environmental assets and natural resources that are valued, protected and continually enhanced.	
Sub-outcome: An effective climate change mitigation and adaptation response ● Main outputs and measures: Green Transport and Implementation Plan; Thematic areas in implementing environmental fiscal reform policy instruments; Renewable power generation (to incorporate off-grid energy); Energy efficient improvement; Sector adaptation strategies and plans; Functional climate change research network formalised; Biennial report on State of Climate Change Science and Technology; National framework for climate services; Framework for reporting on greenhouse emissions by industry; Biennial calorific value for fuel carriers; Annual energy balances to support GHG inventory.	
Sub-outcome: Enhanced governance systems and capacity ● Main outputs and measures: Compliance inspections; Enforcement actions undertaken for non-compliance; Compliance with National Ambient Air Quality Standards; Atmospheric Emission Licenses issued; Atmospheric Emission Licenses reporting to the NAEIS. ● Sub-outcome: Sustainable Human Communities ● Renewable energy deployed off-grid; solar home systems (PV) installed; Reduced total emissions of CO_2; Reduced vulnerability and risks associated with climate change impacts.	

MEDIUM TERM STRATEGIC FRAMEWORK	5 YEAR PLAN
5 year definition of strategic objectives and mandate of government	
Relevant Objectives ● Ensure more equitable distribution of benefits of economic growth and reduce inequality ● Halve poverty and unemployment by 2014	
Relevant Priority Areas ● Cohesive and sustainable communities Sustainable resource management and use Rural development, food security and land reform Economic and social infrastructure	

2.3.2 PROVINCIAL MATTERS OF RELEVANCE TO THE WESTERN CAPE 2ND GENERATION AQMP

ONE CAPE 2040	30 YEAR PLAN
5 year definition of strategic objectives and mandate of government	
Relevant Priority Actions ● Transition from a clean economy is paramount ● Safe and efficient public transport and embracing non-motorised transport ● Energy security from renewable sources ● Enhance municipal service delivery in poor areas	

WESTERN CAPE PROVINCIAL STRATEGIC PLAN 2014 – 2019	5 YEAR PLAN
Provincial Strategic Goals ● Create opportunities for growth and jobs ● Improve education outcomes and opportunities for youth development ● Increase wellness, safety and tackle social ills ● Enable a resilient, sustainable, quality and inclusive living environment ● Embed good governance and integrated service delivery through partnerships and spatial alignment	
Relevant Departmental Working Groups ● Climate Change Response	

2013 WESTERN CAPE STATE OF THE ENVIRONMENT OUTLOOK REPORT	5 YEAR PLAN
Priorities for Green Growth ● Natural gas and renewables ● Green jobs ● Financial infrastructure (attract capital and investment into green innovation)	
Green Drivers ● Smart living and working ● Smart mobility ● Smart eco-systems ● Smart agri-production ● Smart enterprise	
Actions ● Promote innovation ● Create an enabling environment ● Grow / develop the market	

2013 WESTERN CAPE GREEN ECONOMY STRATEGY FRAMEWORK	5 YEAR PLAN
Strategic Priorities ● Green built environment – infrastructure services, human settlement ● Actively strengthen ecological goods and services to enhance resilience and limit impact on the poor ● Enhance systems for integrated planning and implementation incorporating biodiversity and ecosystem vulnerability ● Good governance – environmental monitoring, waste management, integrated planning	

2014 WESTERN CAPE PROVINCIAL SPATIAL DEVELOPMENT FRAMEWORK	5 YEAR PLAN
Relevant Spatial Goals ● Better protection of spatial assets and strengthen resilience of natural and built environments ● Improved effectiveness in the governance of its urban and rural areas	
Spatial Vision ● Green Cape ● Living Cape ● Leading Cape ● Educating Cape ● Working Cape ● Connecting Cape	
Spatial Framework and Themes ● Sustainable use of the Western Cape's spatial assets ● Opening up opportunities in the provincial space-economy ● Developing integrated and sustainable settlements	

2.3.3 LOCAL MATTERS OF RELEVANCE TO THE WESTERN CAPE 2ND GENERATION AQMP

CITY OF CAPE TOWN AQMP	5 YEAR PLAN
Vision ● To be the city with the cleanest air in Africa.	
Mission ● To reduce the adverse health effects of poor air quality on the citizens of Cape Town especially during 'brown haze' episodes.	

CAPE WINELANDS DISTRICT AQMP	5 YEAR PLAN
Vision ● To be a district within which the constitutional right of all inhabitants to clean and healthy air is maintained in a sustainable manner without compromising economic and social development for the benefit of present and future generations.	
Mission ● To implement sustainable air quality management practices throughout the district to progressively achieve air quality goals.	

CENTRAL KAROO DISTRICT AQMP	5 YEAR PLAN
Vision ● To maintain air quality to such a standard that economic and social development will flourish without jeopardizing the environment.	
Mission ● To minimise the impact of air pollutant emissions on the population and the natural environment of the Central Karoo District and to promote the use of renewable energy sources such as wind, sun and water in order to support global initiatives to prevent ozone depletion and global warming.	

OVERBERG DISTRICT AQMP	5 YEAR PLAN
Vision ● To be a district where the constitutional right of all human beings to clean air is maintained to such a standard where economic and social development will flourish without jeopardizing the environment.	
Mission ● To ensure effective and maintain implementation of sustainable air quality management practices throughout the Overberg district to progressively achieve air quality goals minimise the impact of air pollutant emissions on the population and the natural environment of the Overberg municipal district.	

EDEN DISTRICT AQMP	5 YEAR PLAN
Vision ● To have air quality worthy of the names “Eden” and “the Garden Route”	
Mission ● To minimise the impact of air pollutant emissions on the population and the natural environment of the Eden municipal district.	

WEST COAST DISTRICT AQMP	5 YEAR PLAN
Vision ● Attainment and maintenance of good air quality for the benefit of all inhabitants and natural environmental ecosystems within the West Coast District Municipality.	
Mission ● To ensure the maintenance of good quality air through proactive and effective management principles that take into account the need for sustainable development into the future. ● To work in partnership with communities and stakeholders to ensure the air is healthy to breathe and is not detrimental to the well-being of persons in the District. ● To ensure that future developments (transportation, housing etc.) incorporate strategies to minimise air quality impacts. ● To reduce the potential for damage to sensitive natural environmental systems from air pollution, both in the short and long-term. ● To facilitate intergovernmental communication at the Local, Provincial and National levels in order to ensure effective air quality management and control in the WCDM.	

Photograph by: J. Leaner

3. DEVELOPING THE 2ND GENERATION AIR QUALITY MANAGEMENT PLAN

3.1 PUBLIC PARTICIPATION PROCESS (PPP) DURING THE REVIEW OF THE AQMP2010

Members of the public were invited to participate in the review of the Western Cape Air Quality Management Plan 2010 (AQMP 2010). The aim was to assess progress made in terms of implementing the Western Cape AQMP, while identifying potential air quality risks and interventions that can be translated into air quality management (AQM) goals and objectives in going forward. The following phases were followed during the review process:

- **PHASE 1:** a series of regional Public Participation Process (PPP) Workshops was held during September 2015, which contributed towards the development of this Status Quo Report.
- **PHASE 2:** a series of regional PPP Workshops was hosted during August 2016, which further contributed towards the development of the 2nd Generation Western Cape AQMP.

The PPP Workshops were held throughout the Western Cape during September 2015 (Phase 1) and August 2016 (Phase 2), as indicated in Table 3-1a and 3-1b. The public and authorities reviewed the AQMP2010 during the Phase 1 workshops; however, many participants were not aware of the contents of the AQMP2010 prior to attending the Phase 1 review sessions. As such, much workshop time focused on educating participants about the background and content of the AQMP2010. Participation during the Phase 2 review sessions proved to be extremely invaluable, as partipants engaged actively and contributed to finalising the gaps and recommendations, which led to identifying the activities of the 2nd Generation Western Cape AQMP.

Overall, there was excellent representation from Air Quality Officers (AQOs) who possess excellent local knowledge of the air quality issues at hand and have excellent relationships with local stakeholders of all sectors of society and industry.

3.2 KEY OUTCOMES IDENTIFIED DURING THE PUBLIC PARTICIPATION PROCESS

A summary of the outcomes of the PPP Workshops in respect of the four goals of the AQMP2010 is provided below:

- **GOAL 1: To ensure effective and consistent air quality management**
  Participants agreed that AQM was important and further agreed this goal and its targets were relevant five years on; an average score of 7/10 was rated for relevancy. Participants, however, rated the implementation of Goal 1 as low and attributed this to air quality not being prioritised throughout the Province. The general opinion was that air quality management was an "add on", thereby resulting in personnel, budget and training being significantly below the necessary requirements. This was perceived to be especially true at District and Municipal levels, as Municipal AQOs do not focus solely on air quality matters, while at provincial level increased resources are also required.

TABLE 3-1A: PHASE 1 PUBLIC PARTICIPATION PROCESS HELD DURING SEPTEMBER 2015

REGION	DATE	VENUE
Eden	16 September 2015	**Eden District Municipality (EDM),** EDM Council Chambers, 54 York Street, George
Central Karoo	17 September 2015	**Central Karoo District Municipality (CKDM)** Disaster Management Unit, Weighbridge (northern side of Beaufort West)
West Coast	18 September 2015	**West Coast District Municipality (WCDM),** WCDM Recreation Hall, 58 Long Street, Moorreesburg
City of Cape Town	21 September 2015	**City of Cape Town Metropolitan Municipality,** Milnerton Public Library Auditorium, Pienaar Road, Milnerton
Cape Winelands	21 September 2015	**Cape Winelands District Municipality (CWDM),** CWDM Council Chambers, 51 Trappes Street, Worcester
Overberg	22 September 2015	**Overberg District Municipality (ODM),** Bredasdorp Sports Complex, (Glaskasteel) Recreation Road, Bredasdorp

TABLE 3-1B: PHASE 2 PUBLIC PARTICIPATION PROCESS HELD DURING AUGUST 2016

REGION	DATE	VENUE
Central Karoo	17 August 2016	**Central Karoo District Municipality,** Disaster Management Unit, Weighbridge, Beaufort West
Eden	18 August 2016	**Eden District Municipality,** EDM Council Chambers, 54 York Street, George
Overberg	19 August 2016	**Overberg District Municipality,** Welverdiend Library, Ou Meule Street Bredasdorp
West Coast	22 August 2016	**West Coast District Municipality,** Langebaan Council Chambers, Langebaan
Cape Winelands	23 August 2016	**Cape Winelands District Municipality,** Worcester Library, Worcester
City of Cape Town	24 August 2016	**City of Cape Town Metropolitan,** Parow Library, c/o McIntyre Street and 1st Avenue, Parow

Air quality management training and capacity building were needed at all levels of government, as well as for industry and the community. A call was also made for industry to be recognised for their positive achievements in the field.

Overall, participants agreed that co-operative governance on air quality management had improved over the past five years, with the formation of District Air Quality Officer's Forums (AQOFs) being a positive and welcomed development. It was viewed as a process that "narrowed the gap between industry and government" in the Province.

- **GOAL 2: To continually engage with stakeholders to raise awareness with respect to air quality management**

  Participants agreed that raising awareness with respect to air quality management remains very relevant; an average score of 9/10 was rated for relevancy. However, participants overwhelmingly experienced that this goal required significantly more effort, and highlighted that the general public was not informed on most aspects of air quality management and the NEM: AQA. Awareness raising of air quality management and the NEM: AQA is required in the municipal areas; the urgent need for increased air quality awareness was raised. Industry requested that they be engaged more frequently, as "there was a real thirst for knowledge about air quality and its management".

A strong recommendation was made for government to develop an overarching Air Quality Communications Strategy, with a dedicated focus to be established within the DEA&DP, tasked solely with public relations on air quality management. It was recognised that air quality awareness raising and communication was not only the mandate of the Province; the Metropolitan, Local and District Municipalities were also responsible for air quality awareness raising and needed to prioritise this in their jurisdictions. Industry further noted that larger companies were obliged by law to engage their local stakeholders regarding air quality matters, and this was regarded as an obvious opportunity for air quality awareness raising.

- **GOAL 3: To ensure effective and consistent compliance monitoring and enforcement**

  Participants agreed that effective and consistent compliance monitoring and enforcement with respect to air quality management remains very important; an average score of 8/10 was rated for relevancy. There was strong agreement, especially from industry and civil society, for the need for effective compliance monitoring and enforcement, and for Provincial Government to use all its available legislative powers to encourage Local and District Municipalities to perform air quality compliance monitoring and enforcement in their jurisdictional areas.

  There was a strong linkage to awareness raising, as the participants experienced that an awareness of by-laws and the roles and responsibilities of agencies involved was necessary for effective and efficient compliance monitoring and enforcement practices. Further, there was a strong requirement of this goal to be linked to capacity building and training of authorities in municipal by-law or air quality regulation application, as it relates to continuous compliance monitoring and enforcement.

- **GOAL 4: To support climate change protection programmes, including promoting the reduction of greenhouse gas emissions**

  This goal was deemed very relevant and was rated at an average score of 8/10 given for relevancy. Participants called for Local Municipalities to include air quality management in their planning processes (IDPs, town planning, waste management, urban creep) and as it relates to climate change.

  There was a strong call for regulation to reduce carbon emissions through renewable energy, and understand the potential financial benefits from such interventions. Vehicle emissions testing was viewed as extremely important in terms of addressing carbon emissions reduction. Better alignment between air quality management and climate change was emphasized; participants experienced that there was a 'disconnect' between the two areas, yet it is integrally linked. Overall, participants emphasized that the new developments in the climate change arena at an international level (e.g. COP21) needs to be addressed in the 2nd Generation AQMP for the Western Cape.

  Overall, the PPP indicated that the management of air quality was extremely relevant, and needed to be prioritised throughout the Province. Further, the need to emphasize and integrate air quality management and climate change was also highlighted. The gaps and recommendations made at the workshops are further elaborated in Chapter 10.

Photograph by: B. Parker

4. OVERVIEW OF THE WESTERN CAPE

This Chapter provides an overview of the Province's meteorological conditions, population distribution and economic distribution as these either impact on the dynamics of air flow in the region, or are linked to activities that could contribute to anthropogenic air pollution emissions. Typically, topography and meteorology influences the movement of air pollution.

4.1 INTRODUCTION

The Western Cape comprises of one Metropolitan Municipality, viz. City of Cape Town, and five District Municipalities. These are the West Coast, Cape Winelands, Central Karoo, Eden and Overberg District Municipalities, which are further divided into 24 Local Municipalities. Figure 4-1 shows the location of the City of Cape Town, and the five District Municipalities of the Western Cape.

The Western Cape Province covers an area of 129 370 km^2, and makes up 10 % of the country's land surface. With an L-shape, it is bordered in the north by the Northern Cape Province, in the east by the Eastern Cape Province, the Indian Ocean in the south and the Atlantic Ocean in the west. The longest north-south dimension is about 500 km and the longest west-east dimension is about 650 km.

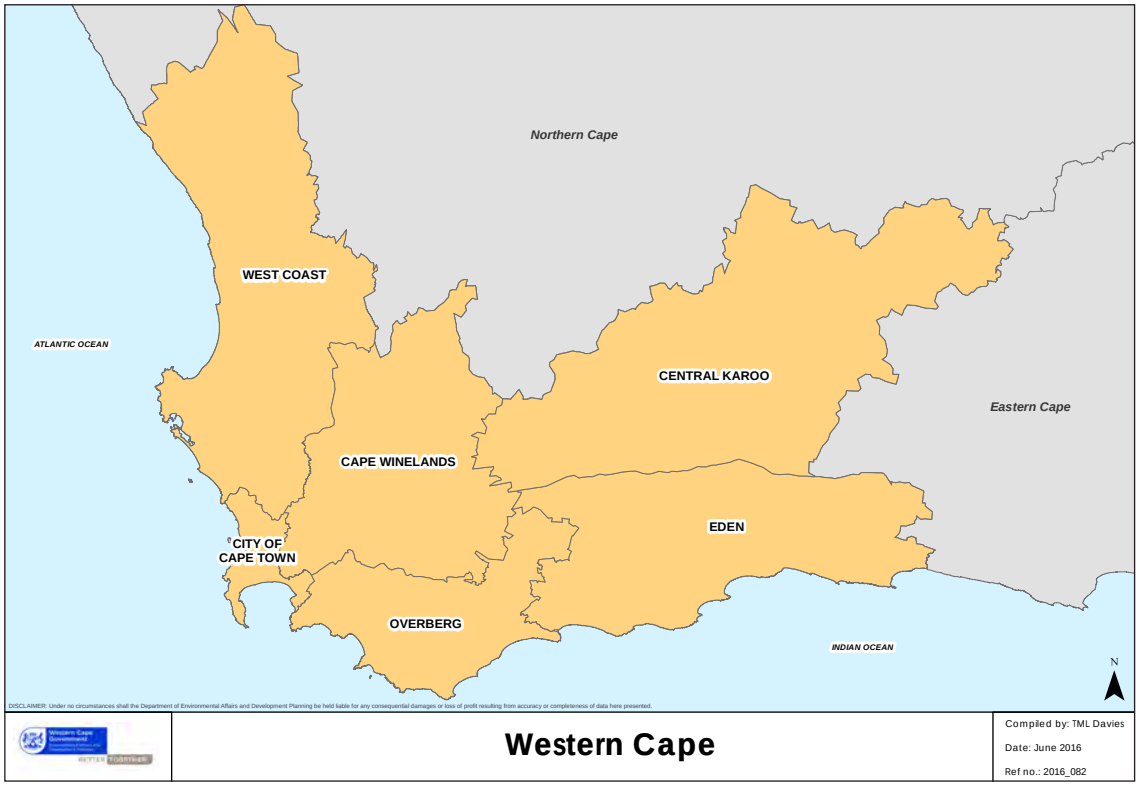


FIGURE 4-1: LOCALITY MAP DEPICTING THE WESTERN CAPE PROVINCE, INDICATING THE FIVE DISTRICTS AND THE CITY OF CAPE TOWN METROPOLITAN MUNICIPALITY

The Province has a diverse climate, created by the varied topography and the influence of the Indian Ocean (warm water) and Atlantic Ocean (cold water). Most parts of the Western Cape have a Mediterranean climate with moderately wet winters and dry, windy warm summers (Tyson and Preston-Whyte, 1988; Midgley et al., 2005). The rainfall pattern is mainly driven by the development of cold fronts associated with mid-latitudes cyclones in winter,

orographic effects, the influence of surrounding oceans, and the geographic location of the region (Tyson and Preston-Whyte, 2000; Blamey et al., 2014).

The Western Cape accommodates 11.3 % of the country's population; with the population having grown relatively rapidly over the past five years to an estimated 6.2 million in 2015. Figure 4-2 shows the population distribution in the Western Cape. Geographically, the City of Cape Town Metropolitan Municipality hosts approximately 64.1 % of the population, followed by the District Municipalities in the order: Cape Winelands (13.5 %), Eden (9.7 %), West Coast (6.8 %), Overberg (4.5 %) and the Central Karoo (1.2 %) (PT, 2015a). The Western Cape is a highly urbanised province, with 81 % of its population residing in formal residential areas; while 7 % reside in informal residential areas and almost 8 % reside on farms (DEA&DP, 2013a).

In terms of spatial patterns of economic activity, the Western Cape economy is geographically concentrated in the City of Cape Town Metropolitan area and the adjacent Cape Winelands District. Approximately 85 % of real value added to the Provincial economy is generated in these two areas (DEA&DP, 2013a).

With population growth, towns are generally transformed into cities and megacities that generate increased anthropogenic air pollution (i.e. man-made air pollution). The Western Cape's increasing population is placing ever greater demand on housing, transportation, energy and water services. Although this growth correlates with economic growth, it will likely also show a concomitant increase in air emissions from sources such as vehicles and industry, etc.

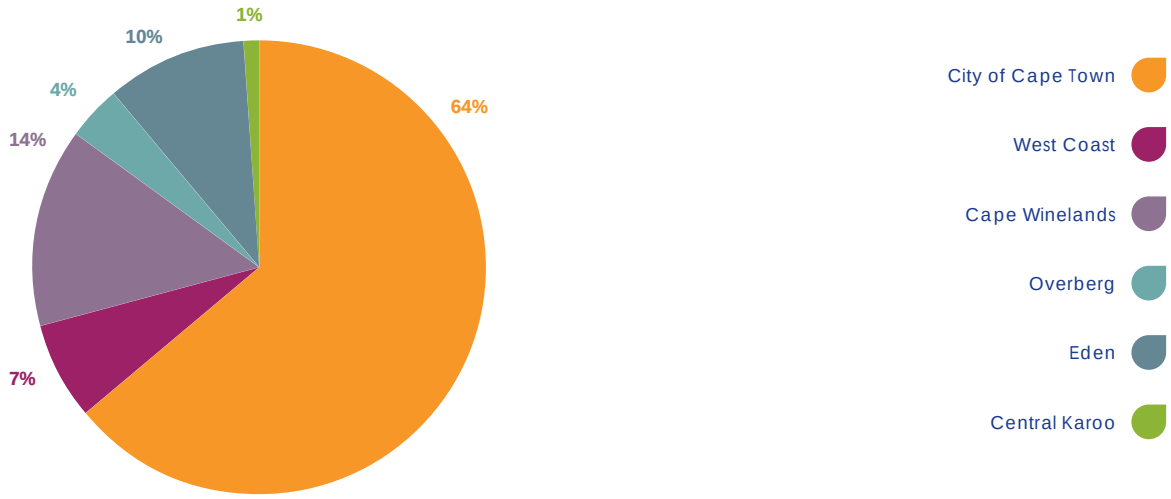


FIGURE 4-2: WESTERN CAPE PROVINCE POPULATION DISTRIBUTION 2014 (PT, 2015a)

4.2 OVERVIEW: METEOROLOGY / TOPOGRAPHY, POPULATION AND ECONOMIC DISTRIBUTION IN THE PROVINCE

A summary of the meteorology and topography, as well as the population and economic distribution in the respective Municipal areas is provided below. Overall, general government, community and social services are the major economic activities in all regions.

4.2.1 CITY OF CAPE TOWN METROPOLITAN MUNICIPALITY

The City of Cape Town Metropolitan Municipality (CCT) is located in the southern peninsula of the Western Cape. It extends over an area of 2 461 km^2 with a coastline that is 294 km long. The Cape Town region has an extensive coastline, rugged mountain ranges, coastal plains, inland valleys and semi-desert fringes. The majority of the area is urbanised, but the open areas are substantial and include the Table Mountain and the Cape of Good Hope Nature Reserves. The Municipalities adjacent to the CCT are the Swartland and West Coast to the north; Drakenstein, Cape Winelands and Stellenbosch to the north-east; and Theewaterskloof, Overberg and Overstrand to the south-east. It is also bounded by the Atlantic Ocean to the south and west (DEA&DP, 2009).

The CCT Metropolitan area experiences warm summers that are relatively dry and mild winters. Summer temperatures range between maximums of 26 °C and minimums of 16 °C. The average winter maximum and minimum temperatures are 17 °C and 7 °C, respectively. Rain occurs throughout the year, but the bulk of the rainfall occurs from May to August (DEA&DP, 2009).

Meteorology is the study of the atmosphere and focuses on the characteristics of parameters, such as wind speed, wind direction, temperature and atmospheric stability to determine weather patterns. Topography refers to the arrangements of physical features, such as rivers and mountains, within a geographical area.

The meteorology of an area assists in understanding the movement of air pollutants in that area. The vertical movement of air pollutants is governed by atmospheric stability, while the horizontal movement of pollutants is dependent on wind speed and direction. The chemical transformation of pollutants in the atmosphere is principally governed by solar radiation and moisture; and finally, removal of pollutants from the atmosphere is dependent on precipitation (DEAT, 2009).

Coastal low pressure systems cause hot dry berg winds in winter. In the summer months in the CCT, the south easterly wind (commonly referred to as the "Cape Doctor") is well-known for carrying air pollutants away from the city. Inversion layers are more prominent in the winter months due to there being less windy conditions (DEA&DP, 2009).

Generally, four synoptic weather systems control Cape Town's meteorology. In summer, the ridging Atlantic Ocean Anticyclone results in a high frequency of strong south-easterly winds and partly cloudy skies. Frontal weather systems in winter result in north westerly winds in advance of the front with low temperatures and cloudy conditions, followed by south-westerly winds with the passage of the front, cold temperatures, cloudy skies and rainfall. In late winter and spring, the frontal systems are weaker and pressure gradients are generally slack. Clear skies result in the development of light berg winds and strong surface temperature inversions at night. In summer, the Atlantic Ocean Anticyclone is situated over the southern parts of the subcontinent resulting in light winds, clear skies and an elevated temperature inversion (DEA&DP, 2009).

Table Mountain, False Bay and Table Bay have a pronounced effect on Cape Town's meteorology, resulting in six distinctive meteorological zones, each with unique characteristics (Figure 4-3) (DEA&DP, 2009).

A summary of the six meteorological zones is provided below:

- **ZONE 1** is known as the so-called City Bowl, and is strongly influenced by Table Mountain. It blocks the southerly wind flow and causes a local scale recirculation of air in the lee of the mountain. Inversions persist in the winter months and the recirculation can cause pollutants to accumulate. Northwesterly winds disperse pollutants most effectively in Zone 1.
- **ZONE 2** runs parallel to the mountains on the Cape Peninsula and it is ventilated by southeasterly and northwesterly winds. The orographic effects of the mountains result in high rainfall. Inversions also persist in Zone 2, but tend to break up quicker than Zone 1 due to heating of the east facing mountain slopes by the rising sun. Down slope drainage winds tend to disperse pollutants downwards.
- **ZONE 3** includes the southern Cape Flats. The area is exposed to the both northwesterly and southerly wind flow. These typically cause an early break-up of the surface temperature inversions that develops at night.
- **ZONE 4** includes the central Cape Flats which is somewhat protected from the effects of the north-westerly and southerly wind flow than Zone 3. As a result, the night time surface temperature inversion in winter persists well into the morning.
- **ZONE 5** lies further north. Here the daytime winds generally have a westerly component. Night time winds are lighter and back to the east.
- **ZONE 6** is the coastal belt along the Atlantic Ocean. The area is well exposed and northerly and southerly airflow dominates. Under stable conditions, a sea-breeze circulation may develop and pollutants may be re-circulated, sometimes to some distance inland, depending on the strength of the sea breeze.

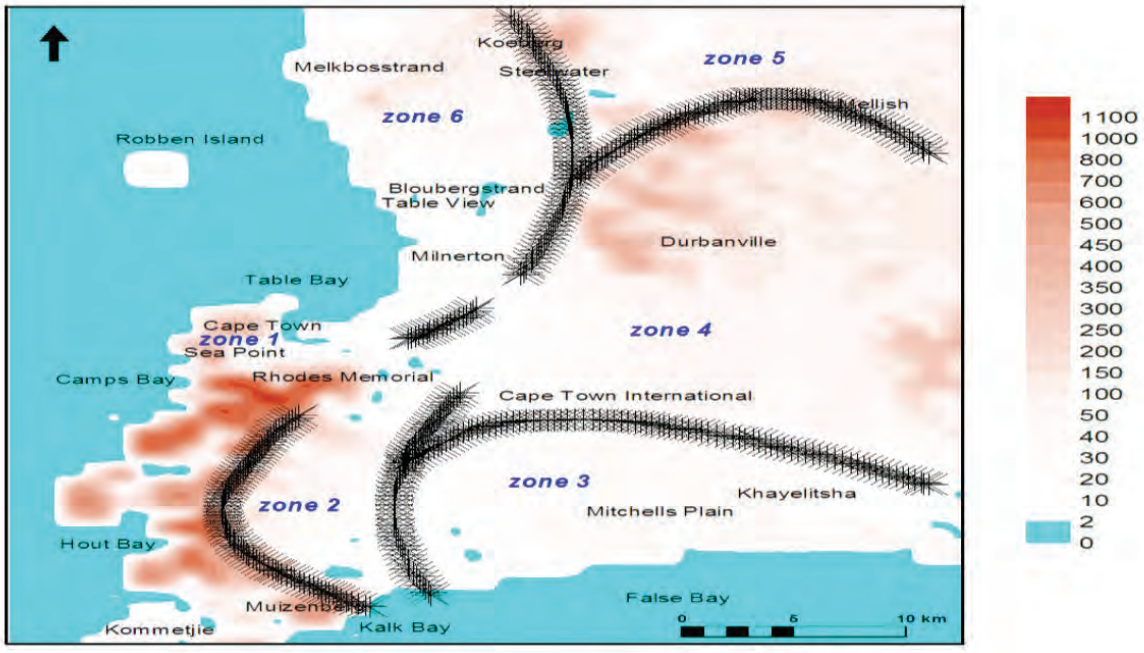


FIGURE 4-3: THE SIX METEOROLOGICAL ZONES IN THE CITY OF CAPE TOWN. THE SHADING DEMONSTRATES THE TERRAIN HEIGHT IN METRES ABOVE SEA LEVEL (DEA&DP, 2009)

- **POPULATION DISTRIBUTION**
  The population of Cape Town was 3.7 million in 2011, an increase of 29.3 % since 2001. It is projected that by 2031 the population of the CCT will grow to at least 4.4 million (StatsSA, 2011; CCT, 2015/2016).

- **ECONOMIC DISTRIBUTION**
  Finance, insurance, real estate and business services constitute 36 % of economic activity in the CCT, followed by manufacturing (16 %), trade and hospitality (16 %) and communication (11 %) (Figure 4-4; CCT, 2013/2014).

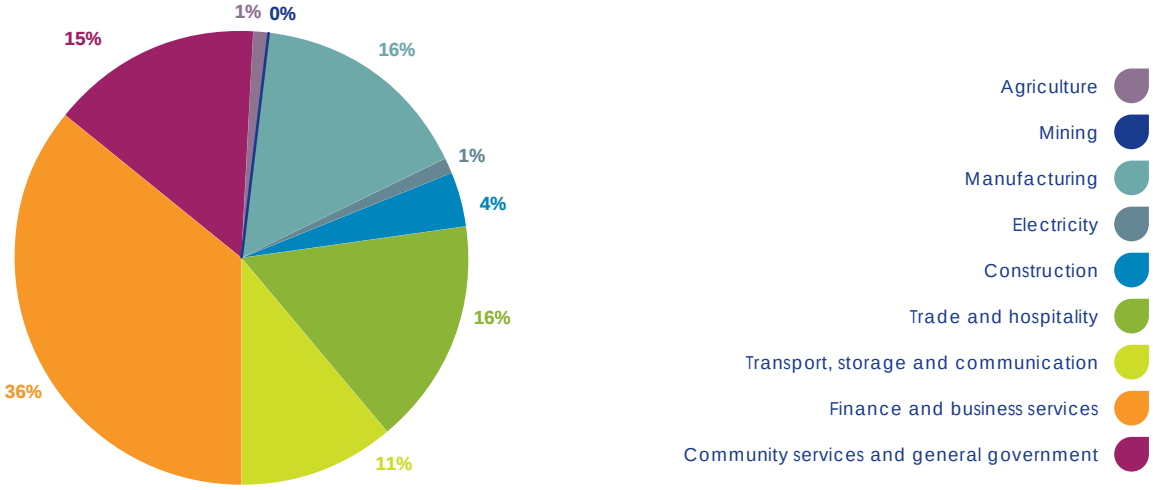


FIGURE 4 4: SECTORAL CONTRIBUTION IN THE CITY OF CAPE TOWN (CCT, 2013/2014)

4.2.2 CENTRAL KAROO DISTRICT MUNICIPALITY

The Central Karoo District Municipality (CKDM) is situated in the northeast of the Western Cape Province and covers an area of 38 853km^2. Central Karoo forms part of the Great Karoo and is classified as a unique arid zone. The Swartberg Mountains near Prince Albert and the Nieuveld Mountains near Beaufort West border the district in the south. The Central Karoo is a semi-desert with only the southernmost parts near Prince Albert, Klaarstroom and Vleiland, classified as semi-arid, and able to sustain agricultural activities other than sheep farming (DEA&DP, 2009).

The climate of the CKDM is arid to semi-arid, with approximately 75 % of the district receiving less than 200 mm of rain per annum. The highest rainfall occurs in the Groot Swartberg mountain range south of Prince Albert and in the Sneeuberge southeast of Murraysburg. Apart from the far western portion which receives mainly winter rain, the highest rainfall probability is during March and April (DEA&DP, 2009).

The temperature regime of the CKDM is typically continental, meaning there is a large difference between the mean temperature of the coldest and warmest month (11 °C – 13 °C). January is generally the warmest month with mean maximum temperatures between 28 °C and 32 °C. Heat wave conditions do occur and could induce temperature in excess of 40 °C. The coldest months are June and July, with early morning temperatures regularly dropping to below 0 °C. Frost is therefore common in the entire district, with severe frost at the higher altitudes (DEA&DP, 2009).

- **POPULATION DISTRIBUTION**

  The Prince Albert Local Municipality includes the towns of Prince Albert, Leeu-Gamka and Klaarstroom and has a total population of approximately 13 136 residents. Laingsburg Local Municipality, which includes the settlement of Matjiesfontein is the smallest Municipality and has the smallest population in the Central Karoo District, at 8 289 residents. Beaufort West Local Municipality has a total population of approximately 49 586 (StatsSA, 2011).

- **ECONOMIC DISTRIBUTION**

  Commercial services (50 %), general government and community, social and personal services (15 %) and manufacturing (15 %) are the prominent economic activities in the Central Karoo District Municipality, with smaller contributions from construction and general services (Figure 4-5). Agricultural activities are important in the Laingsburg and Prince Albert Local Municipalities (PT, 2015b).

  Large-scale uranium mining in Beaufort West and shale gas fracking has been identified as potential economic development drivers for CKDM and are likely to take place in the future (See Section 4.3.8.1). This is significant as both prospecting and mining of these minerals are associated with various environmental impacts, including air quality.

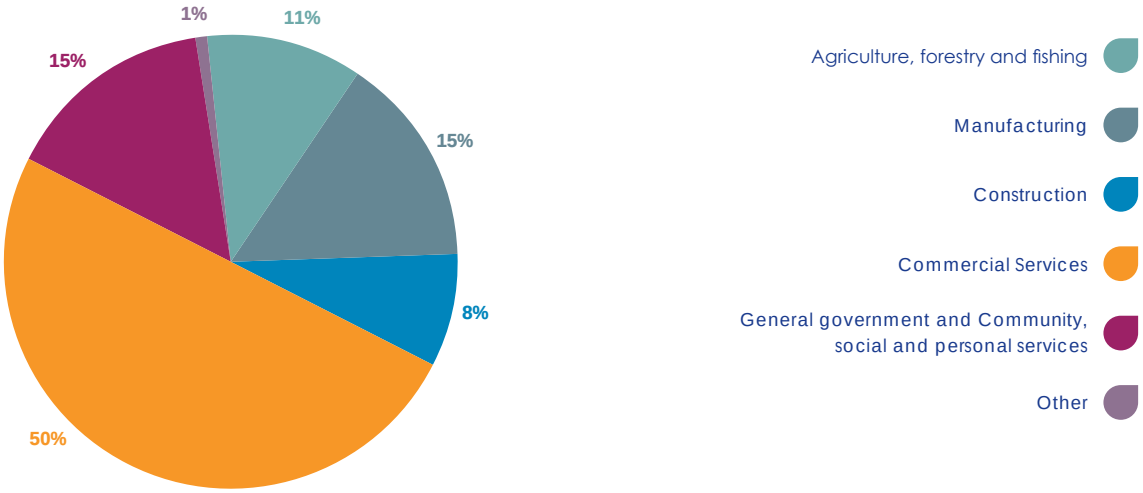


FIGURE 4-5: SECTORAL COMPOSITION OF THE CENTRAL KAROO DISTRICT 2013 (PT, 2015b)

4.2.3 WEST COAST DISTRICT MUNICIPALITY

The West Coast District Municipality (WCDM) covers an area of 31 119 km^2 and is bordered by the Northern Cape in the northeast, by the CWDM in the southeast and by the CCT in the south; while the westerly boundary of the WCDM is the Atlantic Ocean. The WCDM is characterised by varying topography. The landscape is fairly flat to the north, and along the coastline to the west, favouring agricultural activities. A significant part of the district is also covered in mountainous terrain running along the eastern border of the region (DEA&DP, 2009).

The WCDM enjoys a Mediterranean climate, with warm to hot summers and cool winters with the bulk of rainfall occurring about May-August. The annual average rainfall varies dramatically across the district. At Vredendal, an average of 145 mm occurs annually; while up to 1 500 mm occurs in the Cederberg Mountains in the south-west, but decreases sharply to about 200 mm away from the escarpment, to less than 100 mm in the far north. The average maximum temperature at Vredendal reaches 30 °C in summer. The cold Benguela current and the relative differences between sea and land temperatures result in a well-defined land-sea-breeze circulation, particularly in winter (DEA&DP, 2009).

- **POPULATION DISTRIBUTION**

  The population of the WCDM is 410 045. At the end of 2014, the WCDM population represented 6.8 % of the total population of the Western Cape, making it the 3rd largest district, with Saldanha Bay and Swartland being among the ten largest Local Municipalities in the Province, viz. 8th and 6th largest, respectively (PT, 2015b).

  The Swartland and Saldanha Bay populations comprise 55 % of the district's population of 410 045, comprising of 118 704 and 105 351 inhabitants, respectively. The remaining 45 % of the WCDM population is split between Matzikama with 69 495, Bergrivier with 64 892 and Cederberg with 51 603 inhabitants (PT, 2015b).

- **ECONOMIC DISTRIBUTION**

  The WCDM has the third largest non-metro district economy in the Province. It possesses a long coast line and is well-known for the industrial hub surrounding the steel plant in Saldanha Bay (also being the location of the IDZ development recently commissioned and being linked to the oil and gas industry; See Section 4.3.2.1). The grain fields of the Swartland and the natural beauty of the whole region, in turn, are a drawing card for Tourists (PT, 2015b).

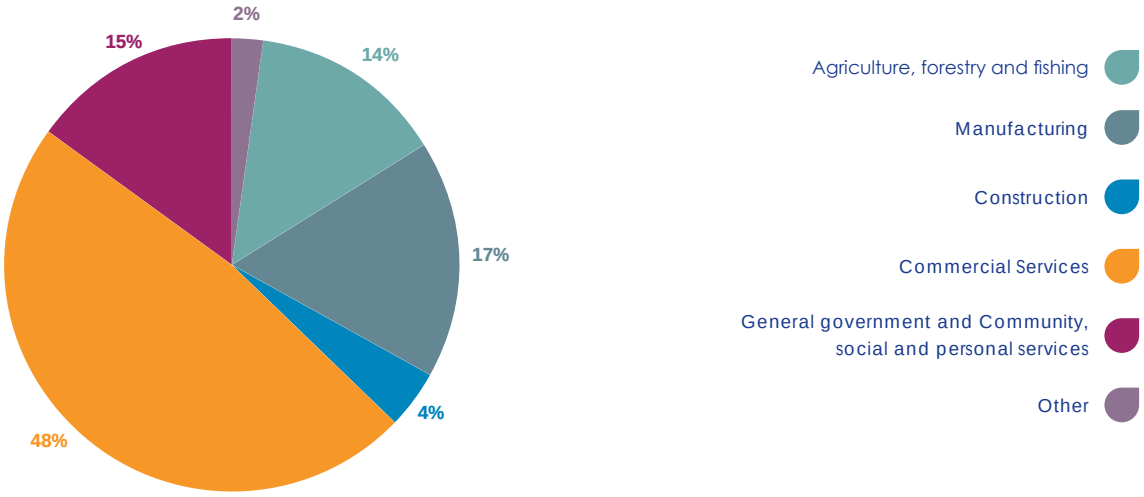


FIGURE 4-6: SECTORAL COMPOSITION OF THE WEST COAST DISTRICT MUNICIPALITY 2013 (PT, 2015b)

4.2.4 EDEN DISTRICT MUNICIPALITY

The Eden District Municipality (EDM) covers an area of approximately 23 331 km^2 and is located on the Western Cape Province's south coast, with the Indian Ocean to the south and the Swartberg Mountains, reaching 1585 m above sea level, in the north. The Outeniqua Mountains lie between the coast and the Swartberg Mountains and separate the coastal plain from the Little Karoo (DEA&DP, 2009).

Climatic conditions vary substantially in the EDM and include the rain forests of Knysna, coastal weather patterns, mountains that receive snow from time-to-time and the dry conditions of the Klein Karoo. Maximum and minimum temperatures vary across the EDM and can fluctuate from in excess of 40 °C on occasion, to close to freezing point during mid-winter. The EDM experiences rainfall throughout the year. This is due to frontal systems during the winter months and the onshore flow of moisture from the warm Agulhas current rising up the coastal mountains to produce summer rain (Blamey et al., 2014).

- **POPULATION DISTRIBUTION**

  The EDM had a population growth rate averaging 2.1 % per annum over the period under review. Municipal specific growth rates across the EDM nevertheless vary, ranging from 0.3 % (Kannaland) to 4.6 % (Bitou). The discrepancies in these growth rates imply that population growth does not stem entirely from natural causes, but is also related to net migration (PT, 2015b).

  As at the end of 2014, the EDM accounted for 9.8 % of the total population of the Western Cape, making it the second largest non-metro district (the largest being the Cape Winelands District), with George and Oudtshoorn being among the 10 largest local municipalities in the Province, viz. 2nd and 10th largest, respectively (PT, 2015b).

  The George and Oudtshoorn populations comprises 50 % of the District's population of 464 105, with each containing 201 736 and 95 954 inhabitants. The remaining 50 percent of the District's population is split between Mossel Bay with 93 803, Knysna with 71 315, Hessequa with 53 935, Bitou with 52 346 and Kannaland with 25 013 inhabitants (PT, 2015b).

- **ECONOMIC DISTRIBUTION**

  Commercial services and manufacturing are the two largest economic sectors in the EDM (Figure 4-7). Manufacturing of animal products increases the contribution of agriculture, as does the trade in agricultural commodities (animal products) and agri-tourism; while tourist attractions include the scenic Garden Route along the coast, including Knysna and the Wilderness, the Cango Caves near Oudtshoorn, the Swartberg and the ostrich farms (PT, 2015b).

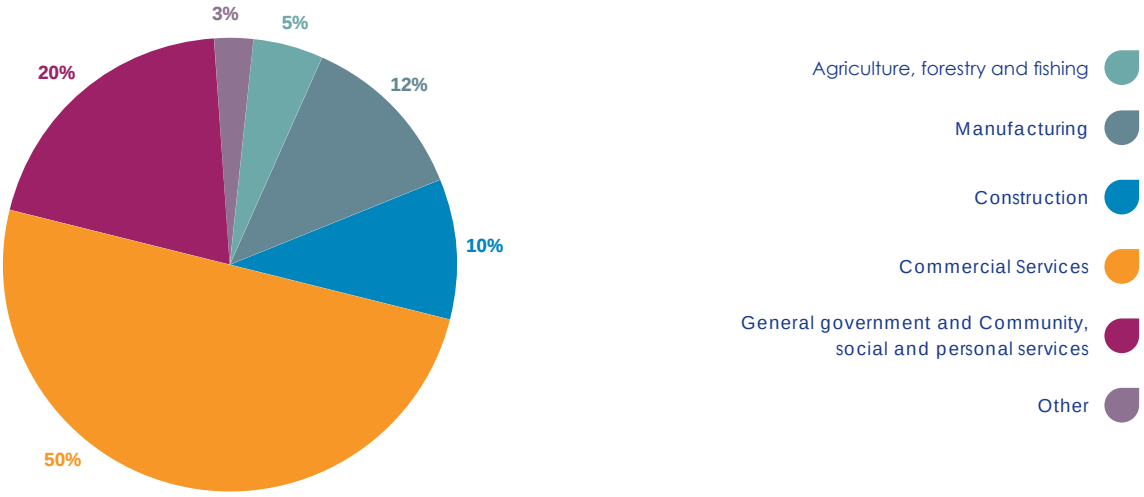


FIGURE 4-7: SECTORAL COMPOSITION OF THE EDEN DISTRICT MUNICIPALITY 2013 (PT, 2015b)

4.2.5 CAPE WINELANDS DISTRICT MUNICIPALITY

The Cape Winelands District Municipality (CWDM) covers a vast area of approximately 22 800 km^2 and is characterised by its mountain ranges, low-lying valleys and world-renowned winelands (DEA&DP, 2009).

The CWDM experiences a Mediterranean climate with hot dry summers and cold wet winters. The position of the south Atlantic Anticyclone in summer and the mountainous topography of the CWDM are key determinants of the weather that is experienced. Summer temperatures range between maximums of 24 °C and minimums of 15 °C. In the winter, westerly winds bring cooler moist conditions. At Paarl, for example, the average winter maximum and minimum temperatures are 18 °C and 8 °C, respectively, while the average monthly rainfall at Paarl is 912 mm. Significant variations occur in the wind field in the CWDM because of the influence of the mountainous topography. These all influence the movement of air, and hence air emissions released from anthropogenic sources (DEA&DP, 2009).

- **POPULATION DISTRIBUTION**

  The CWDM has a total population of approximately 787 490. The CWDM experienced a population growth within the 5 local municipalities ranging from 1.3 to 3.1 % per annum from 2001 to 2013 (StatsSA, 2011). As at the end of 2014, the CWDM population represented 13.7 % of the total population of the Western Cape, making it the largest district (excluding the CCT), with all its municipalities being among the 10 largest Local Municipalities in the Province (PT, 2015b).

  The Drakenstein and Breede Valley populations comprise 53 % of the District's population of 820 695, with each containing 260 472 and 172 268 inhabitants. The remaining 47 % of the CWDM population is split between Stellenbosch with 165 266, Witzenberg with 122 146 and Langeberg with 100 543 inhabitants. The main towns within the District Municipality are Stellenbosch, Paarl, Worcester, Ceres, Wellington and Robertson (PT, 2015b).

- **ECONOMIC DISTRIBUTION**

  Commercial services, manufacturing and agriculture are prominent economic activities in the CWDM, with smaller contributions from construction (Figure 4-8). Agricultural activities are dominated by wine and deciduous fruit production. The Hex River, Paarl, Robertson, Worcester and Stellenbosch are the main wine producing areas. Deciduous fruit is grown and processed in Ceres (PT, 2015b).

  Most of the manufacturing industries are located within Drakenstein, Stellenbosch and Breede Valley. These include food and tobacco, textiles, wood and paper products, chemicals, metals, machinery, household and medical supplies, vehicle and jewellery production (PT, 2015b).

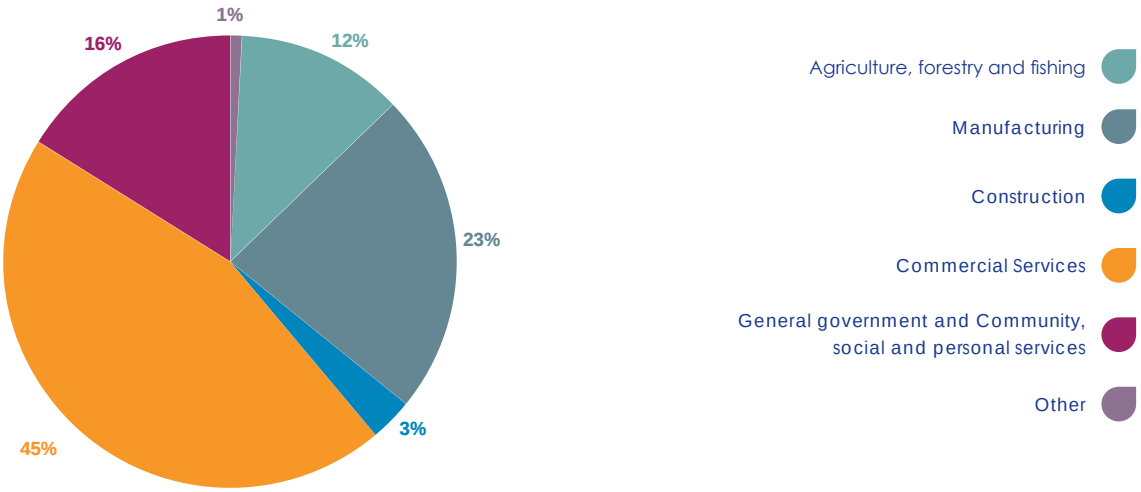


FIGURE 4-8: SECTORAL COMPOSITION OF THE CAPE WINELANDS DISTRICT MUNICIPALITY 2013 (PT, 2015b)

4.2.6 OVERBERG DISTRICT MUNICIPALITY

The Overberg District Municipality (ODM) covers 12 241 km^2 and is nestled between the CWDM, EDM and the CCT Metropolitan Municipality (DEA&DP, 2009).

The ODM experiences a Mediterranean climate with hot dry summers and cool wet winters. The western part of the ODM has a typical winter rainfall pattern (highest rainfall from June to August) and the eastern part receives rain throughout the year (highest rainfall in March and August to October). The winds along the ODM coast are predominantly westerly to west north westerly in winter with the passage of westerly waves along the south coast, and east to east-northeast with the ridging Atlantic Ocean Anticyclone. Strong winds occur during both of these situations. Over the interior, a higher frequency of light winds occurs (DEA&DP, 2009).

- **POPULATION DISTRIBUTION**

  The ODM has a population of approximately 258 175 with a population growth rate within the four local municipalities ranging from 1.5 to 3.4 % per annum (StatsSA, 2011). The Theewaterskloof and Overstrand populations comprise 74 % of the district's population of 269 649, with each containing 113 306 and 85 167 inhabitants. The remaining 17 % of the ODM population is split between Swellendam with 37 133 and Cape Agulhas with 34 004 inhabitants (PT, 2015b).

- **ECONOMIC DISTRIBUTION**

  The major economic activities taking place in the ODM include agriculture, fishing, forestry, commercial services and tourism (Figure 4-9). The strong agricultural sector includes dry land agriculture such as wheat, canola, barley and deciduous fruit. More than a third of the country's exported deciduous fruit is produced in the Elgin Valley. Apples, pears, plums and nectarines are grown at Elgin, Grabouw, Bot River, Houw Hoek, Vyeboom, Villiersdorp and the Hemel-en-Aarde Valley. Some of the country's largest fruit processors are found in Grabouw. Livestock farming includes merino sheep and ostriches. The mariculture industry in sheltered bays includes mussels, oysters, scallops, abalone, finfish, seaweed, prawns and other species such as clams, mullets and red bait. The fishing industry is centred on the harbour towns of Hermanus, Gansbaai and Struisbaai (PT, 2015b).

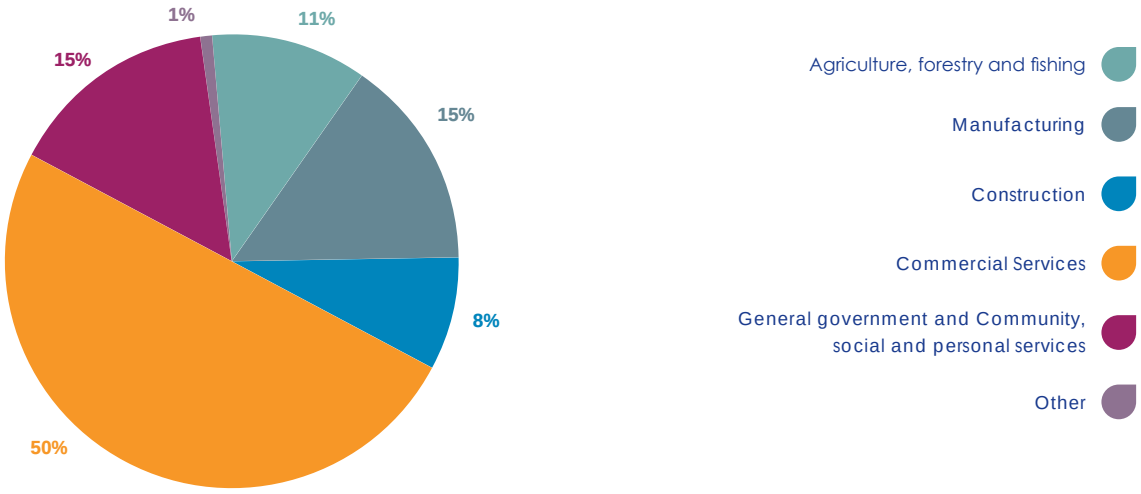


FIGURE 4-9: SECTORAL COMPOSITION OF THE OVERBERG DISTRICT MUNICIPALITY 2013 (PT, 2015b)

4.3 PRIMARY ECONOMIC ACTIVITIES THAT INFLUENCE AIR QUALITY MANAGEMENT

The contribution of the economic sectors, as reported in the Western Cape Spatial Development Framework (Figure 4-10; DEA&DP, 2013a), the Provincial Economic Review and Outlook Report (PERO; PT, 2013; 2015a), the Municipal Economic Review and Outlook Report (MERO; PT, 2015b) and other published reports, are reviewed. The potential impact on air quality in respect of the economic activities in the Province is highlighted below.

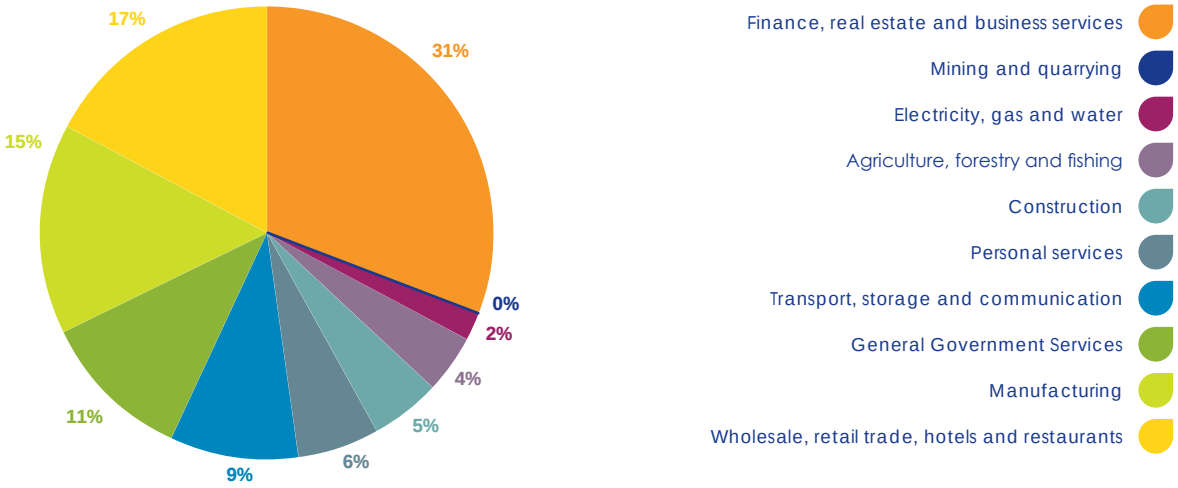


FIGURE 4-10: CONTRIBUTION BY SECTOR TO THE WESTERN CAPE ECONOMY 2012 (DEA&DP, 2013a)

4.3.1 MANUFACTURING

The PERO indicates that manufacturing contributed 15 % towards the GDP in the Western Cape, and that it is forecasted to grow 2.2 % per annum between the period 2015 to 2020 (PT, 2015a). As a mix of electricity, coal and diesel is used for various forms of manufacturing, there is a huge reliance on fossil fuel combustion in the Province, which translates into a concomitant release of GHG emissions.

More than two thirds of the Province's manufacturing sector is located in the CCT area. This, together with the fact that over 60 % of the Western Cape's population is concentrated in this area in the Western Cape, makes it understandably the heaviest energy user of all the Municipal areas. The CCT accounts for 60 % of the Province's total energy consumption (Figure 4-11; DEA&DP, 2013a). This is followed by the West Coast, which is the second highest energy user; attributed to its energy-intensive heavy industries. The West Coast accounts for 24 % of the Province's total energy consumption; while Eden and the Cape Winelands accounts for 7 % each; the Overberg accounts for 2 %; and the Central Karoo accounts for less than 1 % (DEA&DP, 2013a).

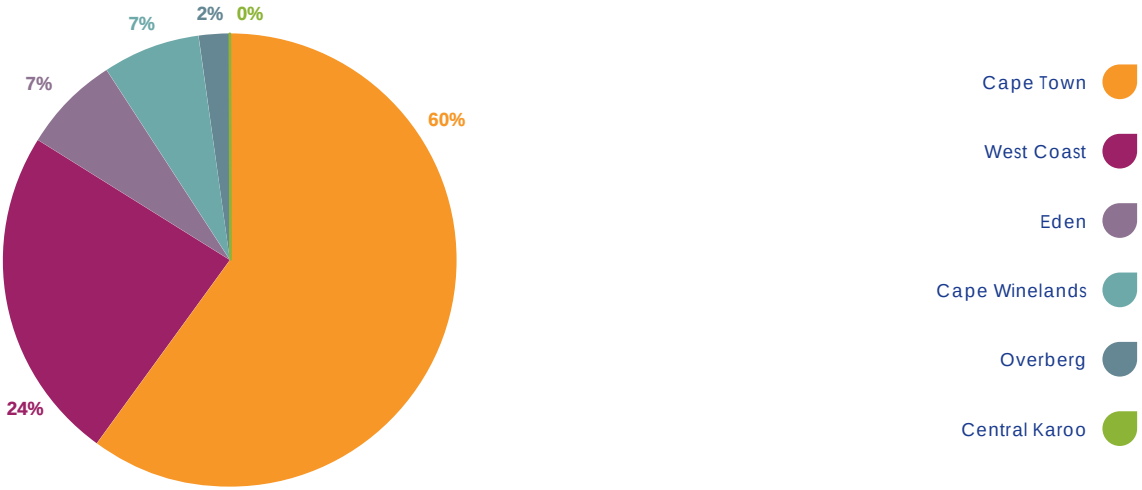


FIGURE 4-11: ENERGY USE PER DISTRICT (DEA&DP, 2013a)

4.3.2 OIL AND GAS SECTOR TRENDS

Although exploration has stalled on the back of the lower oil price, the African oil industry is likely to continue to grow, or at least remain steady, thereby providing a service-market for the Western Cape. According to Transnet, 80 to 100 oil rigs are in operation off the west coast of Africa and a further 120 oil rigs pass by the southern tip of Africa each year (PT, 2015a).

Within the Province, Saldanha Bay is targeted as the home of the key oil rig repair hub; it also hosts a large oil-storage facility. The country's leading gas facility is stationed at the Port of Mossel Bay near PetroSA's gas-to-liquid refinery, operating as a service hub for the regional gas industry (PT, 2015a).

4.3.2.1 SALDANHA BAY INDUSTRIAL DEVELOPMENT ZONE – IDZ

The economy of the Saldanha Bay Functional Region has traditionally been driven by the agricultural sector and fishing activities. However, the presence of the harbour, the regional connectivity in the form of the railway line with the Northern Cape, and the historic investment in the Port of Saldanha Bay have, in recent years, created potential for enhancing economic growth for the sustainable development of the West Coast region (Welman and Ferreira, 2014). The Greater Saldanha Bay (GSB) area is a key focus for national, provincial, regional and local strategic development initiatives. This includes national government's Operation Phakisa, which aims to unlock the country's 'Oceans Economy' for inter alia, oil and gas, mining and industry, aquaculture and tourism and related environmental aspects (SBIDZ, 2016).

As of October 2013, the Saldanha Bay IDZ was promulgated by the Minister for Trade and Industry (SBIDZ, 2016). The IDZ is situated on the outskirts of the town of Saldanha Bay and occupies a total land area of ca. 330 ha. The Saldanha Bay IDZ is a joint project between national, provincial and local government, which aims to attract key investors and companies operating in the upstream (offshore) oil and gas sector of the African east and west coasts (WESGRO, 2014). The zone aims to deliver engineering services, marine repair and supply services to these enterprises.

The Saldanha Bay IDZ has been classified within the Department of Trade and Industry's 'Special Economic Zones' categories (DTI, 2012), as follows:

- **INDUSTRIAL DEVELOPMENT ZONE:** A purpose built industrial estate that leverages domestic and foreign fixed direct investment in value-added and export-oriented manufacturing industries and services;
- **PORT:** A duty free area adjacent to a port of entry where imported goods may be unloaded for value-adding activities within the Special Economic Zone for storage, repackaging or processing, subject to customs import procedures.
- **FREE TRADE ZONE:** A duty free area offering storage and distribution facilities for value-adding activities within the Special Economic Zone.

A feasibility study for the Saldanha Bay IDZ revealed potential for a broad range of industrial project clusters, including mineral beneficiation to renewable energy manufacturing and services to the upstream oil and gas industry (WESGRO, 2011); Phase 1 of the Saldanha Bay IDZ will focus on the Offshore Supply Base and Marine Repair Industry.

- **GREATER SALDANHA BAY INTER-GOVERNMENTAL TASK TEAM (GSB-IGTT)**

  In light of the developments in Saldanha Bay, the DEA&DP has convened the Greater Saldanha Bay Inter-Governmental Task Team with authorities from all three spheres of government in November 2014. The purpose of the GSB-IGTT is to facilitate a co-ordinated and coherent response from all spheres of government and public entities to ensure that the natural resource-based assets are not undermined and that desired environmental qualities for the Greater Saldanha Bay area are achieved into the future. In support of the GSB-IGTT an associated Stakeholder Forum was also established and convened by the Department as a means of meaningful/dedicated engagement with civil society and industry.

  The GSB-IGTT forum's objectives are to:

  - be a vehicle that is representative of all of the interested key stakeholder groups of the Greater Saldanha Bay area;
  - provide a mechanism for the exchange of information between all stakeholders;
  - monitor the management and health of the Greater Saldanha Bay area, as well as initiate and guide research on it;
  - provide a forum for dialogue on the management of the area; and,
  - provide advice and support to regulatory and governmental bodies with responsibilities for the management of the Greater Saldanha Bay area.

Further, in terms of air quality management in the area, it has been recommended that the Saldanha Bay Municipality review their Municipal Air Quality Management Plan (AQMP) every two years. It is proposed that the Saldanha Bay AQMP, as well as the Western Cape 2nd Generation AQMP, place emphasis on measures to manage air quality in the greater Saldanha Bay region.

4.3.3 TRANSPORT, STORAGE AND COMMUNICATION

When looking at the provincial energy use by fuel type, the transport sector is the main energy user in the province. The Energy Consumption and CO_2e Emissions Database for the Western Cape shows that the transport sector is the second largest contributor of GHG emissions in the Province (DEA&DP, 2013a).

The Province has a well-developed transport network that is made-up of airports, ports, roads and public transport and rail lines. Port expansion is required in Cape Town and Saldanha Bay in response to local and international markets, and as economic catalysts (DEA&DP, 2013). These developments will need to be addressed in the 2nd Generation AQMP.

4.3.4 AGRICULTURE, FORESTRY AND FISHING SECTOR

- **AGRICULTURE**

  The agricultural sector comprises 15 % of the West Coast's economic activity, and that of 11 % of the Cape Winelands and the Overberg. In absolute terms, the Cape Winelands has the largest agriculture, forestry and fishing sector and is home to more than one third of the Province-wide agricultural sector. Factoring in downstream linkages with the agro-processing sector, agri-business is a key economic activity across all the districts including the CCT (DEA&DP, 2013b).

  Despite the importance of secondary and tertiary economic activities, agriculture remains the backbone of the Provincial economy. Farming in the Western Cape covers some 11.5m hectares, and contributes almost 21 % of the country's agricultural production. The agricultural sector comprises of 6 682 commercial farmers, 9 844 smallholder farmers, and some 201 230 farm workers (DEA&DP, 2013a).

Outside the CCT, agricultural production and agro-processing of the following products underpins the local economies:

- Horticultural products (i.e. apples, pears and peaches, wine and table grapes, potatoes and onions, citrus; and vegetables) are produced in the Cape Winelands, Cape Metro, West Coast and Overberg.
- Animals and animal products (i.e. poultry, cattle, sheep, ostrich, and pigs) are produced throughout the Province.
- Field crops (i.e. wheat, maize, barley) are produced mainly in the Malmesbury, Moorreesburg, Piketberg regions (West Coast), as well as Caledon and Bredasdorp (Overberg).

Agriculture and the agro-processing industry have substantial competitive advantage in relation to the other Provinces and in terms of export growth. Exports and the development of the local agro-processing industries as a source of local demand for agricultural products should be the focus of developmental policies (DEA&DP, 2013a). In terms of meeting climate change obligations regarding the phasing out of ozone-depleting substances, natural refrigerants for refrigeration and air cooling in the agro-processing industry is a likely option to be investigated.

- **FISHING**
  The Western Cape contributes approximately 90 % of the country's fishing revenue and employs approximately 70 % of its workforce. Trawling contributes just under half of the fish revenues (DEA&DP, 2013a). The fishing industry contributes a large percentage to the country's revenue; inclusive of fish rendering processes in the towns of Hout Bay and St. Helena Bay (See Chapter 8). Alternative measures to reduce odour from fishmeal processing will need to be explored in the Province.

4.3.5 MINING AND QUARRYING

The mining sector contributes less than 1 % to the Western Cape's economy. Whilst current mining activity is concentrated in the West Coast, the Province's mineral resources are widespread (DEA&DP, 2013a).

The following summarizes, to our knowledge, the current mining and / or quarrying activities taking place in the respective Municipal areas of the Province:

- **West Coast District Municipality**
  rare earths; agricultural lime; dimension stone and sandstone; limestone; heavy minerals; titanium and zirconium; phosphate; construction materials
- **Cape Winelands District Municipality**
  limestone
- **Overberg District Municipality**
  pharmaceutical grade manganese; limestone; agricultural lime
- **Central Karoo District Municipality**
  shale-gas; gypsum for construction material and agri-use; uranium; construction materials
- **Eden District Municipality**
  construction materials
- **City of Cape Town**
  construction materials

4.3.5.1 SHALE GAS DEVELOPMENT IN THE KAROO

The use of hydraulic fracturing technologies (also known as fracking) to extract shale gas deposits in the Karoo Basin is undoubtedly one of South Africa's more contentious proposals in the last decade. The intense deliberations between various parties on this topic have frequently made headlines, exposing the public to a multitude of information on the matter. This update distils this discourse into a handful of pivotal achievements, and focuses on the regulatory and informative advancements made since South Africa's first accepted application for an exploration right for onshore shale gas in 2010.

The South African Government has the responsibility to think strategically about the potential risks and opportunities related to onshore shale gas development and how these may affect the Karoo environment. Significant progress has been made in this regard through establishing a regulatory framework for hydraulic fracturing, the milestones of which are outlined below.

In 2011, Cabinet imposed a moratorium on all applications associated with the exploration of shale gas reserves in the Karoo Basin (DMR, 2011). The purpose of the moratorium was to provide an opportunity for Government to establish the necessary regulatory framework, as well as conduct a preliminary assessment of its own into onshore unconventional shale gas development in the Karoo Basin. Shortly after the publication of the aforementioned assessment report in July 2012, Cabinet lifted the moratorium, but specified that hydraulic fracturing would not be authorised until suitable regulations had been promulgated (DMR, 2012). Two months later, the Minister of Mineral Resources proposed a restriction on the granting of new applications for onshore unconventional shale gas within the Karoo Basin.

Another important decision was taken in August of 2013, when the Minister of Water and Sanitation proposed the inclusion of the exploration or production of onshore naturally occurring hydrocarbons that require stimulation (which includes hydraulic fracturing) a controlled activity in terms of section 38(1) of the National Water Act (Act 36 of 1998). Leading from this, hydraulic fracturing was declared a controlled activity in October of 2015 (DWS, 2015). The implications of this declaration are that those wanting to undertake hydraulic fracturing require a Water Use License to do so, which in turn requires comprehensive investigations into the consequences of such an activity on water resources and their surrounds. This decision was regarded by many as a step in the right direction towards establishing an appropriate regulatory context given that the impact of hydraulic fracturing on water resources remains a key concern.

On 3 of February 2014, restrictions promulgated by the Minister of Mineral Resources resulted in a two year hiatus on the granting of new applications in the Karoo Basin (DMR, 2014). The inclusion of a requirement for existing applications to consider regulations that had not yet been promulgated (a version of which had been published for comment in October of 2013) effectively suspended the five applications accepted prior to 1 February 2011. The technical regulations for petroleum exploration and exploitation were subsequently promulgated on 3 June 2015, enabling the three existing applicants to continue with the requisite process. These regulations have since been legally contested by the Treasure the Karoo Action Group, who submitted the related documentation to the North Gauteng High Court in November of 2015.

In summary, the outcome of the above is a regulatory framework that requires a proponent to comprehensively investigate the environmental consequences of hydraulic fracturing, thus enabling the consideration of these consequences when regulatory decisions have to be taken.

- **A STRATEGIC ENVIRONMENTAL ASSESSMENT OF SHALE GAS**

  A Strategic Environmental Assessment (SEA) of shale gas is currently being undertaken. Its mission is to provide an integrated assessment and decision-making framework that will enable South Africa to establish effective policy, legislation, and sustainability conditions under which shale gas development could occur. It is important to note that the mission statement does not presume that shale gas development will occur, but that such development would be of considerable interest if substantial viable deposits of hydrocarbons are discovered during the exploration phase. In such an instance, South Africa would need to be in a position to make informed decisions in a timely and environmentally responsible manner.

  Commissioned in February of 2015, the SEA process is expected to span 24 months, with the preliminary end date set as March of 2017.

  The SEA process will be undertaken in three phases:

  - **PHASE 1:** "The Conceptualisation and Methodology Phase", entailed establishing the necessary project specific provisions such as governance groups, multi-author teams, and negotiating the expert review arrangements. The outcome of Phase One, the Zero Order Draft, was published for public review in October of 2015.
  - **PHASE 2:** "The Strategic Assessment Phase", is currently underway and will encompass the assessment of strategic concerns as prescribed in Phase One. The outputs from this phase will be the draft, and final SEA reports which will be peer reviewed by identified experts, and released for public perusal and comment. Phase Two is expected to take approximately 12 months, ending in October or November of 2016.
  - **THE FINAL PHASE:** "The Decision-making Framework Phase", will evaluate the final SEA and derive operational guidelines and decision frameworks (policies) for shale gas development in the Karoo Basin. The DEA, the Western Cape Department of Environmental Affairs and Development Planning, and its counterparts from the Northern and Eastern Cape will play an integral role in this final phase.

  In keeping with South African legislative requirements, and given the contentious nature of hydraulic fracturing, the SEA will rely heavily on evidence-based evaluations. A multitude of specialist investigations by internationally respected organisations have been commissioned so as to achieve this foundation of evidence. To date, more than 50 investigations undertaken by 29 institutions, as well as other discussions regarding shale gas exploration, are underway and will inform the SEA. Other sources of evidence include research undertaken by other local organisations and by other countries. In short, the extent of research and degree of attention being focused on hydraulic fracturing is substantial, and conducive to providing much needed answers.

  The timely completion of the SEA would be of benefit in addressing any existing regulatory gaps associated with hydraulic fracturing, and in providing an early indication of the most appropriate way forward for shale gas development. To achieve the latter, the assessment will consider a range of scenarios from 'exploration only' through 'minimal development' to 'maximal development', with a 'no shale gas exploration or development' scenario as a benchmark.

Much attention is being focussed on the proposed hydraulic fracturing of shale deposits within the Karoo Basin, and considerable inroads have been made by the South African Government in addressing its regulatory, as well as strategic limitations associated with hydraulic fracturing. The Government's reliance on evidence-based policy development remains a key priority for providing relevant information upon which decisions can be taken.

In terms of air quality management, shale gas exploration and hydraulic fracturing projects will need to be managed in terms of reducing emissions from potential sources of air pollution, e.g. drilling operation and drilling development, drilling activities, as well as activities resulting from transporting of production equipment and fracking fluids. The 2nd Generation Western Cape AQMP will need to take this into account, when setting new targets or inventions to manage air quality in the Province.

Photograph by: A. Carelse

5. GOVERNANCE: AIR QUALITY MANAGEMENT PLANNING

Sections 14 and 15 of the National Environmental Management: Air Quality Act (No. 39 of 2004; NEM: AQA) requires that all three spheres of government designate Air Quality Officers (AQOs) and also develop Air Quality Management Plans (AQMPs), in their areas.

As previously indicated, the Western Cape Air Quality Management Plan (AQMP2010) was approved in 2010 to manage air quality in the Province. To date, a total of 26 of the 30 Municipalities in the Western Cape have developed and adopted their AQMPs.

A summary of the progress made during the implementation of the Provincial AQMP2010 and those of the Municipal AQMPs, where adopted, is provided below.

5.1 PROVINCIAL AIR QUALITY MANAGEMENT PLANNING

5.1.1 INSTITUTIONAL ARRANGEMENTS

The MEC of Local Government, Environmental Affairs and Development Planning has designated the Director responsible for air quality management in the Western Cape as the Provincial AQO. As such, the Provincial AQO is responsible for co-ordinating and overseeing matters pertaining to air quality management in the Province.

Due to the significance of air quality management in the Province, as well as the increasing responsibilities associated with the air quality management mandate in terms of the NEM: AQA, the MEC of Local Government, Environmental Affairs and Development Planning has approved the function to be implemented by the Directorate: Air Quality Management (D: AQM) in 2014.

The D: AQM has three Sub-Directorates to fulfil the roles and responsibilities, as assigned in the NEM: AQA and outlined in the National Framework on Air Quality Management in South Africa 2012. These include the Sub-Directorates Air Quality Monitoring, Air Quality Regulatory Services, and Air Quality Planning and Information Management. The latter unit is responsible for co-ordinating the implementation of, as well as the review of the Western Cape AQMP2010. Moreover, it is responsible for overseeing the development of Municipal AQMPs, as well as the designation of AQOs in Municipalities throughout the Province.

5.1.2 WESTERN CAPE AQMP2010

The Western Cape AQMP2010 has been implemented through the engagements with Municipalities, and progress monitored via the quarterly AQOFs held to date. In terms of the Provincial-Local Government relationship, capacity building opportunities and active engagements on air quality matters have taken place. Moreover, the Provincial DEA&DP meets regularly with local authorities at amongst other, Inter-Governmental Task Teams and Municipal Air Quality Officers Forums on various air quality matters, and provides advice on air quality matters, when required.

The Vision and Mission, as well as the goals of the Western Cape AQMP2010 is provided in Chapter 1. As previously indicated, the Western Cape AQMP2010 makes provision for three Working Groups as the primary mechanism to guide its implementation, and as a means to direct the activities and involve all necessary stakeholders.

The Working Groups have the following areas of work assigned, respectively:

- **AIR QUALITY MANAGEMENT AND CLIMATE CHANGE WORKING GROUP:** governance, management with respect to air quality, climate change, town and regional planning and transport planning.
- **AIR QUALITY AWARENESS RAISING WORKING GROUP:** information management on air quality and climate change.
- **COMPLIANCE MONITORING AND ENFORCEMENT WORKING GROUP:** technical/control and legal.

Progress made in respect of implementing the Western Cape AQMP2010 via the three Working Groups during 2010 – 2015 is further elaborated in Chapter 6.

5.2 MUNICIPAL AIR QUALITY MANAGEMENT PLANNING

During the period 2010 – 2015, the DEA&DPs D: AQM has successfully hosted capacity building workshops with Councillors and Municipal Managers of various Municipalities in terms of developing their Municipal AQMPs. The aim of these workshops was to gain support from Councillors and Municipal Managers to:

- understand and accept the roles and responsibilities of the air quality management function;
- ensure that municipalities designate Air Quality Officers; and
- secure funding for the Municipalities to develop and implement their AQMPs.

To date, a total of 26 Municipalities have developed and adopted their AQMPs, and a total of 29 Municipalities have designated AQOs in their jurisdictional areas (Table 5-1). A summary of the status of the air quality management planning per Metropolitan and District Municipal area is provided below.

TABLE 5-1: STATUS OF AQMPS AND DESIGNATED AQOS IN THE MUNICIPALITIES OF THE WESTERN CAPE

AUTHORITY	YEAR ADOPTED & IMPLEMENTED	AQMP REVIEWED	AIR QUALITY OFFICER DESIGNATED
City of Cape Town	2009	in progress	✓
Cape Winelands	2009		✓
DEA&DP	2010	in progress	✓
Drakenstein	2011		✓
West Coast	2011		✓
Eden	2011	2013	✓
Overberg	2012		✓
Bergrivier	2012		✓
Matzikama	2012		✓
Saldanha	2012		✓
Swartland	2012		✓
Central Karoo	2012		✓
Cape Agulhas	2013		✓
Overstrand	2013		✓
Witzenberg	2013	2014	✓
George	2013		✓
Hessequa	2013		✓
Bitou	2013		✓
Knysna	2013		✓
Kannaland	2013		✓
Mossel Bay	2013		✓
Theewaterskloof	2014	2015	✓
Prince Albert	2014		✓
Swellendam	2015		✓
Stellenbosch	2015		✓
Cederberg	2016		✓
Laingsburg	2016		✓
Breede Valley	draft		✓
Langeberg	draft		✓
Beaufort West	✗		✓
Oudtshoorn	draft		✗

Note: 2016 is included to illustrate current developments.

5.2.1 CITY OF CAPE TOWN

The City of Cape Town (CCT) was the first Municipality in the country to adopt its AQMP in 2005; and has also incorporated it as a sector plan in its Integrated Development Plan (IDP). During 2011, an internal review of the AQMP was initiated. It is envisaged that a Public Participation Process will commence in 2016.

The CCT's vision is "to be the city with the cleanest air in Africa". This vision is aimed to be met through implementing the following objectives:

- To formulate an air quality management system for the City of Cape Town;
- To specify ambient air quality standards and targets for Cape Town;
- To monitor priority pollutants which cause brown haze and affect human health;
- To improve air quality in informal areas;
- To enforce current and future legislation for air quality management;
- To compile a comprehensive emissions inventory database for the City of Cape Town;
- To control vehicle emissions in the City;
- To consider air quality in land use and transport planning;
- To determine the detrimental health effects of poor air quality on the population of the City of Cape Town;
- To establish a comprehensive education and communication strategy for air quality management; and
- To periodically review the air pollution situation, report on progress and adjust and update strategies and objectives where needed.

Overall, the CCT has effectively implemented its AQMP, and has rolled out air quality management priorities in all areas of its identified objectives. See Chapters 7 and 8 for an overview of the various aspects of the CCTs AQMP implementation.

5.2.2 CAPE WINELANDS DISTRICT MUNICIPALITY

The Cape Winelands District Municipality's (CWDM) AQMP was adopted by Council in 2009, and has been included as a sector plan in its IDP since 2011. The CWDM has been implementing interventions in air quality management as per the goals of the CWDMs AQMP, which are to:

- have effective air quality management;
- promote communication in relation to air quality management; and
- implement compliance monitoring and enforcement.

The CWDM is envisaging to initiate a review of their AQMP following the publication of the Western Cape 2nd Generation AQMP, in order to meet the framework fundamentals of the latter.

All Local Municipalities, except the Langeberg and Breede Valley, have developed, adopted and implemented their AQMPs in their jurisdictional areas (Table 5-1). The Drakenstein Local Municipality adopted their AQMP in 2011, while Witzenberg Local Municipality has adopted their 2nd Generation AQMP in 2014, and Stellenbosch Local Municipality adopted their AQMP in 2015. The Breede Valley Local Municipality has developed a draft AQMP, while the Langeberg Local Municipality has not developed their AQMP, as yet.

All the Municipalities in the CWDM have designated AQOs (Table 5-1).

5.2.3 CENTRAL KAROO DISTRICT MUNICIPALITY

The Central Karoo District Municipality (CKDM) Council approved their AQMP in 2012 and incorporated it as a sector plan of their IDP since 2012. The goals of the AQMP address different aspects of the vision, and are as follows:

- To ensure effective and consistent air quality management. This goal aims to address the development and maintenance of the varied requirements for systems, skills and capacity for air quality management, and the establishment of the necessary institutional arrangements;
- To ensure effective and consistent compliance monitoring and enforcement. This goal aims to improve compliance monitoring and enforcement in the district, and to ensure that ambient air quality standards for the protection of health are attained and continually met;
- To support climate change protection programmes, including promoting the reduction of Greenhouse Gas emissions; and
- To raise awareness with respect to air quality. This goal aims to improve awareness of air pollution issues in the Central Karoo District through awareness raising and education.

All Local Municipalities, except Beaufort West have developed, adopted and implemented their AQMPs in their jurisdictional areas. The Prince Albert adopted their AQMP in 2014, while the Laingsburg Local Municipality adopted their AQMP in 2016.

All AQOs have, however, been designated in the CKDM area (Table 5-1).

5.2.4 EDEN DISTRICT MUNICIPALITY

The Eden District Municipality (EDM) reviewed their AQMP, and their Council adopted their 2nd Generation AQMP in 2013. The 2nd Generation AQMP is included as a sector plan in their IDP. The EDM's AQMP vision is as follows:

- "to have air quality worthy of the names 'Eden' and 'The garden route'.

This vision has been pursued through a set of objectives, the status of which is provided in Table 5-2.

TABLE 5-2: THE STATUS OF EDM'S AQMP IMPLEMENTATION

OBJECTIVE	STATUS OF IMPLEMENTATION
OBJECTIVE 1: **Set Air Quality Goals**	Completed and revised annually
OBJECTIVE 2: **Set Up Air Quality Management System**	On-going and liaison with other authorities; Capital budgeting for mobile analyser; Completed Airshed dispersion modelling as part of AQMP development
OBJECTIVE 3: **Carry Out Risk Assessments**	Part of DEA&DP Health Risk Assessment Steering Committee; Planned H_2S monitoring at hotspots
OBJECTIVE 4: **Assess and Select Control Measures**	Work in progress
OBJECTIVE 5: **Implement of Intervention and Monitoring Effectiveness**	Ongoing assessment
OBJECTIVE 6: **Revise Air Quality Goals**	Annually internal and external stakeholders
OBJECTIVE 7: **Integrate the AQMP into the IDP**	Completed and reviewed annually
OBJECTIVE 8 **Compliance Monitoring, Enforcement and Control**	Ongoing, work in progress; Eden Air Quality by-law and spot fine system implemented
OBJECTIVE 9: **Review the Air Quality Management Plan**	Review to be undertaken every 5 years

The EDM further assisted the Local Municipalities within its jurisdiction to develop their AQMPs. The following Local Municipalities have developed, adopted and implemented their AQMPs: George, Mossel Bay, Hessequa, Bitou, Knysna and Kannaland. All adopted AQMPs have been included as sector plans in their respective IDPs. The Oudtshoorn Local Municipality has a concept AQMP that has been developed for approval.

The EDM and all the Local Municipalities, except Oudtshoorn, have designated AQOs (Table 5-1).

5.2.5 OVERBERG DISTRICT MUNICIPALITY

The AQMP of the ODM was approved in 2012 (Table 5-1) and is included as a sector plan in their IDP. The goals of the AQMP is as follows:

- effective and consistent air quality management;
- promote communication in relation to air quality management;
- effective and consistent compliance monitoring and enforcement;
- develop and maintain institutional arrangement between the district and the local municipalities that support air quality management;
- achieve and sustain acceptable air quality levels throughout the district; and
- minimize the negative impact on human health and well-being and on the environment.

All Local Municipalities have developed, adopted and implemented their AQMPs (Table 5-1). The AQMPs of the Overstrand and Cape Agulhus Local Municipalities were adopted in 2013, while that of the Swellendam Local Municipality was adopted in 2015. The 2nd Generation AQMP of the Theewaterskloof Local Muncipality was reviewed and adopted in 2015.

All AQOs have been designated in the District Municipality, as well as the Local Municipalities within the Overberg region (Table 5-1).

5.2.6 WEST COAST DISTRICT MUNICIPALITY

The West Coast District Municipality's (WCDM) Council approved their AQMP in 2011 (Table 5-1), and included it as a sector plan of their IDP. It is envisaged that the AQMP will be reviewed during the Municipality's 2016/2017 financial year. The strategic goals and objectives of the AQMP are:

- implementing the air quality management plan within the District;
- assigning clear responsibilities and function for air quality management at both District and Local levels;
- air quality training of current and future air quality personnel at both District and Local levels;
- obtaining the necessary resources and funding for air quality management in the District;
- preliminary monitoring of identified "hotspot" areas in the District to determine air pollutant concentrations;
- undertake continuous ambient air quality monitoring to obtain a long-term record of air quality in the District. Such information must be available to the public and private sectors;
- maintaining good air quality within the boundaries of the West Coast District, with specific emphasis on PM_{10} and SO_2 concentrations in the District;

- compliance monitoring and enforcement air quality legislation, policies and regulations in the District; and
- assessing the contribution of agriculture to ambient air quality and establishing measures to control emissions from these sources.

All Local Municipalities have developed, adopted and implemented their AQMPs (Table 5-1). The Saldanha Bay Local Municipality adopted their AQMP in 2012; however, because of current and future activities in the Saldanha Bay area, the AQMP has been earmarked for review every two years. The Swartland, Bergrivier and Matzikama Local Municipalities also adopted their AQMPs during 2012; while the Cederberg Local Municipality adopted their AQMP in 2016.

In order to improve communication and co-operative governance between the WCDM and the five Local Municipalities in the West Coast, a Joint Municipal Air Quality Working Group was established in February 2015. The division of air quality management functions was formalised through a Memorandum of Understanding (MoU).

The AQOs have been designated in the District Municipality and in all the Local Municipalities of the West Coast (Table 5-1).

Photograph by: A. Carelse

6. GOVERNANCE: AIR QUALITY OFFICER'S FORUMS

The 2012 National Framework on Air Quality Management (DEA, 2013) outlines that every Province establish a Provincial-Municipal Air Quality Officer's Forum (AQOF) and convene quarterly forum meetings. In order to facilitate the effective, efficient and cohesive functioning of the forum, the National DEA provided a standardised terms of reference for implementation in the Provinces.

The overall objective of the AQOFs, as per the 2012 National Framework (DEA, 2013), is as follows:

> "An effective governance framework is developed, maintained and implemented in a manner that ensures that the unacceptable current and future impacts of atmospheric emissions are minimised, mitigated or managed in line with government policy, legislation, goals, strategies, noms and standards that are protective of everyone's right to an environment that is not harmful to their health or well-being and protect the environment for the benefit of present and future generations through reasonable legislative and other measures that prevent pollution and ecological degradation, promote conservation and secure ecologically sustainable development and the use of natural resources while promoting justifiable economic and social development."

6.1 WESTERN CAPE AIR QUALITY OFFICER'S FORUM

The Western Cape Provincial Air Quality Officer's Forum (AQOF) takes place quarterly and serves as a platform for air quality officers of the Western Cape to discuss air quality matters and coordinate progress on the implementation of the National Environmental Management: Air Quality Act (Act No. 39 of 2004; NEM: AQA), as well as the 2012 National Framework. In addition, the forum provides air quality officials the opportunity to build, strengthen and/or fine-tune their air quality management interventions towards the implementation of NEM: AQA and to share experiences, challenges and to plan for the year ahead.

The Provincial Noise Control Forum forms part of the Western Cape AQOF to ensure and improve the co-ordination of noise control in the Province. In terms of the Constitution of South Africa, noise pollution is a Local Government responsibility. Air Quality Officers from the Local Municipalities actively engage in the Provincial Noise Control Forum, as many complaints from the public are received in this regard. The Noise Control Forum allows the Air Quality Officers to share their achievements and challenges with regards to noise management in their jurisdictional areas.

The Western Cape Air Quality Officers' and Noise Control Forum takes place across the five Districts and the Metropolitan Municipality within the Province. If required, Special forums are arranged to afford Air Quality Officers the opportunity to address air quality-related matters with the National DEA, and to engage on legislative and policy development, as required (See Section 6.1.1.).

Table 6-1 provides an inventory of the Western Cape Air Quality Officer and Noise Control Forums held since 2010.

TABLE 6-1: AIR QUALITY OFFICER'S AND NOISE CONTROL FORUMS HELD SINCE 2010

YEAR	DATE	LOCATION
2010	9 – 11 February	George, EDM
	13 – 14 May	Beaufort West, CKDM
	05 – 06 August	Woodstock, CCT
2011	09 – 11 February	George, EDM
	13 May	Witsand, CWDM
	12 August	Sea Point, CCT
2012	10 February	Langebaan, WCDM
	10 – 11 May	Knysna, EDM
	23 – 24 August	Robertson, CWDM
2013	07 – 08 February	Arniston, ODM
	09 – 10 May	Matjiesfontein, CKDM
	29 – 30 August	Klapmuts, CWDM
2014	13 – 14 February	Citrusdal, WCDM
	15 – 16 May	Cape Town, CCT
	14 – 15 August	Calitzdorp, EDM
	01 – 02 November	Cape Town, CCT – Special AQOF
2015	13 – 14 February	Caledon, ODM
	14 – 15 May	Beaufort West, CKDM
	13 – 14 August	Paarl, CWDM
	03 – 04 November	Driftsands, CCT – Special AQOF
2016	12 – 13 May 2016	Driftsands, CCT
	11 – 12 August 2016	Mossel Bay, EDM

Note: 2016 is included to illustrate current developments

6.1.1 SPECIAL AIR QUALITY OFFICER'S FORUMS

With the NEM: AQA still maturing in terms of its implementation, additional contact time with authorities in the Western Cape were required to discuss air quality matters in comprehensive detail. As such, Special AQOFs were used as vehicle to further discuss proposed legislative reform and policies on air quality management in the country.

Special AQOFs were convened to discuss, amongst other, the following:

- NEM: AQA Ambient Air Quality Standard for Particulate Matter ($PM_{2.5}$);
- The Listed Activities and Minimum Emission Standards of the NEM:AQA;
- Notice 309 of 2011 of the NEM: AQA, 2004 (Draft National Dust Control Regulations);
- NEM: AQA Amendments, Provisions and Associated Implications;
- NEM: AQA AEL Processing Fee Regulations;
- NEM: AQA Amendments to Section 22A;
- NEM: AQA AEL Appeal Regulations;
- Biogas / Animal Matter Licensing Challenges;
- NEM: AQA Section 22A Calculator for determining Administrative Fines; and
- NEM: AQA Dust Regulations.

Other topics discussed at the Special AQOFs include the following:

- NAEIS Capacity Building Training;
- AEL Postponement Applications;
- Review of the Western Cape AQMP2010; and
- Introduction to the South African Atmospheric Emission Licensing and Inventory Portal (SAAELIP), which incorporates the National Atmospheric Emissions Inventory System (NAEIS) and System for National Atmospheric Emission Licensing (SNAEL).

6.1.2 KEY DISCUSSIONS AND OUTCOMES OF THE FORUMS

The scope of the AQOF is to provide clarity on complex air pollution/noise matters, as well as to report air quality challenges and successes, and areas that need further improvement.

PRESENTATIONS AND DISCUSSIONS AT THE FORUMS INCLUDED THE FOLLOWING:

- **AIR QUALITY PLANNING**
  - Overview of the Provincial Air Quality Projects 2014/2015
  - Roles and Responsibilities of AQOs: District vs. Local Municipalities
  - Western Cape Climate Change Response Strategy
- **AIR QUALITY MONITORING**
  - Emission Reporting Requirements
  - Interpretation and Analysis of Air Quality Monitoring Data
  - Ambient Air Quality Monitoring Stations Locations
  - City of Cape Town Monitoring Network
- **REGULATION / COMPLIANCE AND ENFORCEMENT**
  - Appeal Regulations and Case Studies
  - An Environmental Case Study: Compliance and Enforcement
  - The Impact of Crematoriums on Ambient Air Quality
  - The Dangers of Landfill Sites
  - Environmental Impact Assessment Authorisations
  - Handling of Applications that does not trigger an Environmental Impact Assessment (EIA) or AEL
  - AEL Postponement Process
  - Registration of Controlled Emitters
  - Variation of an Atmospheric Emission License, and Animal Matter Processing: Section 21 Listed Activities – Cape EAPRAC
- **NOISE CONTROL**
  - Noise Management: A Focus on Compliance and Enforcement Matters
  - Update on Noise Control in the Western Cape Province
  - Noise Management: Monitoring and Legislation
- **LEGISLATION AND POLICY**
  - Legislative Background on Stack Monitoring
  - Progress with regards to Legislation and Regulations
  - National Dust Control Regulations
  - Noise Control Regulations
  - Section 30 Emergency Incidences
  - NEM: AQA Amendments and AEL Implications
  - Air Quality Legislative Developments
  - Section 22A of NEM: AQA

- **CAPACTIY BUILDING**
  - The Boiler design, Fuels and Emissions (John Thompson (Pty) Ltd.)
  - Introduction to Ecostat
  - Introduction to Hydraulic Fracking
  - Best Practices for Animal Matter Processes
  - Introduction to Stack Monitoring
- **AWARENESS RAISING**
  - Air Quality Improvement Programmes

Air Quality Officers from the Directorate: Air Quality Management (D: AQM) and Municipalities actively engaged and discussed the above topics, and resolved air quality matters in terms of proposed NEM: AQA amendments, Atmospheric Emission Licensing (new applications, processing fee, applications for postponement of compliance time-frames, etc.), compliance monitoring and enforcement, as well as streamlining government ambient air quality monitoring initiatives.

OTHER MATTERS OF RELEVANCE, AS DISCUSSED AT THE AQOF'S:

- **ATMOSPHERIC EMISSION LICENSING**

District Municipalities are required to report back on the number of AELs issued during the preceeding quarter. As this was a new function assigned to the Provinces, Metropolitan and District Municipalities on 01 April 2010, discussions regarding the atmospheric emission licensing system included the license fee calculator, templates and service level agreements. In 2011, Licensing Authorities in the Western Cape agreed that the DEA AEL License Fee Guideline, as published on the South African Air Quality Information System (SAAQIS) website (www.saaqis.org.za/) would be used as an interim measure. This has been replaced by the NEM: AQA Atmospheric Emission Licence Processing Fee Regulations (See Chapter 2).

Presentations and discussions also informed the development of various legislative reform and policy development as it pertains to atmospheric emission licensing (e.g. Amended Section 21 Listed Activities Implementation and the Companion Documents Section 21: Notice on AEL Interpretation). A summary of the AELs and PAELs issued in the Western Cape during the period 2010 – 2015 is provided in Chapter 8.

- **HUMAN HEALTH RISK ASSESSMENT ON AIR QUALITY**

The DEA&DP undertook a Human Health Risk Assessment Needs Analysis (HRA) during 2010 to:

- inform the identification and prioritisation of study areas in the Western Cape Province, where air quality is of growing concern in terms of its effects on human health of susceptible population groups, as well as to
- develop a detailed protocol that would inform the commissioning of HRA studies in the prioritized areas.

The HRA Needs Analysis identified the locations listed in Table 6.2, where a possible Human Health Risk Assessment on Air Quality should be undertaken. The DEA&DP appointed a service provider in December 2012 to undertake the Human Health Risk Assessment of Air Quality in the identified areas (Table 6-2). As not all areas could be selected for a comprehensive epidemiological study, the following areas were selected for the latter: Khayelitsha, Milnerton and Oudtshoorn, with Noordhoek selected as a control site. The main objective of the study is to determine the impacts of air quality on human health in the Western Cape. The DEA&DP confirmed the scope of the project and identified the key stakeholders involved.

Public consultations were held in George, Paarl, Milnerton, and Saldanha in 2013, with an additional two workshops held in November 2012 and February 2013, at the Milnerton Library, during the Needs Analysis. Similarly, public meetings were held in 2015, following Phase 1 of the HRA Study. Moreover, progress on the assessment was also reported annually

at the AQOFs held. The study is in its final phase and is envisaged to be completed in early 2017.

TABLE 6-2: LOCATIONS PROPOSED BY THE HRA NEEDS ANALYSIS

MUNICIPALITY	TYPE OF STUDY	
	EPIDEMIOLOGICAL STUDY	HUMAN HEALTH RISK ASSESSMENT
CAPE TOWN	Milnerton/ Milnerton ridge including Phoenix and Joe Slovo, Nyanga, Philippi, Khayelitsha	Bluedowns, Elsies River Fisantekraal Table View, Bothasig and Richwood
EDEN	Oudtshoorn	Mossel Bay
WEST COAST	N/A	St Helena Bay Saldanha Bay
OVERBERG	N/A	Grabouw
CAPE WINELANDS	N/A	Paarl and Wellington

- **EMISSIONS INVENTORY AND AMBIENT AIR QUALITY MONITORING**

  Updates on the Western Air Pollutant and Greenhouse Gas Emissions Inventory (see Chapter 9), as well as the Western Cape Ambient Air Quality Monitoring Network are reported regularly at the AQOFs. In 2013, the National DEA presented on the functionality of the SAAQIS and the roles and responsibilities of the stakeholders. The system is to ensure that relevant authorities provide the required emissions data in a prescribed manner and within prescribed timeframes. It also addressed sectors reporting into the system, which are residential, vehicle emissions, transport, waste, agriculture and fishing, land use and forestry, and natural sources. See Chapter 7 for more information on SAAQIS.

  More detailed information on the Western Cape Air Pollutant and Greenhouse Gas Inventory, as well as the status of the Western Cape Ambient Air Quality Monitoring Network is provided in Chapter 9 and Chapter 7, respectively.

- **LEGISLATIVE REFORM AND POLICY DEVELOPMENT**

  Various legislative reform and policy development in terms of the NEM: AQA took place during the period 2010 – 2016; these are listed in Table 2-1, Table 2-2 and Table 2-3 (See Chapter 2).

  Authorities generally discussed the proposed legislative reform and policies at the Western Cape AQOFs, and provided joint comments to the National DEA, prior to its promulgation. The Special AQOFs provided the required time for authorities to engage on air quality legislative reform and policy development.

6.2 WESTERN CAPE AIR QUALITY MANAGEMENT PLAN WORKING GROUPS I – III

As indicated previously, the Western Cape AQMP2010 outlines a framework for the implementation of air quality management in the Province in terms of timeframes, responsibilities, and sources of funding and estimated costs (DEA&DP, 2010b). Timeframes were described as short, medium, long-term or continuous; and responsibilities encompassed a broad range of stakeholders that included National, Provincial and Local environmental authorities, as well as other sectors of government, industry, business, agricultural, non-governmental organisations, as well as civil society.

The AQMP Steering Committee and three Provincial AQMP Working Groups were the primary mechanisms identified to implement the AQMP2010. The Working Group meetings were held concurrently with the Western Cape AQOFs, and were held during the period 2010 – 2015, as outlined in Table 6-1. The following Working Groups were established during these sessions as follows:

- **WORKING GROUP I** – Air Quality Management and Climate Change;
- **WORKING GROUP II** – Air Quality Education and Awareness Raising; and
- **WORKING GROUP III** – Compliance Monitoring and Enforcement.

The first Provincial AQMP Working Group meeting was held in June 2010 in Paarl, in the CWDM area. During this initial meeting, the Terms of Reference (ToR) for the three Working Groups, as well as the activities assigned to each Working Group, were identified.

During August 2010, the second Provincial AQMP Working Group meeting was held, and focused on prioritising the activities for each Working Group.

During December 2010, the third Provincial AQMP Working Group meeting focused on electing the Chairpersons of the respective Working Groups and to collectively interrogate the proposed list of activities that were agreed upon previously.

Air Quality Officers from the Municipalities accepted their nominations for the respective AQMP Working Groups in 2010, and were later replaced in 2014 by air quality officials from the DEA&DP, as members of the AQOF's considered it more strategic to facilitate the Working Groups from a Provincial level:

- **WORKING GROUP I:** Air Quality Management and Climate Change
  2010 – 2014: Drakenstein District Municipality
  2014 – current: Air Quality Planning and Information Management – DEA&DP
- **WORKING GROUP II:** Air Quality Education and Awareness Raising
  2010 – 2014: West Coast District Municipality
  2014 – current: Air Quality Planning and Information Management – DEA&DP
- **WORKING GROUP III:** Compliance Monitoring and Enforcement
  2010 – current: Air Quality Regulatory Services – DEA&DP

Each Working Group identified initial priorities for implementation in the Province. A short summary of the priorities are outlined below.

WORKING GROUP I: AIR QUALITY MANAGEMENT AND CLIMATE CHANGE

This Working Group is responsible for information management on air quality and climate change, and mainly addresses governance, the management of air quality, climate change, town and regional planning. The roles and responsibilities of the Working Group are as follows:

- Ensure the development of AQMPs and appointment of AQO's by Municipalities;
- Review, finalise and recommend the emissions inventory reporting format and/or tools for publication by DEA&DP;
- Develop an emissions inventory reporting format and/or tools;
- Monitor IDP process and ensure AQMPs as a Sector Plan of Municipal IDPs;
- Propose and recommend By-laws for municipal consideration and adoption;
- Establish and adopt minimum standards for energy efficiency for all new houses, major renovations and redevelopments; and
- Develop and implement an integrated plan to manage precursors to reduce regional scale ozone.

The impact of climate change on the environment was emphasised in the Working Group, with AQOs being regularly updated on awareness raising campaigns. During 2014, the DEA&DP's Directorate: Climate Change joined the Working Group and regularly provides updates on climate change matters, as it relates to air quality management.

The need for integration with other areas of specialisation was also realised, and representatives were nominated to participate in the development of the Spatial Development Framework and Western Cape Climate Change Response Strategy, to ensure that future plans address air quality matters.

Progress with regards to the development of emissions inventories and the status of incorporation of AQMPs as sector plans into IDPs was assessed. The Working Group also facilitates the development of Municipal AQMPs and the designation of AQOs. During the period 2010 to 2016, a total of 26 of the 30 Municipalities have adopted and implemented their AQMPs, while a total of 29 of the 30 AQOs were designated in the Western Cape. See Chapter 5 for more information on the status of AQMPs and AQO designation in the Province (Table 5-1).

WORKING GROUP II: AIR QUALITY EDUCATION AND AWARENESS RAISING

This Working Group is responsible for information management on air quality and climate change, and mainly addresses governance, the management of air quality, climate change, town and regional planning. The roles and responsibilities of the Working Group are as follows:

- To develop and recommend awareness raising material for distribution;
- To facilitate annual awareness raising events at municipalities;
- Review air quality management activities;
- Recommend content for inclusion in the State of Air Quality Management Report for the Western Cape on an annual basis; and
- To develop a ToR for Health Risk Assessment studies linked to air quality related diseases, for identified areas of the Province.

The implementation of Working Group II has highlighted the need for all Municipalities to create awareness raising programmes and establish various forums. A summary of the activities in the various regions is provided below.

- **CAPE WINELANDS DISTRICT MUNICIPALITY**

  The CWDM developed awareness raising programs, which include an interactive theatre at schools and the development of placards, pamphlets, posters and other educational material. During 2012, the CWDM reached 14 211 primary and high school learners at various schools with their awareness raising campaign. In addition to this, the CWDM educates first time home owners and farmers about ambient air pollution.

  Drakenstein Local Municipality invites all fuel burning appliance certificate holders to attend a quarterly Air Quality Forum at the Municipality. This forum forms part of an integrated Environmental Management Committee meeting with the Drakenstein Environmental Management Committee and the Drakenstein Waste Forum. During 2013, the Drakenstein Local Municipality participated in the Youth Expo; where air quality management was featured as a component.

- **CITY OF CAPE TOWN**

  The CCT facilitates a number of projects with local communities to raise awareness of air quality matters. Various air quality related projects were implemented. For example, in 2012, the CCT performed the following:

  - a door-to-door community survey, inclusive of brochures on air quality management was distributed in Wallacedene;
  - an air quality management tour of ambient air quality monitoring stations was held with the CCTs Health Portfolio Committee members; and
  - the CCTs Air Quality Management Unit assisted with the design of awareness raising information on the burning of Cremated Copper Arsenate (CCA) Treated Timber, with the South African Wood Preservers Association and assisted in distributing pamphlets to potentially affected communities.

  In 2013 and 2014, the CCT implemented a Shack Fires Programme at primary schools. The Programme was well received by the educators and principals, as it was in line with the grade 5, 6 and 7 curricula. In 2015, Councillors of the CCTs Energy and Climate Change Portfolio Committee was updated on progress made in terms of managing ambient air quality in the CCT.

  The CCT continues to deliver the message of clean air to young learners with the help of their air quality mascot "Sniffles the air pollution sniffing cat".

- **EDEN DISTRICT MUNICIPALITY**

  Since 2011, the Eden District Municipality has successfully implemented their Eden Clean Fires Campaign that entails active engagement with communities and the distribution of pamphlets to identified communities with the emphasis being on landfill sites where people burn plastic for cooking purposes.

  The EDM has also been conducting its Diesel Vehicle Smoke Detection Campaign at the traffic and fire department in Oudtshoorn and in the region, regularly. Overall, the roll-out of air quality awareness raising has been very well received in the EDM.

- **WEST COAST DISTRICT MUNICIPALITY**
  The WCDM has established Working Groups and environmental stakeholders' forums. The Joint Municipal Air Quality Working Group provides a good opportunity for air quality information and awareness raising between District and Local Municipal officials, and the public and industry.
- **OVERBERG DISTRICT MUNICIPALITY**
  The ODM established an Air Quality Forum with Local Municipalities to share information and awareness raising ideas. Since its commencement, various awareness raising programmes to fulfil the objectives of their AQMP and to promote public participation in air quality decision making has taken place.

WORKING GROUP III: COMPLIANCE MONITORING AND ENFORCEMENT

This Working Group is responsible for all co-ordinating activities regarding the implementation of the atmospheric emission licensing system. The roles and responsibilities of the Working Group are as follows:

- Develop and recommend a plan of action to identify and manage illegal listed activities and participation in crime prevention forums;
- Establish air quality management Working Groups between industries and the various licensing authorities to facilitate report back from the Section 21 Listed Activities on compliance and enforcement activities;
- Update officials on any amendments to air quality management legislation from national to local level;
- Assist and capacitate officials with the administration of atmospheric emission licences in respect of Section 21 Listed Activities; and
- Establish training needs and available training programmes in respect of atmospheric emission licensing.

As the atmospheric emission licensing function was very new to Provinces in 2010, air quality officials required capacity building to implement, amongst others, Section 21 Listed Activities of the NEM: AQA. A list of training requirements was submitted to the DEA, and training on the AEL system was rolled out across the Province. The AQOs in the Western Cape developed their own templates, which were discussed at the AQOFs and rolled out to all Licensing Authorities in order to ensure that a standardised approach was followed in terms of implementing the atmospheric emission licensing function in the Province. The Licensing Authorities in the Western Cape have embraced the function and have successfully carried out their mandate. See Chapter 8 (Table 8-1), for more detail on the licensing of Section 21 Listed Activities of NEM: AQA in the Western Cape during the period 2010 – 2015.

Other capacity building included training on Section 30: Emergency Incidents of NEMA. Further, Environmental Management Inspectorate training was deemed to be important at the Municipal level. During 2012, a total of 17 Municipal AQOs attended and successfully completed the EMI course; the AQOs were designated as Environmental Management Inspectors during 2012 and 2013.

The Working Group encourages Municipalities to develop Municipal By-Laws. Since 2008, a total of 12 Municipal By-laws, in respect of air quality management were gazetted in the Western Cape (Table 6-3).

TABLE 6-3: LIST OF MUNICIPAL BY-LAWS PROMULGATED, IN RESPECT OF AIR QUALITY MANAGEMENT IN THE WESTERN CAPE

MUNICIPALITY	BY-LAW	GAZETTE NO.	DATE
HESSEQUA	Air Pollution Control By-Law	6588	19 December 2008
CITY OF CAPE TOWN	Air Quality Management By-Law	6772	30 July 2010
GEORGE	Air Pollution Control By-Law	6816	30 November 2010
EDEN	Air Quality Management By-Law	7043	12 October 2012
SALDANHA BAY	Air Pollution Control By-Law	7077	24 December 2012
WEST COAST	Air Quality Management By-Law	7170	06 September 2013
MOSSEL BAY	Air Quality Control By-Law	7184	04 October 2013
BERGRIVIER	Air Pollution Contro By-Law	7208	06 December 2013
SWELLENDAM	Air Quality Control By-Law	7338	05 December 2014
OVERBERG	Air Quality Management By-Law	7389	15 May 2014
SWARTLAND	Air Quality By-Law	7394	22 May 2014
THEEWATERSKLOOF	Air Quality Management By-Law	7488	11 September 2015

In addition to the above, the DEA&DP published the Western Cape Noise Control Regulation on 20 June 2013 (P.N. 200/2013). The promulgation of the Regulations have largely assisted Municipalities to manage noise pollution in their areas.

The AQOs also undertook the following initiatives in their jurisdictional areas, and reported on this at the Working Group meeting:

- **CITY OF CAPE TOWN**

  The CCT reported that its Air Quality Management By-law was approved by Council and gazetted on 30 July 2010. Due to a High Court challenge in respect of the scrap metal recovery sector, the CCT commenced a review of its Air Quality Management By-law 2010. Amongst others, the amendment of the By-law sought to regulate the scourge of burning related to copper wires, tires and other material for the recovery of scrap metal. The High Court challenge was postponed *sine die,* pending the By-law review process.

  The CCT further utilised the review process to remove certain sections of the By-law that were adequately addressed by National legislation, e.g. NEM: AQA, and to strengthen air quality matters, which are not adequately addressed, e.g. dust nuisances etc.

  The CCT envisages that the review process will ultimately result in the repeal of the Air Quality Management By-law 2010, which will be replaced by the City of Cape Town Air Quality Management By-law 2016. The draft By-law was adopted by Council on 31 March 2016, and was submitted for gazetting during July 2016. The public will be afforded an opportunity to provide comments on the draft City of Cape Town Air Quality Management By-law 2016.

- **EDEN DISTRICT MUNICIPALITY**

  The EDM reported that their Air Quality Management By-law was approved by Council and gazetted on 12 October 2012. The EDM also reported on the complaints handled by the IGTT formed in Oudtshoorn, to address odour in the Oudtshoorn area. See Chapter 8 for more detail on the IGTT.

- **OVERBERG DISTRICT MUNICIPALITY**
  The ODM reported that they developed their Air Quality Management By-Law, which was adopted by Council and gazetted on 15 May 2015.
- **WEST COAST DISTRICT MUNICIPALITY**
  The WCDM reported that their Air Quality Management By-law was gazetted on 06 September 2013. The WCDM also reported on the complaints received in Saldanha Bay and St. Helena Bay, in respect of red dust and odour, respectively. In both instances, IGTTs were formed to address these complaints, as discussed in Chapter 8.
- **CAPE WINELANDS DISTRICT MUNICIPALITY**
  The CWDM reported that the Municipality has developed a draft Air Quality Management By-law, which will be gazetted for public comment.
- **CENTRAL KAROO DISTRICT MUNICIPALITY**
  The CKDM reported that the Municipality has not developed a Air Quality Management By-law, as yet. The DEA&DP is actively engaging with the CKDM in this regard. The By-law will need to take into consideration the proposed shale gas development in the area.

6.3 MUNICIPAL AIR QUALITY OFFICERS / INDUSTRY FORUMS

As of 2012, two District Municipalities (viz. WCDM and EDM) have established Municipal Air Quality Officers / Industry Forums within their respective areas in the Western Cape. The municipal forums are conducted on a quarterly basis and attended by industries that operate under Section 21 Listed Activities, the Local Municipal AQOs, as well as the DEA&DP air quality officials. These forums serve as platforms to communicate important air quality matters to the industries and Local Municipalities in their respective areas.

The forums allows for, amongst other:

- Industries to submit quarterly reports to the Licensing Authorities, in order to establish compliance, as well as non-compliance to air quality management, as per the conditions of their AELs.
- District Municipal AQOs to share information on amendments in respect of air quality regulatory reform and policy development.
- Local Municipal AQOs to attend the forums to gain insight into the activities of the regulated industries in their areas, as well as share information on air quality impacts as it relates to their By-law.

Photograph by: Western Cape Government

7. AMBIENT AIR QUALITY MONITORING

Air quality management aims to estimate human exposure to criteria air pollutants in order to manage air quality. Criteria pollutants are commonly found in the ambient air and can cause harm to human health, the environment and damage to property (USEPA, 2016). To this end, the the National DEA has identified seven criteria pollutants for which the South African Ambient Air Quality Standards (SA-AAQS; DEA, 2009, 2012) were promulgated. The criteria pollutants include the following:

- Nitrogen Dioxide (NO_2);
- Sulphur Dioxide (SO_2);
- Ozone (O_3);
- Particulate Matter of particle size less than 10 micron (PM_{10});
- Particulate Matter of particle size less than 2.5 micron ($PM_{2.5}$);
- Benzene (C_6H_6);
- Carbon Monoxide (CO); and
- Lead (Pb).

The SA-AAQS consists of an **averaging period,** a **concentration limit value,** and a maximum permitted **frequency of exceedance**. The averaging period is the period over which an average concentration of a pollutant is determined. The concentration limit value is defined as a concentration fixed on the basis of scientific knowledge, with the aim of reducing harmful effects on human health or the environment. The frequency of exceedance represents the tolerated number of exceedances of the limit value at a specific monitoring location in a calendar year (DEA, 2009).

The SA-AAQS for criteria pollutants monitored in the Western Cape, with the exception of Lead, are listed in Table 7-1.

The dust fallout standards in residential and non-residential areas is represented in Table 7-2. Two (2) non-consecutive exceedances of the monthly limit value is permitted annually; while dust fallout rate is reported in units of $mg/m^2/day$.

TABLE 7-1: SA-AAQS FOR CRITERIA POLLUTANTS, MONITORED IN THE WESTERN CAPE

PARAMETER	AVERAGING PERIOD	CONCENTRATION	FREQUENCY OF EXCEEDANCE
SA-AAQS (DEA, 2009)			
NITROGEN DIOXIDE (NO_2)	1 hour	200 µg/m³ (106 ppb)	88
	1 year	40 µg/m³ (21 ppb)	0
SULPHUR DIOXIDE (SO_2)	10 minutes	500 µg/m³ (191 ppb)	526
	1 hour	350 µg/m³ (134 ppb)	88
	24 hours	125 µg/m³ (48 ppb)	4
	1 year	50 µg/m³ (19 ppb)	0
OZONE (O_3)	8 hours (running)	120 µg/m³ (61 pp)	11
PARTICULATE MATTER (PM_{10})	24 hours	75 µg/m³	4
	1 year	40 µg/m³	0
PARTICULATE MATTER ($PM_{2.5}$)	24 hours	40 µg/m³	4
	1 year	25 µg/m³	0
BENZENE (C_6H_6)	1 year	5 µg/m³	0
CARBON MONOXIDE (CO)	1 hour	30 µg/m³ (26 ppm)	88
	8 hours	10 µg/m³ (8.7 ppm)	11

TABLE 7-2: NATIONAL STANDARDS FOR DUST FALLOUT (DEA, 2013)

LAND USE TYPE	DUST FALLOUT RATE (D) (IN MG/M2/ DAY, 30 DAYS AVERAGE)	PERMITTED FREQUENCY OF EXCEEDANCE
RESIDENTIAL	D < 600	2 per annum, non-consecutive months
NON-RESIDENTIAL	600 < D < 1200	2 per annum, non-consecutive months

7.1 HEALTH EFFECTS ASSOCIATED WITH EXPOSURE TO CRITERIA POLLUTANTS

Air pollution in urban and rural areas was estimated to cause 3.7 million premature deaths worldwide in 2012 and 88% of those premature deaths occurred in low and middle-income countries, with the greatest number in the Western Pacific and South-East Asia regions (WHO, 2014). Exposure to air pollutants can result in acute and chronic effects on human health, which may result in irritations (allegic reactions), chronic respiratory disease and premature deaths (Table 7-3). The susceptibility of certain population groups to adverse health effects from air pollution varies, with the elderly, children, and individuals with pre-existing health conditions, being the most vulnerable.

Estimating human exposure to air pollution levels can assist in reducing the negative impact of the air pollutants on the recognised vulnerable groups. These estimates are based on measurements of pollutant concentrations, which is determined through established ambient air quality monitoring networks. The severity of health effects from exposure to air pollutants are dependent on the following: the magnitude of the pollution; the duration of exposure to pollution; and the frequency of exposure of pollution (Sexton and Ryan, 1988).

TABLE 7-3: SUMMARY OF THE SOURCES, HEALTH AND ENVIRONMENTAL EFFECTS OF POLLUTANTS (DEA&DP, 2009)

POLLUTANT	DEFINITION	MAJOR SOURCES	HUMAN HEALTH AND/OR ENVIRONMENTAL IMPACTS
PARTICULATE MATTER **SYMBOL:** **PM_{10}, $PM_{2.5}$**	PM_{10}: Respirable solid or liquid particles with a diameter smaller than 10 microns : Fine airborne solid or liquid particles with a diameter smaller than 2.5 microns	• Products of combustion, including wood, coal and fossil fuels; automotive exhaust and windborne dust from construction sites, roads and soil erosion	• Higher risk of cardio-respiratory mortality • Irregular heartbeat • Exacerbation of existing respiratory conditions • Decreased lung function • Higher risk of chronic respiratory disease
SULPHUR DIOXIDE **SYMBOL:** **SO_2**	A colourless non-flammable gas with a distinctly detectable odour and taste	• Combustion of fossil fuels by power plants and other industrial facilities • Industrial processes such as extracting metal from ore • Vehicle emissions • Natural sources, including volcanic plumes	• Increased airway resistance • Reduction in lung function • Wheezing and shortness of breath • Long term exposure may result in chronic pulmonary impairment • Contributes to the formation of sulphuric acid rain and mist • Acidification of lakes and streams • Leaf injury and stunted growth in plants • Decrease in plant yield • Corrosion of natural and anthropogenic structures
CARBON MONOXIDE **SYMBOL:** **CO**	An odourless, colourless and tasteless gas	• Incomplete combustion of carbon-based fuels in motor vehicles and industrial boilers	• Tissue and organ hypoxia • Diminished mental alertness and vision, dizziness • Impaired coordination and manual dexterity • Unconsciousness and/or death
OZONE **SYMBOL:** **O_3**	A colourless or blue-ish gas	• Tropospheric ozone is formed naturally • Ground level ozone is formed in a photochemical reaction between NO_x and VOC's emitted from vehicles and industrial processes.	• Exposure to ozone can trigger a variety of health problems including: • Chest pain, coughing, throat irritation, and airway inflammation • Reduction of lung function • Morphological changes in lungs in the event of prolonged exposure • Eye irritating at low concentrations • Ozone affects sensitive vegetation and ecosystems and harms sensitive vegetation during the growing season. • Contributes to urban smog

POLLUTANT	DEFINITION	MAJOR SOURCES	HUMAN HEALTH AND/OR ENVIRONMENTAL IMPACTS
NITROGEN DIOXIDE **SYMBOL:** **NO_2**	A reddish-brown gas with a highly detectable odour, a highly corrosive and oxidising agent	• Fuel combustion in motor vehicles • Industrial and chemical manufacturing processes	• Increased airway resistance • Nose, eye and throat irritation, coughing, dyspnoea, headache and nausea • Exacerbation of existing respiratory disease, such as emphysema and bronchitis • Exacerbation of existing heart disease • Corrosion and stunted growth in plants
BENZENE **SYMBOL:** **C_6H_6**	A colourless, clear liquid readily evaporating at room temperature	• Combustion of petroleum products, service stations, and motor vehicle exhaust fumes • Unvented wood fires • Cigarette smoke • Vapours from products such as glues, paints, furniture waxes and detergents	Acute effects include: • Narcosis • Headaches • Dizziness • Tiredness • Confusion • Unconsciousness Effects following chronic exposure: • Higher risk to carcinogenic effects • Aplastic anaemia • Loss of red and white blood cells • Stunted growth in plants
HYDROGEN SULPHIDE **SYMBOL:** **H_2S**	A colourless and flammable gas with a characteristic rotten egg odour	• Crude petroleum • Natural gas • Formed as the result of the breakdown of organic matter	• Headache • Skin complications • Respiratory and mucous membrane irritation • Conjunctivitis • Unconsciousness and/or death at high concentrations

7.2 AMBIENT AIR QUALITY MONITORING IN THE WESTERN CAPE

In terms of Section 8 of the NEM: AQA, Provinces and Municipalities are mandated to monitor ambient air quality. In the Western Cape, the Department of Environmental Affairs and Development Planning's Directorate: Air Quality Management (DEA&DP D:AQM), the City of Cape Town (CCT) and the Saldanha Bay Municipality (SBM) have installed air quality monitoring equipment within their jurisdiction, as part of the Western Cape Ambient Air Quality Monitoring Network within the Western Cape Province (Table 7-4).

TABLE 7-4: THE AMBIENT AIR QUALITY MONITORING NETWORKS IN THE WESTERN CAPE

MUNICIPAL AREA	LOCATION	DATE COMMENCED
DEA&DP'S WESTERN CAPE AMBIENT AIR QUALITY MONITORING NETWORK		
CAPE WINELANDS	Traffic Department, van Riebieck Rd, Paarl	March 2008 – May 2009*
EDEN	Voorbaai electrical substation, Mosselbay	August 2008 – February 2010*
WEST COAST	Vredenburg High School, Vredenburg	April 2008*
CAPE WINELANDS	Meirings Park Electrical Substation, Worcester 33° 37' 39.26" S, 19° 28' 54.2" E	July 2009
WEST COAST	Swartland High School, Malmesbury 33° 27' 19.51" S, 18° 43' 54.62" E	April 2010
EDEN	Municipal Swimming Pool, George 33° 58' 45.75" S , 22° 28' 22.50"E	July 2010
CITY OF CAPE TOWN	Panther Park, Berkeley Rd, Maitland	August 2010*
EDEN	Bongolethu Clinic, Oudtshoorn 33° 36' 22.56'' S, 22° 14' 17.80'' E	April 2011
WEST COAST	HP Williams Primary School, St Helena Bay 32° 43' 24.03" S, 17° 58' 21.74" E	April 2011
CITY OF CAPE TOWN	Khayelitsha Training Centre, Khayelitsha 34° 2'21.51"S, 18°40'11.25"E	May 2011-December 2014*
CITY OF CAPE TOWN	Khayelitsha District Hospital, Khayelitsha 34° 3'4.39"S, 18°40'33.07"E	January 2015
CITY OF CAPE TOWN	Morningstar Small Holdings, Vissershok 33°45' 07.37"S, 18° 31' 53.65"E	September 2011
CAPE WINELANDS	CWDM Office, Dorp Street, Stellenbosch 33° 55' 39.50" S , 18° 51' 25.94" E	October 2011
EDEN	Dana Bay Reservoir, Dana Bay 34° 11' 29.42" S, 22° 03' 06.61" E	November 2011
CITY OF CAPE TOWN	Sentinel Primary School, Hout Bay 34°25'12.42" S, 19°12'47.37" E	March 2014
OVERBERG	Mount Pleasant Primary School, Hermanus 34°25'12.40" S, 19°12'47.17" E	March 2014
CITY OF CAPE TOWN's AMBIENT AIR QUALITY MONITORING NETWORK		
CITY OF CAPE TOWN	Molteno	1992
CITY OF CAPE TOWN	Goodwood	1993
CITY OF CAPE TOWN	Athlone	1993

MUNICIPAL AREA	LOCATION	DATE COMMENCED
CITY OF CAPE TOWN	City Hall, City of Cape Town	1994
CITY OF CAPE TOWN	Tableview	1994
CITY OF CAPE TOWN	Foreshore, City of Cape Town	1995
CITY OF CAPE TOWN	Bothasig	1995
CITY OF CAPE TOWN	Khayelitsha, Site C, Khayelitsha	2002
CITY OF CAPE TOWN	Bellville South, Bellville	2003
CITY OF CAPE TOWN	Wallacedene	2006
CITY OF CAPE TOWN	Atlantis	2008
CITY OF CAPE TOWN	Plattekloof Reservoir, Plattekloof	2013
SALDANHA BAY MUNICIPALITY's AMBIENT AIR QUALITY MONITORING NETWORK		
SALDANHA BAY	Saldanha Bay Harbour 33° 00' 57.0" S, 17° 56' 43.3" E	July 2014
SALDANHA BAY	Louwville substation, 32° 54' 30.3" S, 18° 00' 32.2" E	July 2014
SALDANHA BAY	Saldanha Bay Substation 33° 00' 03.7"S, 17° 56' 42.2" E	*

**Decomissioned*

The ambient air quality monitoring stations of the DEA&DP, City of Cape Town and Saldanha Bay Municipality are operated in accordance with the US EPA ambient air quality monitoring methods (Quality Assurance Handbook for Air Pollution Measurement Systems, Vol II), ISO/IEC17025:2005 standards and SANAS TR07-03 requirements.

Air quality monitoring data measured at the stations are recorded on data loggers, after which it is transferred via a modem to a server for storage and further processing. The data is quality controlled and quarterly assured and is used to produce daily and monthly reports. All data in the Western Cape Ambient Air Quality Monitoring Network is reported to the South African Air Quality Information System (SAAQIS) on a monthly or quarterly basis.

7.3 THE DEA&DP'S AMBIENT AIR QUALITY MONITORING NETWORK

The DEA&DP commissioned its first air quality monitoring station in 2008 as part of its Ambient Air Quality Monitoring Network. To date, sixteen (16) locations have been monitored, with eleven (11) currently in operation and reporting on various air quality parameters (Figure 7-1 and Table 7-5).

The set of air quality parameters measured at each monitoring station was primarily determined by the historical air quality conditions at the location. Each set of parameters measured may include complimentary sets of parameters, i.e. SO_2, O_3 and NO_2 (vehicle emissions and combustion), PM_{10} and CO (combustion), and H_2S and CO_2 (odour and combustion), which often provides an indication of the possible causes of air pollution in an area. Meteorological parameters (wind speed and direction, ambient temperature, pressure, relative humidity) are also measured to provide the context within which the air quality is measured. The information recorded also assists in reporting on air quality that impact on the larger area, which is being monitored (Table 7-5).

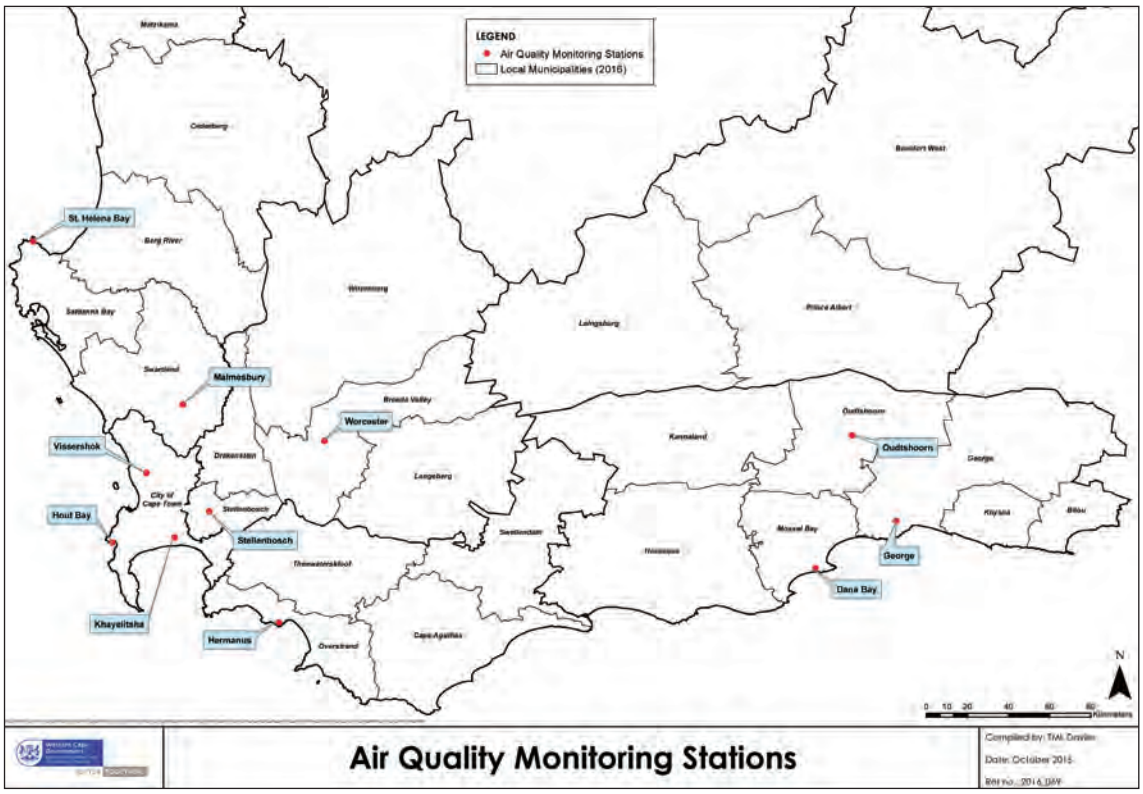


FIGURE 7-1: LOCATIONS OF THE AMBIENT AIR QUALITY MONITORING STATIONS OPERATED IN THE DEA&DP'S AMBIENT AIR QUALITY MONITORING NETWORK

A synopsis of the ambient air quality, as currently monitored at each location of the DEA&DPs Ambient Air Quality Monitoring Network is provided below.

7.3.1 ST. HELENA BAY (WEST COAST DISTRICT MUNICIPALITY)

The St. Helena Bay monitoring station was commissioned at the HP Williams Primary School during April 2011, and was primarily located in the area to address the odour-related complaints received by the Local and District Municipalities. The monitoring station is placed in a residential area near three local fish processing facilities (Figure 7-2).

Data capture for St Helena Bay has been relatively good for the years 2011, 2012 and 2013, while it dropped in 2014 and 2015 due to power supply challenges. The DEA&DP has since upgraded the power supply to the station and it is envisaged that data recovery will improve in the future.

TABLE 7-5: LIST OF PARAMETERS MONITORED AT THE AIR QUALITY MONITORING STATIONS

STATION LOCATION	AIR QUALITY PARAMETERS MEASURED
WORCESTER	SO_2, O_3, NO_2, CO, PM_{10} and full meteorological parameters
MALMESBURY	SO_2, O_3, NO_2, CO, PM_{10} and full meteorological parameters
GEORGE	SO_2, O_3, NO_2, CO, PM_{10} and full meteorological parameters
VISSERSHOK	O_3, NO_2, CO, PM_{10}, and full meteorological parameters
ST. HELENA BAY	H_2S, CO_2, TRS and full meteorological parameters
OUDSTHOORN	H_2S, CO_2 and full meteorological parameters
STELLENBOSCH	SO_2, O_3, NO_2, CO, CO_2, PM_{10} & $_{2.5}$, and full meteorological parameters

STATION LOCATION	AIR QUALITY PARAMETERS MEASURED
KHAYELITSHA	SO_2, O_3, NO_2, CO, CO_2, PM_{10}, $PM_{2.5}$ and full meteorological parameters
DANA BAY	H_2S, and full meteorological parameters full met only added in 2016.
HOUT BAY	H_2S and full meteorological parameters
HERMANUS	SO_2, O_3, NO_2, CO, CO_2, PM_{10} & $PM_{2.5}$ and full meteorological parameters

FIGURE 7-2: AERIAL IMAGE OF THE AMBIENT AIR QUALITY MONITORING STATION AT ST. HELENA BAY

The long term CO_2 data monitored at St. Helena Bay shows a steady concentration of between 380 ppm to 430 ppm (Figure 7-3), which is consistent with the global baseline of 400 ppm.

The H_2S concentrations measured at the St. Helena Bay monitoring station (Figure 7-4) shows a steady value of approximately 9 µg/m³, with annual elevated levels in May, with the highest values being recorded in 2015. The highest H_2S values measured at the station are primarily associated with easterly winds, as shown in Figure 7-5. The H_2S levels recorded at the station at times exceeded the 150 µg/m³ (30 minute mean) WHO Health Guideline (WHO, 2000).

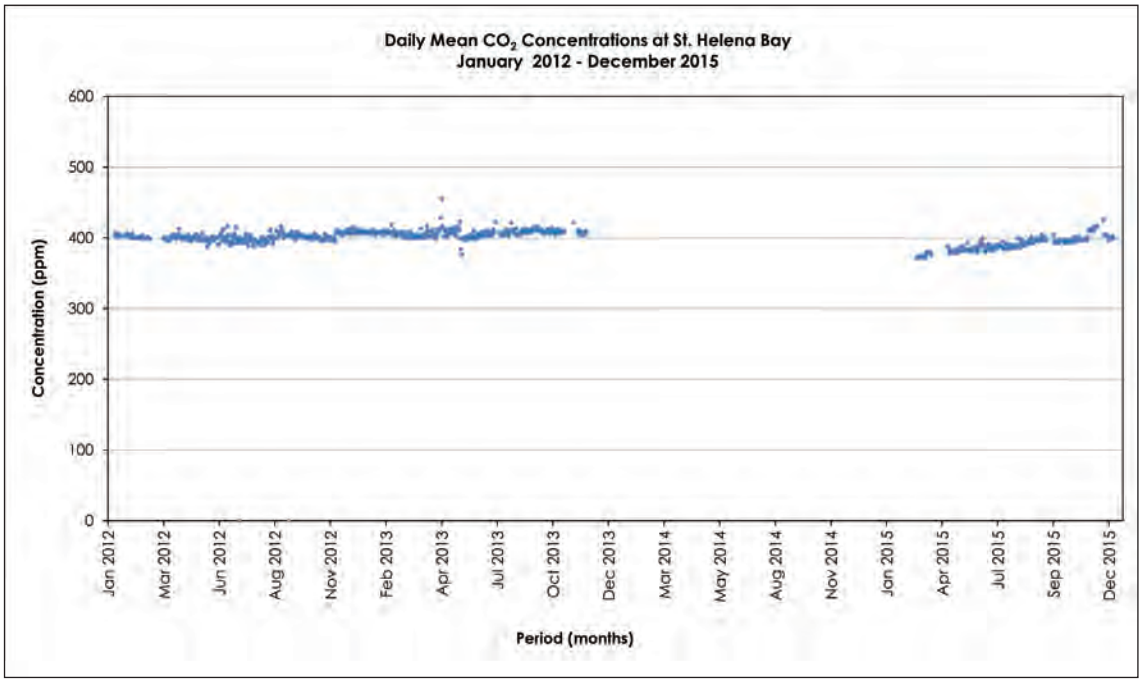


FIGURE 7-3: LONG TERM CO_2 MEASUREMENTS AT ST HELENA BAY (2012 – 2015)

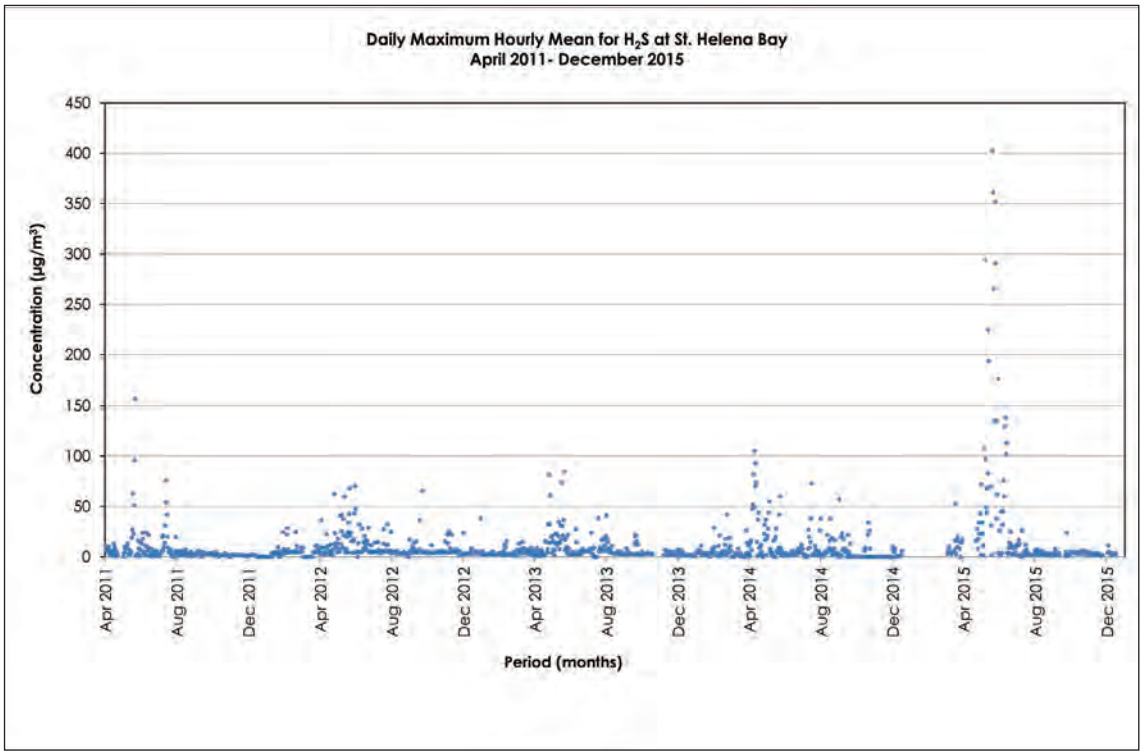


FIGURE 7-4: LONG TERM H_2S AT ST. HELENA BAY (2011 – 2015)

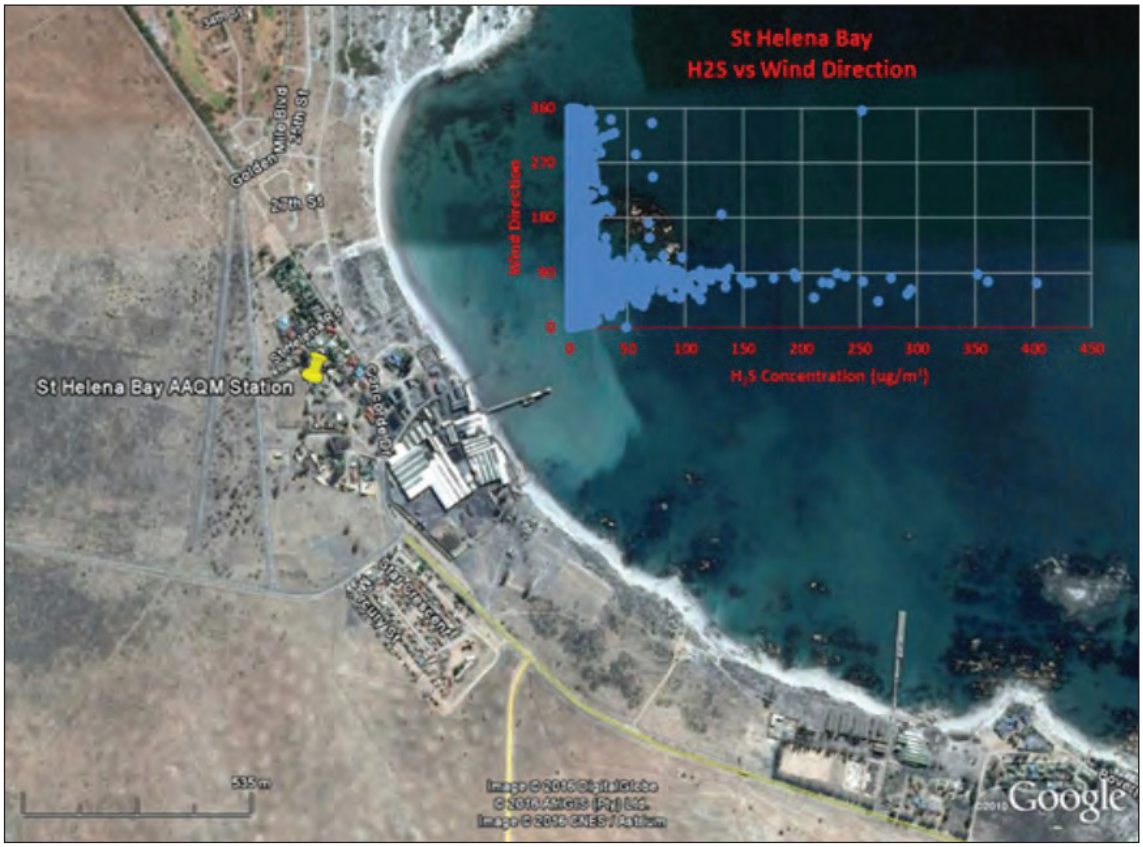


FIGURE 7-5: H_2S CONCENTRATION IN RELATION TO WIND DIRECTION AT ST HELENA BAY MONITORING STATION (2013 – 2015)

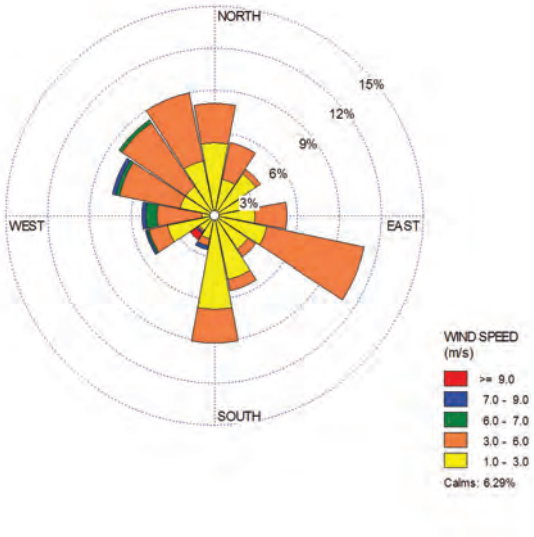


FIGURE 7-6: ST HELENA BAY WIND ROSE FOR 2014

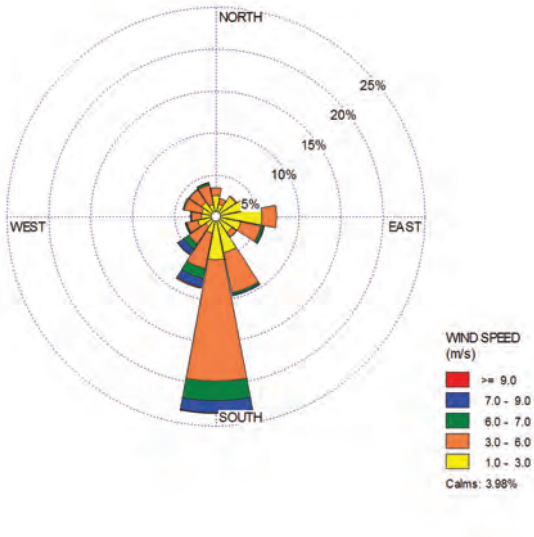


FIGURE 7-7: ST HELENA BAY WIND ROSE FOR 2015

The wind roses for St Helena Bay shows the dominant southerly wind experienced at the station, while an easterly wind component was evident for 2014 (Figure 7-6 and Figure 7-7). It should be noted that strong southerly winds across the St Helena Bay area provides for good pollutant removal, while periods of low wind speeds would allow for the concentration of odourous substances in dips and valleys across the area.

7.3.2 MALMESBURY (WEST COAST DISTRICT MUNICIPALITY)

The Malmesbury monitoring station was located at the Swartland High School in April 2010. The station is situated in a residential area, downwind of industries, a central business district and the N7 National Road (Figure 7-8) construction activities and vehicle emisions, which are the major sources of pollution in the area.

FIGURE 7-8: AERIAL IMAGE OF THE MALMESBURY AMBIENT AIR QUALITY MONITORING STATION

The long term trends for all air pollutants measured at the Malmesburg monitoring station are represented in Figure 7-9 to Figure 7-13. A brief summary of each follows:

- The long term Malmesbury O_3 data shows a steady decline from approximately 43 µg/mµ to 34 µg/m^3 over the five-year measurement period (Figure 7-9). The O_3 (8 – hour) SA-AAQS of 120 µg/m^3 (NEM: AQA 39, 2004) during this period. High O_3 levels were generally observed during December - February, which co-incides with the hot summer months.
- The long term Malmesbury NO_2 data (Figure 7-10) shows a steady average of approximately 20 µg/m^3, over the four-year measurement period.
- The long term Malmesbury SO_2 (Figure 7-11) data shows a steady average of 4 µg/m^3 over the measurement period.
- The long term Malmesbury PM_{10} data (Figure 7-12) shows a steady average of 19 µg/m^3 over the measurement period reviewed.
- The long term trend for CO (Figure 7-13) shows a steady average of approximately 0.7 mg/m^3, with no exceedances of the SA-AAQS.

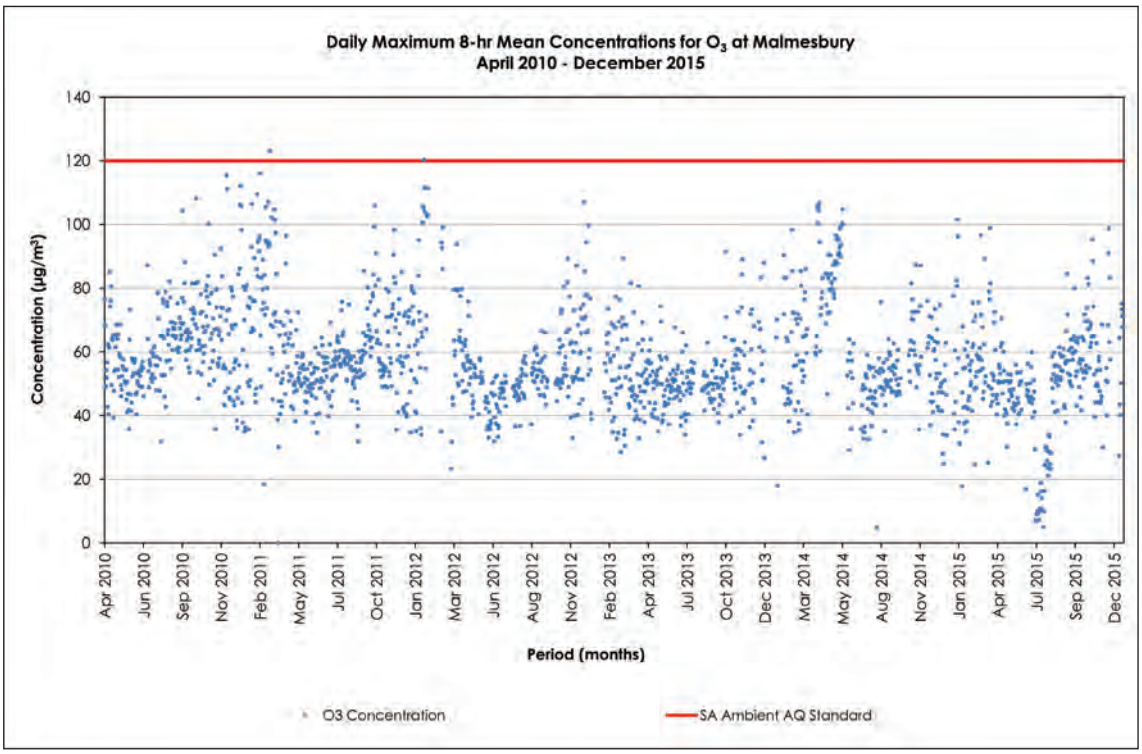


FIGURE 7-9: LONG TERM O_3 MEASUREMENTS AT MALMESBURY (2010 – 2015)

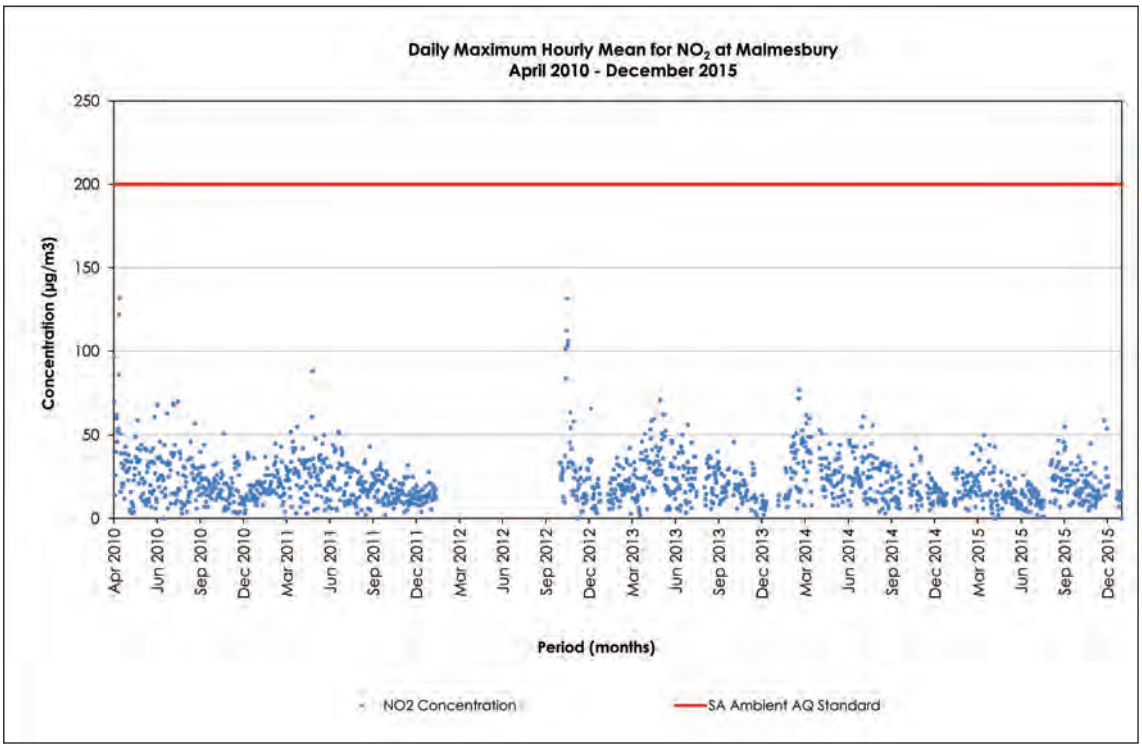


FIGURE 7-10: LONG TERM NO_2 MEASUREMENTS AT MALMESBURY (2010 – 2015)

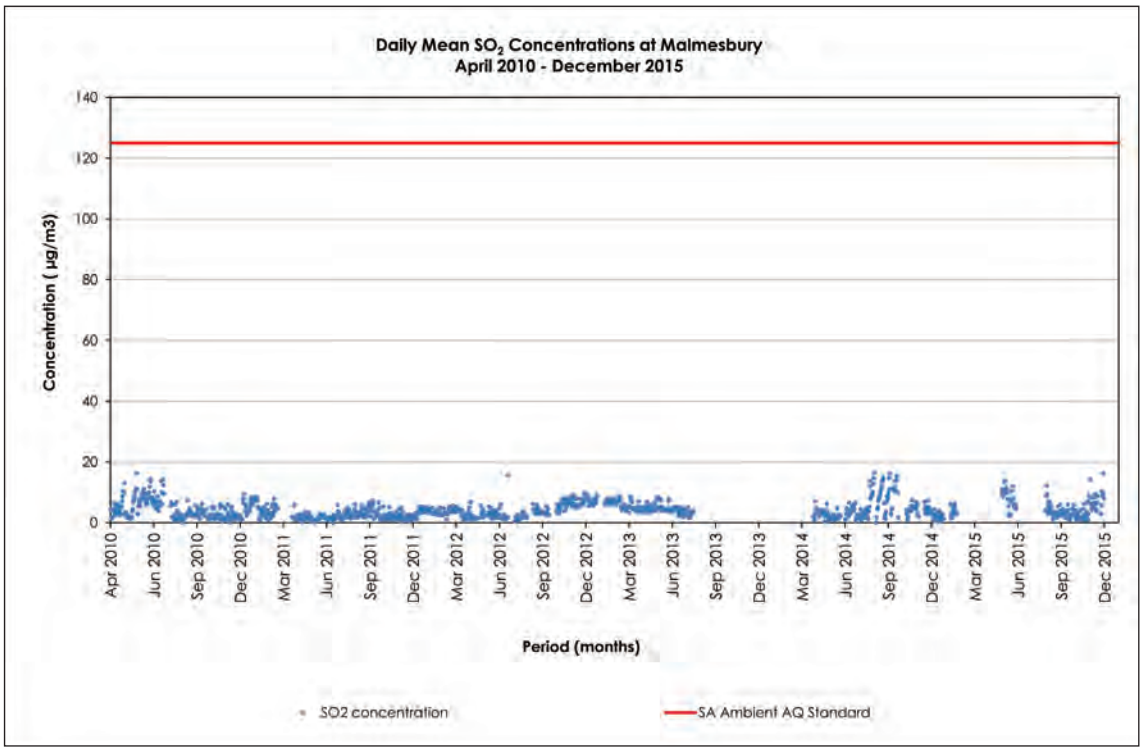


FIGURE 7-11: LONG TERM SO_2 MEASUREMENTS AT MALMESBURY (2010 – 2015)

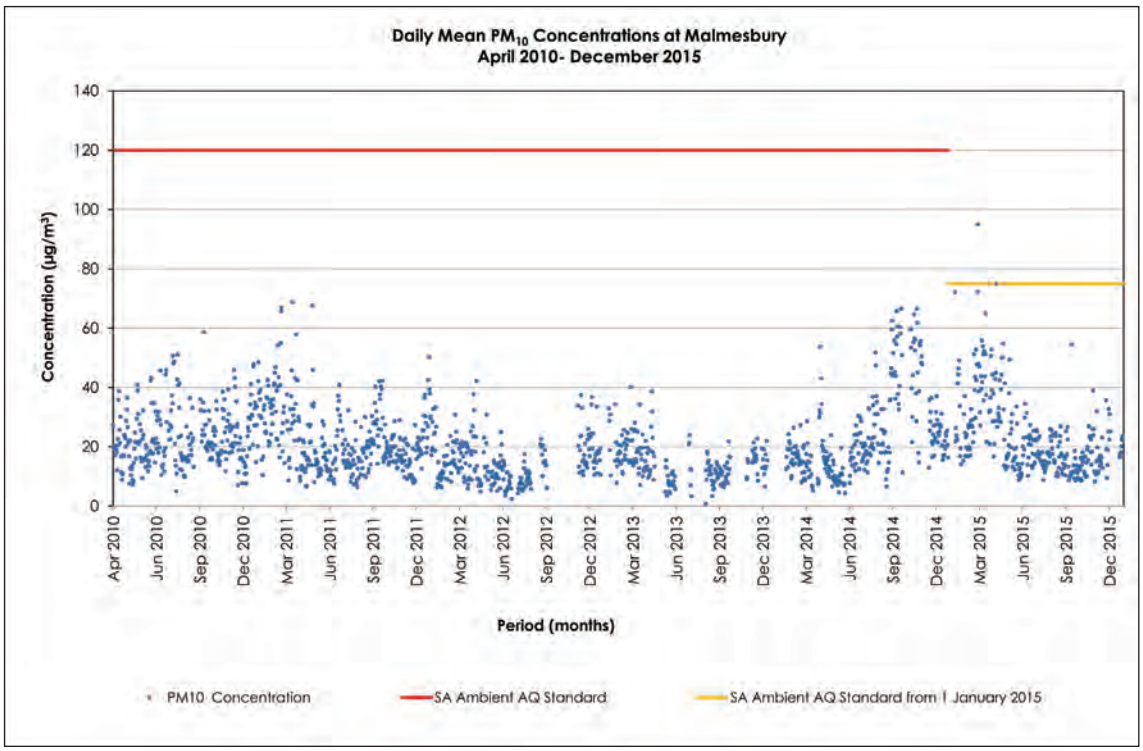


FIGURE 7-12: LONG TERM PM_{10} MEASUREMENTS AT MALMESBURY (2010 – 2015)

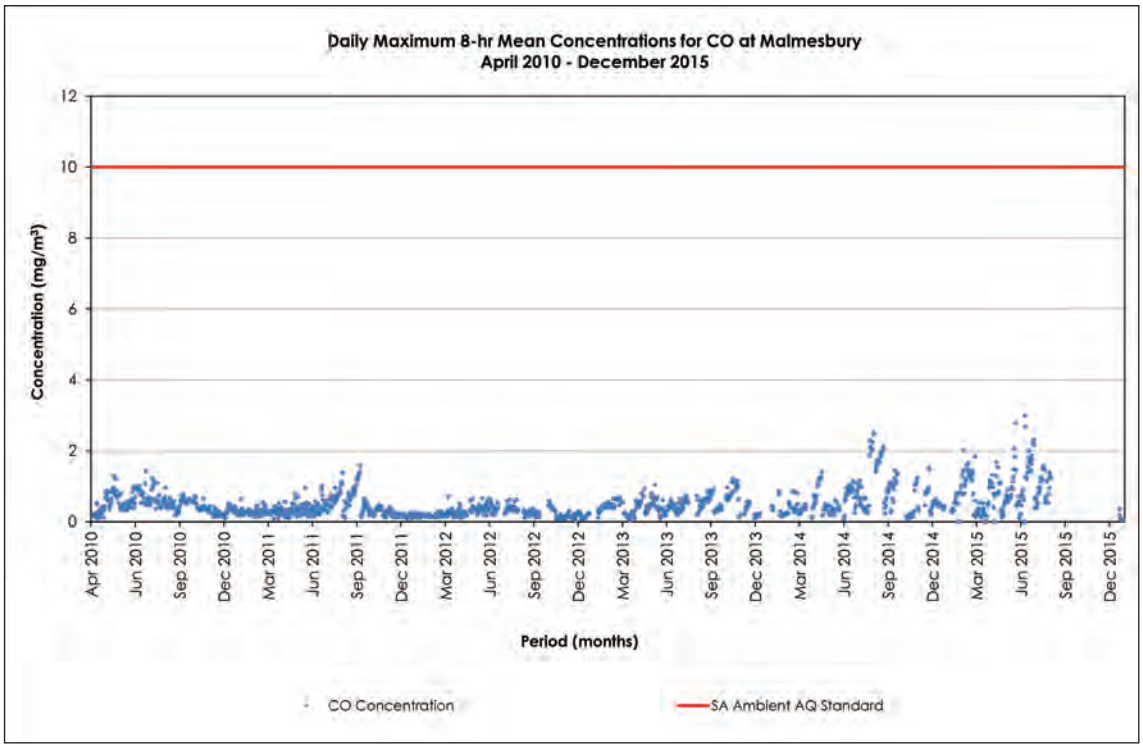


FIGURE 7-13: LONG TERM CO AT MALMESBURY (2010 – 2015)

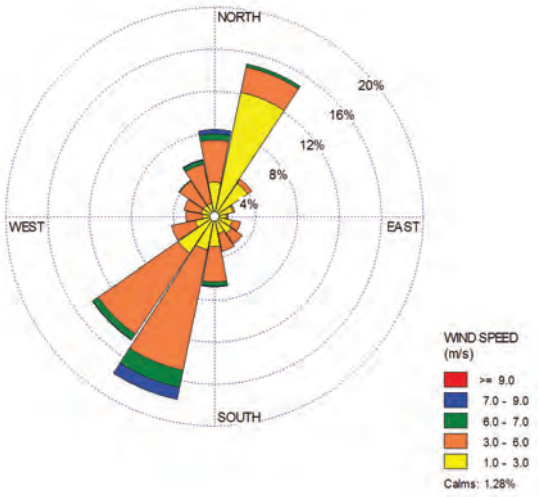


FIGURE 7-14: ANNUAL WIND ROSE FOR MALMESBURY 2011

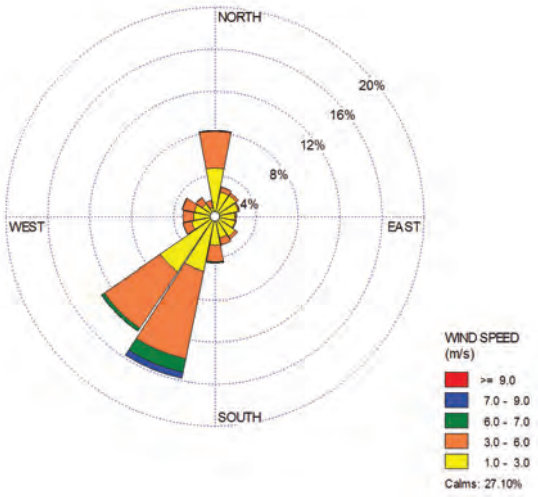


FIGURE 7-15: ANNUAL WIND ROSE FOR MALMESBURY 2012

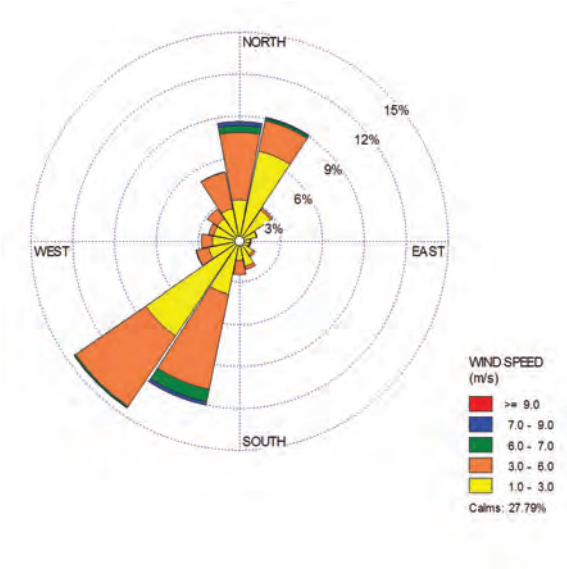


FIGURE 7-16: ANNUAL WIND ROSE FOR MALMESBURY 2013

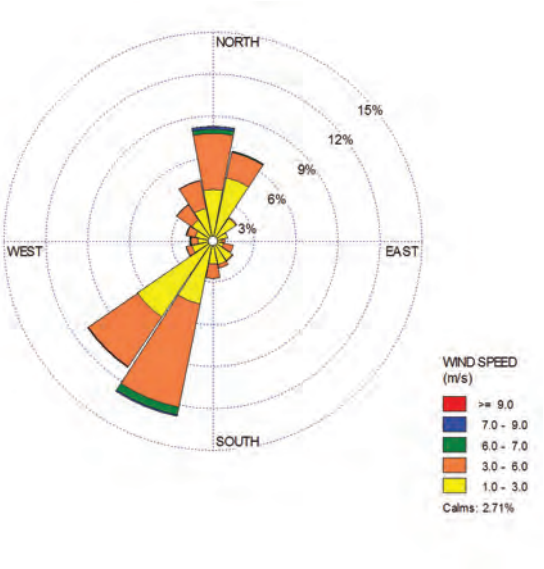


FIGURE 7-17: ANNUAL WIND ROSE FOR MALMESBURY 2014

7.3.3 VISSERSHOK (CITY OF CAPE TOWN)

The Vissershok ambient air quality monitoring station is located at a small holding at Morningstar, north-east of Cape Town (Figure 7-18). The station was commissioned during September 2011 and is located downwind of industries, the N7 National Road and a large landfill site.

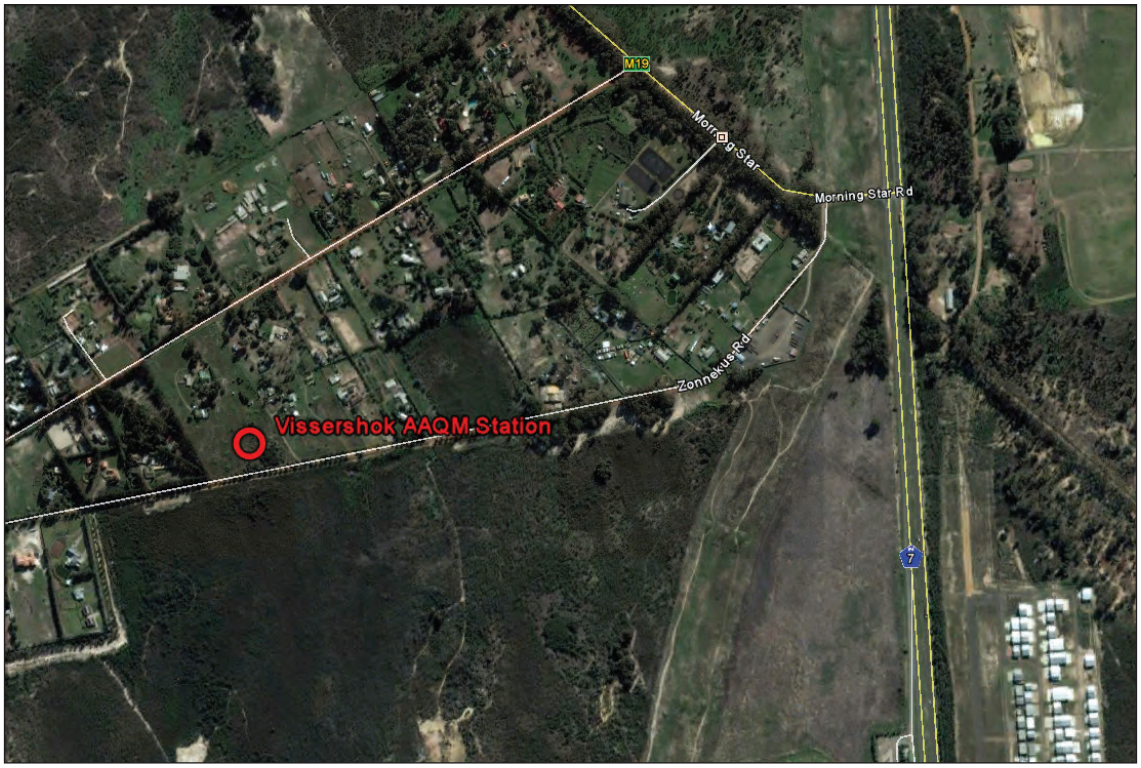


FIGURE 7-18: AERIAL IMAGE OF THE VISSERSHOK AMBIENT AIR QUALITY MONITORING STATION

The long term trends for all pollutants measured at Visserhok monitoring station are represented in Figure 7-19 to Figure 7-22. A brief summary of the pollutants measured is provided below:

- The long term trend for CO shows a steady average of approximately 0.25 mg/m^3 (Figure 7-19).

- The long term trend for O_3 at Vissershok was generally below SA-AAQS of 120 µg/m³ (8-hour, running) and shows peaks during the summer months (Figure 7-20).
- The long term trend for NO_2 was below SA-AAQS of 200 µg/m³ (1-hour) (Figure 7-21).
- The PM_{10} daily maximum concentrations measured for the period are below the SA-AAQS of 120 µg/m³ (24-hour) (Figure 7-22). The long term trend for PM_{10} shows a decline in concentration below the SA-AAAQS of 120 µg/m³ (pre-2015) and the SA-AAQS of 75 µg/m³ (effective 1 January 2015).

The wind roses for the period 2012 to 2015 (Figure 7-23 to Figure 7-26) shows a predominantly southerly wind direction for the period monitored.

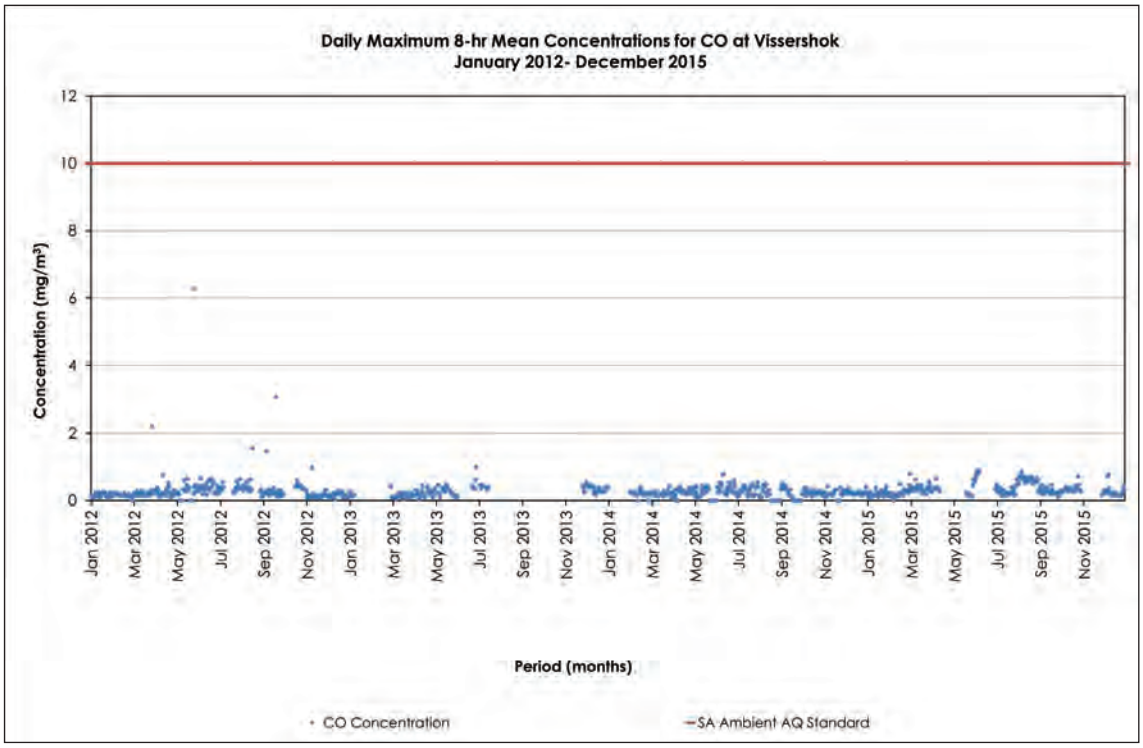


FIGURE 7-19: LONG TERM CO MEASUREMENTS AT VISSERSHOK (2012 - 2015)

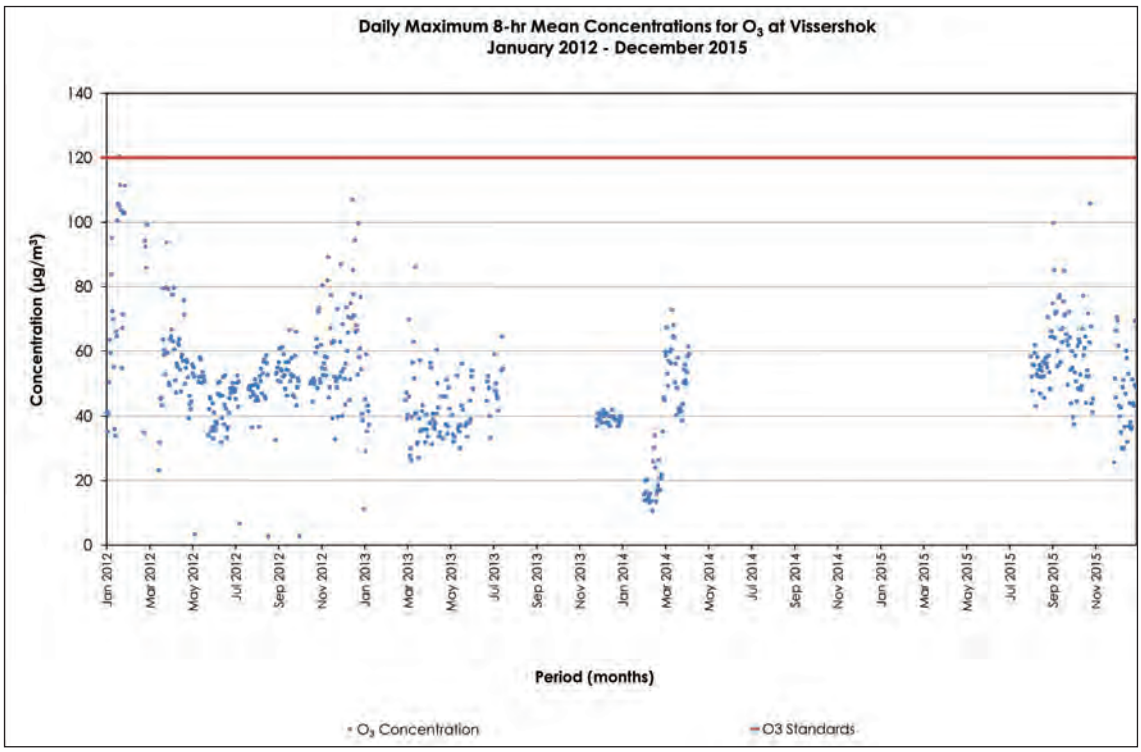


FIGURE 7-20: LONG TERM O_3 MEASUREMENTS AT VISSERSHOK (2012 - 2015)

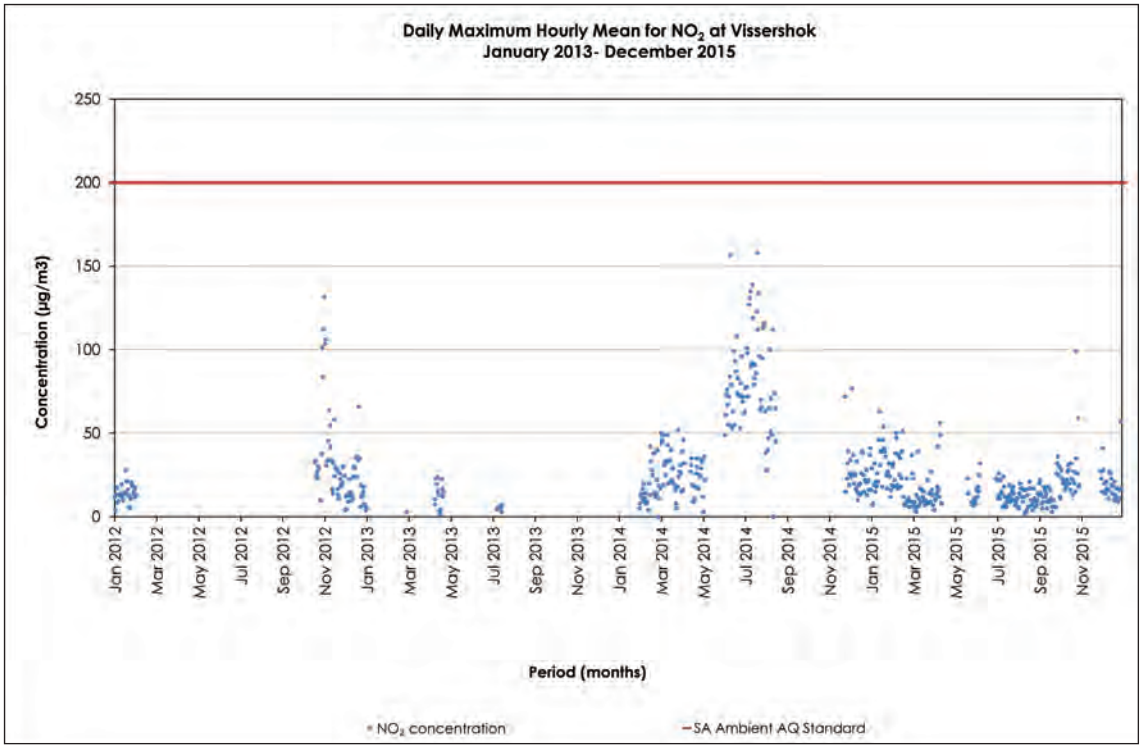


FIGURE 7-21: LONG TERM NO_2 MEASUREMENTS AT VISSERSHOK (2012 - 2015)

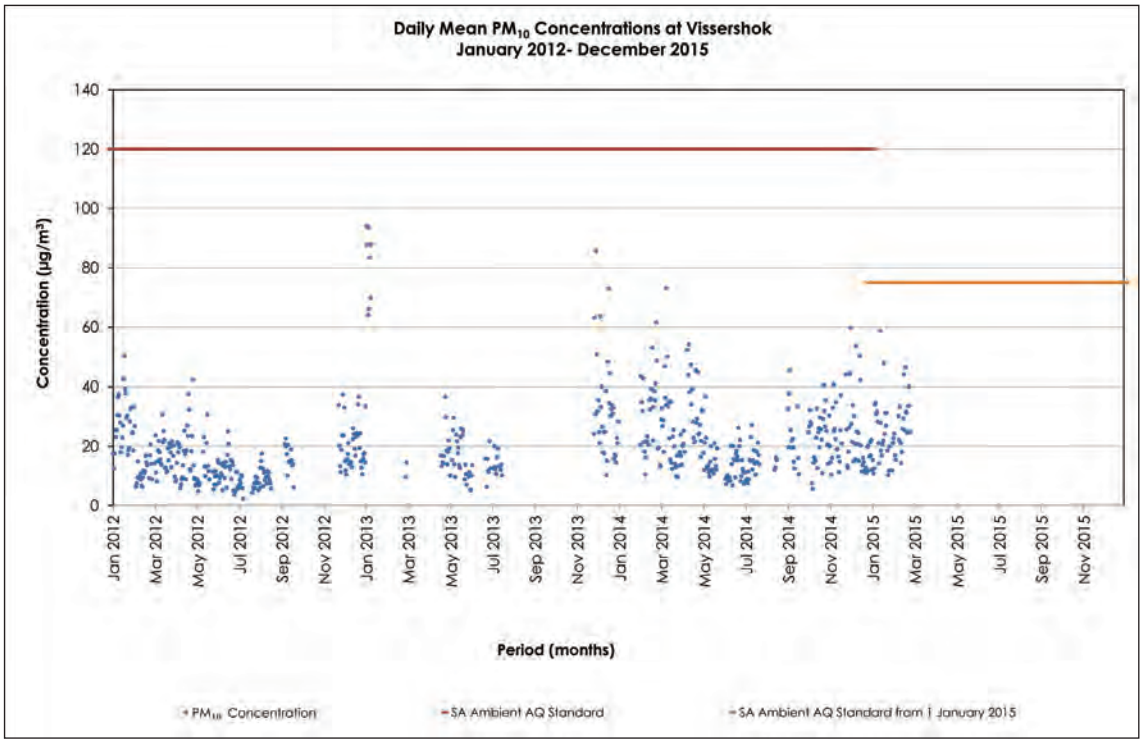


FIGURE 7-22: LONG TERM PM_{10} MEASUREMENTS AT VISSERSHOK (2012- 2015)

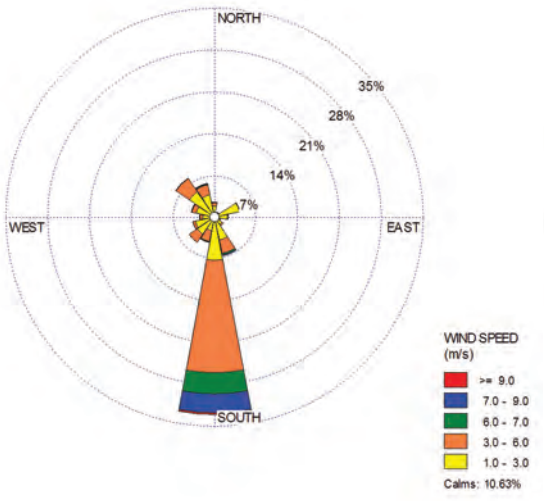


FIGURE 7-23: VISSERSHOK WIND ROSE FOR 2012

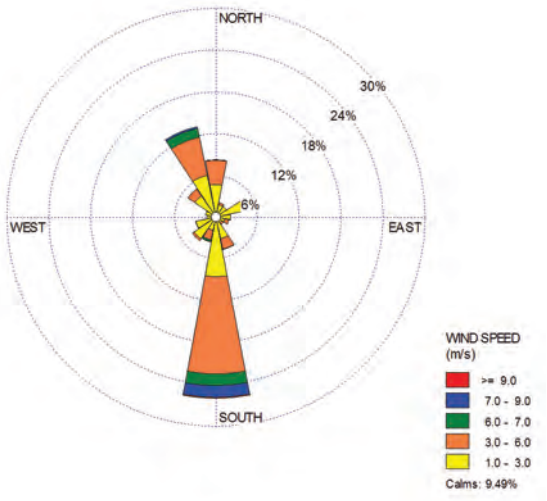


FIGURE 7-24: VISSERSHOK WIND ROSE FOR 2013

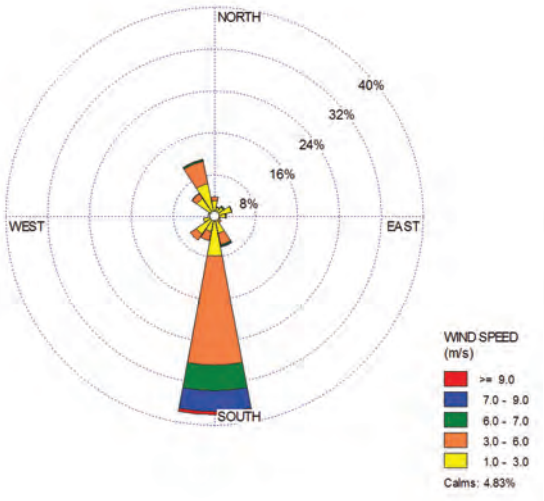


FIGURE 7-25: VISSERSHOK WIND ROSE FOR 2014

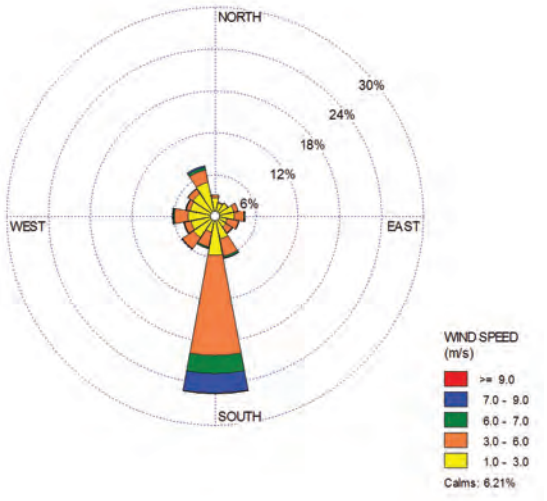


FIGURE 7-26: VISSERSHOK WIND ROSE FOR 2015

7.3.4 KHAYELITSHA (CITY OF CAPE TOWN)

The Khayelitsha monitoring station was initially commissioned in May 2011 at the Khayelitsha Training Centre, and relocated in December 2014 to the new site at the Khayelitsha District Hospital (Figure 7-27). The Khayelitsha monitoring station is located less than 5km from an informal settlement situated south-east of Cape Town. The new meteorological equipment was installed at the new location in January 2016 due to modification and site requirements.

FIGURE 7-27: AERIAL IMAGE OF THE KHAYELITSHA AIR QUALITY MONITORING STATION

Long term trends for all pollutants measured at Khayelitsha monitoring station are represented in Figure 7-28 to Figure 7-32. A brief summary of each pollutant measured is provided, noting that the station was moved to a new loaciton less than 2km from the original location. On site costruction at both locations resulted in major delays in re-installation with the resultant data gap for 2014.

- The long term trend for CO is steady at approximately 1 mg/m^3 (Figure 7-28). The daily maximum concentrations measured were well below the SA-AAQS.
- The long term data for O_3 at Khayelitsha shows a downward trend from approximately 45 µg/m^3 to 20 µg/m^3 (Figure 7-29).
- The long term trend for NO_2 shows a slight downward trend. The daily maximum concentrations measured were well below the SA-AAQS (Figure 7-30).
- The long term trend for SO_2 is steady at approximately 4 µg/m^3. The daily mean concentrations measured were well below the SA-AAQS (Figure 7-31).
- The long term trend for CO_2 shows an average value of approximately 400 ppm which is consistent with the global average (Figure 7-32).
- The long term PM_{10} average is not represented due to analyser and power problems as well as the station relocation, however the 2011 data shows a 20 µg/m^3 average which is well below the SA-AAQS (Figure 7-33).

The wind roses for 2012 and 2013 (Figure 7-34 and Figure 7-35) show a predominantly southerly wind direction for the period monitored, however, there is a distinct northerly component during 2013.

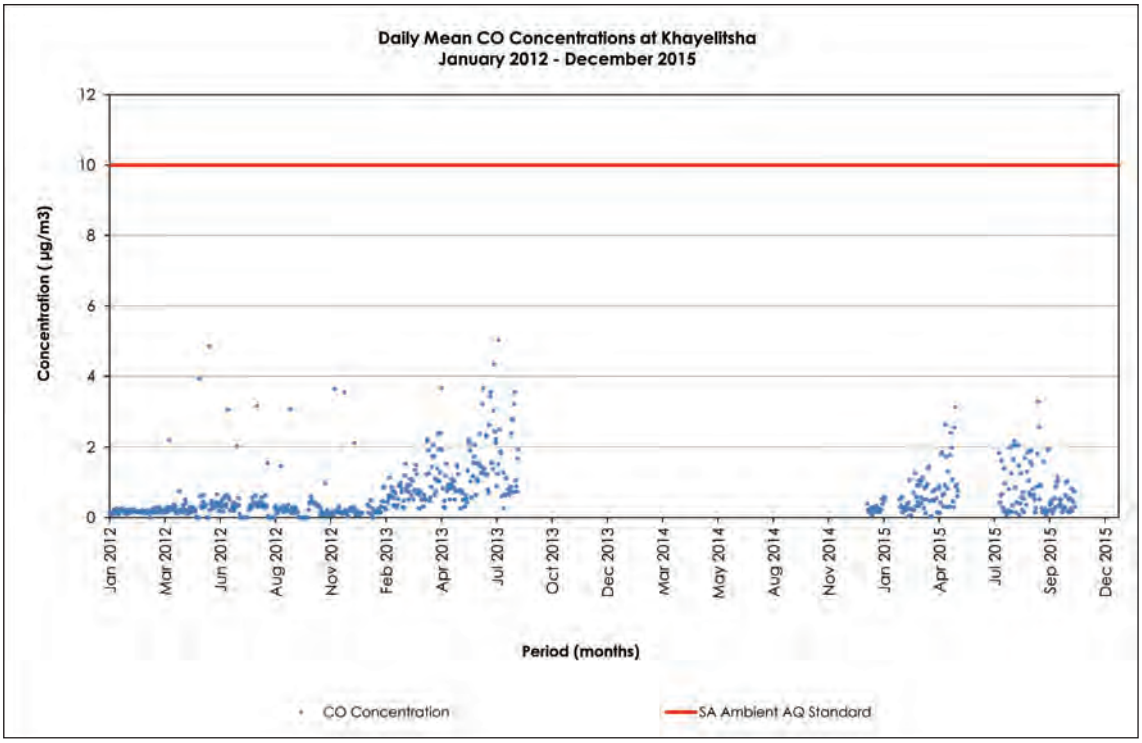


FIGURE 7-28: LONG TERM DAILY MAXIMUM 8-HR MEAN CO MEASUREMENTS AT KHAYELITSHA (2012 – 2015)

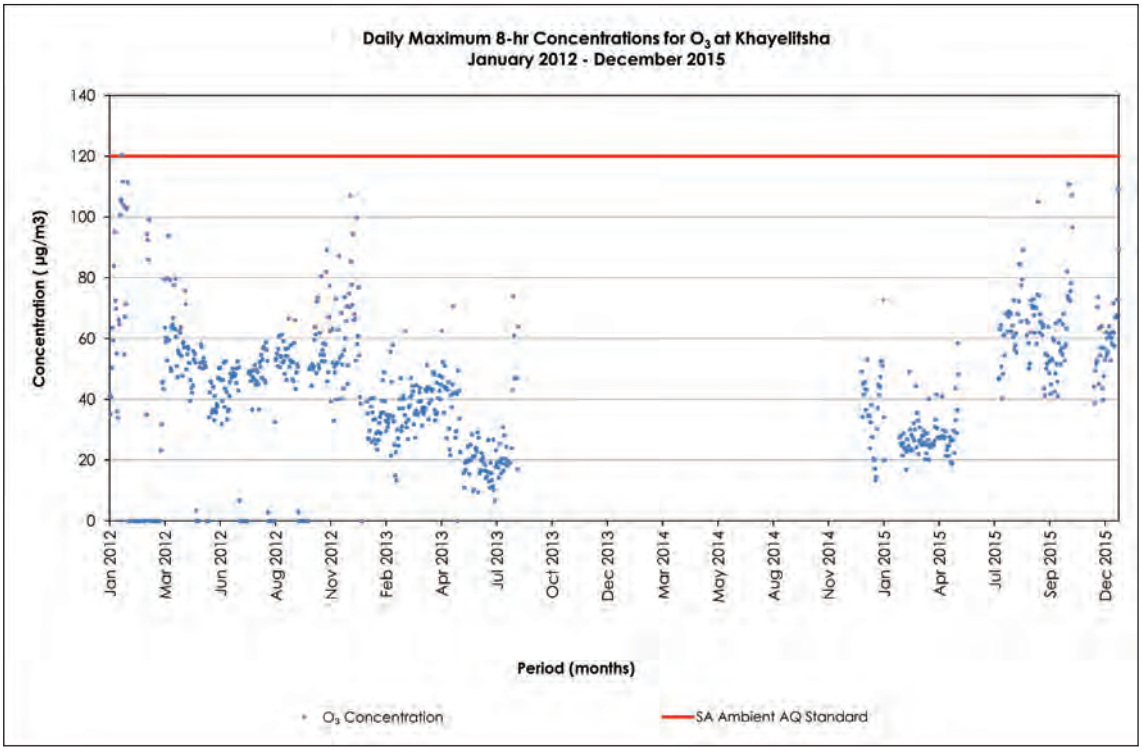


FIGURE 7-29: LONG TERM DAILY MAXIMUM 8-HR O_3 MEASUREMENTS AT KHAYELITSHA (2012 – 2015)

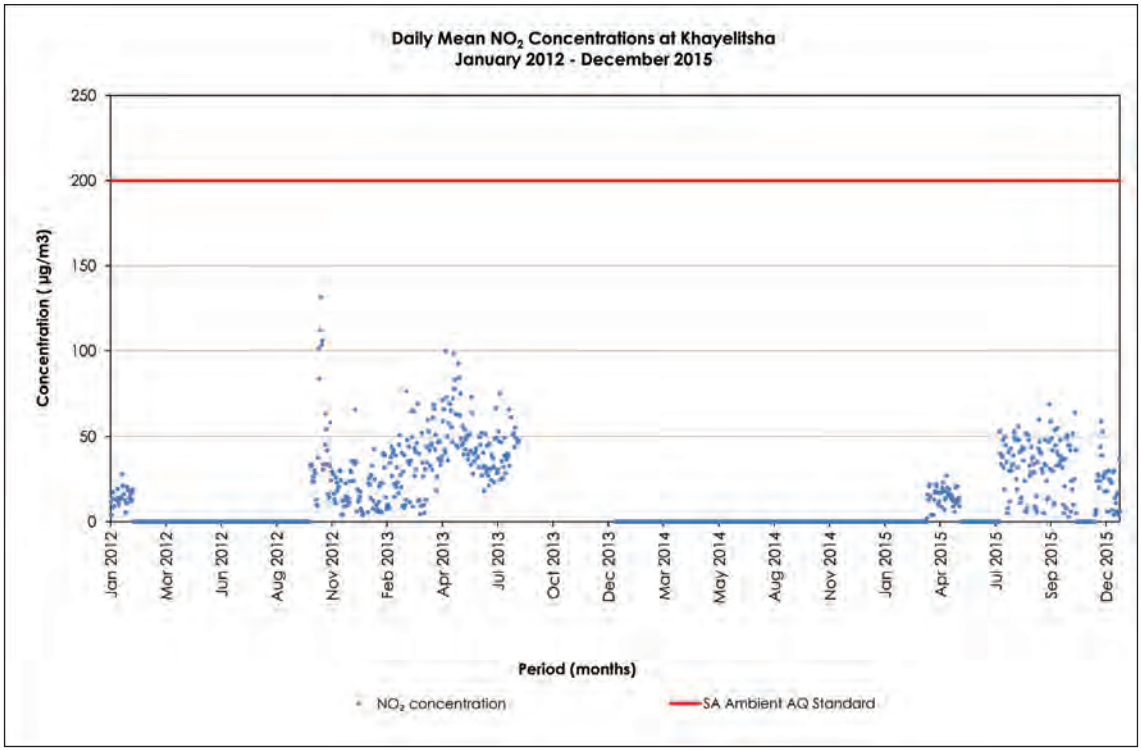


FIGURE 7-30: LONG TERM DAILY MAXIMUM HOURLY MEAN NO_2 MEASUREMENTS AT KHAYELITSHA (2012 – 2015)

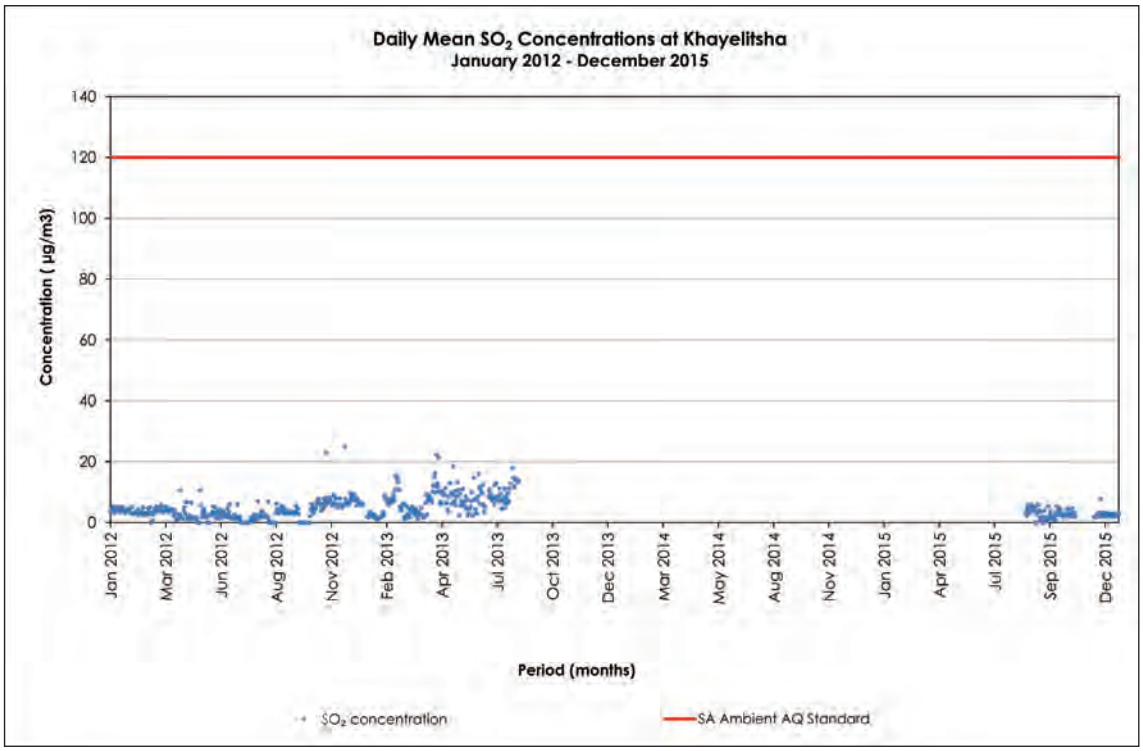


FIGURE 7-31: LONG TERM DAILY MEAN SO_2 MEASUREMENTS AT KHAYELITSHA (2012 – 2015)

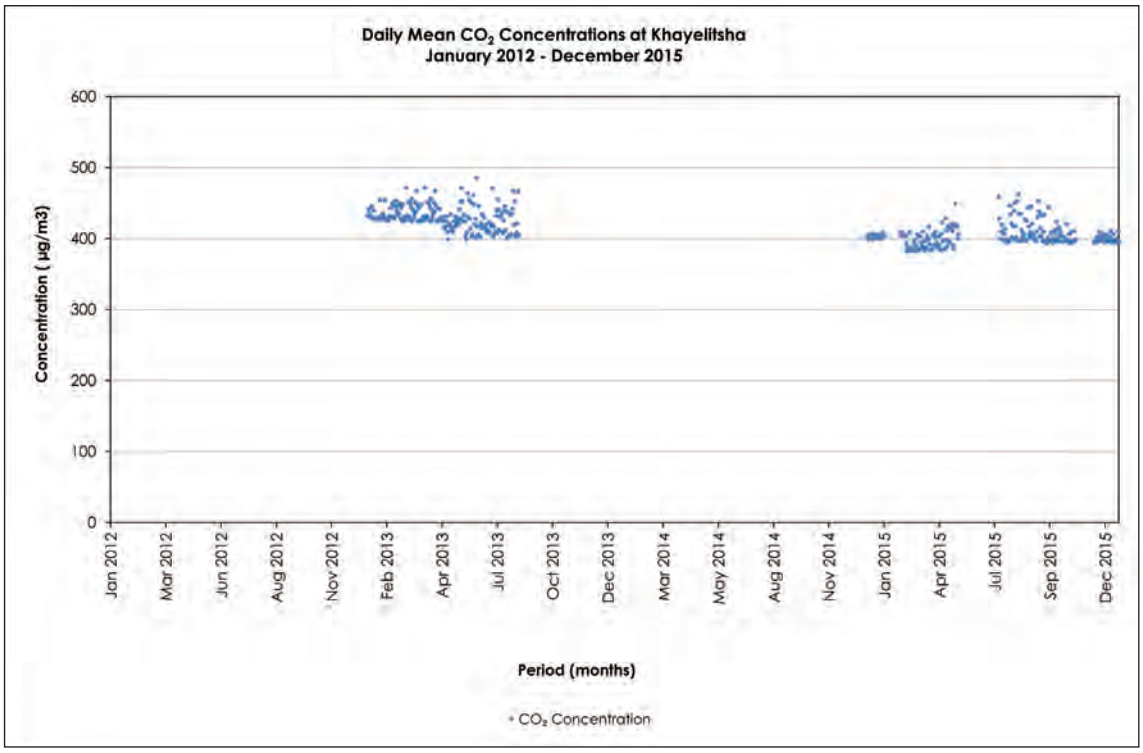


FIGURE 7-32: LONG TERM MEAN CO_2 MEASUREMENTS AT KHAYELITSHA (2012 – 2015)

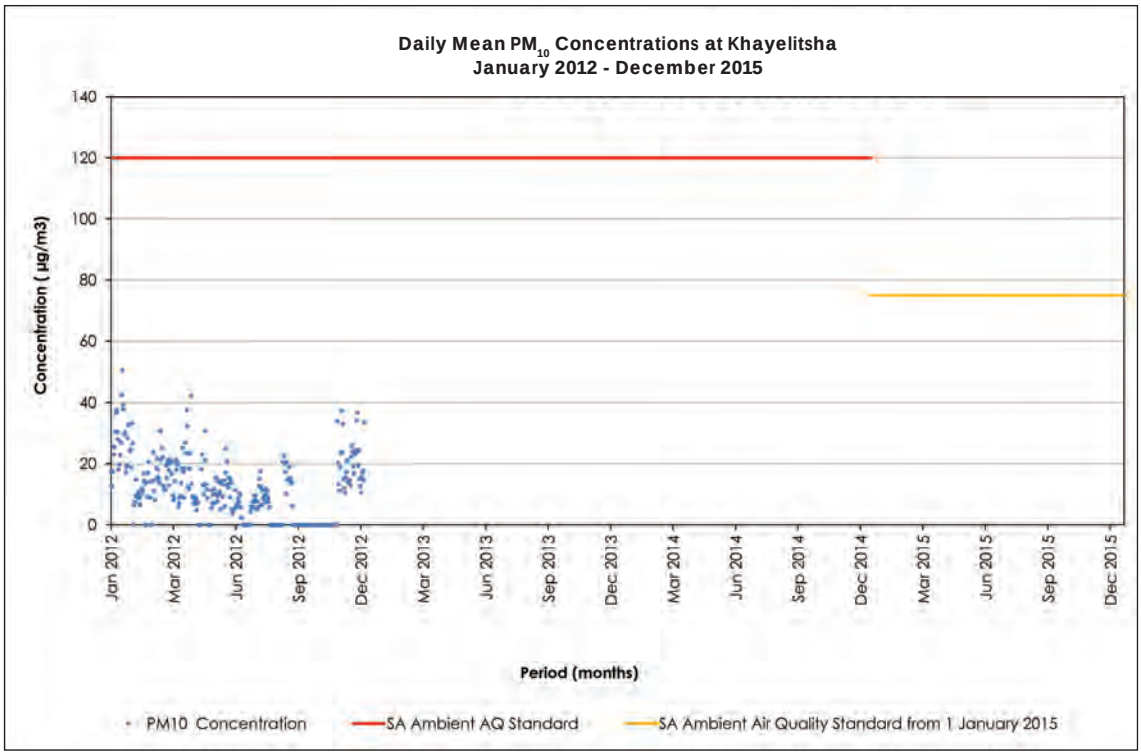


FIGURE 7-33: LONG TERM PM_{10} MEASUREMENTS AT KHAYELITSHA (2012 – 2015)

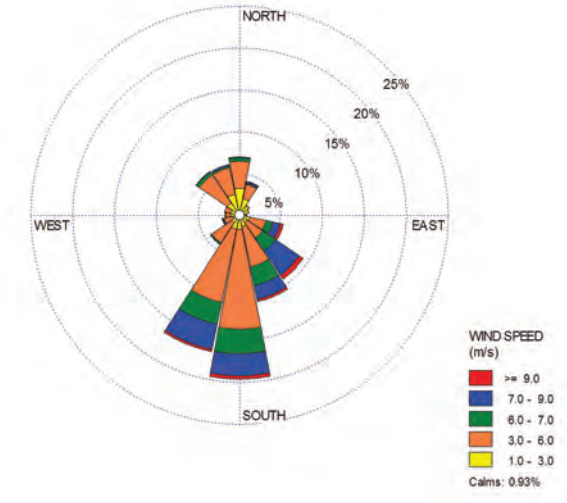


FIGURE 7-34: KHAYELITSHA WIND ROSE FOR 2012

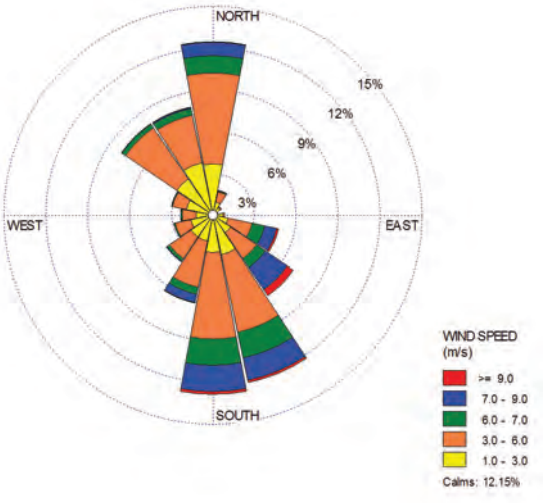


FIGURE 7-35: KHAYELITSHA WIND ROSE FOR 2013

7.3.5 STELLENBOSCH (CAPE WINELANDS DISTRICT MUNICIPALITY)

The Stellenbosch monitoring station is located at the CWDM offices on the corner of Bird and Langenhoven Streets in Stellenbosch; the station was commissioned in August 2011. While located close to residential areas, the station is also adjacent to a major roadway into the town of Stellenbosch and is impacted by vehicle emissions (Figure 7-36).

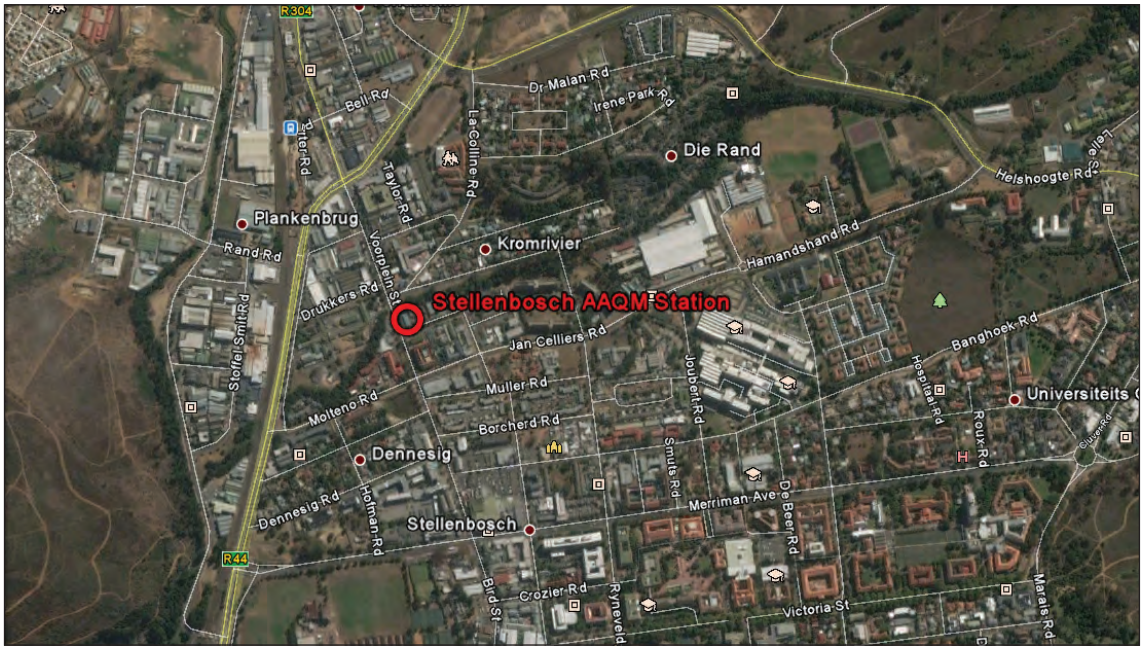


FIGURE 7-36: AERIAL IMAGE OF THE STELLENBOSCH AIR QUALITY MONITORING STATION

A brief summary of the trends observed for each air pollutant is provided:

- The long term O_3 concentration appears to be around 40 µg/m³. However, values for the winter 2014 period range from 40 to 120 µg/m³ (Figure 7-37).
- The long term CO trend of less than 1 mg/m³ remains well below the 10 mg/m³ SA-AAQS, while there appears to be a seasonal cycle, with lower values in summer and higher values in winter (Figure 7-38). These are most likely due to stronger and more consistent summer southerly winds and more stable atmospheric conditions in winter.

- The long term PM_{10} concentration remained steady at about 20 µg/m³ for the monitoring period (Figure 7-39).
- The long term SO_2 concentrations remained below 20 µg/m³, except during the period from March 2012 to July 2013, however remained below the SA-AAQS (Figure 7-40).

The wind roses for Stellenbosch are presented for 2014 (Figure 7-41) and 2015 (Figure 7-42), and show a distinct south westerly component.

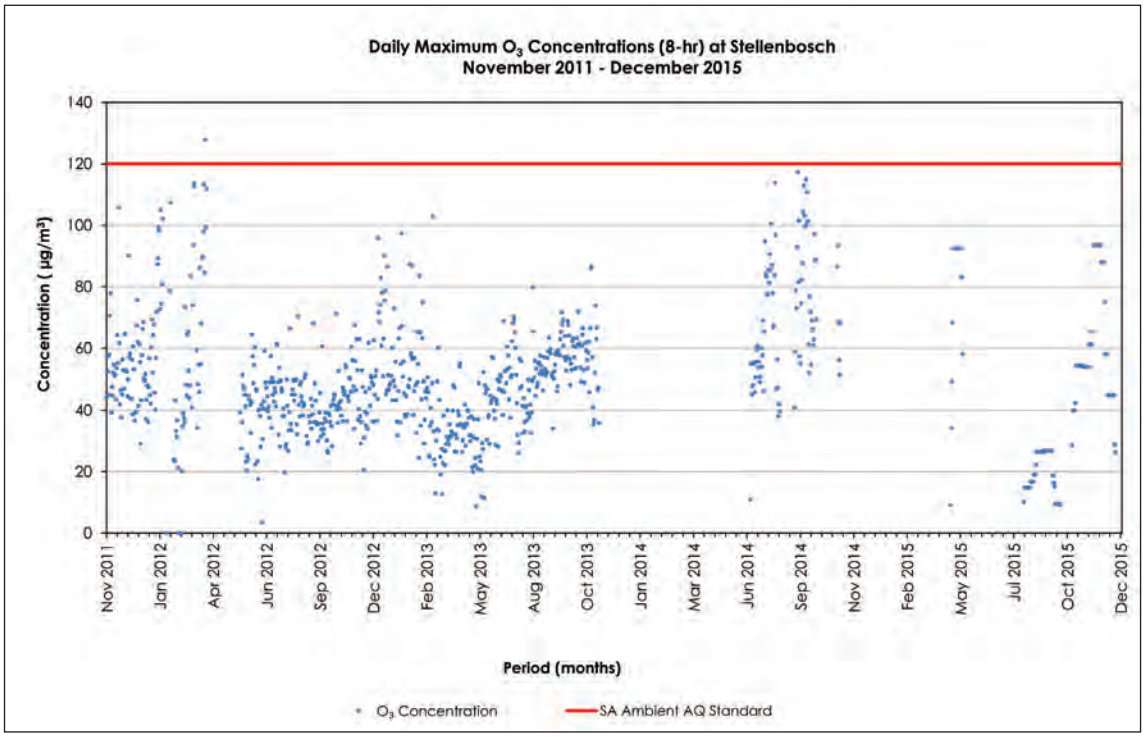


FIGURE 7-37: LONG TERM O_3 MEASUREMENTS AT STELLENBOSCH (2011- 2015)

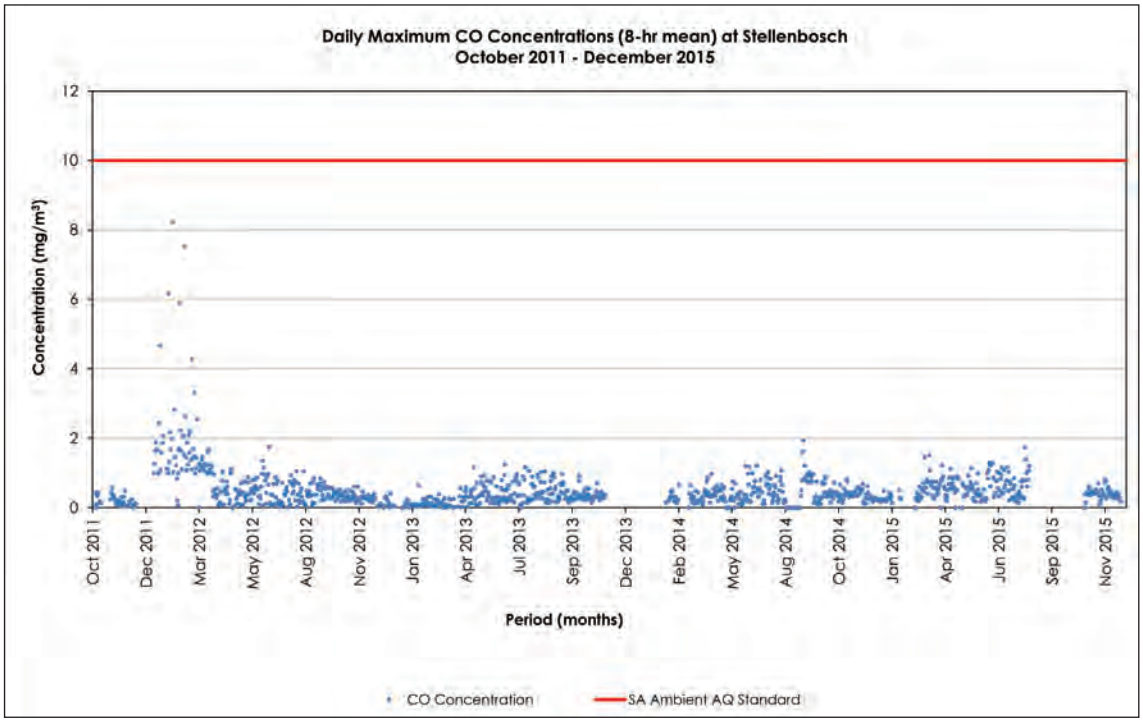


FIGURE 7-38: LONG TERM CO MEASUREMENTS AT STELLENBOSCH (2011 - 2015)

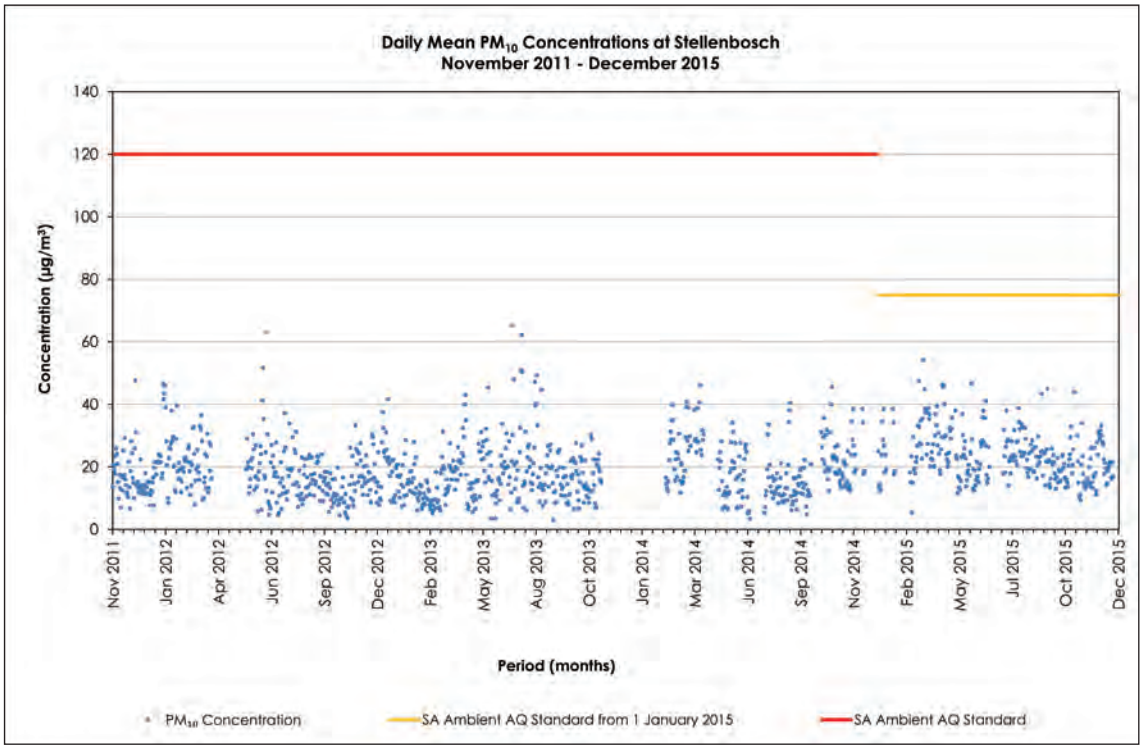


FIGURE 7-39: LONG TERM PM_{10} MEASUREMENTS AT STELLENBOSCH (2011 - 2015)

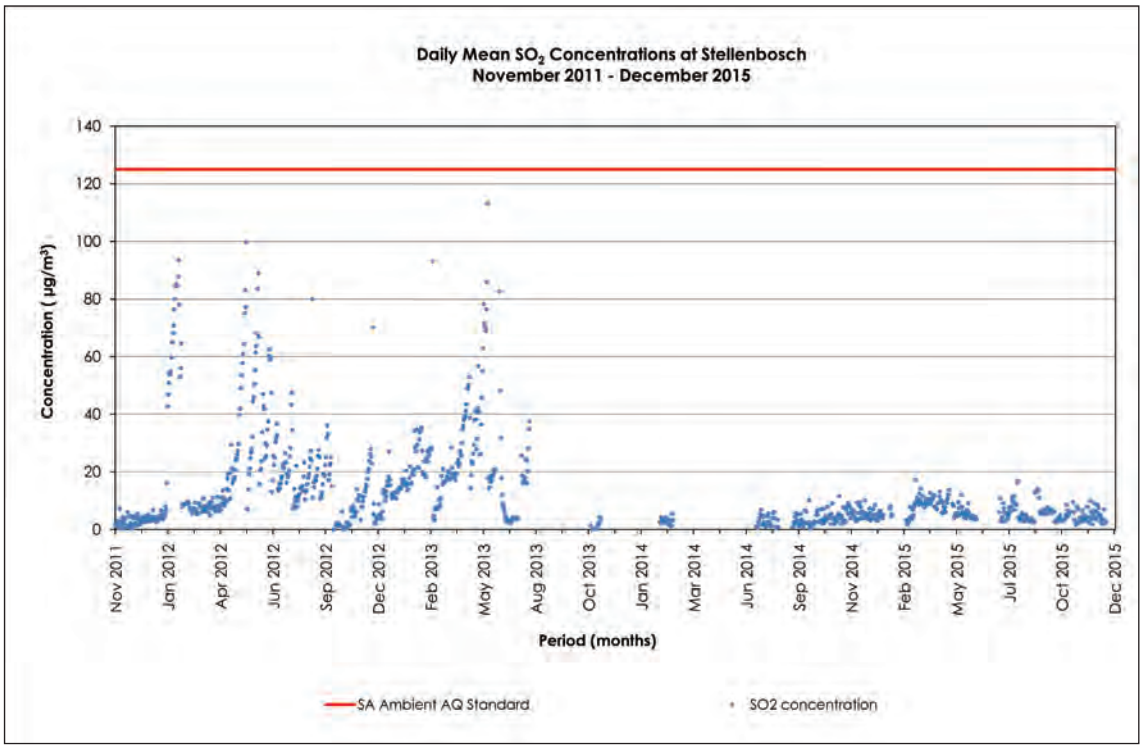


FIGURE 7-40: LONG TERM DAILY MEAN SO_2 MEASUREMENTS AT STELLENBOSCH (2011 - 2015)

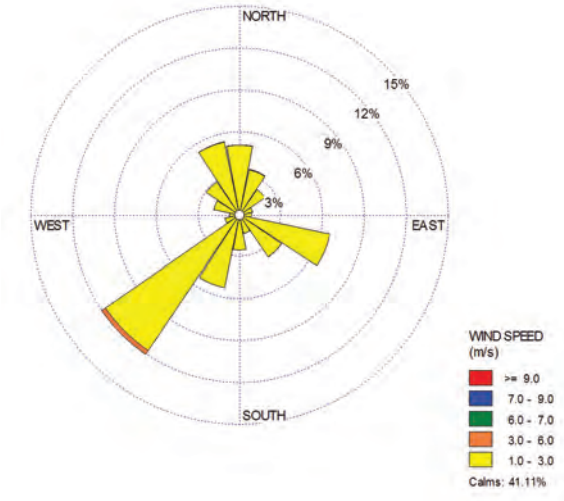


FIGURE 7-41: ANNUAL WIND ROSE FOR STELLENBOSCH 2014

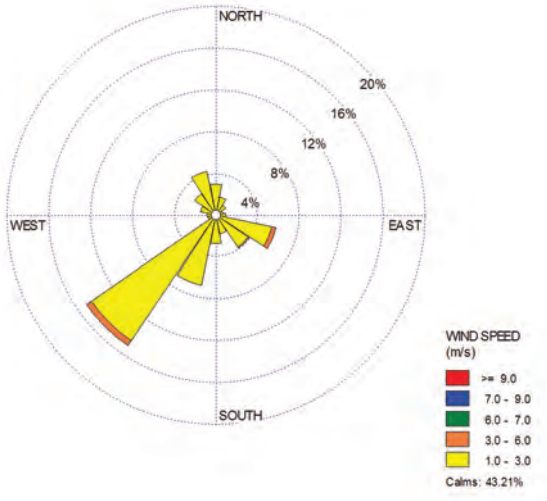


FIGURE 7-42: ANNUAL WIND ROSE FOR STELLENBOSCH 2015

7.3.6 WORCESTER (CAPE WINELANDS DISTRICT MUNICIPALITY)

The Worcester monitoring station was commissioned at the Meirings Park Electric Sub-station during August 2009. Air pollution related complaints received effected the commissioning of the monitoring station in this residential area, which is downwind from industry and is adjacent to the N1 National Road (Figure 7-43).

FIGURE 7-43: AERIAL IMAGE OF WORCESTER AMBIENT AIR QUALITY MONITORING STATION

Long term trends in pollutants measured at Worcester are presented in Figure 7-44 to Figure 7-47. Overall, all parameters monitored in Worcester were below the SA-AAQS.

The wind roses for Worcester are presented in Figure 7-48 to Figure 7-50, showing the dominant east-west component at this inland station unlike the north-south component dominating at the coastal stations.

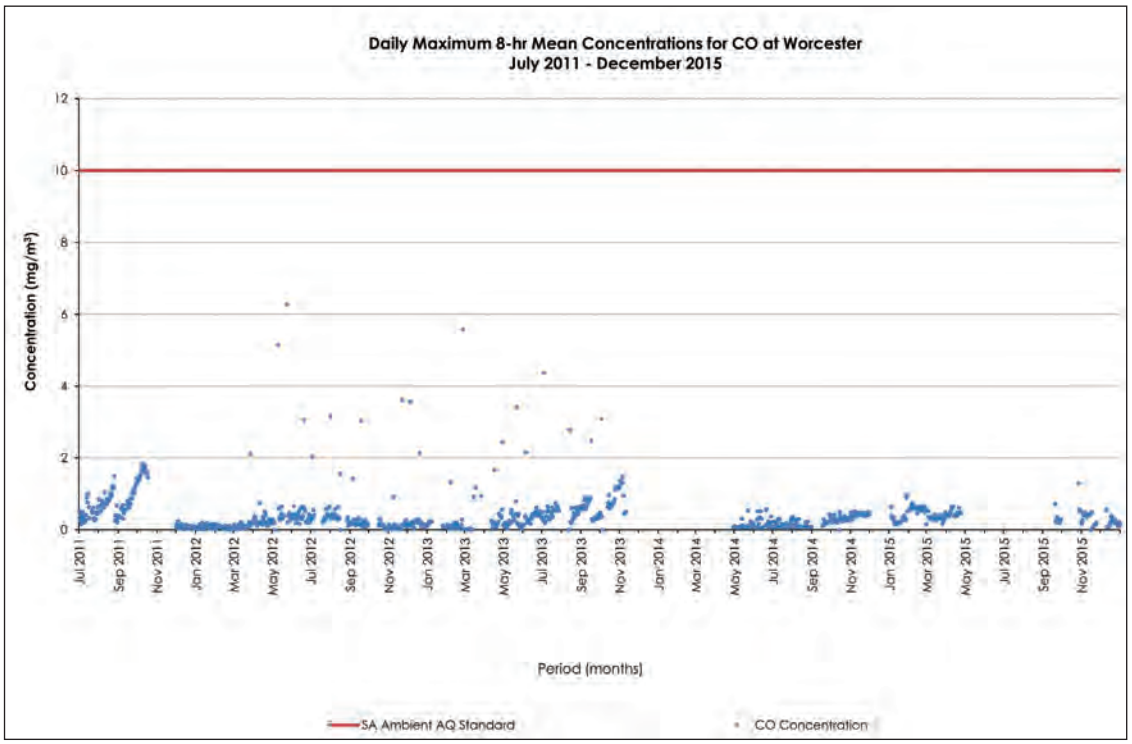


FIGURE 7-44: LONG TERM CO MEASUREMENTS AT WORCESTER (2011 - 2015)

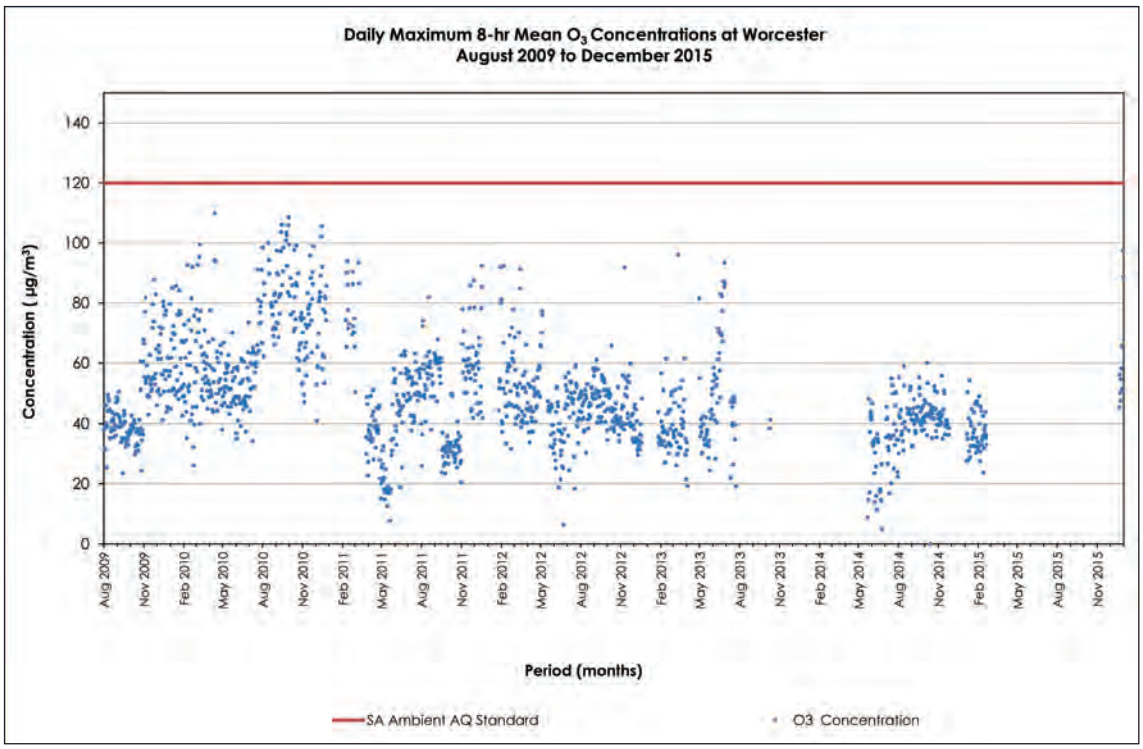


FIGURE 7-45: LONG TERM O_3 MEASUREMENTS AT WORCESTER (2009 - 2015)

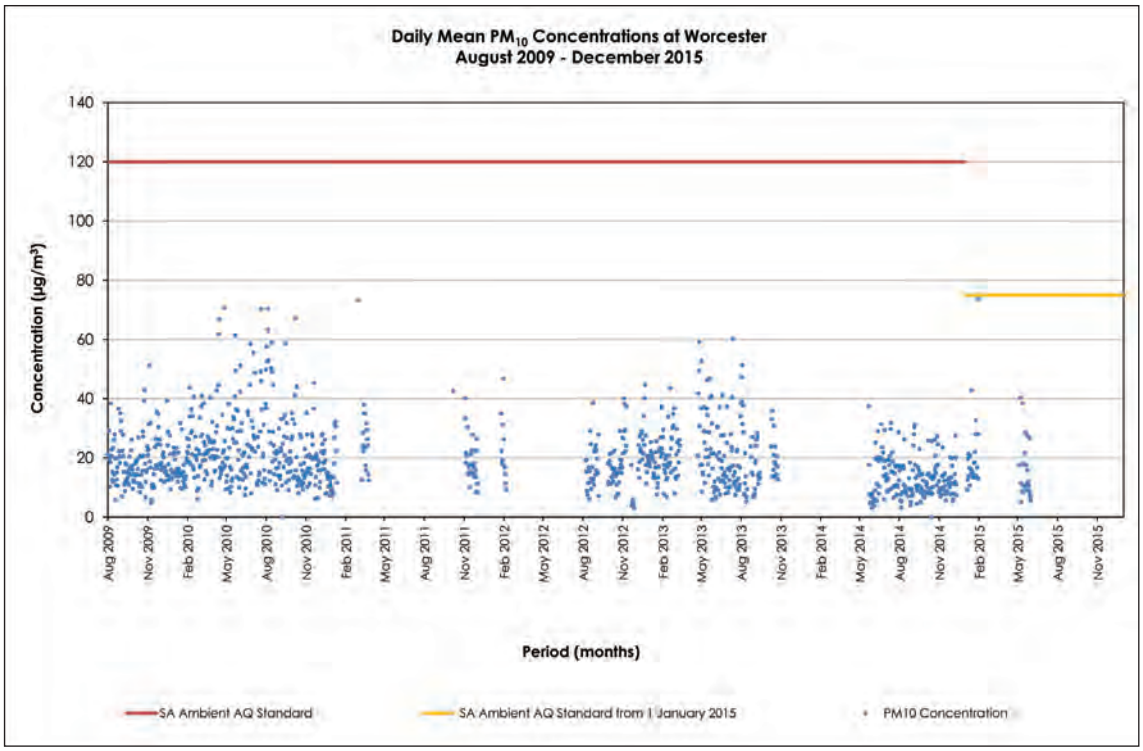


FIGURE 7-46: LONG TERM PM_{10} MEASUREMENTS AT WORCESTER (2009 - 2015)

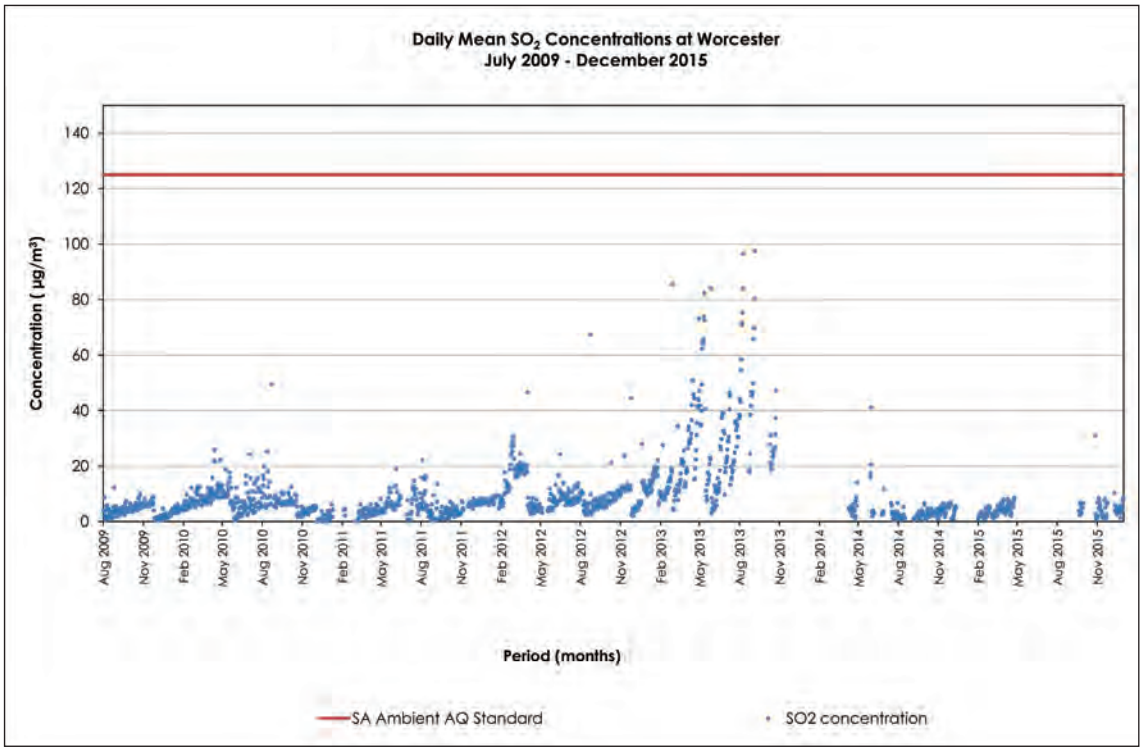
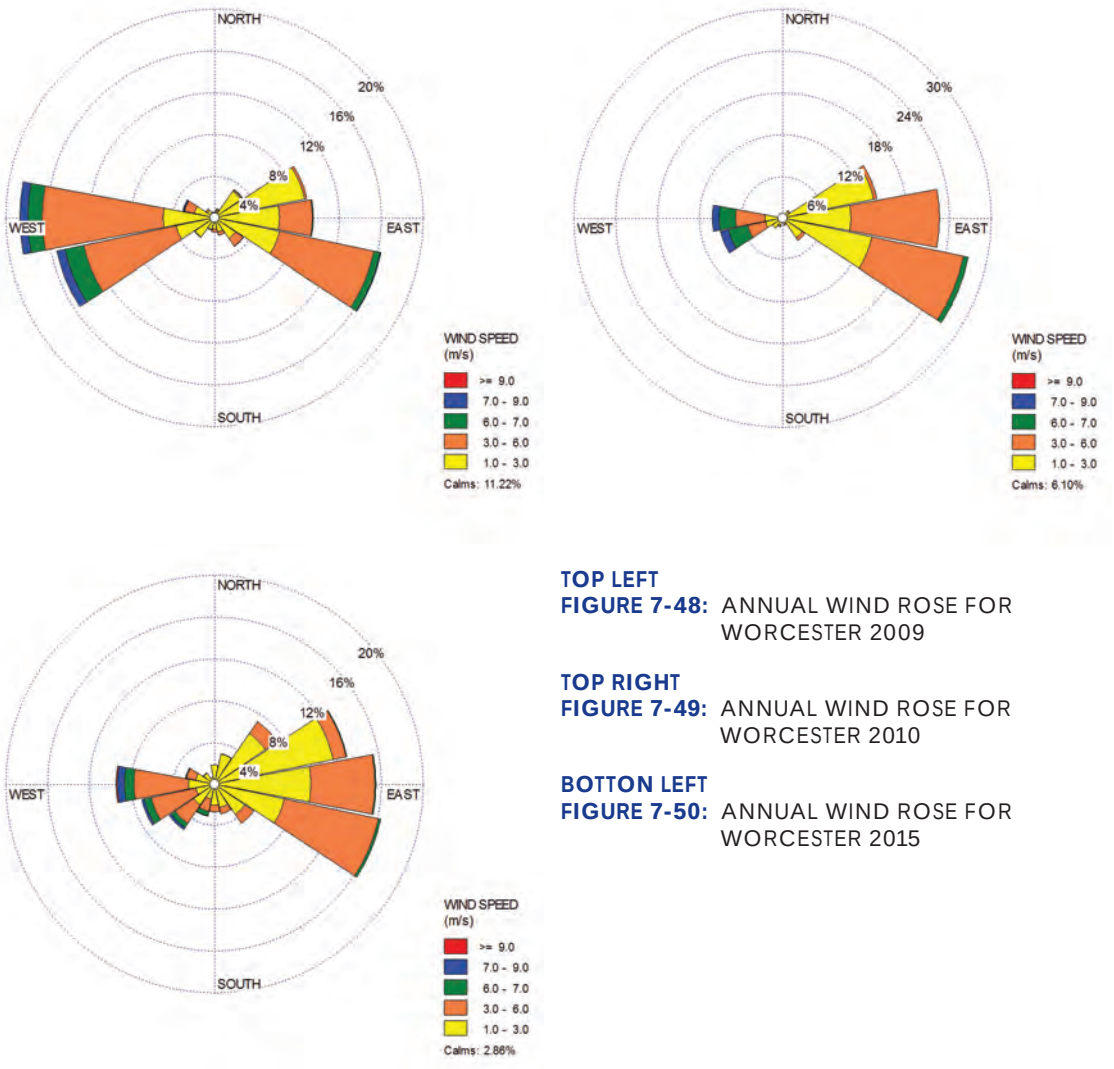


FIGURE 7-47: LONG TERM SO_2 MEASUREMENTS AT WORCESTER (2009 - 2015)



TOP LEFT
FIGURE 7-48: ANNUAL WIND ROSE FOR WORCESTER 2009

TOP RIGHT
FIGURE 7-49: ANNUAL WIND ROSE FOR WORCESTER 2010

BOTTON LEFT
FIGURE 7-50: ANNUAL WIND ROSE FOR WORCESTER 2015

7.3.7 OUDTSHOORN (EDEN DISTRICT, OUDTSHOORN MUNICIPALITY)

The Oudtshoorn monitoring station was commissioned at Bongolethu Clinic on April 2011 and is located in a residential area, in close proximity to an abattoir, tannery and municipal sewerage treatment facility (Figure 7-51).

FIGURE 7-51: AERIAL IMAGE OF OUDTSHOORN AMBIENT AIR QUALITY MONITORING STATION

The long term trend for H_2S measured at Oudtshoorn station is represented in Figure 7-52. The H_2S concentrations measured at the Oudtshoorn monitoring station shows a steady trend, with values measured at approximately 45 µg/m³.

The wind roses as measured for the Oudtshoorn monitoring station are presented in Figure 7- 53 to Figure 7-55, showing the dominant east-west component of the interior stations.

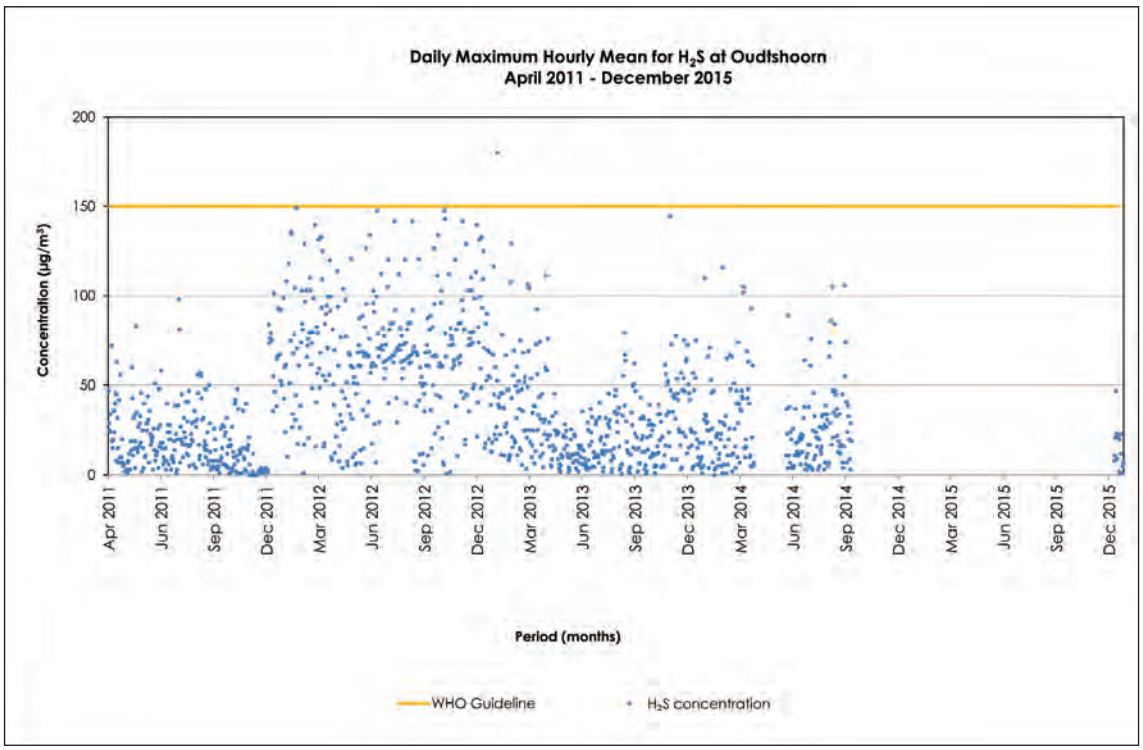


FIGURE 7-52: LONG TERM H_2S MEASUREMENTS AT OUDTSHOORN (2011 - 2015)

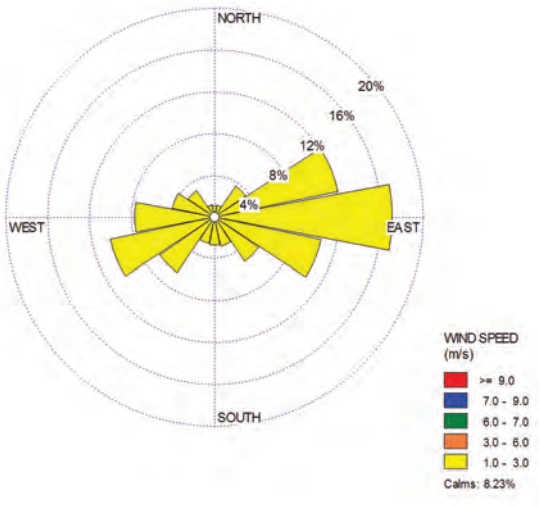


FIGURE 7-53: ANNUAL WIND ROSE FOR OUDTSHOORN 2011

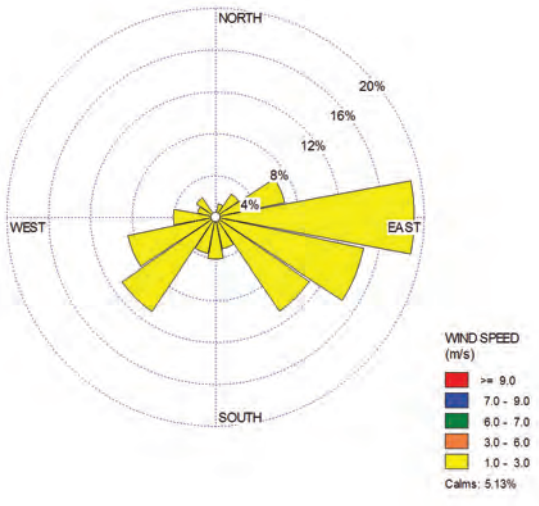


FIGURE 7-54: ANNUAL WIND ROSE FOR OUDTSHOORN 2013

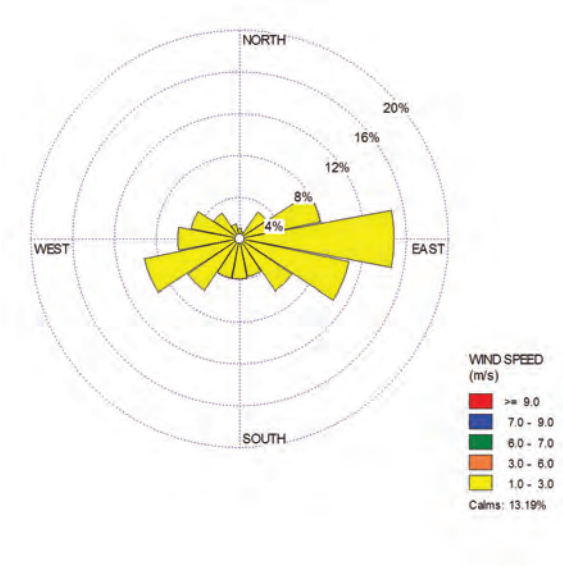


FIGURE 7-55: ANNUAL WIND ROSE FOR OUDTSHOORN 2014

7.3.8 GEORGE (EDEN DISTRICT MUNICIPALITY)

The George monitoring station was commissioned at the George Municipal swimming pool during July 2010. The monitoring station is located in a residential area surrounded by industries and a Central Business District (about 1.5km), a heavily used main road and the N2 National Road (Figure 7-56).

FIGURE 7-56: AERIAL IMAGE OF GEORGE AMBIENT AIR QUALITY MONITORING STATION

The long term trends for all pollutants measured at George monitoring station are represented in Figure 7-57 to Figure 7-61. A brief summary of each pollutant measured is presented below:

- The long term CO values measured at the George monitoring station shows a slight increase from approximately 0.5 mg/m^3 to 1 mg/m^3, which was well below the SA-AAQS of 10 µg/m^3 (Figure 7-57).
- The long term O_3 concentrations measured show a steady trend of approximately 50 µg/m^3 in average concentrations (Figure 7-58). There appears to be a seasonal cycle present with lower values in summer compared to winter.

- The long term NO_2 concentrations measured at the George monitoring station show a steady decline from approximately 70 µg/m^3 to 40 µg/m^3 (Figure 7-59).
- The long term SO_2 concentrations measured show a steady decline (Figure 7-60).
- The long term PM_{10} measured shows a steady concentration of approximately 54 µg/m^3 (Figure 7-61).

Overall, the meteorological conditions for the period 2010 - 2015 were characterized by variable light to moderate winds, with strong westerly and south-easterly components and a 9% occurrence of calms (Figure 7-62 to Figure 7-64).

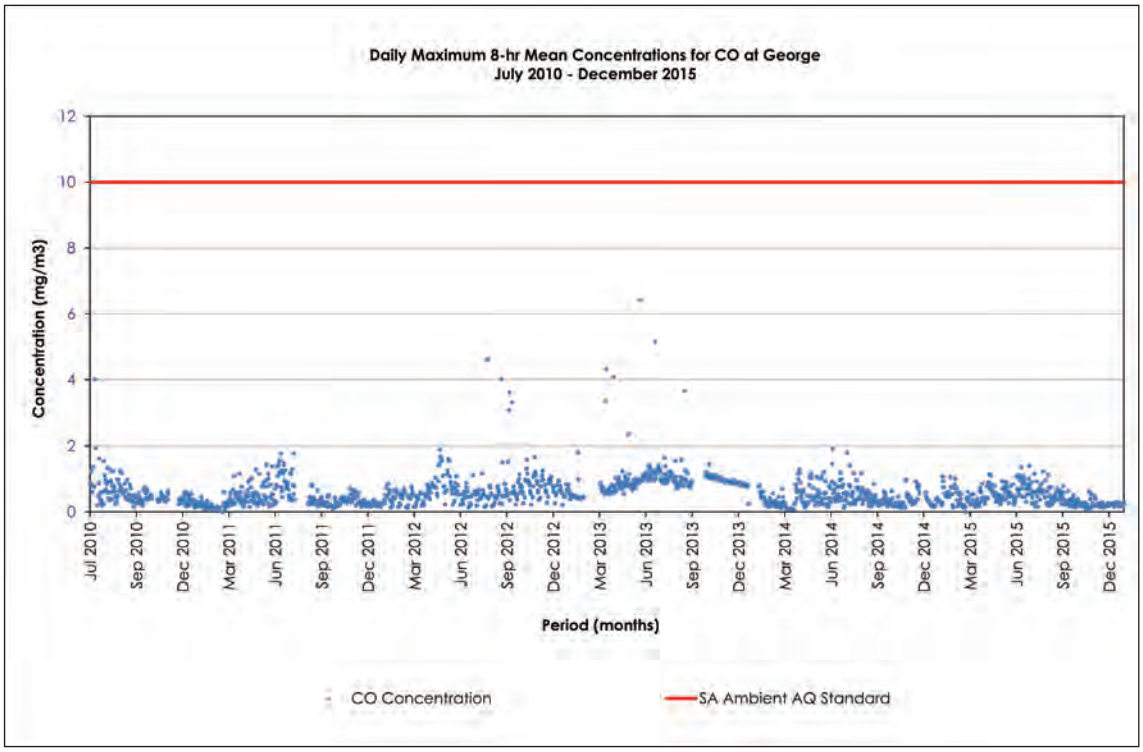


FIGURE 7-57: LONG TERM CO MEASUREMENTS AT GEORGE (2010 - 2015)

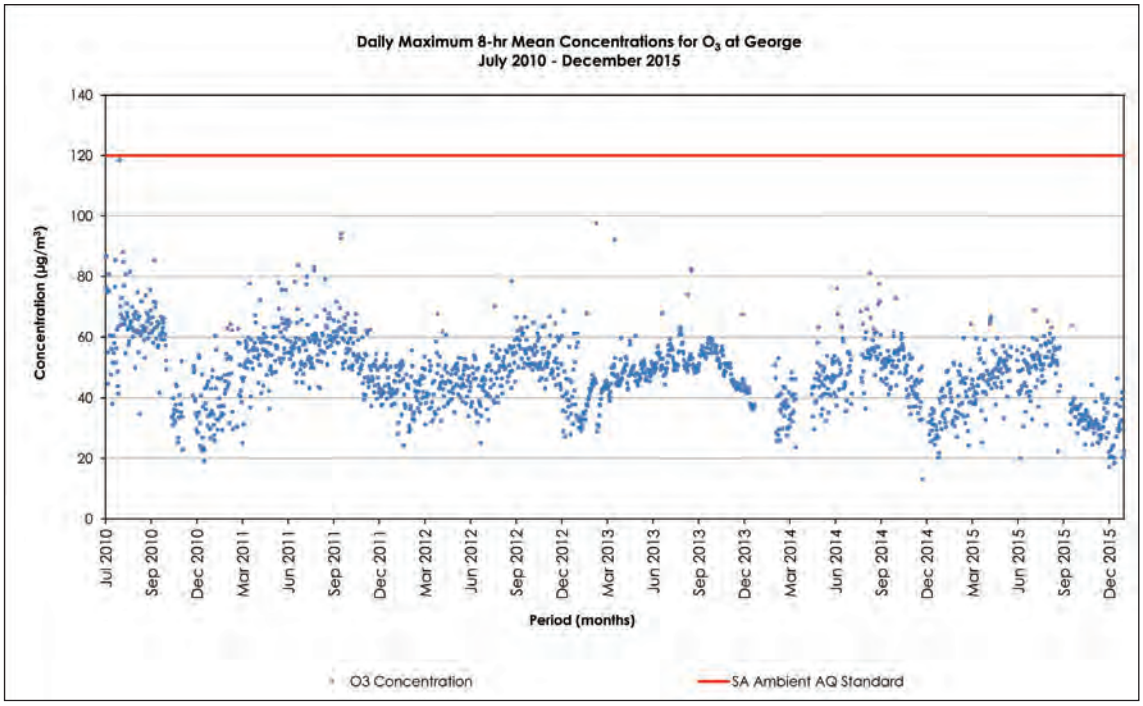


FIGURE 7-58: LONG TERM O_3 MEASUREMENTS AT GEORGE (2010 - 2015)

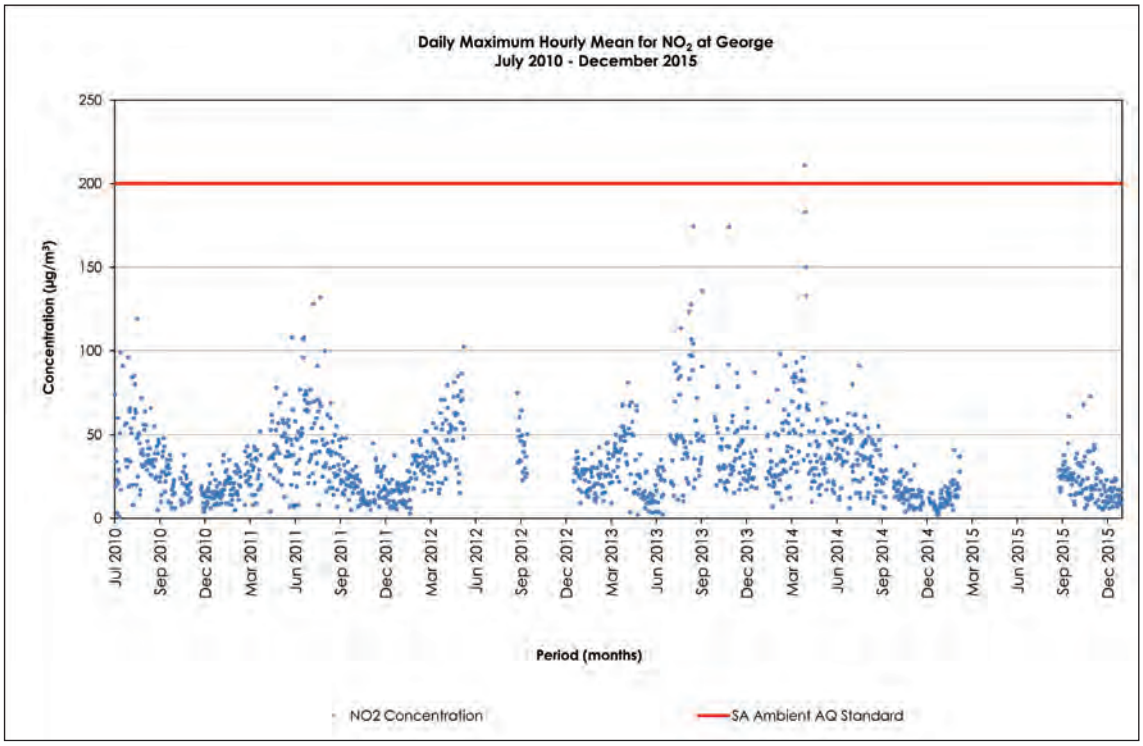


FIGURE 7-59: LONG TERM NO_2 MEASUREMENTS AT GEORGE (2010 - 2015)

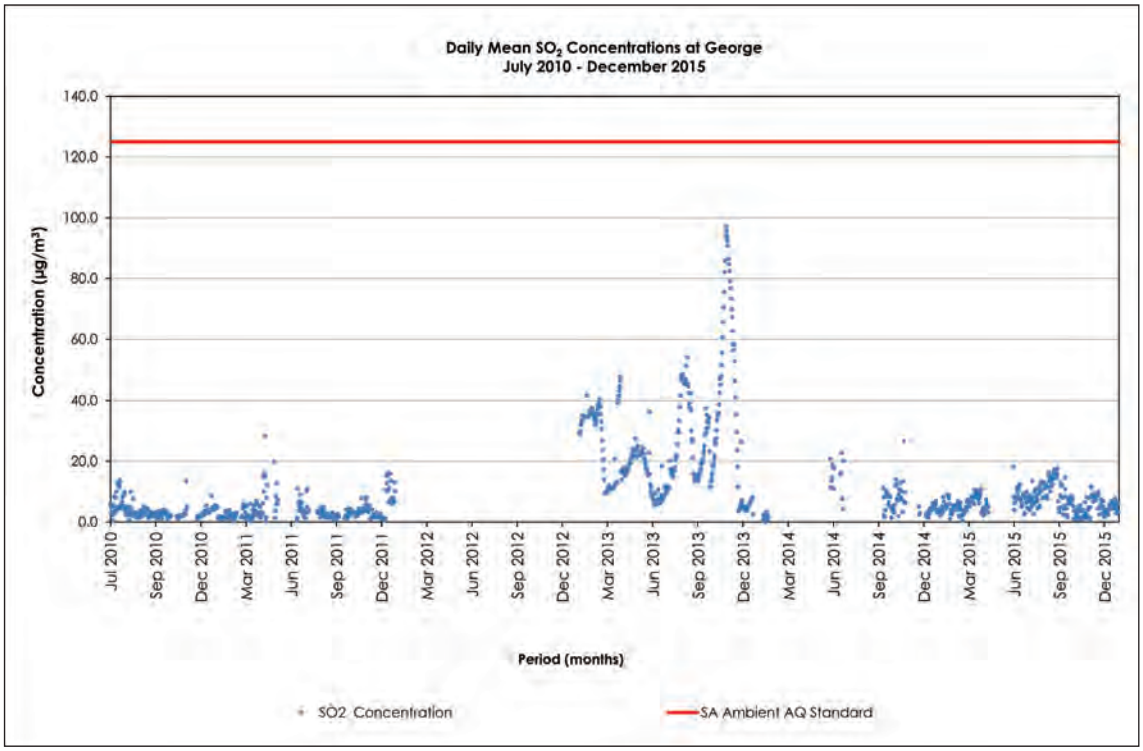


FIGURE 7-60: LONG TERM SO_2 MEASUREMENTS AT GEORGE (2010 - 2015)

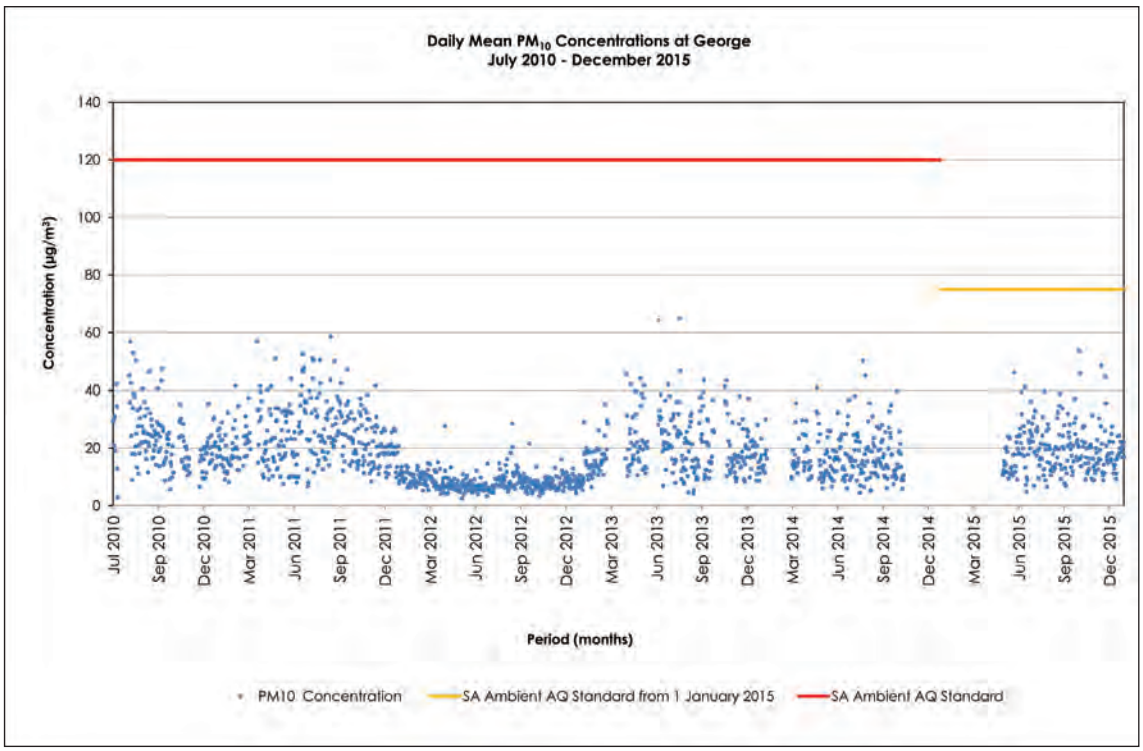
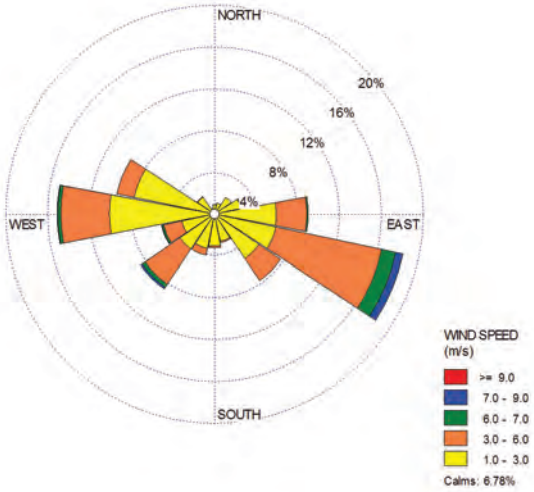
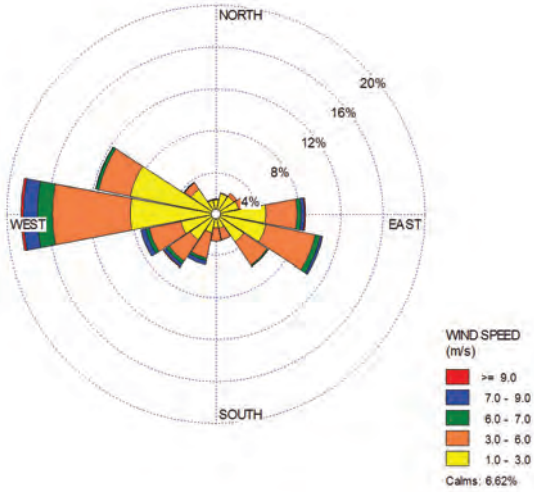
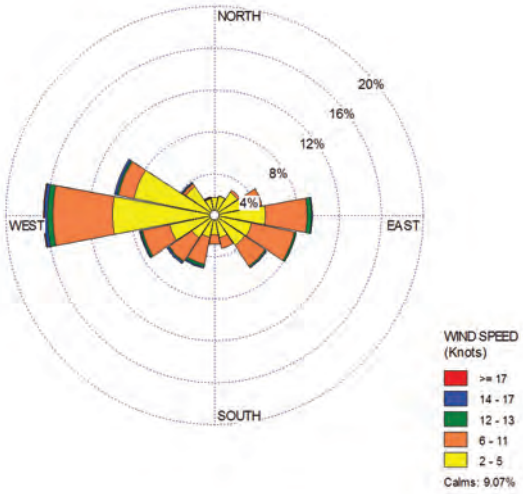


FIGURE 7-61: LONG TERM PM_{10} MEASUREMENTS AT GEORGE (2010 - 2015)







TOP LEFT
FIGURE 7-62: ANNUAL WIND ROSE FOR GEORGE 2010

TOP RIGHT
FIGURE 7-63: ANNUAL WIND ROSE FOR GEORGE 2011

BOTTOM LEFT
FIGURE 7-64: ANNUAL WIND ROSE FOR GEORGE 2015

7.3.9 DANA BAY (EDEN DISTRICT MUNICIPALITY)

The Dana Bay ambient air quality monitoring station is located at the Reservoir in Dana Bay, which is located to the north-eastern part of the town and south-east of the Mossel Bay industries and south-west of the KwaNonqaba Township. Dana Bay is situated on the eastern coastline of the Western Cape Province. The monitoring station was commissioned in November 2011 (Figure 7-65).

The Dana Bay monitoring station is currently not operational due to vandalism and equipment theft that occurred in December 2015. The monitoring station is expected to be recommissioned in 2016 following repairs.

FIGURE 7-65: AERIAL IMAGE OF DANA BAY AMBIENT AIR QUALITY MONITORING STATION

The long tern trend for H_2S measured at Dana Bay is represented in Figure 7-66. Although there are gaps in the data due to power supply and analysers problems the data presented shows that H_2S values are generally below 20 µg/m^3, well below the WHO health guideline of 150 µg/m^3.

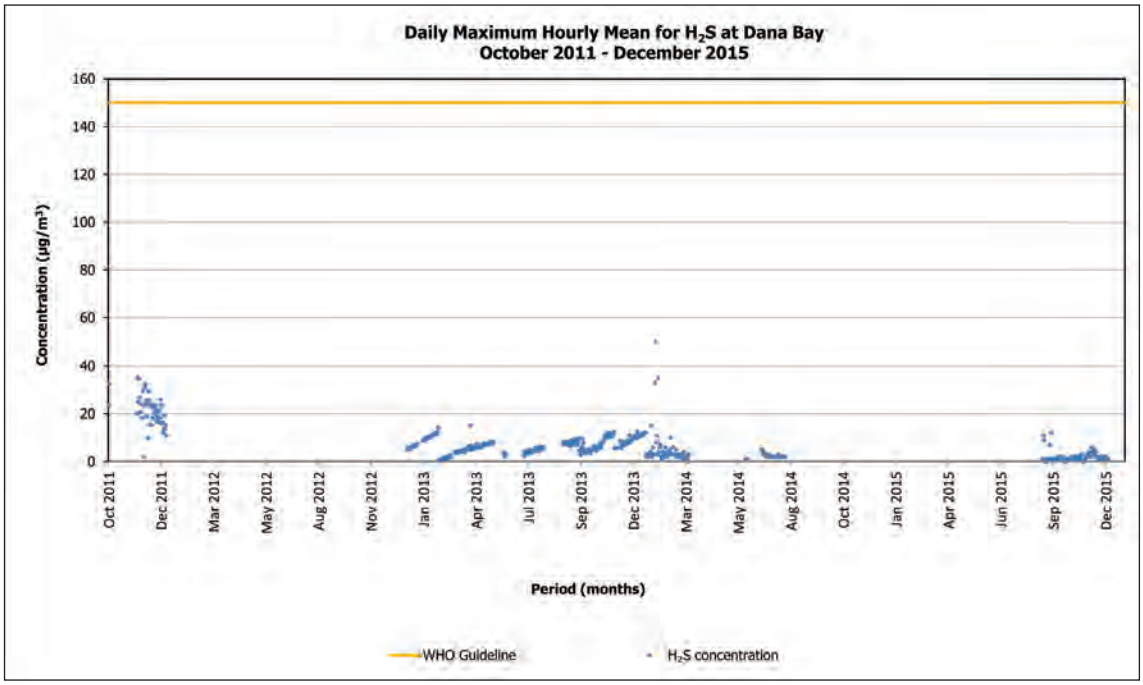


FIGURE 7-66: LONG TERM H_2S MEASUREMENTS AT DANA BAY (2011 - 2015)

7.3.10 HOUT BAY (CITY OF CAPE TOWN)

The station commissioned in March 2014, is located at the Sentinel Primary School in Hout Bay (Figure 7-67). The location of the monitoring station is in a residential area, in proximity of industrial activities and a working harbour.

FIGURE 7-67: AERIAL IMAGE OF HOUT BAY AMBIENT AIR QUALITY MONITORING STATION

The long term H_2S data measured at Hout Bay station is represented in Figure 7-68. The H_2S data is generally below 10 µg/m³ for the two years since the station has been operational. The highest H_2S value of approximately 41 µg/m³ was recorded in April 2015.

The wind rose for 2014 shows the strongest winds coming from the south east, with weaker but consistent winds coming from the north-west (Figure 7-69). The wind rose for 2015 shows the strongest winds coming from the south east, while there is also a consistent wind from the north-westerly sector during the period monitored (Figure 7-70).

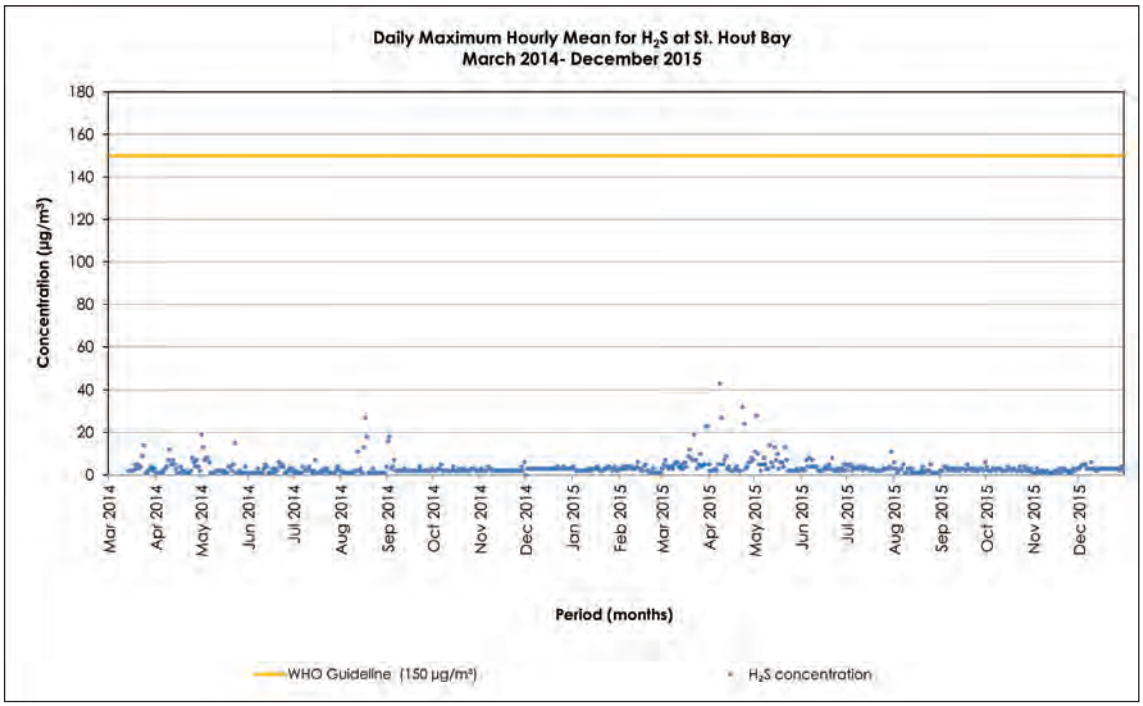


FIGURE 7-68: LONG TERM H_2S MEASUREMENTS AT HOUT BAY (2014 - 2015)

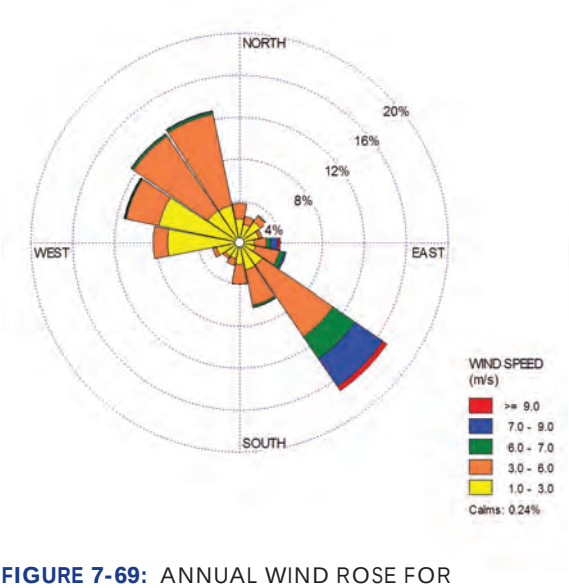


FIGURE 7-69: ANNUAL WIND ROSE FOR HOUT BAY 2014

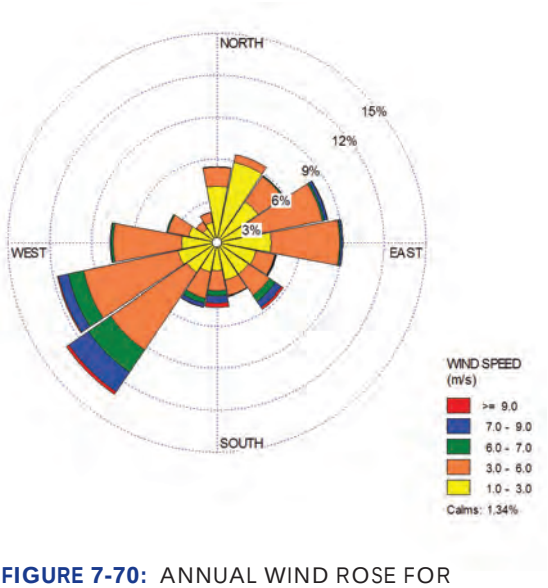


FIGURE 7-70: ANNUAL WIND ROSE FOR HOUT BAY 2015

7.3.11 HERMANUS (OVERBERG)

The Hermanus ambient air quality monitoring station is located at the Mount Pleasant Primary School in Hermanus, which is located in the west of the town and between the major road (R43) and the coastline to the south (Figure 7-71). Hermanus is situated on the southern coastline of the Western Cape Province. The monitoring station was commissioned in March 2014.

Low data recovery was experienced in Hermanus due to power supply problems, which resulted in increased analyser failures.

FIGURE 7-71: AERIAL IMAGE OF HERMANUS AMBIENT AIR QUALITY STATION

The long term trends for pollutants measured at Hermanus (2014 – 2015) are represented in Figure 7-72 and Figure 7-73. Overall, air quality parameters monitored in Hermanus were below the SA-AAQS.

Wind roses are shown for the Hermanus station in Figure 7-74 and Figure 7-75. Overall east west components dominate the area with 2015 showing a definite reduction in the northwesterly.

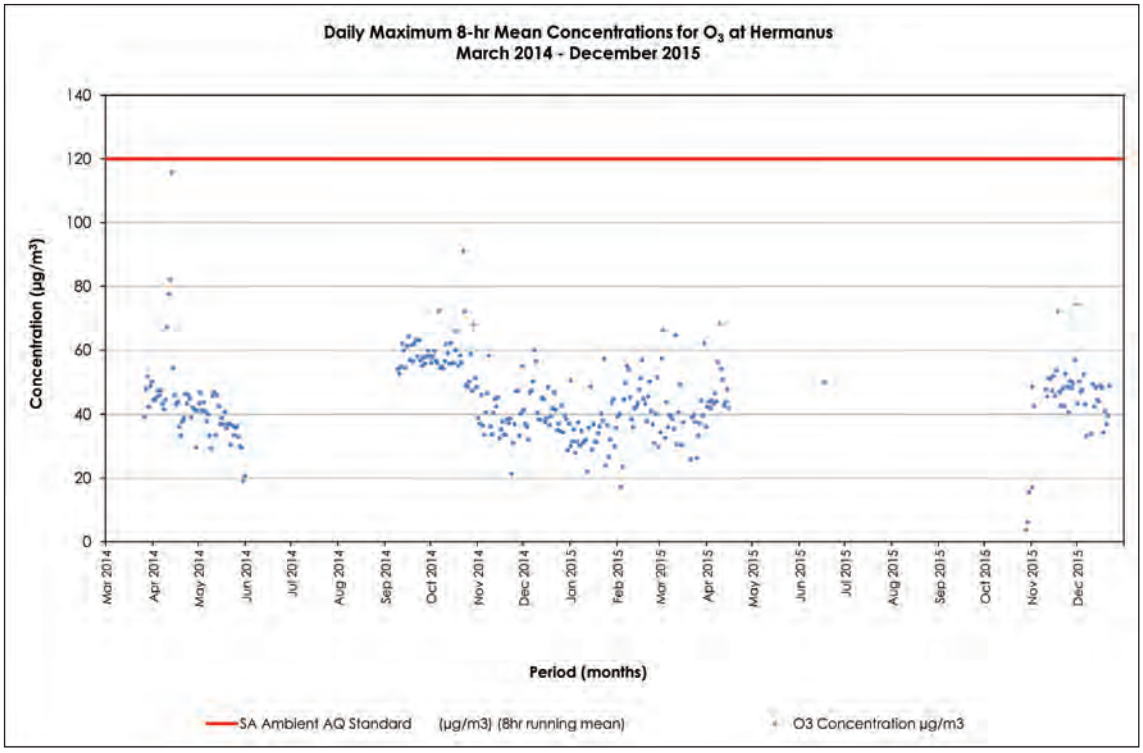


FIGURE 7-72: LONG TERM O_3 MEASUREMENTS FOR HERMANUS (2014 - 2015)

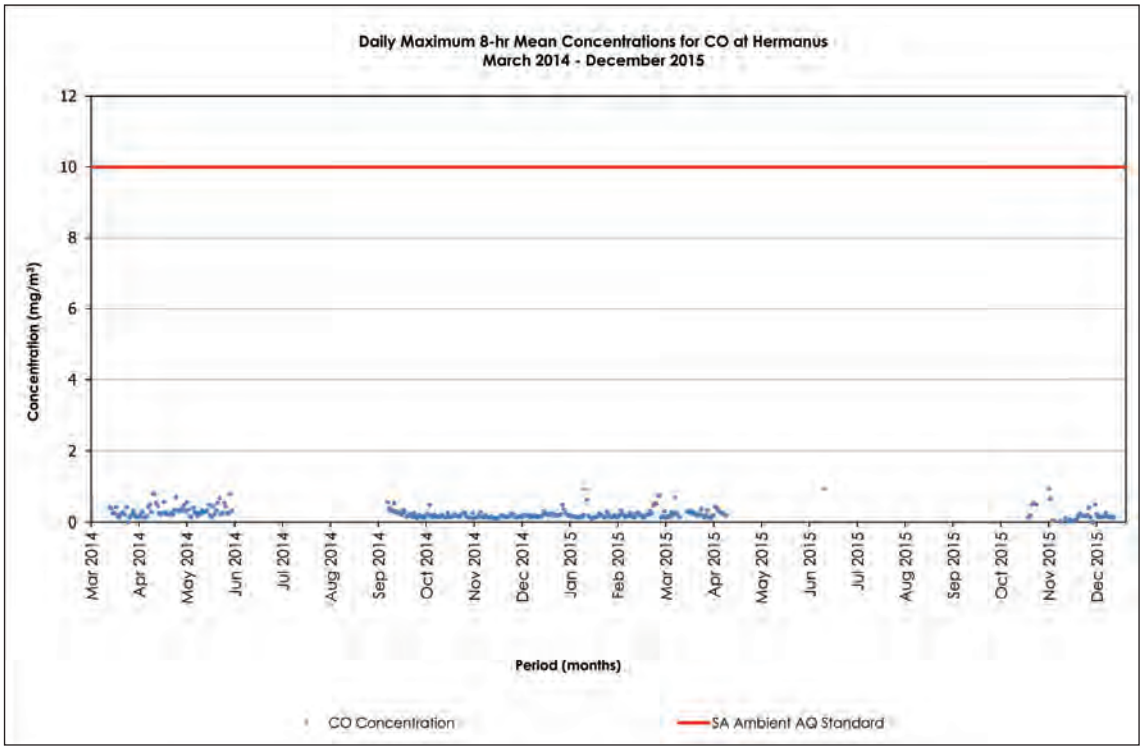


FIGURE 7-73: LONG TERM CO MEASUREMENTS FOR HERMANUS (2014 - 2015)

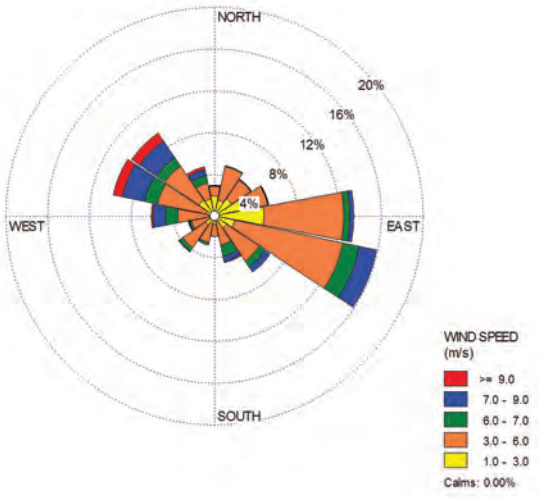


FIGURE 7-74: ANNUAL WIND ROSE FOR HERMANUS 2014

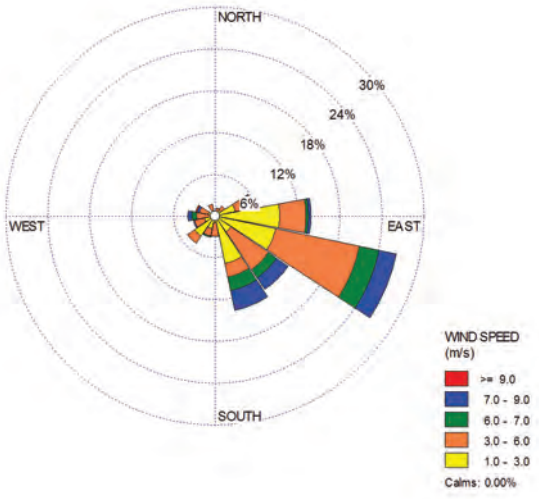


FIGURE 7-75: ANNUAL WIND ROSE FOR HERMANUS 2015

7.4 SALDANHA BAY MUNICIPAL AMBIENT AIR QUALITY MONITORING NETWORK

The Saldanha Bay Local Municipality (SBM) has recently established their Municipal Ambient Air Quality Monitoring Network and commissioned two ambient air quality monitoring stations in 2014, located in Saldanha Bay and Vredenburg, respectively. The air quality monitoring site in Vredenburg is located in a residential area and measures air quality from the prevailing wind sector to detect the impact of emissions from the Saldanha Bay industrial areas; while the Saldanha Bay monitoring site is removed from the primary impact zone of Saldanha Bay industries, and ideally located to monitor changes in ambient air quality as a result of development at the Port of Saldanha Bay. The ambient air quality monitoring stations measure Sulphur Dioxide, (SO_2), Oxide of Nitrogen (NO, NO_2, NO_x), Ozone (O_3), Particulate Matter (PM_{10} and $PM_{2.5}$), as well as meteorological parameters. The monitoring station locations are illustrated in Figure 7-76.

In addition to the two ambient air quality monitoring stations located in Vredenburg and Saldanha Bay, seven dust fallout monitors are located at various sites in the Saldanha Bay municipal area (Figure 7-76). The dust fallout monitoring locations were commisioned during May 2014. All monitoring sites are listed in Table 7-4.

FIGURE 7-76: AERIAL IMAGE OF SALDANHA BAY MUNICIPAL AIR QUALITY AND DUST MONITORING LOCATIONS

Additional ambient air quality monitoring in the Saldanha Bay district is conducted by Transnet Port Terminals (viz. PM_{10}) and Saldanha Steel (viz. PM_{10}, H_2S and SO_2). A summary of the trends in the air pollutants measured (Figure 7-77 to Fgure 7-81) is provided:

- The $PM_{2.5}$ concentrations measured at Saldanha Bay are presented in Figure 7-77. There were no exceedances of the $PM_{2.5}$ (24 – hours) SA-AAQS of 65µg/m³. The data gaps for $PM_{2.5}$ record during 2015 was as a result of power supply interruptions.
- The NO_2 concentrations measured at Saldanha Bay are presented in Figure 7-78. The NO_2 SA-AAQS of 106ppb was not exceeded during the monitoring period. The data gaps for NO_2 recorded during 2015 was as a result of power supply interruptions. (1ppb NO_2 = 1.88µg/m³)
- The O_3 concentrations measured at Saldanha Bay are presented in Figure 7-79. The O_3 SA-AAQS of 61ppb (8-hr running mean) was not exceeded during the monitoring period. The data gaps for O_3 recorded during 2015 was as a result of power supply interruptions. (1ppb O_3 = 1.96µg/m³)
- The SO_2 concentrations measured at Saldanha Bay are presented in Figure 7-80. The SO_2 SA-AAQS of 191ppb (10 minute mean) was not exceeded during the monitoring period. The data gaps for SO_2 recorded during 2015 was as a result of analyser problems. (1ppb = 2.62µg/m³)
- The PM_{10} concentrations measured at Saldanha Bay are presented in Figure 7-81. There were no exceedances of the PM_{10} (24 – hours) SA-AAQS of 75µg/m³. The data gaps for PM_{10} record during 2015 was as a result of power supply interruptions.

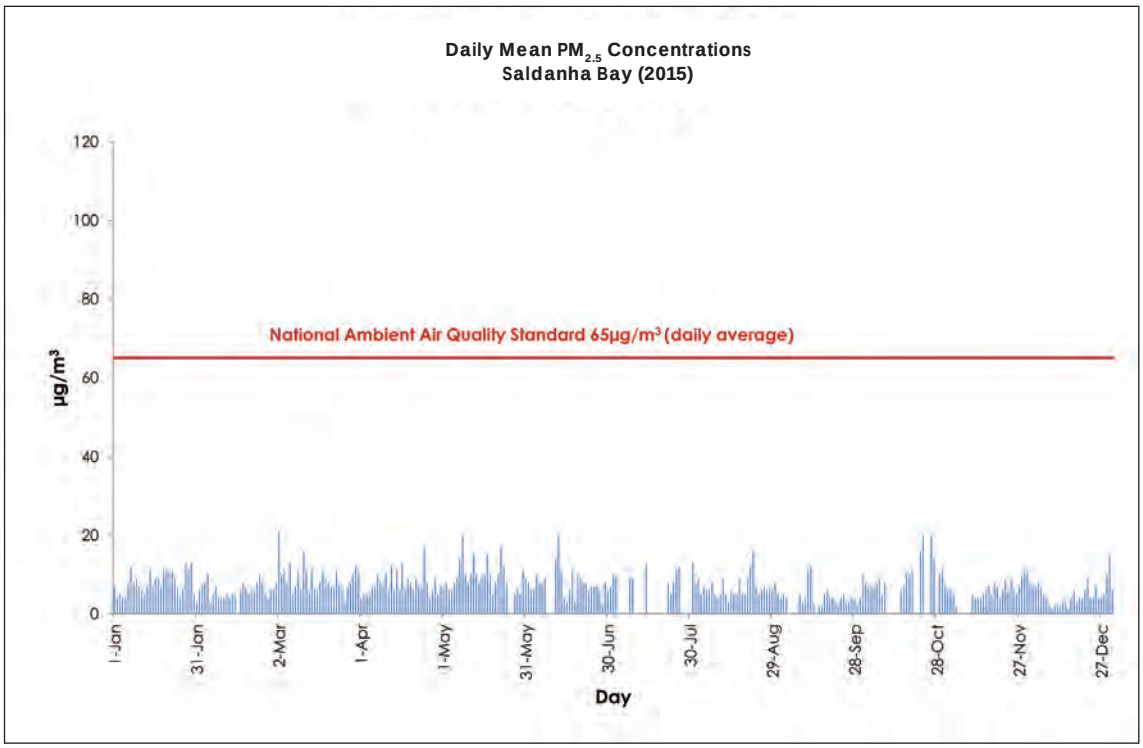


FIGURE 7-77: DAILY MEAN $PM_{2.5}$ MEASUREMENTS AT SALDANHA BAY (2015)

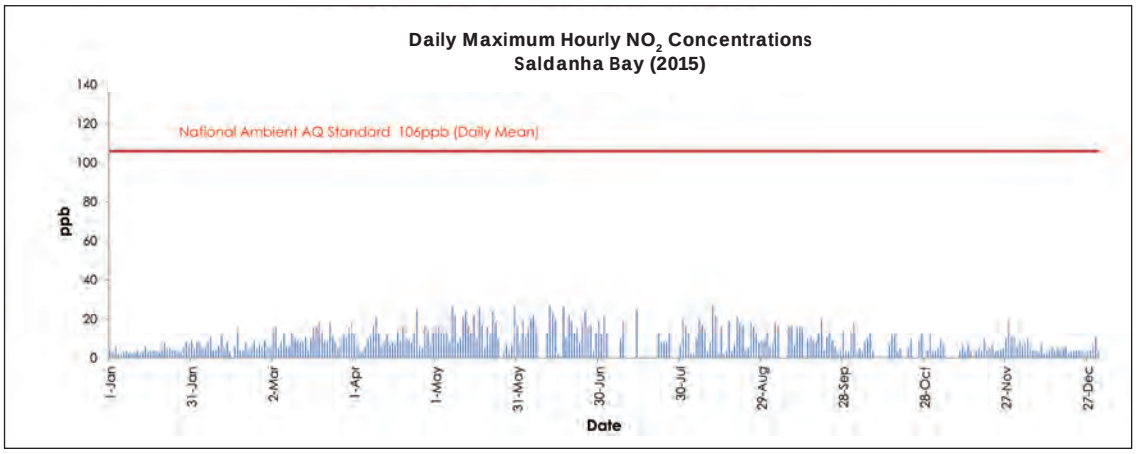


FIGURE 7-78: DAILY MAXIMUM HOURLY NO_2 MEASUREMENTS AT SALDANHA BAY (2015)

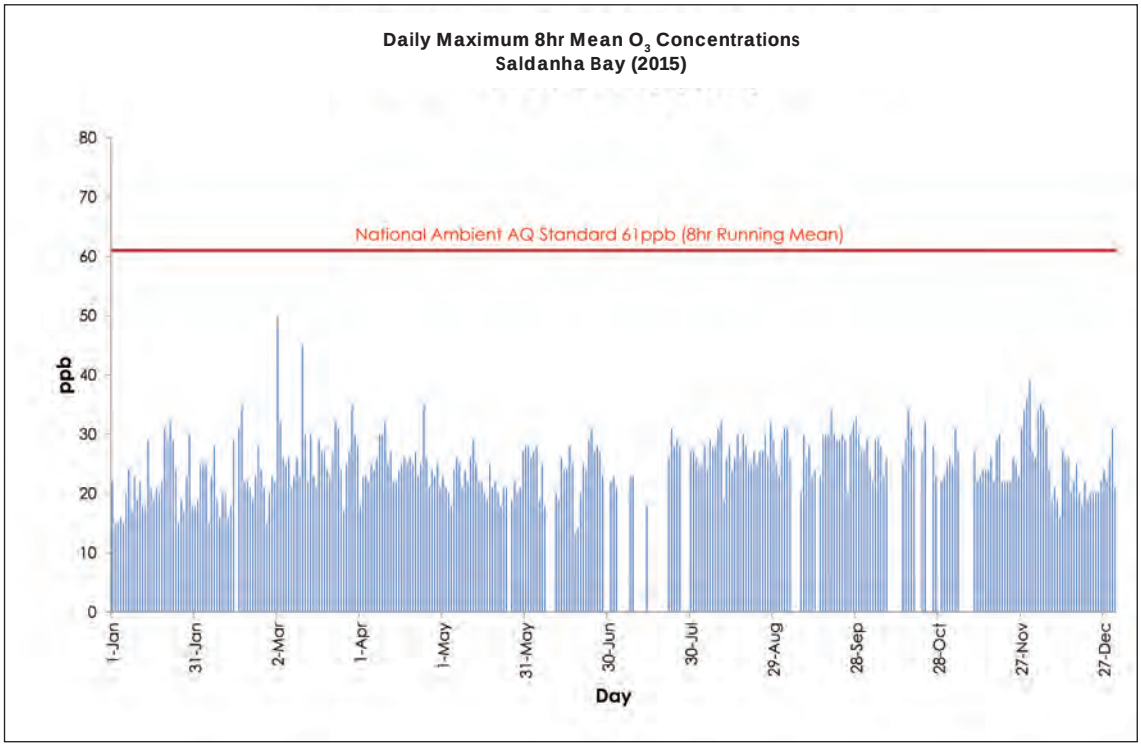


FIGURE 7-79: DAILY MAXIMUM 8-HR MEAN O_3 MEASUREMENTS AT SALDANHA BAY (2015)

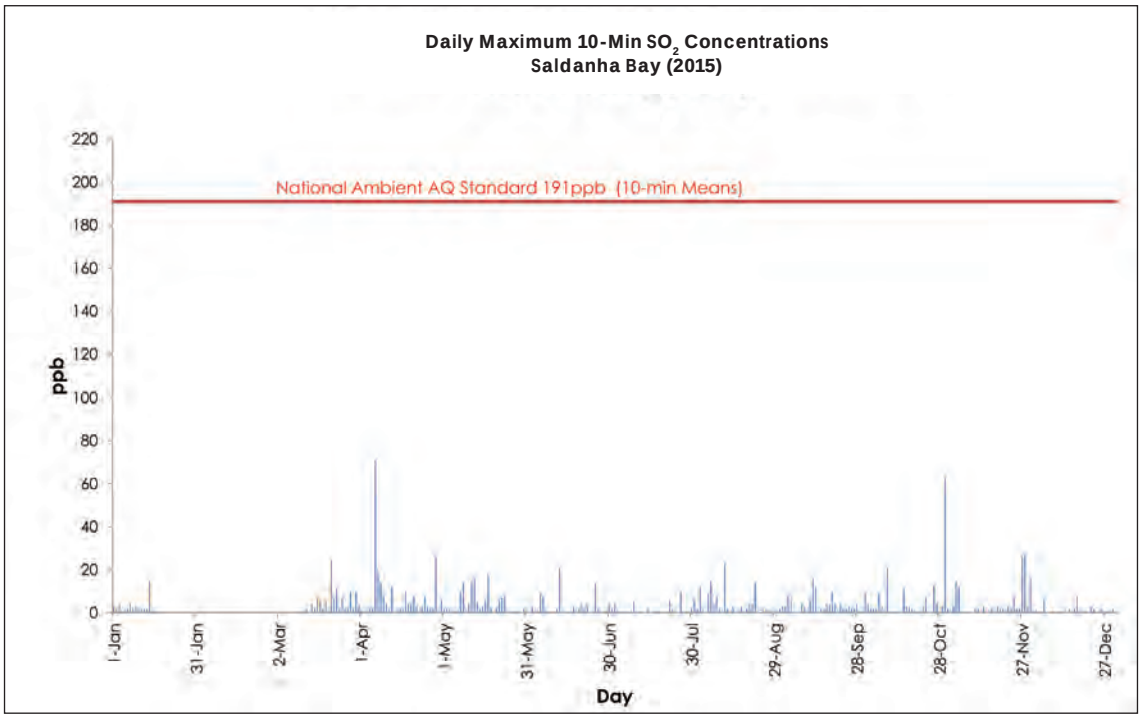


FIGURE 7-80: DAILY MAXIMUM SO_2 MEASUREMENTS AT SALDANHA BAY (2015)

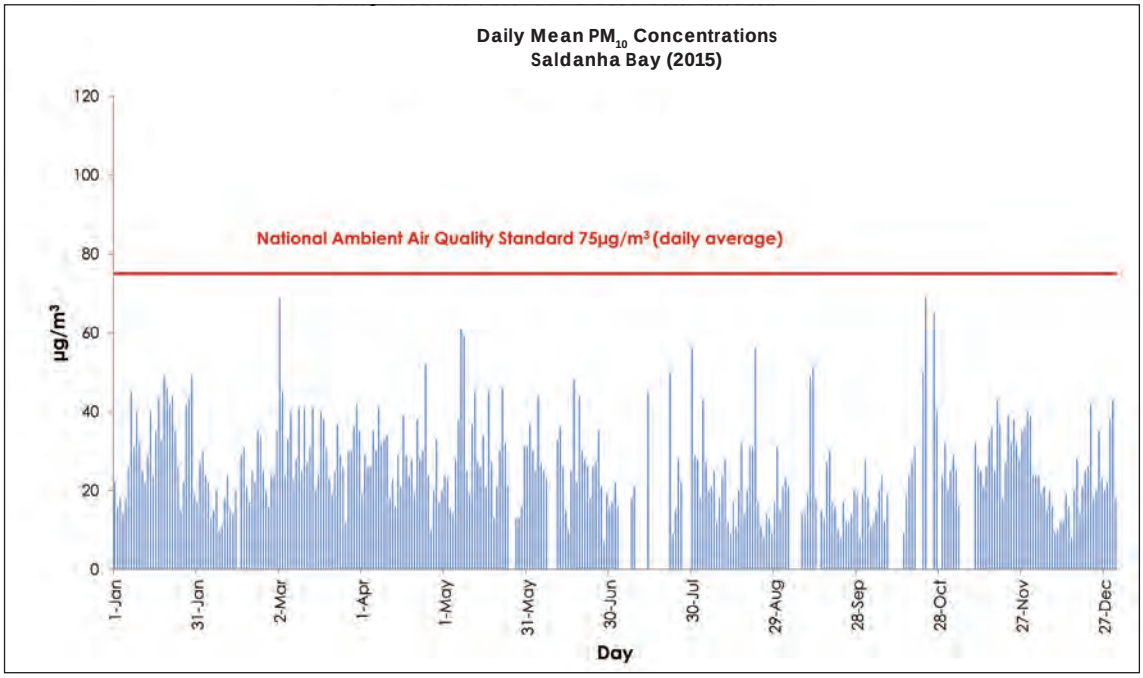


FIGURE 7-81: DAILY MEAN PM_{10} MEASUREMENTS AT SALDANHA BAY (2015)

7.5 CITY OF CAPE TOWN'S MUNICIPAL AMBIENT AIR QUALITY MONITORING NETWORK

The City of Cape Town (CCT) is responsible for monitoring ambient air quality within the metropolitan area. Currently, 13 air quality monitoring stations are in operation, with the Athlone monitoring station serving as a reference station for the entire city network, while the Killarney station is a fence line monitoring station for the Chevron Refinery (Figure 7-82).

In addition, the three ambient air quality monitoring stations managed by the DEA&DP, viz. Vissershok, Khayelitsha and Hout Bay, are located within the CCT Metrolpolitan area to assist with regional air quality monitoring.

Potential sources that contribute to air pollution in the Metropolitan area include industry, vehicle emissions, electricity generation and domestic fuel use (heating and cooking). A combination of local topography (mountain range forms a basin that traps pollution) and climate cause the city to be susceptible to increased air pollution during autumn and winter inversions. Early morning inversions are exacerbated by morning peak traffic, causing visible levels of air pollution in the form of a white or brown haze (CCT, 2005). Studies of the brown haze and air pollution episodes showed that PM_{10} forms a major part of the city pollution (Benson, 2007). Furthermore, summers are marked by a general high potential for air pollution dispersion across the Metropolitan area due to the constant South-Easter or 'Cape Doctor'.

FIGURE 7-82: THE CITY OF CAPE TOWN MUNICIPAL AMBIENT AIR QUALITY MONITORING NETWORK

The pollutants in the ambient air are measured on a continuous basis with data being collected on a central server at the CCT's Scientific Services Department. The data is processed into averages, compared to the criteria pollutant guidelines and exceedances reported on a daily basis on the CCT's Air Quality Website (www.capetown.gov.za/airqual), as well as monthly reports.

Particulate matter with a diameter less than 10µm (PM_{10}) have caused concern because of their potential harmful effects on human health. Exposure to high concentrations of PM_{10} is associated with increased incidences of respiratory ailments such as asthma and chronic bronchitis. Studies on PM_{10} indicate that there is no threshold in particulate concentrations below which health would not be jeopardized (Benson, 2007).

The CCT developed and published an Air Quality Management Plan (AQMP) as a tool for the management of the air quality in the Metropolitan area to protect human health and the environment as part of their constitutional responsibility as Local Authority to comply with NEM: AQA. One of the key objectives of the CCT's AQMP is "to specify ambient air quality standards and targets for Cape Town". See Chapter Chapter 5 for more information on the CCT's AQMP. A summary of the air quality measurements undertaken at the CCTs Municipal Ambient Air Quality Monitoring Network is presented below.

7.5.1 BOTHASIG

The Bothasig monitoring station forms part of the ambient air quality monitoring network undertaken in the Milnerton area. The primary aim is to monitor the impact of industrial activities and other sources of air pollution from the area, on ambient air quality.

Ambient air quality monitoring at the Bothasig monitoring station commenced during 1995. The pollutants measured are SO2 and NOx; while, PM10 monitoring was discontinued in 2003. The air quality measurements are shown in Figure 7-83 and Figure 7-84, for SO2 and NO2, respectively; a brief summary air quality trends observed during 2011 – 2015 is provided:

- SO_2 levels did not exceed the 24-hour average of 125 µg/m^3 for the period 1 January 2011 – 31 December 2015. The highest 24-hour average recorded was 64 µg/m^3 on 17 September 2013. The data capture for the period was 84%. The gaps in the data are due to analyser malfunction.
- NO_2 levels did not exceed the 1-hour average of 200 µg/m^3 for the period 1 January 2011 – 31 December 2015. The highest 1-hour average recorded was 128 µg/m^3 on 11 April 2014. The data capture for the period was 59%. The gaps in the data are due to analyser malfunction.

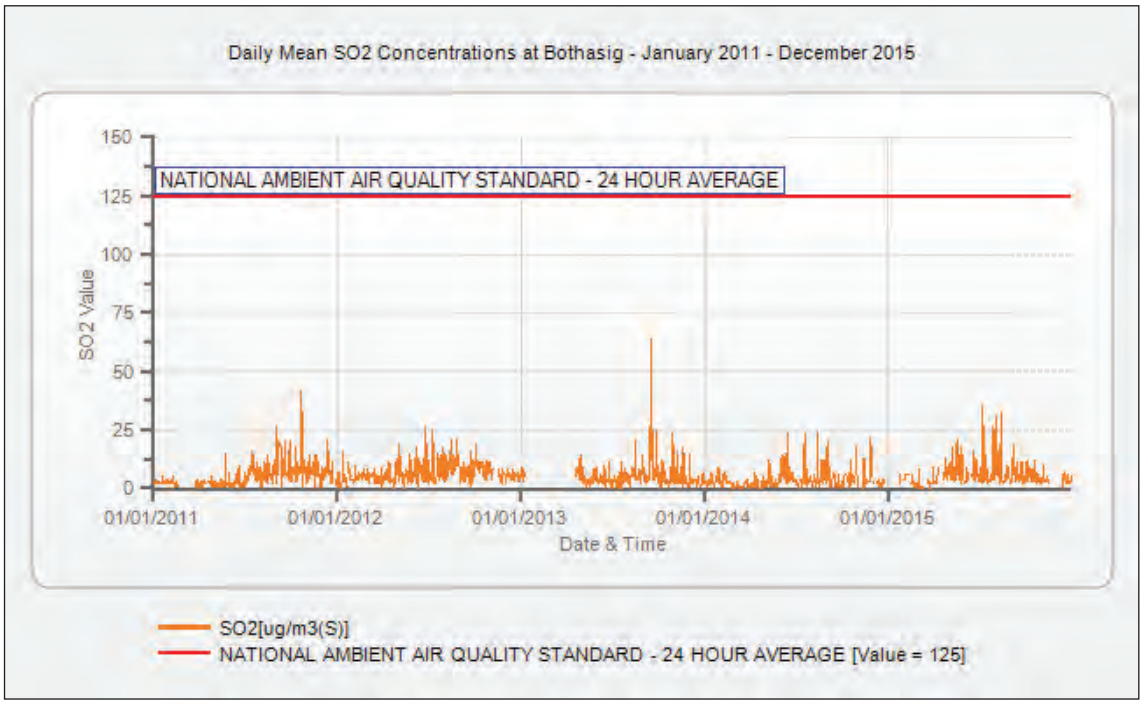


FIGURE 7-83: DAILY MEAN SO_2 MEASUREMENTS FOR BOTHASIG (2011 – 2015)

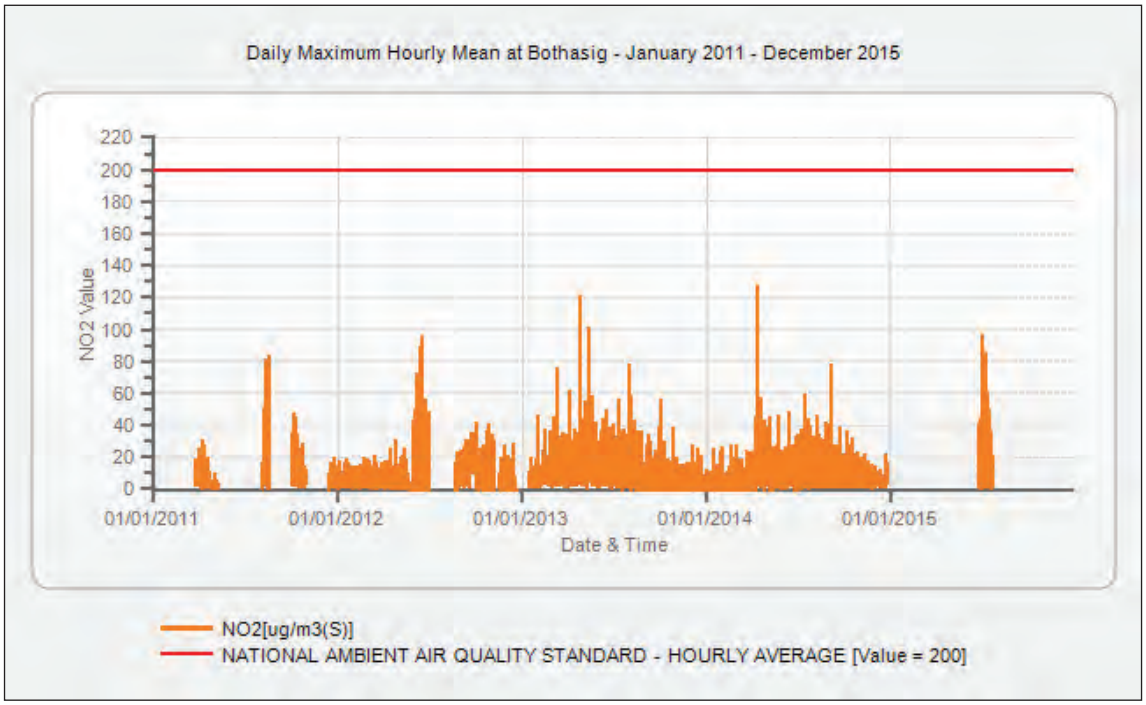


FIGURE 7-84: DAILY MAXIMUM HOURLY MEAN NO_2 MEASUREMENTS FOR BOTHASIG (2011 – 2015)

7.5.2 FORESHORE

The air quality monitoring station was located at the Foreshore to assess vehicular emissions and to characterize emissions from other nearby sources such as the Port activities in the area.

Ambient NO_2 and PM_{10} monitoring commenced during 1995. Only monthly averages for PM_{10} are presented in Figure 7-85, as there was inadequate NO_2 data to report. The PM_{10} levels did not exceed the 24-hour average of 120 µg/m³ for the period 01 January 2011 – 31 December 2014; while it also did not exceed the 24-hour average of 75 µg/m³ for the period 1 January 2015 – 31 December 2015. The highest 24-hour average recorded was 74 µg/m³ on 07 August 2015. The data capture for the period was 76%. The gaps in the data are due to analyser malfunction and air conditioner problems experienced.

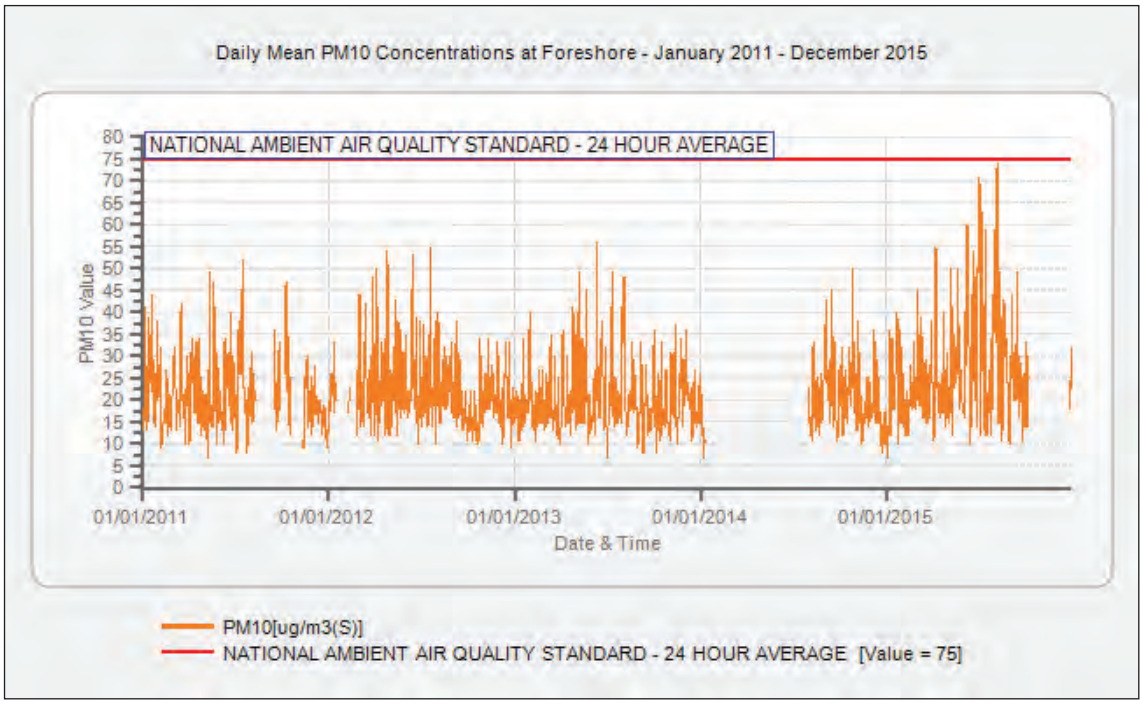


FIGURE 7-85: DAILY MEAN PM_{10} MEASUREMENTS FOR THE FORESHORE (2011- 2015)

7.5.3 GOODWOOD

The Goodwood monitoring station serves as a Regional station to monitor background air pollution levels. Ambient air quality monitoring at the Goodwood monitoring station commenced during 1993. The pollutants measured are SO_2, NO_x, O_3 and CO. Monitoring of CO and O_3 was discontinued in 2007 and 2008, respectively, due to instrument failure.

A brief summary of each pollutant measured is provided:

- The SO_2 concentrations for Goodwood did not exceed the 24-hour average of 125 µg/m³ for the period 1 January 2011 – 31 December 2015 (Figure 7-86). The highest 24-hour average recorded was 39 µg/m³ on 04 September 2014. The data capture for the period was 30%, the gaps in the data are due to analyser malfunction.
- The NO_2 concentations for Goodwood exceeded the 1-hour average of 200 µg/m³ on 3 occasions (*viz*. 287 µg/m³ on 18 July 2012; 230 µg/m³ on 06 September 2013; 207 µg/m³ on 11 June 2014) during the period 1 January 2011 – 31 December 2015 (Figure 7-87). The highest 1-hour average recorded was 287 µg/m³ on 18 July 2012. The data capture for the period was 57%; the gaps in the data are due to analyser malfunction.

- The PM_{10} concentrations exceeded the 24-hour average of 120 µg/m^3 on 1 occasion (*viz*. 143 µg/m^3 on 17 January 2012) for the period 1 January 2011 – 31 December 2014 (Figure 7-88). The PM_{10} concentrations exceeded the 24-hour average of 75 µg/m^3 on 1 occasion (85 µg/m^3 on 14 September 2015) for the period 1 January 2015 – 31 December 2015. The data capture for the period was 80%; the gaps in the data are due to analyser malfunction.

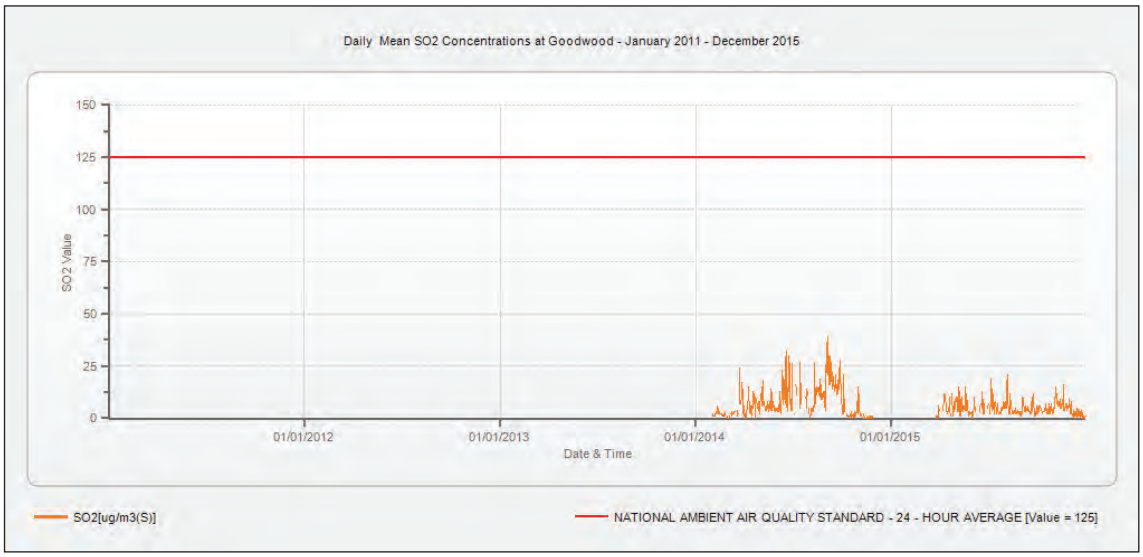


FIGURE 7-86: DAILY MEAN SO_2 MEASUREMENTS FOR GOODWOOD (2011 – 2015)

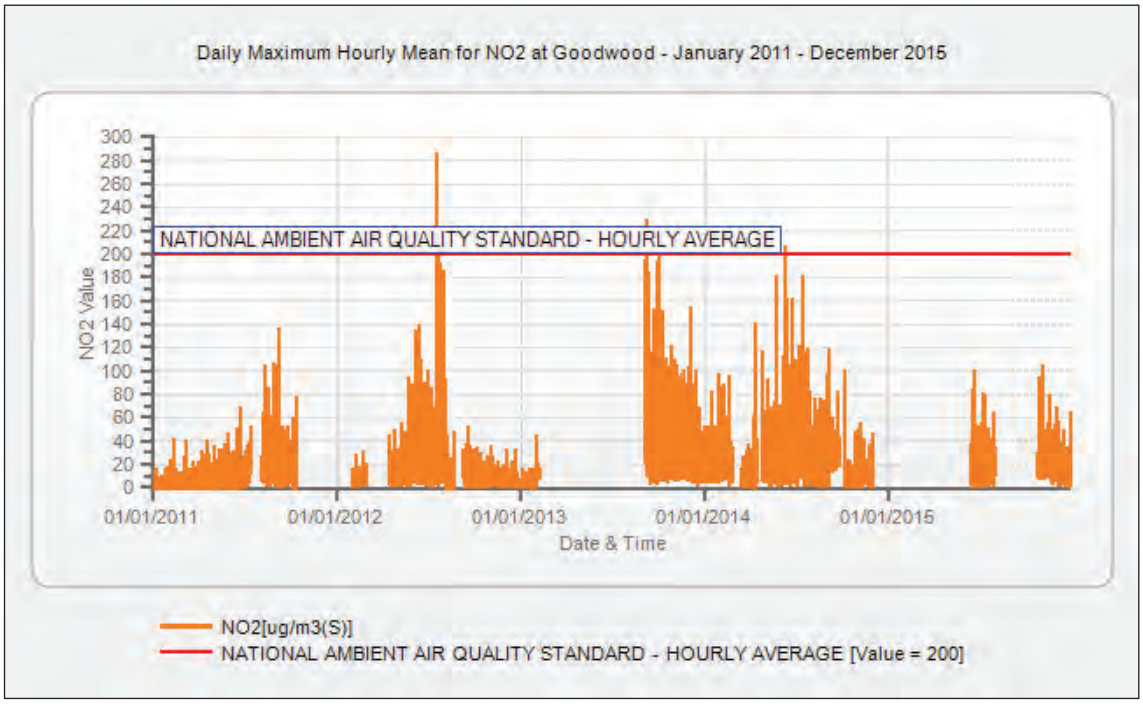


FIGURE 7-87: DAILY MEAN NO_2 MEASUREMENTS FOR GOODWOOD (2011 – 2015)

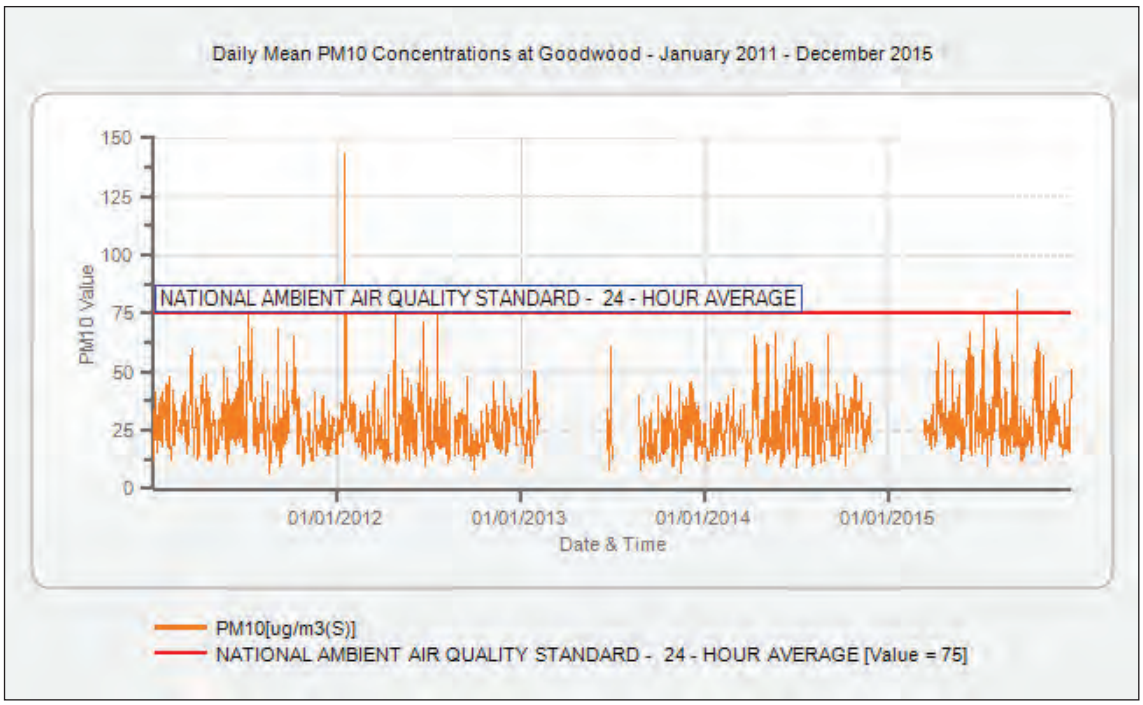


FIGURE 7-88: DAILY MEAN PM_{10} MEASUREMENTS FOR GOODWOOD (2011 – 2015)

7.5.4 KHAYELITSHA

The Khayelitsha monitoring station was established to assess the impact of emissions from informal settlement related activities on ambient air quality in the area. Ambient air quality monitoring at the Khayelitsha monitoring station commenced in 2002.

The pollutants measured are SO_2, NO_x and PM_{10}. The analyses of the results are shown in Figure 7-89 and Figure 7-90 for NO_2 and PM_{10}, respectively. There were 40 exceedances of the 1-hour AAQS for NO_2 during the period 1 January 2011 – 31 December 2015 (Figure 7-89). The highest 1-hour average recorded was 441 µg/m³ on 29 September 2014. The exceedances were due to a temporary mini bus taxi rank in close proximity to the ambient air quality monitoring station. The data capture for the period was 61%; the gaps in the data are due to analyser and air conditioner malfunction.

The PM_{10} concentrations for Khayelitsha exceeded the 24-hour average of 120 µg/m³ on 10 occasions for the period 01 January 2011 – 31 December 2014 (Figure 7-90). The PM_{10} concentrations for Khayelitsha exceeded the 24-hour average of 75 µg/m³ on 3 occasions for the period 1 January 2015 – 31 December 2015. The data capture for the period was 61%; the gaps in the data are due to analyser malfunction and air conditioner problems experienced.

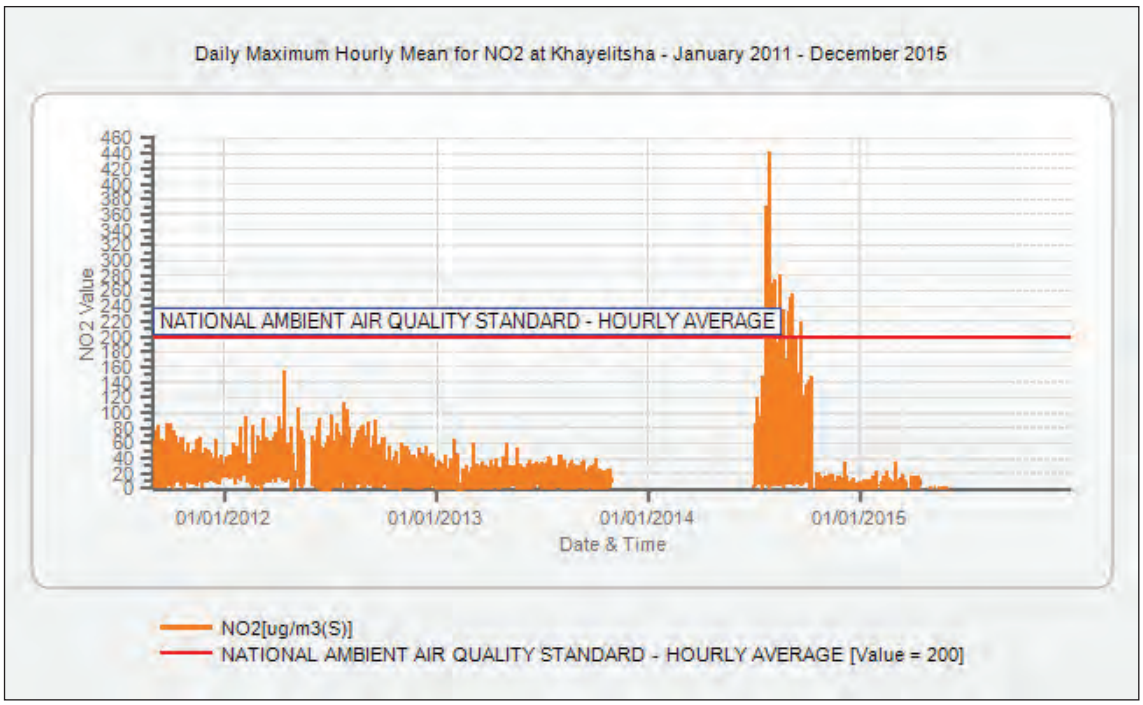


FIGURE 7-89: DAILY MEAN NO_2 CONCENTRATIONS FOR KHAYELITSHA (2011 – 2015)

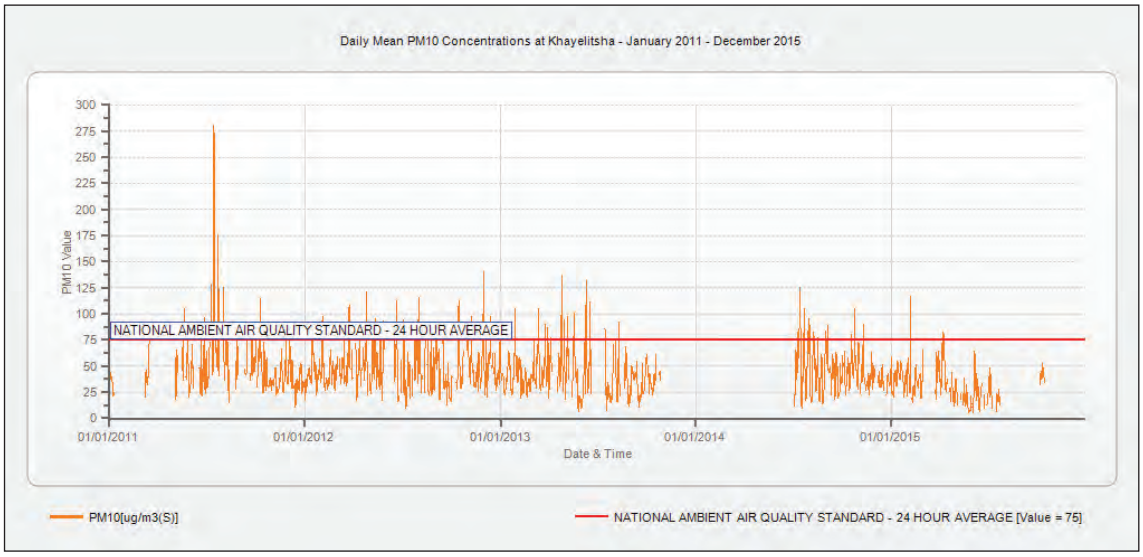


FIGURE 7-90: DAILY MEAN PM_{10} CONCENTRATIONS FOR KHAYELITSHA (2011 – 2015)

7.5.5 TABLE VIEW

The Table View monitoring station forms part of the Milnerton air quality monitoring network. The primary aim is to monitor the impact of industrial activities and other sources of air pollution from the area, on ambient air quality.

Ambient air quality monitoring at the Tableview monitoring station commenced during 1994. The pollutants measured are SO_2, NO_x and PM_{10}. The measurement results are shown in Figure 7-91 to Figure 7-93:

- The SO_2 concentrations did not exceed the 24-hour average of 125 µg/m^3 for the period 1 January 2013 – 31 December 2015. The highest 24-hour average recorded was 86 µg/m^3 on 24 April 2013. The data capture for the period was 74%; the gaps in the data are due to analyser malfunction.

- The NO_2 concentrations did not exceed the 1-hour average of 200ug/m^3 for the period 1 January 2014 – 31 December 2015. The highest 1-hour average recorded was 96 µg/m^3 on 31 July 2013. The data capture for the period was 71%; the gaps in the data are due to analyser malfunction.
- The PM_{10} concentrations did not exceed the 24-hour average of 120ug/m^3 for the period 1 January 2011 – 31 December 2014. The PM_{10} concentrations did not exceed the 24-hour average of 75 µg/m^3 for the period 1 January 2015 – 31 December 2015. The highest 24- hour average recorded was 68 µg/m^3 on 07 October 2011. The data capture for the period was 61%; the gaps in the data are due to analyser malfunction.

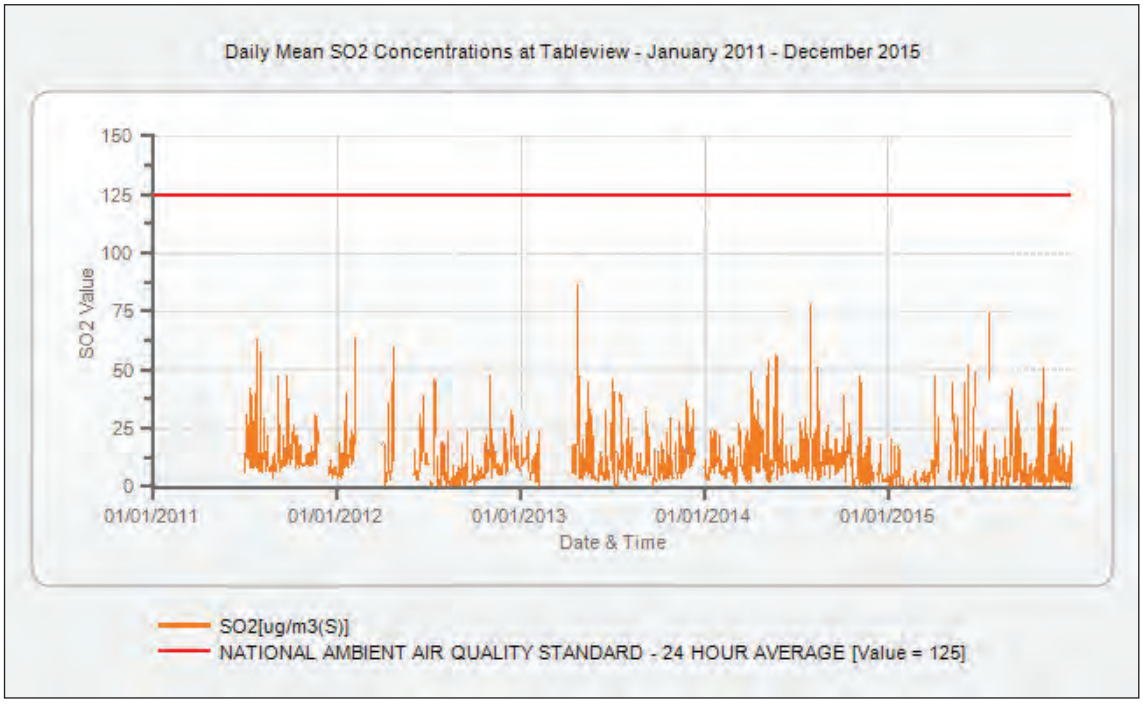


FIGURE 7-91: DAILY MEAN SO_2 CONCENTRATIONS FOR TABLEVIEW (2011 – 2015)

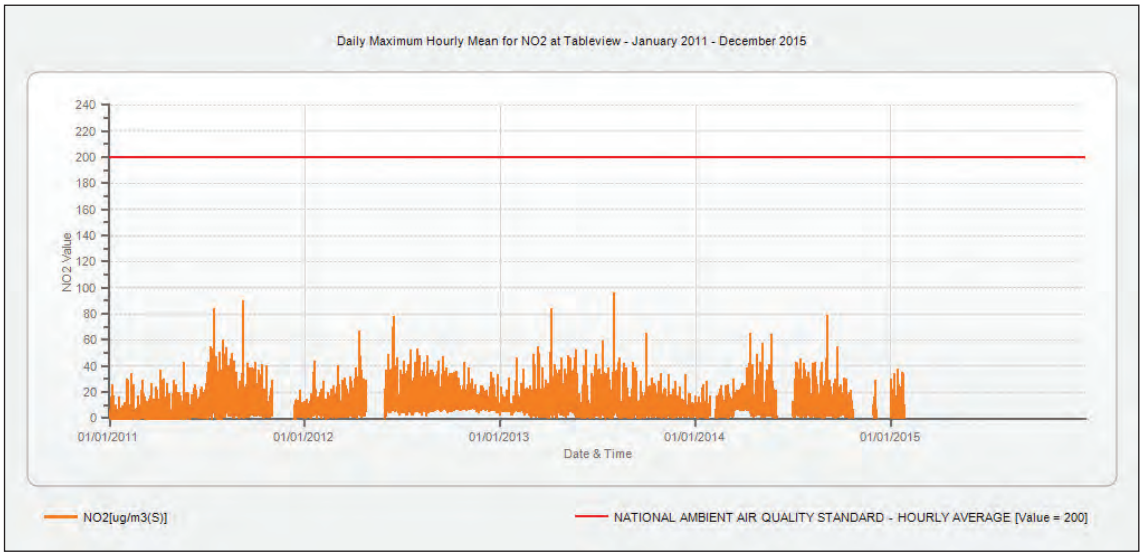


FIGURE 7-92: DAILY MEAN NO_2 CONCENTRATIONS FOR TABLEVIEW (2011 – 2015)

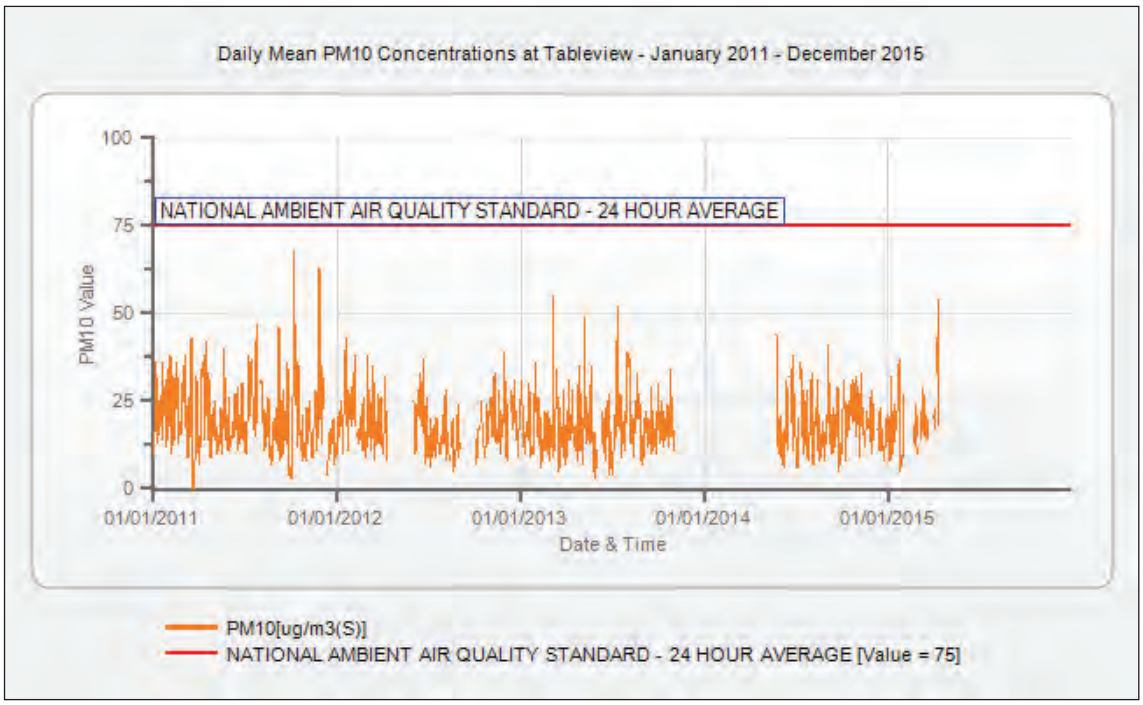


FIGURE 7-93: DAILY MEAN PM_{10} CONCENTRATIONS FOR TABLEVIEW (2011 – 2015)

7.5.6 WALLACEDENE

The primary aim of the Wallacedene air quality monitoring station is to monitor the impact of emissions from the Wallacedene informal settlement on ambient air quality. Ambient air quality monitoring at the Wallacedene monitoring station commenced during 2006. The pollutants measured are SO_2, NO_x and PM_{10}. A brief summary of the pollutants measured is provided:

- The NO_2 concentrations exceeded the 1-hour average of 200 µg/m³ on 1 occasion for the period 1 January 2014 – 31 December 2015 (Figure 7-94). The highest 1-hour average recorded was 234 µg/m³ on 24 November 2015. The data capture for the period was 48%; the gaps in the data are due to analyser malfunction.
- The PM_{10} concentrations did not exceed the 24-hour average of 120 µg/m³ for the period 1 January 2011 – 31 December 2014 (Figure 7-95). The highest 24-hour average recorded was 117 µg/m³ on 15 July 2011. The PM_{10} concentrations for Wallacedene exceeded the 24-hour average of 75 µg/m³ on 2 occasions (79 µg/m³ on 05 September 2015 and 77 µg/m³ on 30 October 2015) for the period 1 January 2015 – 31 December 2015. The data capture for the period was 67%; the gaps in the data are due to analyser malfunction.

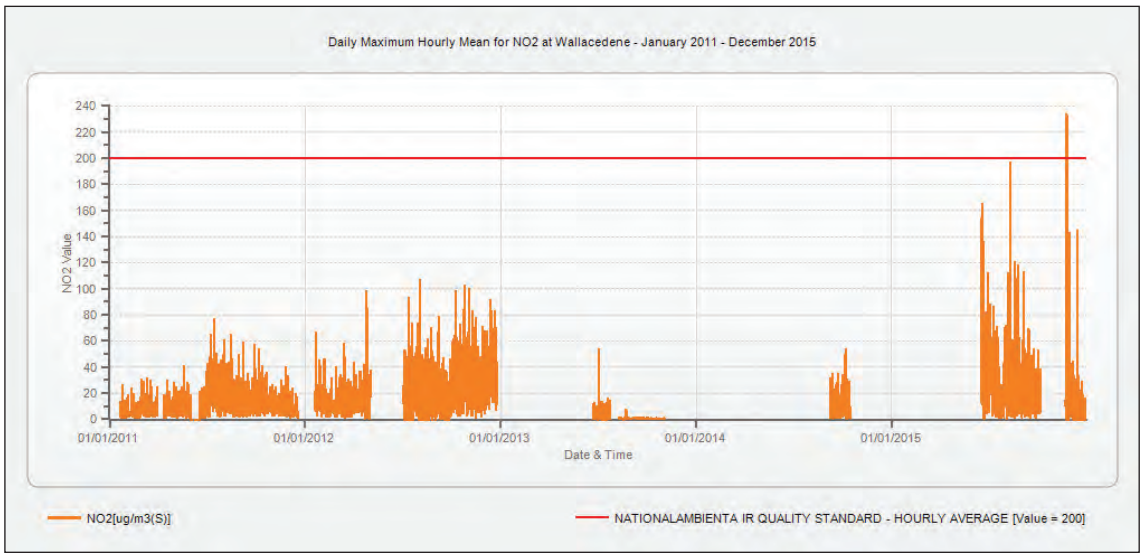


FIGURE 7-94: DAILY MAXIMUM HOURLY MEAN NO_2 CONCENTRATIONS FOR WALLACEDENE (2011 – 2015)

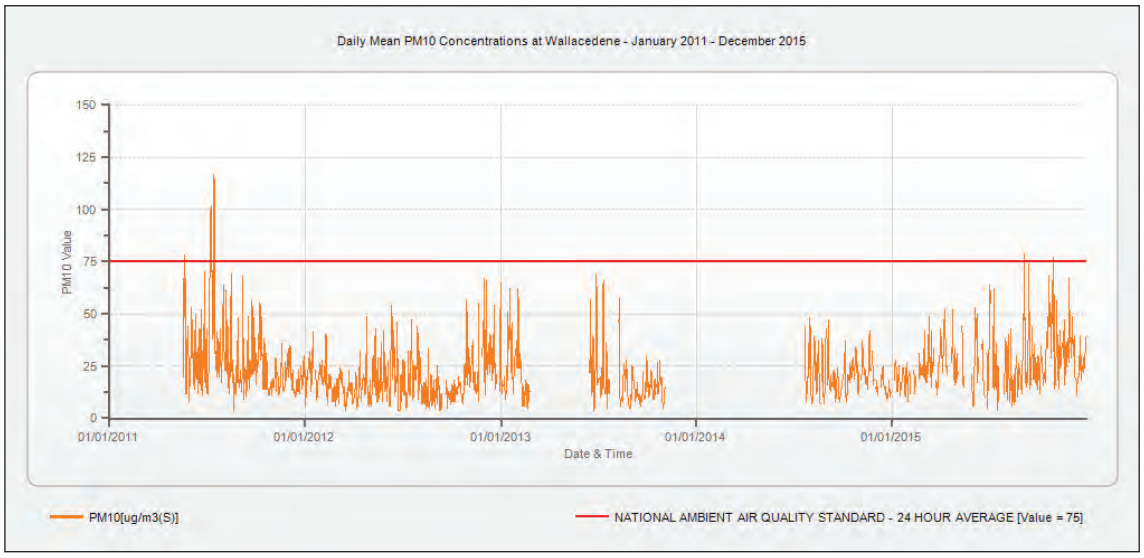


FIGURE 7-95: DAILY MEAN PM_{10} CONCENTRATIONS FOR WALLACEDENE (2011 – 2015)

7.5.7 PLATTEKLOOF

The Plattekloof monitoring station is positioned to monitor any potential impacts of the nearby industries on ambient air quality in the area. The air quality monitoring stations was commissioned in June 2013. The pollutants measured are SO_2, NO_x, O_3 and PM_{10}. The analyses of the results for SO_2, NO_x, O_3 are shown in Figure 7-96 to Figure 7-98. A brief summary of the each pollutant measured, is provided:

- The SO_2 concentrations did not exceed the 24-hour average of 125 µg/m^3 for the period 1 January 2013 – 31 December 2015 (Figure 7-96). The highest 24-hour average recorded was 43 µg/m^3 on 02 May 2015. The data capture for the period was 62%; the gaps in the data are due to analyser malfunction and data logging problems.
- The NO_2 concentrations did not exceed the 1-hour average of 200 µg/m^3 for the period 1 January 2014 – 31 December 2015 (Figure 7-97). The highest 1-hour average recorded was 146 µg/m^3 on 22 May 2015. The data capture for the period was 60%; the gaps in the

data are due to communication problems experienced and data logging problems.

- The O_3 concentrations exceeded the 8-hour running average of 120 µg/m^3 on 1 occasion (122 µg/m^3 on 05 October 2014) for the period 1 January 2014 – 31 December 2015 (Figure 7-98). The highest 8–hour running average recorded was 122ug/m^3 on 05 October 2014. The data capture for the period was 52%; the gaps in the data are due to analyser malfunction and logging problems.

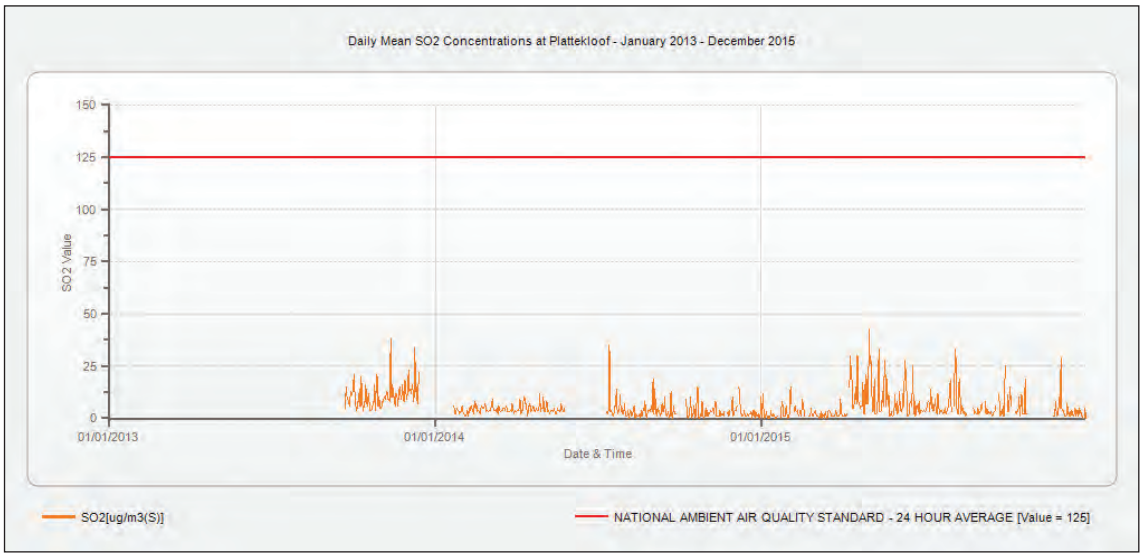


FIGURE 7-96: DAILY MEAN SO_2 CONCENTRATIONS FOR PLATTEKLOOF (2013 – 2015)

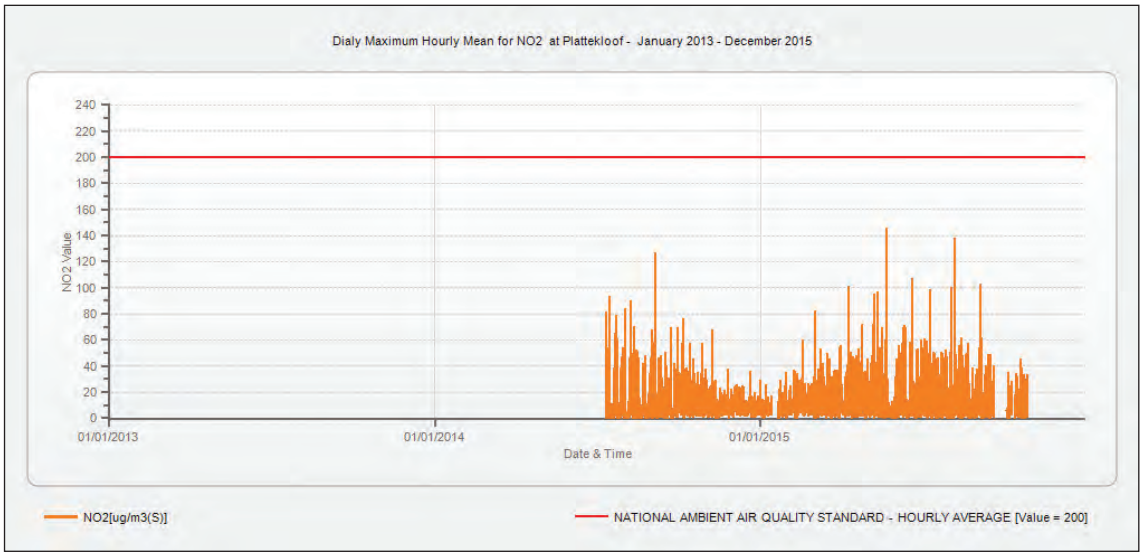


FIGURE 7-97: DAILY NO_2 CONCENTRATIONS FOR PLATTEKLOOF (2013 – 2015)

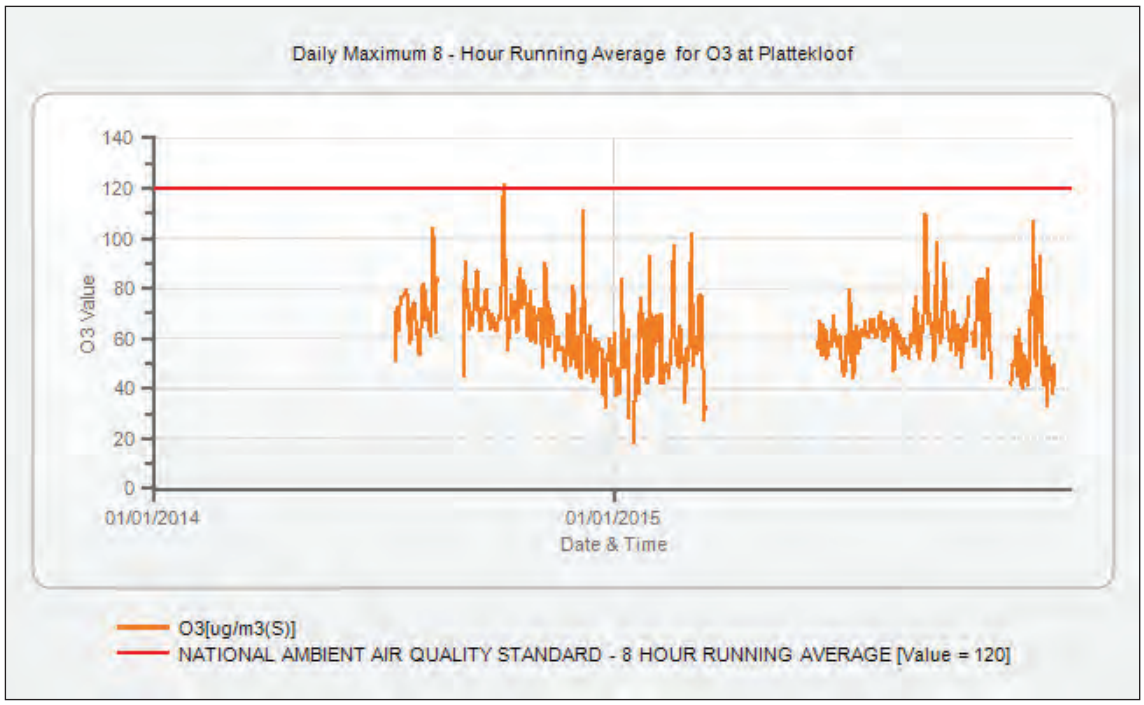


FIGURE 7-98: DAILY MEAN O_3 CONCENTRATIONS FOR PLATTEKLOOF (2014 – 2015)

7.5.8 BELLVILLE-SOUTH

Ambient air quality monitoring at the Bellville monitoring station commenced during 2003. The pollutants measured are SO_2 and PM_{10}. The measured results for each pollutant, as shown in Figure 7-99 and Figure 7-100, are below the SA-AAQS.

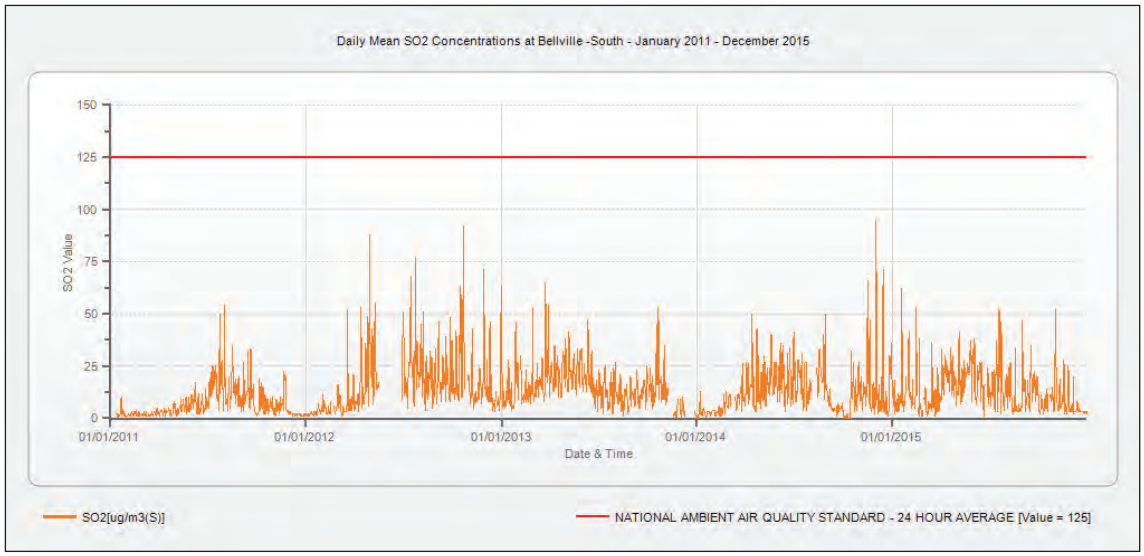


FIGURE 7-99: DAILY MEAN SO_2 CONCENTRATIONS FOR BELLVILLE-SOUTH (2011 – 2015)

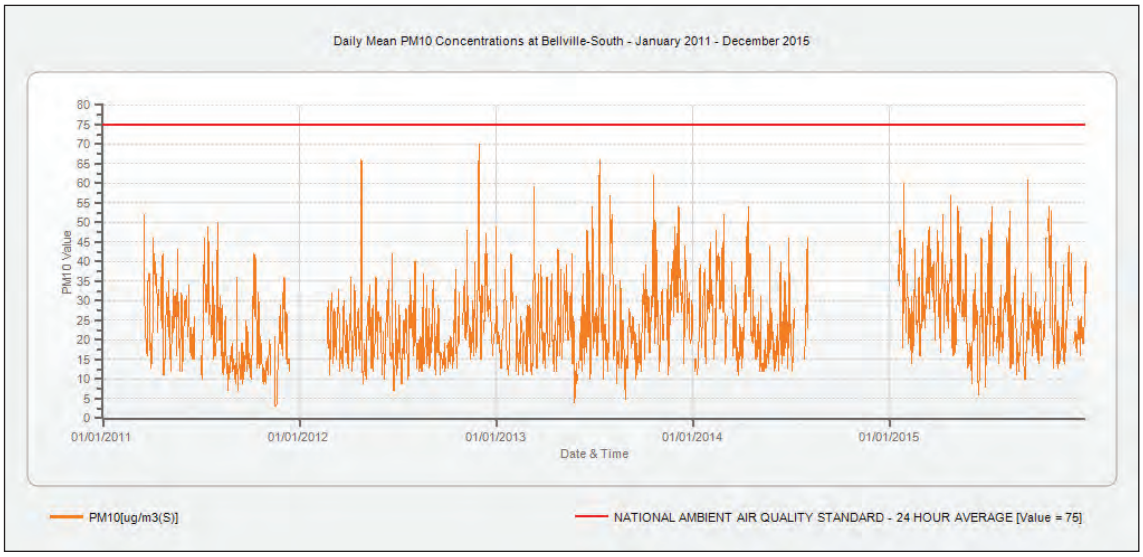


FIGURE 7-100: DAILY MEAN PM_{10} CONCENTRATIONS FOR BELLVILLE-SOUTH (2011 – 2015)

7.5.9 CITY HALL

Ambient monitoring at the City Hall monitoring station commenced during 1994. The pollutants measured are SO_2, NO_x and CO. The analyses of the results for NO_2 and CO are shown in Figure 7-101 and Figure 7-102. A brief summary of the pollutants measures is provided:

- The NO_2 concentrations did not exceed the 1-hour average of 200 µg/m³ for the period 1 January 2011 – 31 December 2015 (Figure 7-101). The highest 1-hour average recorded was 129 µg/m³ on 05 September 2012. The data capture for the period was 42%; the gaps in the data are due to analyser malfunction.
- The CO concentrations did not exceed the 8-hour average of 10 mg/m³ for the period 1 January 2011 – 31 December 2015 (Figure 7-102). The highest 8 – hour average recorded was 5 mg/m³ on 25 April 2013. The data capture for the period was 48%; the gaps in the data are due to analyser malfunction.

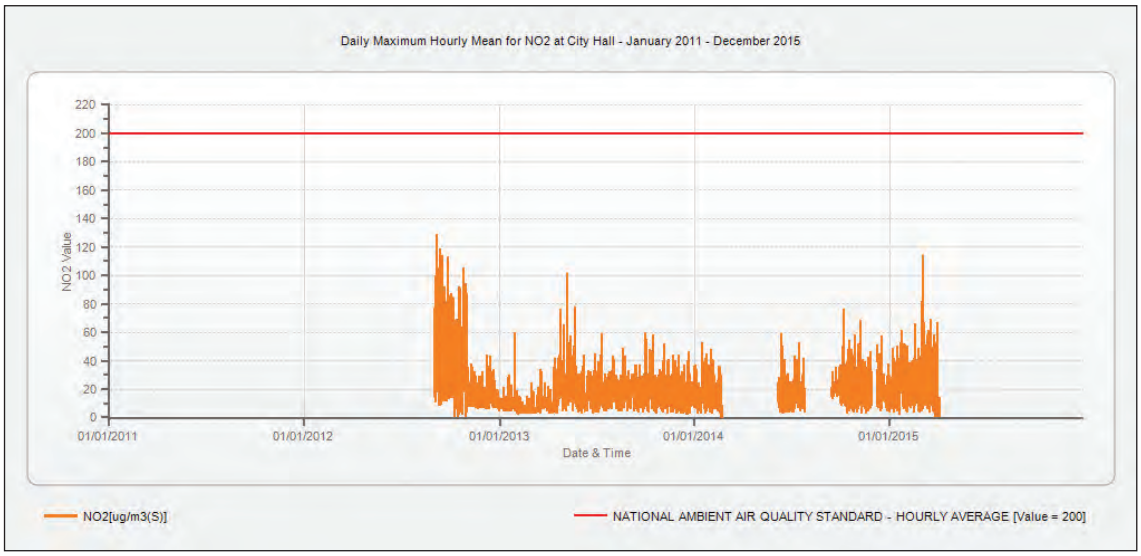


FIGURE 7-101: DAILY MEAN NO_2 CONCENTRATIONS FOR CITY HALL (2011 – 2015)

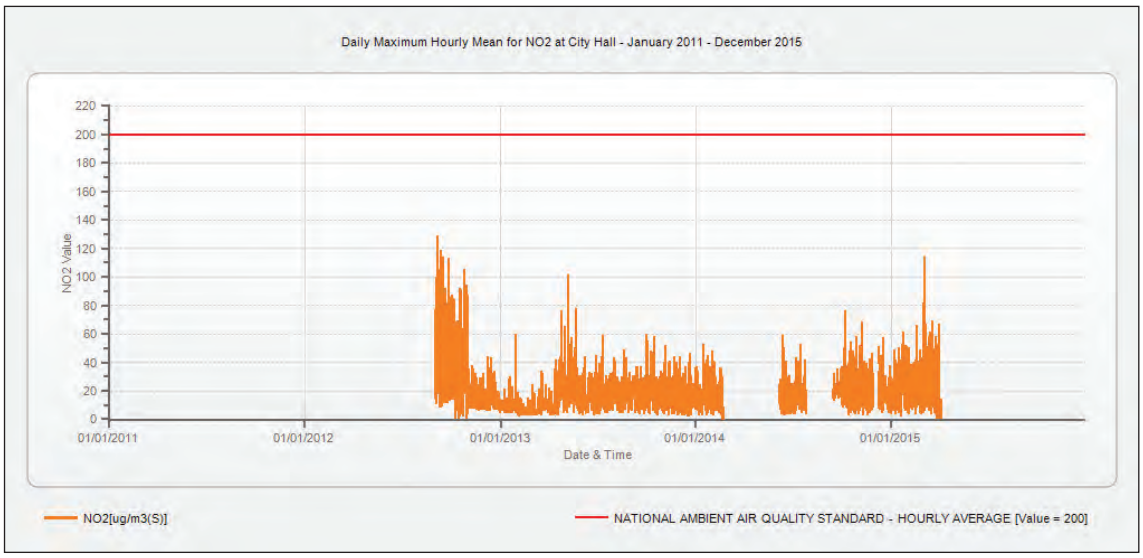


FIGURE 7-102: DAILY MEAN CO CONCENTRATIONS FOR CITY HALL (2011 – 2015)

7.5.10 ATLANTIS

Ambient monitoring at the Atlantis monitoring station commenced in 2008. The pollutants measured are SO_2, and NO_2. A brief summary of the trends for each pollutant is provided:

- The SO_2 concentrations did not exceed the 24-hour average of 125 µg/m^3 for the period 1 January 2011 – 31 December 2015 (Figure 7-103). The highest 24-hour average recorded was 24 µg/m^3 on 20 June 2015. The data capture for the period was 35%; the gaps in the data are due to analyser malfunction and air conditioner problems experienced.
- The NO_2 concentrations did not exceed the 1-hour average of 200 µg/m^3 for the period 1 January 2011 – 31 December 2015 (Figure 7-104). The highest 1-hour average recorded was 159 µg/m^3 on 28 June 2013. The data capture for the period was 42%; the gaps in the data are due to analyser malfunction and air conditioner problems experienced.

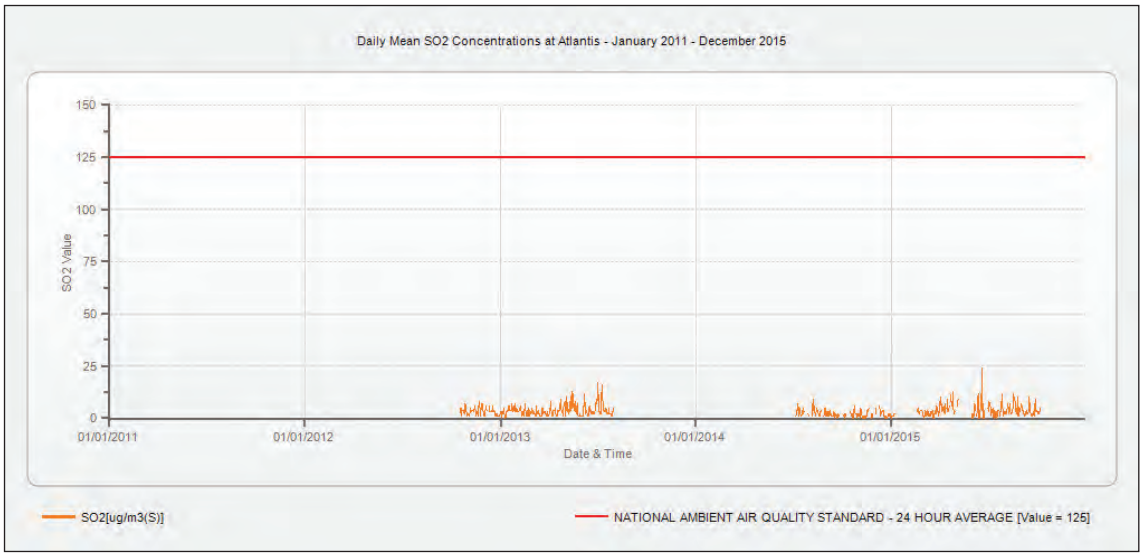


FIGURE 7-103: DAILY MEAN SO_2 CONCENTRATIONS FOR ATLANTIS (2011 – 2015)

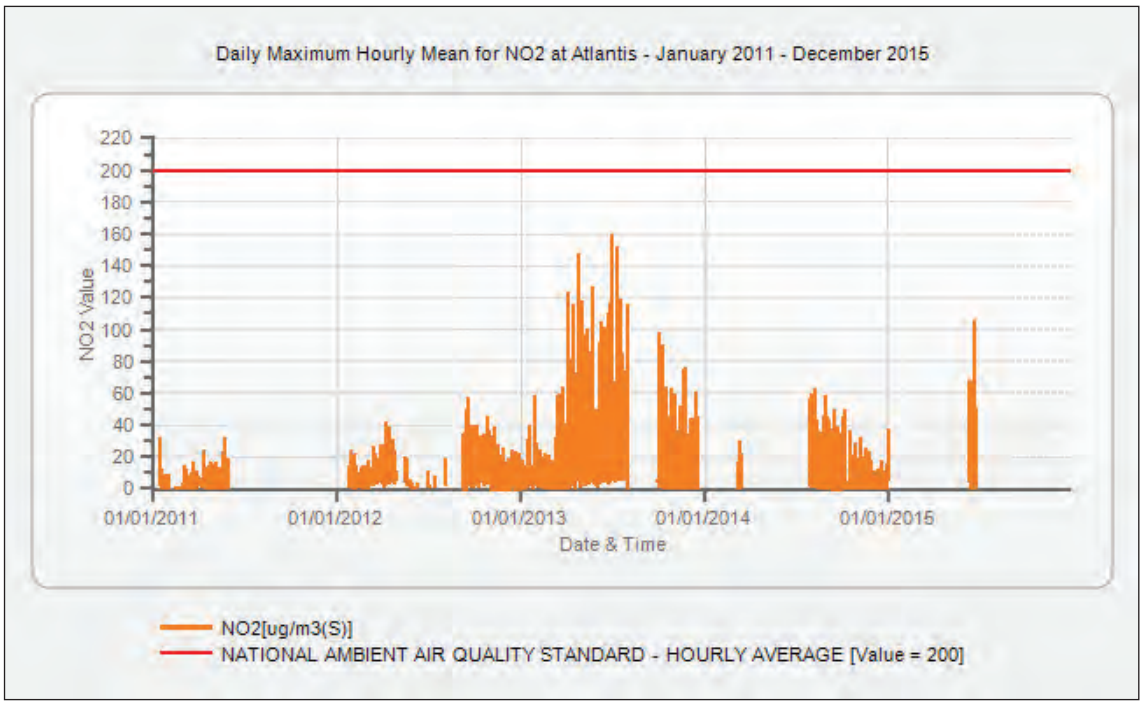


FIGURE 7-104: DAILY MEAN NO_2 MEASUREMENTS FOR ATLANTIS (2011 – 2015)

7.6 EDEN DISTRICT MUNICIPALITY – PASSIVE SAMPLING

The Eden District Municipality is conducting passive air quality monitoring for SO_2, NO_2, H_2S and BTEX in various towns within the Eden region (Table 7-6). The towns were selected due the potential air quality impacts in the area and also to assess the air quality where complaints were received.

TABLE 7-6: EDM PASSIVE SAMPLING FOR SO_2, NO_2, H_2S AND BTEX

TOWN	POLLUTANT
Albertinia	SO_2/ NO_2, BTEX
Mossel Bay	SO_2/ NO_2
Great Brak river	SO_2/ NO_2
Riversdale	H_2S
George	H_2S

Photograph by: J. Ruiters

8. AIR QUALITY COMPLIANCE AND ENFORCEMENT

8.1 ATMOSPHERIC EMISSION LICENSING

The National Environmental Management: Air Quality Act (Act No. 39 of 2004; NEM: AQA) sets out the legal requirements for Air Quality Officers (AQOs) and Licensing Authorities to regulate air quality management, and implement the atmospheric emission licensing system in the Province. It further provides for access to information on air quality matters via the Promotion of Access to Information Act (Act No. 2 of 2000), as well as for administrative justice legal requirements on air quality matters via the Promotion of Administrative Justice Act (Act No. 3 of 2000).

The NEM: AQA came into full effect on 1 April 2010. This brought about a shift in the responsibility of authorities to administer the receipt, processing and issuing of Atmospheric Emission Licenses (AELs) from the national government to the Provincial and Local spheres of government. Through further amendments of the NEM: AQA on 19 May 2014, the national DEA was mandated to be a Licensing Authority for certain Section 21 Listed Activities (See Chapter 2).

Chapter 5 of the NEM: AQA sets out the procedures for the licensing of listed activities, with Section 36 assigning the function to the Metropolitan and District municipalities, Provinces and the National DEA, as the Licensing Authorities for Section 21 Listed Activities. The procedures for AELs are outlined, as well as the factors to be taken into account by Licensing Authorities to make a decision to grant or refuse an application, in terms of Section 40 of the NEM: AQA.

The NEM: AQA makes provision for the following applications in terms of atmospheric emission licensing:

- Section 42 - 43: provisional and final AELs;
- Section 44: transfer of provisional AEL or AEL;
- Section 45: review of provisional AEL or AEL;
- Section 46: variation of provisional AEL or AEL; and
- Section 47: renewal / extension of provisional AEL or AEL.

The implementation of the atmospheric emission licensing regime has proven to be complex.

8.1.1 STATUS OF ATMOSPHERIC EMISSION LICENSING IN THE WESTERN CAPE

The Licensing Authorities in the Western Cape have embraced the atmospheric emission licensing process. As at 31 December 2015, a total of 43 PAELs and 73 AELs were being regulated within the Province. Table 8-1 provides a summary of the AELs and PAELs issued annually during the period 2010 – 2015.

The City of Cape Town (CCT) has formally engaged with the vast majority of operators of Listed Activities in the metropolitan area in order to raise awareness regarding the legal requirement to renew / convert all existing APPA certified premises to AELs by 01 April 2014. Similarly, the Eden District Municipality (EDM) and West Coast District Municipality (WCDM) have embraced the atmospheric emission licensing mandate and have engaged with industries in their respective areas. This has resulted in all facilities with APPA Registration Certificates being issued a PAEL within the required timeframes, as specified by the NEM: AQA.

TABLE 8-1: SUMMARY OF THE AELS AND PAELS ISSUED BY LICENSING AUTHORITIES IN THE WESTERN CAPE DURING 2010 – 2015

LICENSING AUTHORITY	2010		2011		2012		2013		2014		2015		REGULATED, AS AT 31 DECEMBER 2015	
	PAEL	AEL	PAEL	AEL	PAEL	AEL	PAEL	AEL	PAEL	AEL	PAEL	AEL	PAEL	AEL
WCDM	0	0	5	1	1	1	6	1	7	9	3	1	12	9
EDM	5	0	4	0	7	2	2	14	3	6	1	1	2	23
ODM	0	0	0	0	0	0	1	0	2	0	2	0	5	0
CKDM	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CCT	0	0	2	0	1	3	3	2	14	19	11	8	16	31
CWDM	0	0	1	0	0	0	0	0	4	11	0	0	5	10
DEA&DP	0	0	0	0	0	0	0	0	1	0	2	0	3	0
TOTAL PER YEAR	5	0	12	1	9	6	12	17	31	45	19	10	43	73

8.1.2 SOUTH AFRICAN ATMOSPHERIC EMISSION LICENSING AND INVENTORY PORTAL (SAAELIP)

The National DEA launched the South African Atmospheric Emission Licensing and Inventory Portal (SAAELIP) at the 10th Air Quality Governance Lekgotla in Bloemfontein on 30 September 2015.

The SAAELIP provides a singular platform to monitor AEL emission reporting and atmospheric emission inventory reporting via the System National Atmospheric Emission Licensing (SNAEL) and the National Atmospheric Emission Inventory System (NAEIS), respectively. The portal aims to improve service delivery and ensure transparent governance as it relates to air quality management in South Africa. A brief explanation of the NAEIS and SNAEL is provided in Sections 8.1.2.1 and 8.1.2.2.

The portal can be accessed by the authorities, industry and the general public, and provides information on AELs issued, as well as emissions inventory reports for specific geographic areas. More importantly, the SAAELIP allows the user to:

- Create and manage user accounts;
- Submit and manage AEL applications online;
- Track the status of an application;
- Submit emission inventory data & compliance reports;
- Receive e-mail notifications on licensing results;
- Receive e-mail alerts of upcoming reporting obligations; and
- Track historical versions of all applications.

The portal can be accessed: https://saaelip.environment.gov.za/SAAELIP/home/

8.1.2.1 NATIONAL ATMOSPHERIC EMISSION INVENTORY SYSTEM – NAEIS

The main objectives of the NAEIS are to manage online reporting of emission inventories as mandated under the National Atmospheric Emission Reporting Regulations (G.N. 38633 of 2015). The system requires of facilities who have been issued AELs or PAELs to submit and manage their emission inventory reports online.

To date, a total of 138 facilities in the Western Cape have registered on the NAEIS. Table 8-2 provides a summary of the number of facilities registered on the NAEIS, as per the different Licensing Authorities in the Western Cape.

TABLE 8-2: NUMBER OF FACILITIES IN THE WESTERN CAPE, AS REGISTERED ON THE NAEIS

LICENSING AUTHORITY	NUMBER OF REGISTERED FACILITIES
CCT	73
CWDM	18
EDM	25
ODM	3
WCDM	16
DEA&DP	3
TOTAL	138

The NAEIS provides the public with a summary of the National Emission Inventory Report of significant pollutants.

8.1.2.2 SYSTEM FOR NATIONAL ATMOSPHERIC EMISSION LICENSING – SNAEL

The main objectives of the System for National Atmospheric Emission Licensing (SNAEL) are to standardize the processing and issuing of AELs and reduce the associated administrative burden.

The system provides for industries, who have with Section 21 Listed Activities, to apply for an AEL online, as well as track the status of their AEL applications online. The system further provides for Licensing Authorities to schedule licensing related inspections and track inspection results, as well as manage online compliance reporting. The general public can access information about air pollutants permitted in AELs for specific industries.

8.2 COMPLIANCE MONITORING AND ENFORCEMENT

8.2.1 AEL COMPLIANCE INSPECTIONS PROGRAMME

The Western Cape currently has designated Environmental Management Inspectors, who are empowered to enforce any authorisations issued under their mandated legislation, including licences such as AELs issued in terms of the NEM: AQA.

The DEA&DP's Directorate: Air Quality Management initiated an AEL Compliance Inspection Programme in 2013, and applied strategic enforcement action on targeted sectors that are likely to have a significant environmental burden in the Province. The DEA&DPs Air Quality Officers and Environmental Management Inspectors, together with the Metropolitan, District and Local Municipalities, undertook compliance inspections of facilities that have Section 21 Listed Activies throughout the Western Cape.

Various Section 21 Listed Activities were targeted, viz. animal matter processing, combustion installations, as well as mineral processing, storage and handling. The compliance inspections consisted of at least two contact sessions whereby authorities discussed AEL conditions, compliance with those conditions and measures to improve the air quality management at the facility. The compliance audit entailed assessing the AEL conditions with activities undertaken at the facility.

To date, a total of 18 facilities were formally inspected for compliance with their AEL conditions. Table 8-3 provides a summary of the type of Section 21 Listed Activity that was formally inspected for compliance to their AEL conditions.

The AEL Compliance Inspections Programme has strengthened air quality governance procedures in the Province. The engagements also promoted cooperative governance and built capacity in the municipalities where air quality management was a relatively new area of specialisation.

TABLE 8-3: SUMMARY OF THE AEL COMPLIANCE INSPECTION PROGRAMME UNDERTAKEN IN THE WESTERN CAPE SINCE 2013

MUNICIPAL AREA	YEAR	SECTION 21 LISTED ACTIVITY	NUMBER OF FACILITIES INSPECTED
CAPE WINELANDS	2013	Category 10. Animal Matter Processing	1
WEST COAST	2013	Category 10. Animal Matter Processing	2
WEST COAST	2013	Sub-Category 5.4. Cement Production	1
CITY OF CAPE OF TOWN	2013	Category 10. Animal Matter Processing	1
CITY OF CAPE OF TOWN	2014	Sub-Category 2.4. Storage and Handling of Petroleum Products & Sub- Category 2.5. Installations Used to Recycle or Recover Oil from Waste Oils	1
EDEN	2014	Category 10. Animal Matter Processing	3
OVERBERG	2014	Sub-Category 5.6. Lime Production	1
WEST COAST	2014	Sub-Category 4.7. Electric Arc Furnaces & Sub- Category 5.2. Drying	1
CITY OF CAPE OF TOWN	2015	Sub-Category 8.2. Crematoria and Veterinary Waste Incineration	1
EDEN	2015	Sub-category 4.22. Hot Dip Galvanizing	1
WEST COAST	2015	Sub-Category 5.1. Storage and Handling of Ore and Coal	1
WEST COAST	2015	Sub-Category 5.6. Lime Production	1
CAPE WINELANDS	2015	Sub-Category 5.6. Lime Production	1
CAPE WINELANDS	2016	Sub-Category 7.2. Production of Acids & Sub-Category 8.3. Burning Grounds	1
OVERBERG	2016	Category 10. Animal Matter Processing	1

Note: 2016 is included to illustrate current developments

8.2.2 SECTION 22A – UNLAWFUL CONDUCT OF LISTED ACTIVITIES

The amendments to the NEM: AQA, as promulgated in the National Environmental Management: Air Quality Amendment Act (Act No. 20 of 2014; NEM: AQAA) on 19 May 2014 introduced amendments to Section 22 Consequences of Listing. Section 22A empowers Licensing Authorities to address the unlawful conduct of listed activities resulting in atmospheric emissions in the following instances, applicable to the:

- operating without a Provisional Registration or Registration Certificate of a scheduled process in terms of the APPA, at any time prior to the commencement of the NEM: AQA; or
- conducting without a PAEL or an AEL, of any activity listed in terms of Section 21 of the NEM: AQA, which results in atmospheric emission.

Licensing Authorities encountered various challenges when implementating Section 22A in the Province. As the process to handle facilities that trigger an unlawful conduct in terms of Section 22A was not set out, municipalities in particular, experienced much difficulty with implementing this function fully.

Regulations informing the Section 22A administrative fine fee structure were promulgated on 18 March 2016, and provides for the determination of an administrative fine, as well as for an applicant to pay the applicable AEL processing fee as stipulated. No Section 22A administrative fines have been issued in the Western Cape, to date.

8.3 AIR POLLUTION COMPLAINTS HANDLING DURING 2010 – 2015

8.3.1 INTER-GOVERNMENTAL TASK TEAMS (IGTT)

Air Quality Officers also investigated complaints and applied the NEM: AQA, as well as Municipal Air Quality Management By-laws to regulate air quality within their jurisdictional areas.

During the period 2010 – 2015, the DEA&DP convened various Inter-Governmental Task Teams (IGTTs) in order to investigate and resolve complaints related to complex air quality matters. Generally, the IGTTs comprised of all three spheres of government, industry and the community. Following initial meetings, the convening of the IGTTs were transferred to the Metropolitan or District Municipality in their respective jurisdictional areas. This approach has proven to be advantageous with regards to the handling and resolving of air pollution complaints and activities.

Table 8-4 summarises the areas where the IGTTs were formed, the nature of the complaints that required investigation and the actions undertaken to resolve the complaints.

TABLE 8-4: SUMMARY OF INTER-GOVERNMENTAL TASK TEAMS FORMED IN THE WESTERN CAPE

AREA	NATURE OF COMPLAINT
OUDTSHOORN	Complaints of alleged offensive odours emanating from various industries were lodged, resulting in the formation of an IGTT in February 2010. The EDM has actively investigated and worked closely with industries to reduce odour from its processes. The EDM continues to undertake routine inspections to ensure that industries comply with their AEL conditions.
ALBERTINIA	Alleged air pollution complaints in Albertinia were extensively investigated in 2010. Matters were successfully resolved following the implementation of all actions by the relevant industry, as recommended by the IGTT.
MOSSEL BAY	Alleged offensive, as well as chemical odours, in the Dana Bay area in Mossel Bay were extensively investigated and have resulted in complaints having reduced, mainly as result of action items implemented by the IGTT.

AREA	NATURE OF COMPLAINT
ST. HELENA BAY	Alleged adverse health effects associated with emissions from fish processing plants in St. Helena Bay were investigated. Industry has implemented various odour abatement equipment at their facilities. There has been a noticeable reduction in odour related complaints since 2013.
SALDANHA BAY	Alleged unlawful activities with regards to iron ore dust pollution in Saldanha Bay were investigated following complaints received by all three spheres of Government. An IGTT, headed by WCDM, focused on ensuring that iron ore dust emissions in the area do not pose a nuisance or health risk to surrounding communities. Complaints from the public are ongoing, and are being addressed at the Greater Saldanha Bay IGTT. More recently, complaints related to manganese ore handling and dust have also been lodged; these are also being addressed by the IGTT, with the longer term view being to address ore storage and handling via airshed planning mechanisms.

8.3.2 COMPLAINTS HANDLING: EDEN DISTRICT MUNICIPALITY

The Eden District Municipality (EDM) actively assisted Local Municipalities to address air pollution related complaints in their areas. Complaints were generally lodged with the Local Municipality, and occasionally directly with the EDM. All complaints are captured on an electronic database and dealt with timeously.

Complaints overwhelmingly included smoke and odour, with the former having reduced over the past few years (Figure 8-1). Odour, however, remains a challenge, with most complaints received for activities undertaken in this regard. The odour-related complaints have largely been resolved in Oudtshoorn; however, ongoing odour-related complaints are being currently being addressed in the Mossel Bay area. In 2015, the EDM formulated a task team comprising of officials, complainants and industry to address the odour related to animal matter processing in Mossel Bay. A full facility-wide study was conducted and the mitigation measures were transformed into an Action Plan, linked to specific time scales for implementation. The EDM is actively engaged in this process and managing air quality in the area.

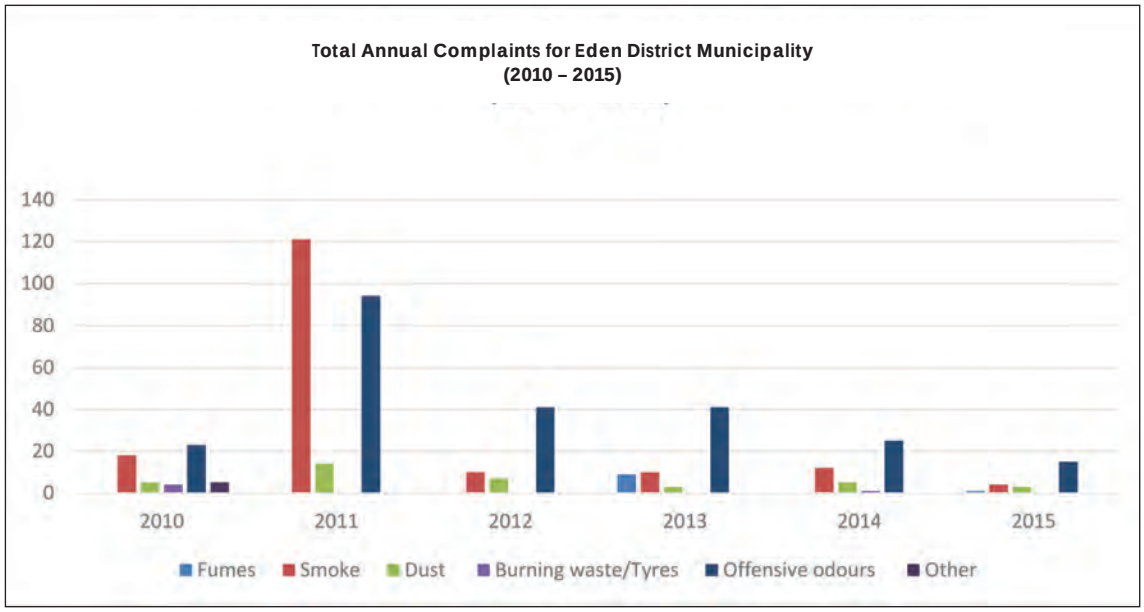


FIGURE 8-1: TOTAL COMPLAINTS RECEIVED BY THE EDEN DISTRICT (2010 – 2015)

8.3.3 COMPLAINTS HANDLING: WEST COAST DISTRICT MUNICIPALITY

The West Coast District Municipality (WCDM) was active with following up on complaints in their jurisdictional area since 2010. Three staff members were trained as Environmental Management Inspectors. Moreover, an Air Quality Complaints Register was implemented at the District Municipality, and legally required that all industries with Section 21 Listed Activities record and investigate complaints lodged directly at their facilities.

Figure 8-2 provides a summary of the complaints received in the WCDM during the period 2010 – 2015. Many complaints were resolved through discussions with industry at the West Coast Air Quality Management Working Group, which meets on a quarterly basis.

Odour, however, remains a challenge in the St. Helena Bay area, arising mainly from the fishmeal processes undertaken in the area, irrespective of the installation of advanced technologies by the facilities. Facilities were required to establish communication forums and meet at regular intervals with the public. During these meetings industry explained the processes-flow and informed the public representatives of planned upgrades and improvements. The WCDM is confident that conditions will improve through continuous engagement and good public communication.

During this period, complaints with regards to iron ore dust increased in the Saldanha Bay region. The complaints were mostly related to iron ore storage and handling in the area. The WCDM and DEA&DP have worked co-operatively to address the matter via the atmospheric emission licensing process and its associated compliance monitoring and enforcement. Authorities are therefore actively engaging with industry to reduce iron ore dust emissions in the area.

Recent complaints have been lodged with both the WCDM and DEA&DP in terms of manganese storage and handling in the area. Authorities have investigated the complaints, and have resolved that airshed planning, linked to the Precautionary Principle of NEMA, will be required to address all ore storage and handling in the Saldanha Bay region. In the absence of the requirement of an authorisation, authorities have resolved to apply the Section 28 – Duty of Care Principle in terms of the NEMA. These undertakings have been communicated to the public at the Greater Saldanha Bay IGTT Authorities and Public meetings, convened by the DEA&DP in 2016. The public, however, should note that airshed planning is complex and will require time for authorities to make informed decisions for the region.

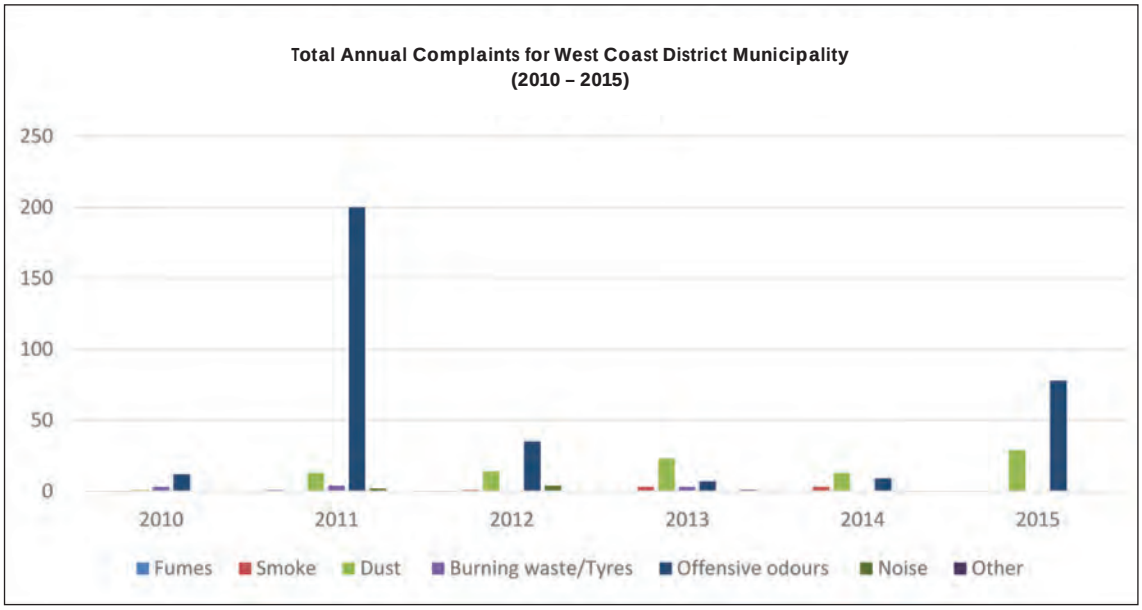


FIGURE 8-2: TOTAL COMPLAINTS RECEIVED BY THE WEST COAST DISTRICT MUNICIPALITY (2010 – 2015)

8.3.4 COMPLAINTS HANDLING: CAPE WINELANDS DISTRICT MUNICIPALITY

Air quality complaints in the Cape Winelands District Municipality (CWDM) were mostly odour, noise and agricultural (dust, crop spraying, farmland/tyre burning) related (Figure 8-3). Due to the nature of complaints, particularly with regards to crop spraying and agricultural burning, the CWDM expressed the need for a harmonized legislative approach between the different Departments, which has been explored with the Department of Agriculture.

The CWDM has also established an Industrial Air Quality Forum in May 2011 to ensure appropriate discussion on air quality compliance and the relevant legislative requirements in terms of air quality management in the region.

Odour related complaints, particularly in the Breede Valley Municipal region has required that the CWDM and DEA&DP set up an IGTT to investigate the conditions of authorisation for a Category 10: Animal Matter Processing listed activity; which has since been resolved.

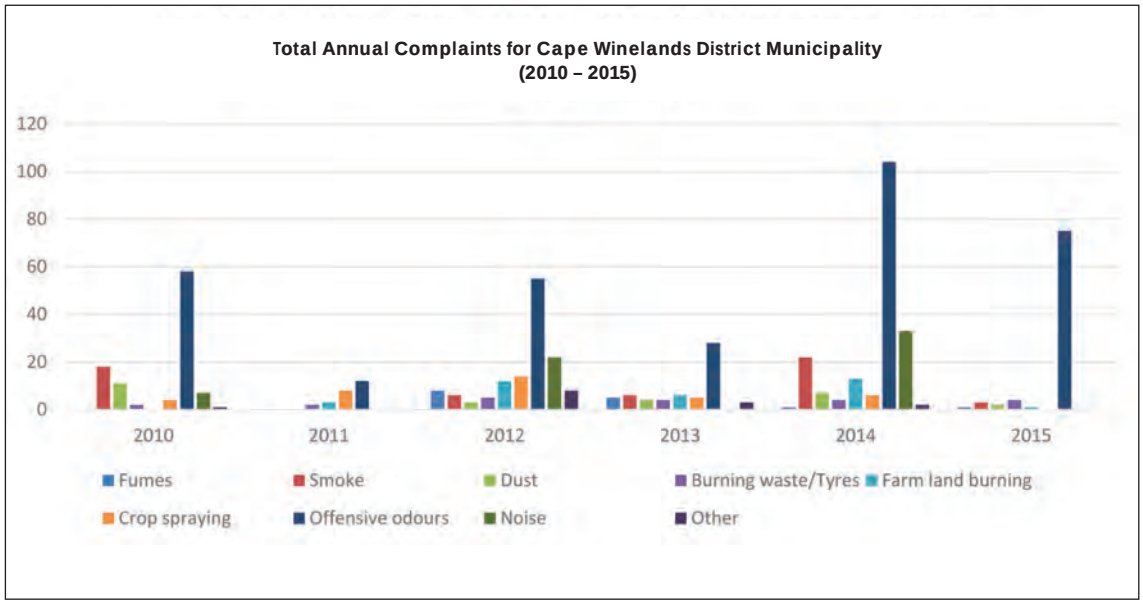


FIGURE 8-3: TOTAL COMPLAINTS RECEIVED BY THE CAPE WINELANDS DISTRICT MUNICIPALITY (2010 – 2015)

8.3.5 COMPLAINTS HANDLING: CENTRAL KAROO DISTRICT MUNICIPALITY

The Central Karoo District Municipality (CKDM) has received very few air quality related complaints (Figure 8-4). Complaints received comprised mostly of noise, offensive odour and waste/tyre burning, particularly at the Beaufort West refuse site. These matters were investigated and resolved by the CKDM.

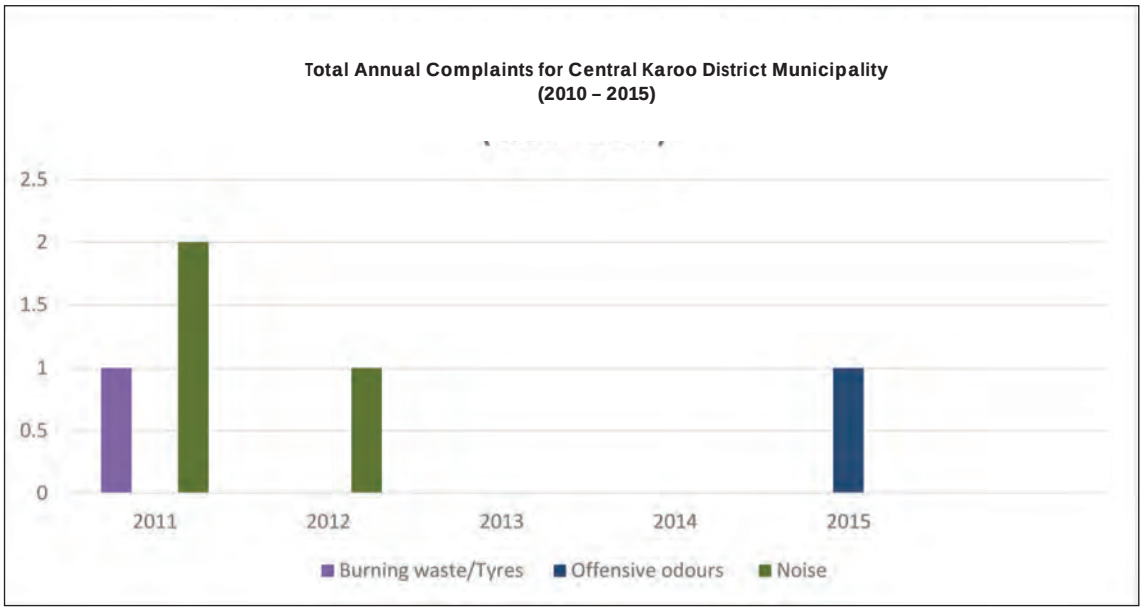


FIGURE 8-4: TOTAL COMPLAINTS RECEIVED BY THE CENTRAL KAROO DISTRICT MUNICIPALITY (2010 – 2015)

8.3.6 COMPLAINTS HANDLING: OVERBERG DISTRICT MUNICIPALITY

The Overberg District Municipality (ODM) has received complaints comprising mostly of offensive odour, followed by dust, smoke from waste and land burning, as well as noise (Figure 8-5). These matters were investigated and resolved by the ODM.

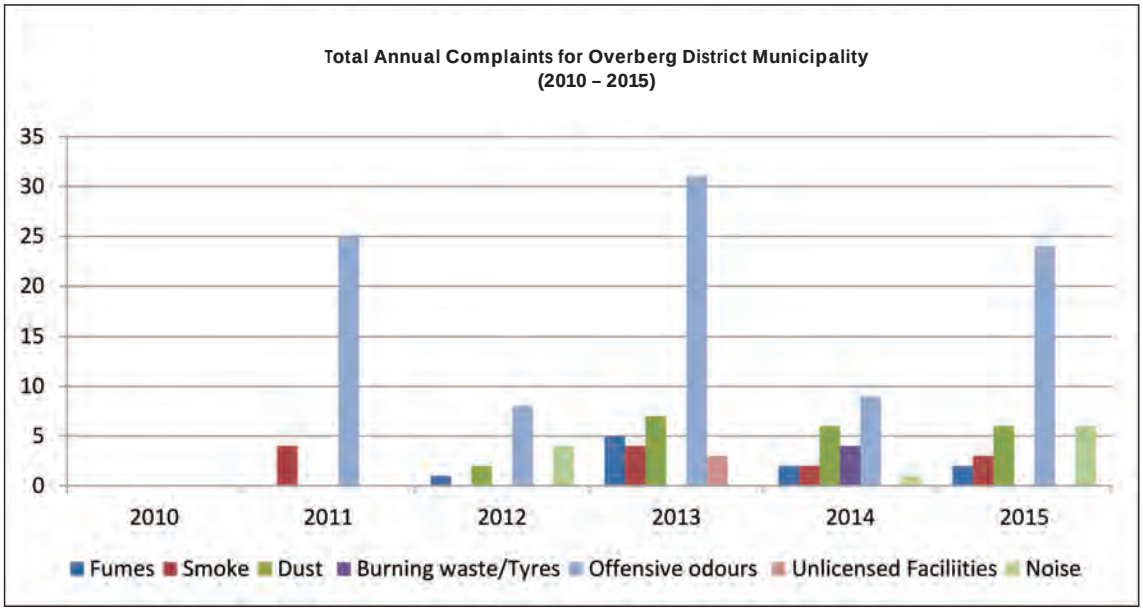


FIGURE 8-5: TOTAL COMPLAINTS RECEIVED BY THE OVERBERG DISTRICT MUNICIPALITY (2010 – 2015)

8.3.7 COMPLAINTS HANDLING: CITY OF CAPE TOWN

Overall, air quality complaints in the City of Cape Town (CCT) comprised mostly of noise, fumes, odour and farmland/tyre/waste burning (Figure 8-6).

During the period 2010 – 2015, the CCT conducted compliance and enforcement actions investigations on the following activities:

- galvanising facilities;
- illegal foundry operators;
- metal spray operators; and
- hazardous waste incinerator operators.

Complaints cases related to amongst other, odour emissions and nuisance smoke, were referred to the Director: Public Prosecutions for consideration for prosecution. Numerous By-law enforcement actions were also undertaken during the reporting period.

The CCT reported in 2015 that their three diesel vehicle emission testing teams conducted daily roadside vehicle testing operations; in excess of 7000 vehicles were tested. It was also noted that the vehicle emission failure rates have dropped to below 1% for all vehicles tested during the period.

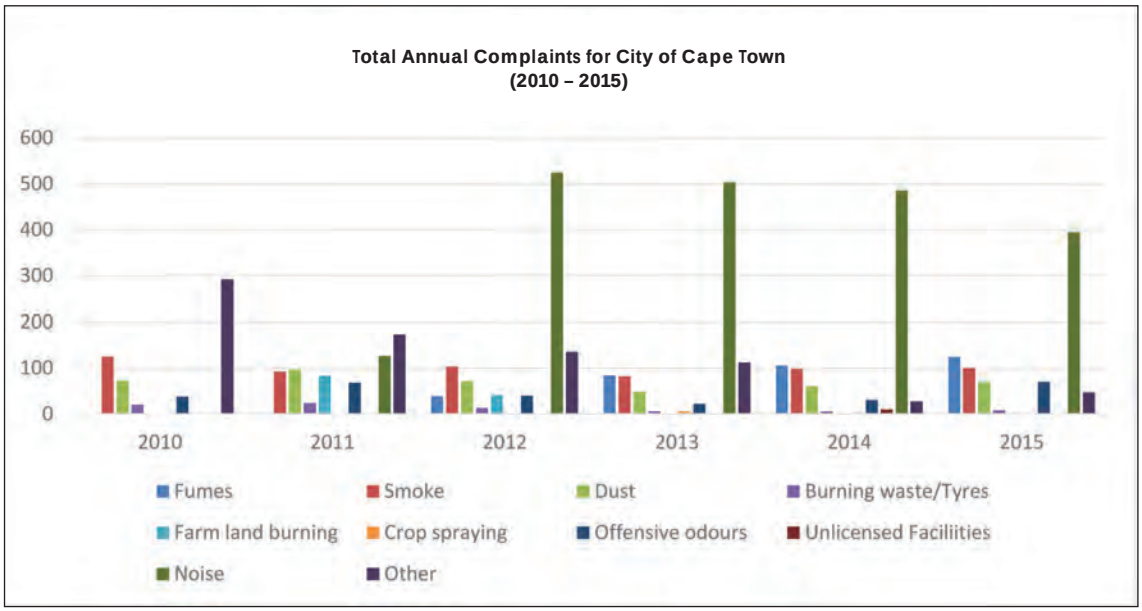


FIGURE 8-6: TOTAL ANNUAL COMPLAINTS RECEIVED BY THE CITY OF CAPE TOWN (2010 – 2015)

Photograph by: J. Leaner

Photograph by: D. Hendricks

9. EMISSIONS INVENTORIES

In terms of Sections 12 (b-c) and 43(l) of the NEM: AQA, the Minister must prescribe the manner in which:

a) measurements of emissions from point, non-point or mobile sources must be carried out; and

b) the format in which such measurements must be reported on and the organs of state to whom such measurements must be reported to.

This Chapter provides an overview of the inventories developed at Provincial and Municipal level in the Western Cape.

9.1 WESTERN CAPE AIR POLLUTANT AND GREENHOUSE GAS INVENTORY

The Department of Environmental Affairs and Development Planning (DEA&DP) developed the Western Cape Emissions Inventory during 2006, which was limited to fuel burning equipment. The DEA&DP expanded this into the Western Cape Air Pollutant and Greenhouse Gas Inventory during 2011. The inventory houses data on point, non-point and mobile sources of air pollution in the Province. This information was subsequently made available to the National Department of Environmental Affairs (DEA) for developing and populating the National Atmospheric Emissions Inventory System (NAEIS; see Chapter 8).

Moreover, the DEA, notified authorities of their intention to develop an additional system for atmospheric emission licensing to enhance the function of the NAEIS and to aid in the processing of Atmospheric Emission Licenses (AELs). As previously indicated, the NAEIS is an online national atmospheric emissions monitoring and reporting system, with the purpose to provide accurate, current and complete information on all significant sources of identified atmospheric emissions, including greenhouse gas (GHG) emissions.

The DEA&DP assisted in the reporting of sources to the NAEIS during the initial phase of implementation; only facilities in possession of a PAEL or AEL were considered in the process.

During 2013, officials of the DEA&DP Directorate: Air Quality Management (D: AQM) attended "NAEIS Train the trainer" workshops, which intended to enable officials to capacitate themselves and provide training to facility or authority users on the online system. Feedback from workshops held in 2013 indicated that the proposed NAEIS system implementation must take place at the industry (source) level, with the authorities being responsible for auditing, management and reporting on emission sources. It was also proposed that reporting obligations with regard to industry be included as part of the AQMP and AEL process to aid in overall reporting efficiency. During 2014, the DEA&DPs air quality officials provided basic training to facilities and authorities on the NAEIS online system; while user guidelines were provided by the DEA on the NAEIS system during the testing phase.

In 2015, air quality officials from the DEA&DP investigated the manner in which the air quality data could be presented in a way that could be automated to optimize business processes. The process for the development of a dashboard was identified and its development is currently in progress. It is envisaged that the dashboard be a dynamic reporting environment that is constantly enhanced, as required by the air quality management function. Furthermore, it will add value to the decision making chain by supporting the air quality management and climate change functions, with strategic information that will assist with all aspects of

the management, monitoring and planning of air quality management and climate change activities in the Western Cape.

It is envisaged that improved management of the Western Cape's Air Pollutant and Greenhouse Gas Emissions Inventory will be attained using NAEIS, particularly as it provides the ability for authorities to manage the reporting online; reports can be used to inform economic development within the Province. With the promulgation of the National Atmospheric Emissions Reporting Regulations, the DEA&DP has conducted various capacity-building workshops for authorities and facilities, such as, but not limited to, the following:

- NAEIS Training Workshop in Saldanha Bay (WCDM) to train the industry on the use of the NAEIS;
- Facilitated a NAEIS Training Workshop in Moorreesburg (WCDM) presented by DEA to assist the industry on the use of the NAEIS;
- Facilitated a NAEIS Training Workshop in the City of Cape Town (CCT), presented by DEA, to assist authorities on the use of the NAEIS.

The Western Cape Air Pollutant and Greenhouse Gas Emissions Inventory and NAEIS platform can also be used as a decision-supporting tool to inform air quality management planning in the Western Cape. This is to be used in an effort to produce accurate air quality dispersion modelling results, through the necessary air quality dispersion modelling tools.

A synopsis of the different sources of air pollutants in the Western Cape Air Pollutant and Greenhouse Gas Emissions Inventory is provided below.

9.1.1 POINT SOURCES

Point sources are "stationary sources", occupying a very small area and having a concentrated output. It includes smoke stacks of power plants, manufacturing facilities (factories) and waste incinerators, as well as furnaces and other types of fuel-burning heating devices.

The Western Cape Emissions Inventory mainly focuses on these sources since it can be managed via the Section 21 Listed Activities and the Section 23 Controlled Emitters of the NEM: AQA. Furthermore, information on fuel burning appliances can be obtained from most Local Municipalities.

- **EMISSION ESTIMATIONS FROM POINT SOURCES**

  An emission estimation calculation was used to determine the emissions from fuel burning appliances in the Province. The estimated pollution loads from the various point sources in the Western Cape were calculated based on production rates of operations (excluding emissions from petrol/diesel filling stations). Emission estimations showed that the total pollution load is driven mostly by CO_2 emissions from the industries (see Section 9.4). As CO_2 is a GHG, its load from the industries concerned needs to be addressed in terms of reducing overall GHG emissions in the Province, and the country.

  Currently, the Western Cape Government is integrating its focus on GHG emissions, air quality management and climate change, in order to honour its reporting obligations to the National DEA, and hence all relevant international agreements.

9.1.2 AREA SOURCES

Area sources of pollution which emit a substance or radiation from a specified area. These include small industrial sources that fall below the "major source" threshold, where emissions are not emitted through an identifiable source. These sources include dust and controlled burn practices in agriculture and forestry management.

Area source inventories generally report emissions as categories rather than individual sources, which is a common approach in terms of reporting area source emissions. Quantification of emissions from area sources (e.g. landfills, animal feedlots, formal and informal residential

areas, etc.) contribute to the determination of total emission load.

The Western Cape Air Pollutant and Greenhouse Gas Emissions Inventory was updated to include all known landfill facilities, as well as the wastewater treatment works in the Province. Area sources within the inventory include brickfields. It was, however, not possible to calculate emissions from the latter sources, and are therefore not included in the calculations.

9.1.3 MOBILE SOURCES

Mobile sources include both on-road (such as cars, trucks and buses) and non-road transportation (such as marine vessels, aircraft, agricultural and construction equipment).

9.1.3.1 ON-ROAD TRANSPORTATION

Information regarding the traffic count of licensed vehicles at 29 locations and that of unlicensed vehicles at 28 locations, respectively, were obtained from the National Department of Transport for the period ending 31 October 2009. This information provides an indication of the number of vehicles within a particular municipality. Emission estimation for on-road transportation in the emission inventory is required; however, further investigations will be needed in order to ascertain the impact of traffic/vehicle emissions on air quality in the Province. The Department envisages working co-operatively with the Department of Transport to further elucidate the impact of on-road transportation on air quality management and hence climate change in the Province.

9.1.3.2 AIRPORTS AND SEAPORTS

Emission information in terms of the major seaports of Mossel Bay, Cape Town and Saldanha Bay was were obtained for the period ending 31 December 2011. The ports manage maritime and commercial operations in the Western Cape. The location of all ports in the Western Cape is presented in Table 9-1, while an indication of the vessels entering and exiting the major ports is provided in Table 9-2.

The Transnet National Ports Authority (TNPA) manages and controls the Port of Cape Town, one of the busiest container ports in South Africa. The TNPA coordinates all port activities to take full advantage of each port's unique capabilities in terms of the handling of containers and general cargo. Furthermore, larger vessels utilize Cape Town or Durban where offshore bunkering facilities are available. Ports are key channels of sea borne trade, and invariably compete for ships passage. They often offer efficient methods of handling goods and having well developed corridors that link major economic surroundings. Approximately 10 shipping vessels enter the Cape Town harbour on a daily basis (Govender, 2012).

Mossel Bay is also an active harbour and caters mainly for the fishing industry and Mossgas since the late 1980s. The Mossel Bay harbour is the smallest of the commercial harbours along the South African coastline. An increasing number of ships for the emerging oil industry, including several oil rigs operate off Mossel Bay (Govender, 2012). Approximately 10 shipping vessels enter the Port of Mossel Bay on a daily basis (Govender, 2012).

The Port of Saldanha Bay is located ca. 60 nautical miles from Cape Town and is South Africa's main iron ore export harbor, with plans in place to increase throughput from the current 31 to 50 million tons per annum. A highly mechanised ore handling plant at a bulk handling terminal remains the largest and most important facility at the Port while a multi-purpose terminal is also used for handling other material at the Port. Overall, the Port of Saldanha Bay plays a large role in the iron ore industry, and is South Africa's main iron ore export harbour.

Browning (2006) indicated that marine emissions originate primarily from diesel engines operating on ocean going vessels, tugs and tows, dredges, and other vessels operating within a port area. It is therefore important that the emissions from ships entering, leaving, and idling in the ports is the primary source of emissions and must be addressed.

TABLE 9-1: LOCATION OF ALL PORTS IN THE WESTERN CAPE

NO.	NAME OF PORT/HARBOUR	DISTRICT MUNICIPAL AREA	LOCAL MUNICIPAL AREA
1.	PORT OF MOSSEL BAY	Eden Municipality	Mossel Bay
2.	PORT OF SALDANHA	West Coast	Saldanha Bay
3.	PORT OF CAPE TOWN	City of Cape Town	City of Cape Town
4.	HOUT BAY HARBOUR	City of Cape Town	Hout Bay
5.	KALK BAY HARBOUR	City of Cape Town	Kalkbay
6.	HERMANUS HARBOUR	Overberg District	Overstrand
7.	LAMBERTS BAY HARBOUR	West Coast Municipality	Lamberts Bay
8.	MOUILLE POINT MARINA	City of Cape Town	City of Cape Town
9	KNYSNA HARBOUR	Eden Municipality	Knysna
10.	GANS BAY HARBOUR	Overberg District	Cape Agulhas
11.	STRUIS BAY HARBOUR	Eden Municipality	Langerberg
12.	SIMONS TOWN HARBOUR	City of Cape Town	City of Cape Town
13.	ROBBEN ISLAND HARBOUR	City of Cape Town	City of Cape Town
14.	KOEBERG NUCLEAR POWER STATION	City of Cape Town	City of Cape Town

TABLE 9-2: NUMBER OF SHIPPING VESSELS ENTERING THE PORTS OF CAPE TOWN, MOSSEL BAY AND SALDANHA BAY

TYPE OF SHIPPING VESSEL	DESCRIPTION OF SHIPPING VESSELS USAGE	CAPE TOWN	MOSSEL BAY	SALDANHA BAY
GENERAL CARGO/ WORKING	Vessels loaded with cargo sailing or delivering supplies.	268	1	49
TANKER	Bulk carriers designed to transport liquid cargo, most often petroleum products.	180	108	14
PASSENGER	Vessels carrying passengers, which operates between scheduled times.	30	-	-
CAR/VEHICLE CARRIERS	Vessels that transport vehicles into the Port & out	2	-	-
TRAWLERS	Vessels used for fishing.	217	514	16
FOREIGN FISHING VESSELS	Vessels that transport fresh fish into the harbour.	356	47	5
COASTERS(BONA FINE)/LAY-BY	Vessels that usually wait for cargo or a charter, often laying outside a port.	49	36	1
BUNKERS	Fuel consumed by the engines of a ship; compartments or tanks in a ship for fuel storage.	219	3	331
CONTAINERS	Vessels designed to handle container cargo. A fully cellular container ship is one that carries no cranes & is reliant on shore-based cranes for loading & discharging.	963	-	7
OTHER	Any vessel other than shipping, e.g. oil rigs, Hopper Barge, Naval Vessels, Tug etc.	235	241	22

Information on 90 airports located in the Western Cape was received from the Civil Aviation Authority, Johannesburg and Airports Company South Africa (ACSA). The various airports and seaports identified in the Western Cape are illustrated in Figure 9-1, below. The airports range from small landing strips to major airports in the Western Cape.

FIGURE 9-1: THE LOCATION OF AIRPORTS AND SEAPORTS IN THE WESTERN CAPE

9.2 MODEL READY DATA

The newly acquired atmospheric emission licensing process by Provincial and Local Government necessitated a linkage with the Emissions Inventory process. As such, industry participation and an understanding of the data requirements for air quality modelling became critical. In this regard, the DEA&DP conducted two workshops during 2011 to illustrate the use of an Emissions Inventory reporting toolkit, while engaging with industry on the required reporting format / template.

The minimum requirements for the reporting toolkit included the following:

- Actual emission rates (g/s), per stack, for all relevant pollutants required;
- Emissions concentrations (g/Nm^3 and g/Am^3) required;
- Description gas parameters (O_2 %, moisture) required;
- Descriptive stack parameters (each stack) required; and
- Accurate stack coordinates (each stack) required.

Ideally, emission reporting should not only include air emissions from stacks related to the Section 21 Listed Activities of the NEM: AQA, but should include all sources of air emissions. Such inclusion would provide an understanding of the overall impact of all sources of air emissions on the surrounding environment.

The data in the Western Cape Air Pollutant and Greenhouse Gas Emissions Inventory was analysed in various modeling programmes, in order to determine the best approach for reporting on air emissions in the Province.

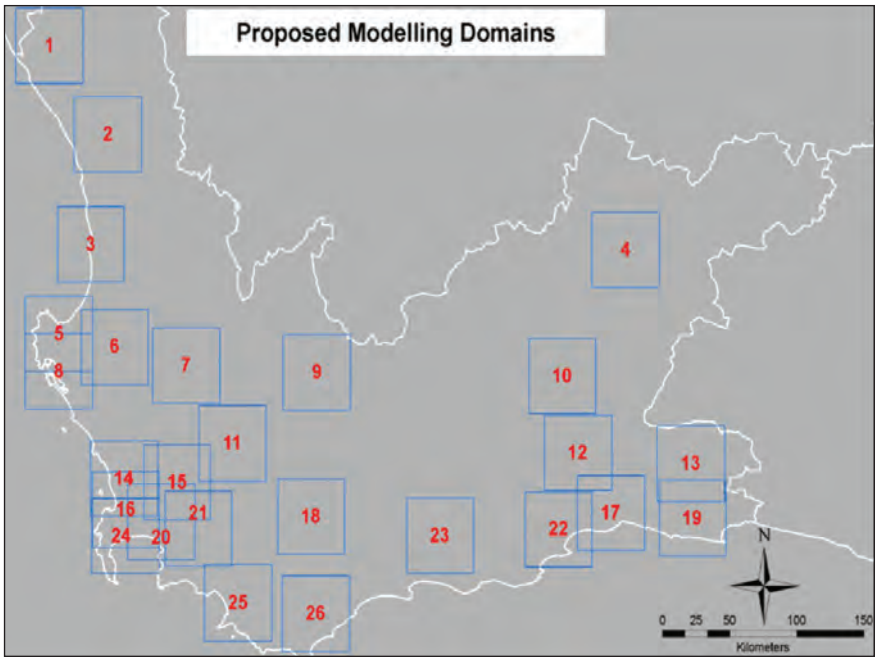
In recent years, various dispersion modelling tools have been developed for use in air quality modelling. Of these models, the DEA has identified CALPUFF and AERMOD dispersion model software, amongst others, as the preferred systems for South Africa.

In December 2010, the DEA&DP appointed a service provider to develop model ready data sets for use with CALPUFF and AERMOD, in order to perform atmospheric dispersion modeling in areas throughout the Province. The main aim of the model ready data sets is to support and inform all atmospheric dispersion modelling that are undertaken for regulatory impact analysis and emission trends within the Province. Additional flexibility in how they submit air emission data will increase the efficiency with which Licensing Authorities are able to conduct an air quality model simulation, using meteorological input, exclusively from a prognostic grid model. An advantage of modelled meteorology datasets is that it is consistent with regional modeling applications, and is less costly than to develop real-time and forecasting applications.

The modelling tools, viz. CALPUFF and AERMOD, were adopted by the United States Environmental Protection Agency (USEPA) as a preferred model for assessing long range transport of air pollutants and their impacts on priority areas, and on a case-by-case basis for certain near-field applications involving complex meteorological conditions. CALPUFF is designed to simulate the dispersion of buoyant, puff or continuous point and area pollution sources, as well as the dispersion of buoyant, continuous line sources and the AERMOD atmospheric dispersion modelling system is an integrated system that includes a dispersion model designed for short-range (up to 50 kilometers) dispersion of air pollutant emissions from stationary industrial sources. These models also include algorithms for modelling the effects of downwash created by the pollution plume flowing over nearby buildings and make use of pollutant, meteorological and terrain data. The models are also available at no cost to the licensing authorities and the regulated community.

A total of 26 air quality modeling domains were proposed throughout the Province (Figure 9-2). This was based on the location of potential sources, as identified in the Emissions Inventory. The specific domains allows for emissions scenario modeling, when proposed Section 21 Listed Activities of the NEM: AQA are applied for.

A graphical representation of its use is provided as two options in Figure 9-3 and Figure 9-4. The performance of both the CALPUFF and AERMOD modeling tools under various conditions must, however, be evaluated further by means of comparative studies.



NAME	ID#
BITTERFONTEIN	1
VREDENDAL	2
LAMBERT'S BAY	3
BEAUFORT WEST	4
CAPE COLUMBINE	5
LANGEBAANWEG	6
PORTERVILLE	7
GEELBECK	8
BREEDE RIVER	9
PRINCE ALBERT	10
WORCESTER	11
OUDSHOORN	12
UNIONDALE	13
ATLANTIS	14
WELLINGTON	15
PAROW	16
GEORGE	17
TYGERHOEK	18
PLETTENBERG BAY	19
STELLENBOSCH	20
ELGIN	21
MOSSEL BAY	22
RIVERSDALE	23
CAPE TOWN	24
HERMANUS	25
CAPE AGULHAS	26

FIGURE 9-2: AIR QUALITY MODELING POINT SOURCE DOMAINS IN THE WESTERN CAPE

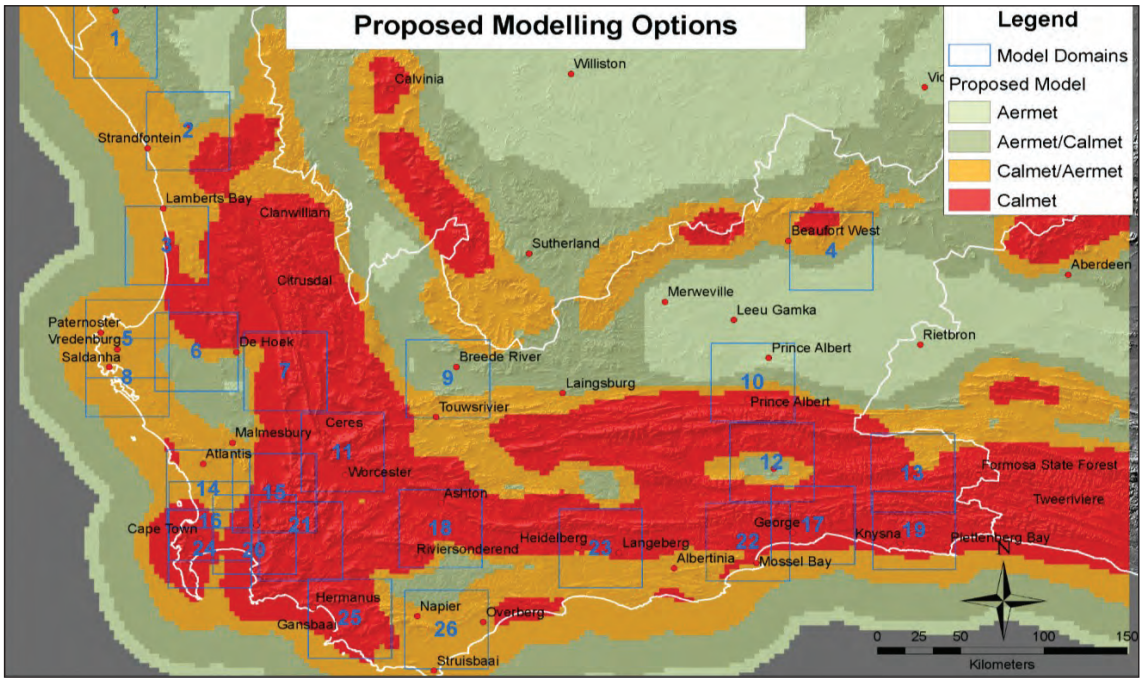


FIGURE 9-3: PROPOSED MODELING OPTION A

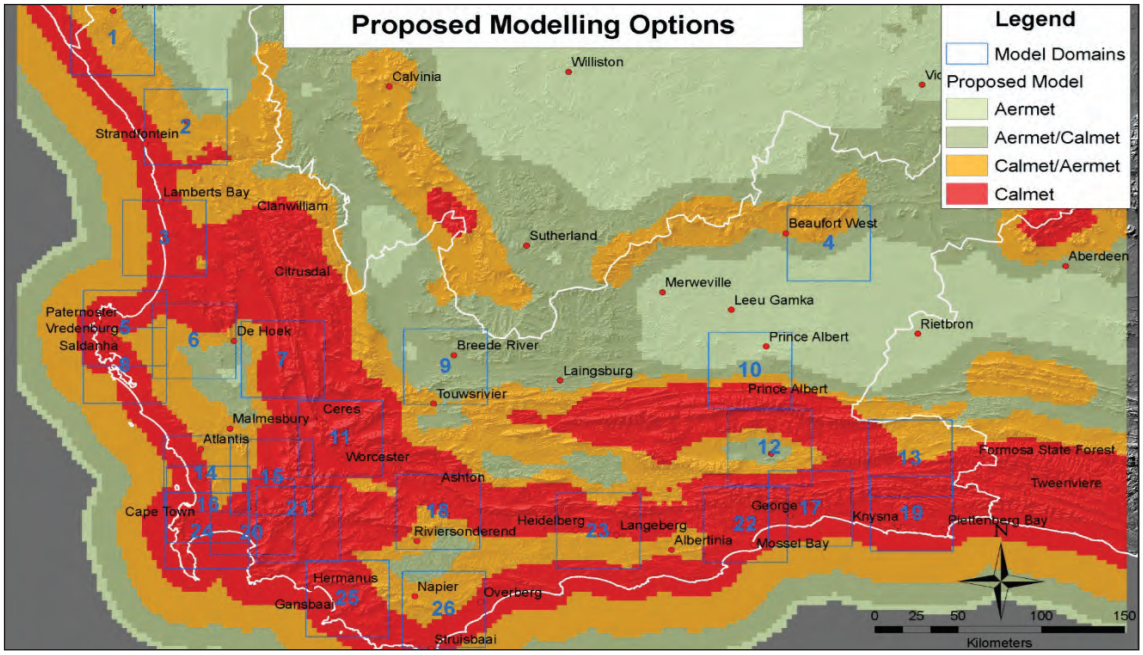


FIGURE 9-4: PROPOSED MODELING OPTION B

The following activities were undertaken as part of the model ready data set development:

- Physical verification of the Listed Activity;
- Sourced information to update the Emissions Inventory;
- Performed calculations to obtain production rates from the fuels combusted or used over a certain timeframe;
- Sourced production rates to estimate emissions based on emission factors for various processes; and
- Sourced air emission monitoring data from industry, where such data were collected.

The DEA&DP have received numerous requests for the use of the Model Ready Datasets for air dispersion modelling in the Western Cape. Although, the information is readily available, the Access to Information process has to be followed in order to obtain the datasets. Stakeholders interested in acquiring such information, can request it formally via the Promotion for Access to Information Act (Act No.2 of 2000; PAIA) process from the DEA&DP.

9.3 CLIMATE CHANGE INITIATIVES

Information from the Western Cape Air Pollutant and Greenhouse Gas Emissions inventory assisted parallel initiatives administered by the DEA&DP Directorate: Climate Change, that serve similar purposes. The projects were overseen by various Departments at all spheres of government, and include SAAQIS Phase II, Climate Change Energy Efficiency Project and the Mercury Emission Inventory Project. Investigations into the inclusion of GHG's within current emissions inventories is underway, in order to meet reporting requirements and South Africa's international obligations.

- **CLIMATE CHANGE ENERGY EFFICIENCY PROJECT**

  The DEA&DPs Directorate: Air Quality Management served as an integral part of the development of a Provincial Energy Balance and GHG inventory, as headed by the DEA&DP's Directorate: Climate Change. The purpose of this project was amongst others, to establish a baseline for monitoring and evaluation relating to Provincial commitments, as per the Western Cape White Paper on Sustainable Energy (DEA&DP, 2008) and national goals relating to the National Climate Change Response White Paper (DEA, 2011). The D: AQM contributed towards identifying the synergies between different work areas, and suggested actions to promote these synergies.

  The Western Cape Air Pollutant and Greenhouse Gas Emissions Inventory provided useful insight into where the 'hotspots' were, and important emissions activity spots for inclusion into the energy and GHG data collection. The Directorate: Climate Change has actively engaged with the Air Quality Officers at the quarterly Western Cape Air Quality Officers Forums, with the aim of informing the Licensing Authorities of the project and the important linkages with air quality management. Additionally, a database of the fuel usage within the Western Cape was provided in order to aid in the completion of the project.

  Ideally, emission reporting should not only include air emissions from stacks related to the Section 21 Listed Activities of the NEM: AQA, but should include all sources of air emissions, such as that from vehicles, agricultural, residential, etc. Such inclusion would provide an understanding of the overall impact of all sources of air emissions on the surrounding environment.

9.4 MUNICIPAL EMISSION INVENTORIES

Emission inventories were compiled during 2014 to show the estimated yield for PM_{10}, SO_2, NO_x, CO and VOCs per category of Section 21 Listed Activities in each Municipal region in the Western Cape. A synopsis of the emissions estimated in the Municipal emission inventories, as well as activities implemented in respect of reducing emissions in the various Municipal regions, is provided below.

- **CITY OF CAPE TOWN**

  The total estimated emissions (kg / annum) in respect of PM_{10}, SO_2, NO_x, VOC and CO from all Section 21 Listed Activities in the City of Cape Town is presented in Table 9-3. The estimated emissions of all pollutants, expressed as a percentage (%) per Section 21 Listed Activity category in the City of Cape Town, are presented in Figures 9-5 to 9-9. Estimated emissions were negilible in certain listed categories, viz. SO_2 emissions were neglible in the metallurgical industry (Figure 9-6); while CO emissions were neglible in most industries, except the mineral and metallurgic industries (Figure 9-8); and VOC emissions were neglible in all industries, except the metallurgic and petroleum industries (Figure 9-9).

The total estimated emissions (kg / annum) in respect of CO_2, N_2O, CH_4, $PM_{2.5}$, PM_{10}, SO_2, NO_x, CO, Benzene and VOCs from unlisted activities in the City of Cape Town are presented in Table 9-4. Overall, estimates of CO_2 emissions were the highest, followed by NO_x, PM_{10}, CO, SO_2, $PM_{2.5}$ and then VOC and other emissions.

TABLE 9-3: ESTIMATED EMISSIONS FROM SECTION 21 LISTED ACTIVITIES IN THE WESTERN CAPE (KG / ANNUM)

DISTRICT MUNICIPALITY	PM_{10}	SO_2	NO_x	VOC	CO
CAPE WINELANDS	50 425	64 665	25 486	236 620	13 689
CITY OF CAPE TOWN	2 767 037	15 301 562	4 382 425	1 465 096	1 501 385
EDEN	1 626 296	6 624 969	5 310 474	503 626	1 439 350
WEST COAST	1 528 822	7 694 044	6 733 757	627 991	1 335 007

TABLE 9-4: ESTIMATED EMISSIONS FROM UNLISTED ACTIVITIES IN THE WESTERN CAPE (KG / ANNUM)

DISTRICT MUNICIPALITY	CO_2	N_2O	CH_4	PM_{10}	NO_x	SO_2	VOC	BENZENE	CO	$PM_{2.5}$
CAPE WINELANDS	658 666 181	12 808	17 021	507 947	788 820	6 791 709	2 015 615	2 130	1 121 517	329 678
CENTRAL KAROO	788 245	14	6	215	618	9 988	8	0	1 346	70
EDEN	497 623 976	16 727	630 398	763 682	1 431 378	1 146 023	32 246	80 644	2 981 839	647 649
OVERBERG	97 023 369	2 307	5 027	80 693	137 298	817 395	3 087	738	212 210	60 539
WEST COAST	541 247 608	9 312	4 484	708 328	3 035 974	7 389 887	44 362	1 521	450 193	222 701
CITY OF CAPE TOWN	268 957 797	4 514	2 870	287 206	320 615	198 195	23 679	1 245	255 264	195 396

In terms of managing air quality, the City of Cape Town's Air Quality Management Unit has three dedicated diesel vehicle emissions testing teams, comprising of a Diesel Vehicle Testing Officer and a Senior General official per team. The teams operate on a daily basis and perform roadside testing of compression ignition vehicles at predetermined testing sites in partnership with the City of Cape Town's Traffic Services. This programme was initiated in 2000. By 2015, in excess of 7000 vehicles were tested; with vehicle failure rates having reduced to below 1% of all vehicles tested.

The City of Cape Town has compiled an inventory of fuel burning appliances. The City of Cape Town Air Quality Management By-law (2016) indicates that owners of all fuel burning appliances are required to apply for a permit to install, alter, extend or replace a fuel burning appliance. The permit approval process requires consultation with stakeholders, followed by the final approval, which has been delegated to the air quality officer.

The majority of approvals granted related to the installation of LPG fueled burners, paraffin fueled appliances; wood; heavy fuel oil burners; coal and various other fuelled appliances.

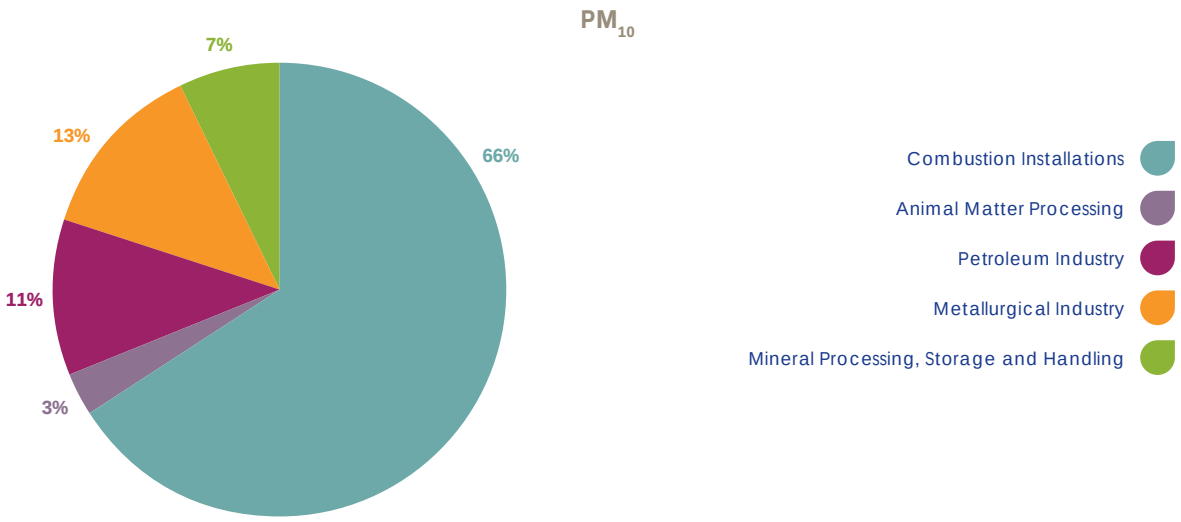


FIGURE 9-5: ESTIMATED PM_{10} EMISSIONS PER SECTION 21 LISTED ACTIVITY CATEGORY (%)

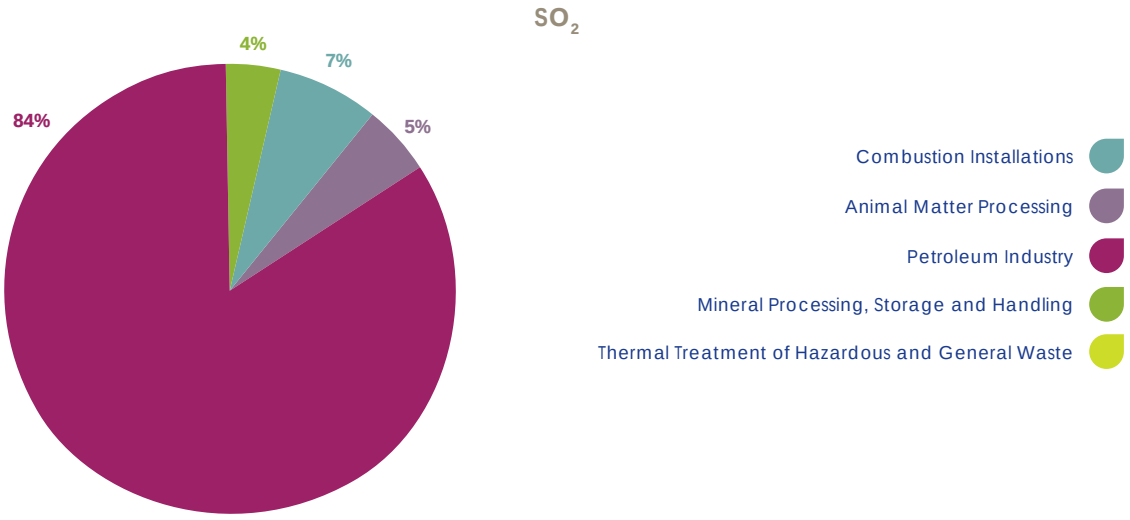


FIGURE 9-6: ESTIMATED SO_2 EMISSIONS PER SECTION 21 LISTED ACTIVITY CATEGORY (%)

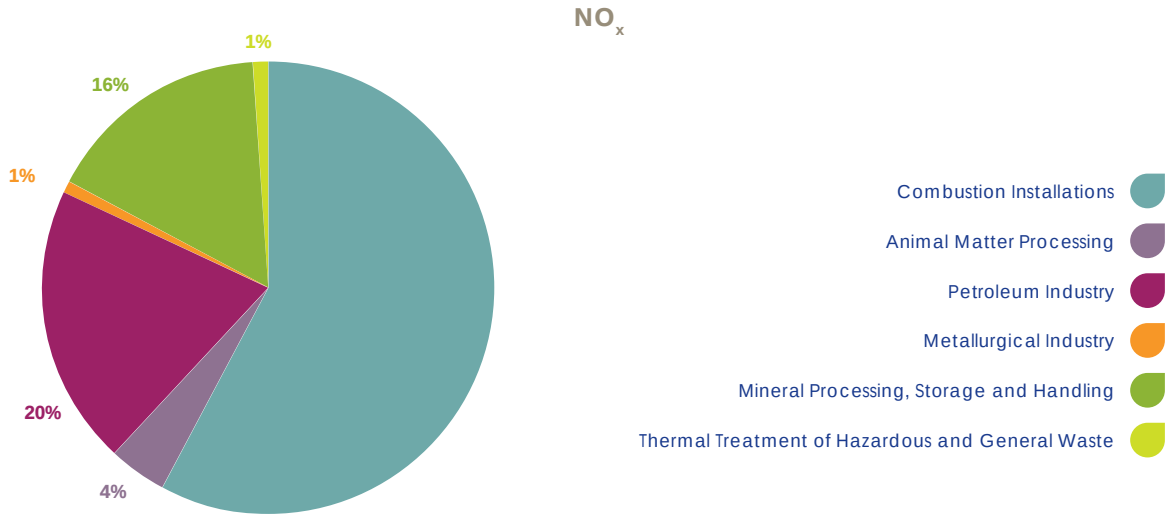


FIGURE 9-7: ESTIMATED NO_x EMISSIONS PER SECTION 21 LISTED ACTIVITY CATEGORY (%)

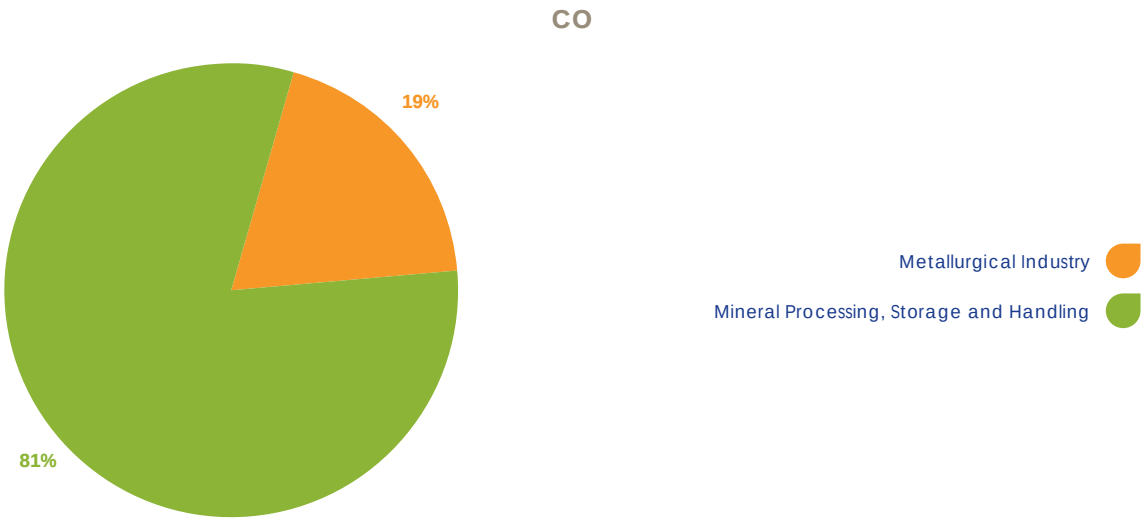


FIGURE 9-8: ESTIMATED CO EMISSIONS PER SECTION 21 LISTED ACTIVITY CATEGORY (%)

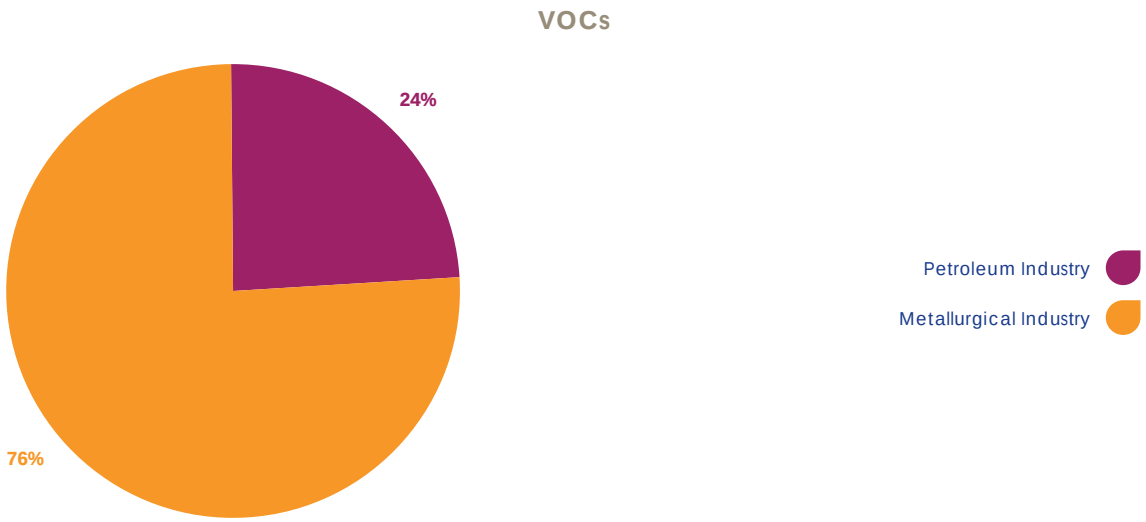


FIGURE 9-9: ESTIMATED VOC EMISSIONS PER SECTION 21 LISTED ACTIVITY CATEGORY (%)

- **EDEN DISTRICT MUNICIPALITY**

  The Eden District Municipality has developed an emissions inventory for all its air quality activities, including fuel filling stations. Other sectors are small boilers and fuel burning appliances, spray painting industry and the sand blasting sector (Schoeman, 2012).

  The total estimated emissions (kg / annum) in respect of PM_{10}, SO_2, NO_x, VOC and CO from all Section 21 Listed Activities in the Eden District Municipality are presented in Table 9-3. The estimated emissions of all pollutants, expressed as a percentage (%) per Section 21 Listed Activity category in the Eden District Municipality, are presented in Figures 9-10 to 9-14. Estimated emissions were negilible in some listed categories, viz. SO_2 emissions were neglible in all industries, except the petroleum and animal matter processing industries (Figure 9-11); while for NO_x, CO and VOC, the emissions were neglible in all industries, except the animal matter processing, petroleum and coal gasification industries (Figure 9-12 to Figure 9-14).

  The total estimated emissions (kg / annum) for CO_2, N_2O, CH_4, $PM_{2.5}$, PM_{10}, SO_2, NO_x, CO, Benzene and VOCs for unlisted activities in the Eden District Municipality are presented in Table 9-4. For the Eden District Municipality, it is evident that CO_2 emissions were estimated to be the highest, followed by CO, NO_x, SO_2, PM_{10}, VOC and then $PM_{2.5}$ and other emissions. The Eden District Municipality has trained all their registered industries on the NAEIS system. By 2015, all industries were confirmed and 11 reports have been submitted. The industry reports were reviewed and audited by the Eden District Municipality, as required.

In terms of managing its air quality, the Eden District Municipality procured a vehicle smoke check sampler, as vehicle transport emissions were highlighted in the Eden Air Quality Management Plan as a priority, especially in the Lakes region where the N2 National Road passes the towns of Knysna and Plettenberg Bay.

The Eden District Municipality has also embarked on a project where all its diesel vehicle fleet were tested for excessive smoke emissions. This project was rolled out in Oudtshoorn, George, Knysna, Plettenberg Bay and Riversdale. The test results revealed that 80% of the Eden District Municipality's fleet complied with the SA Standards (RSA, 2009). The project was further rolled out to industry, resulting in the vehicles from major industries in the area being tested. Furthermore, the Knysna Municipality has also requested the Eden District Municipality to test their vehicle fleet during 2011.

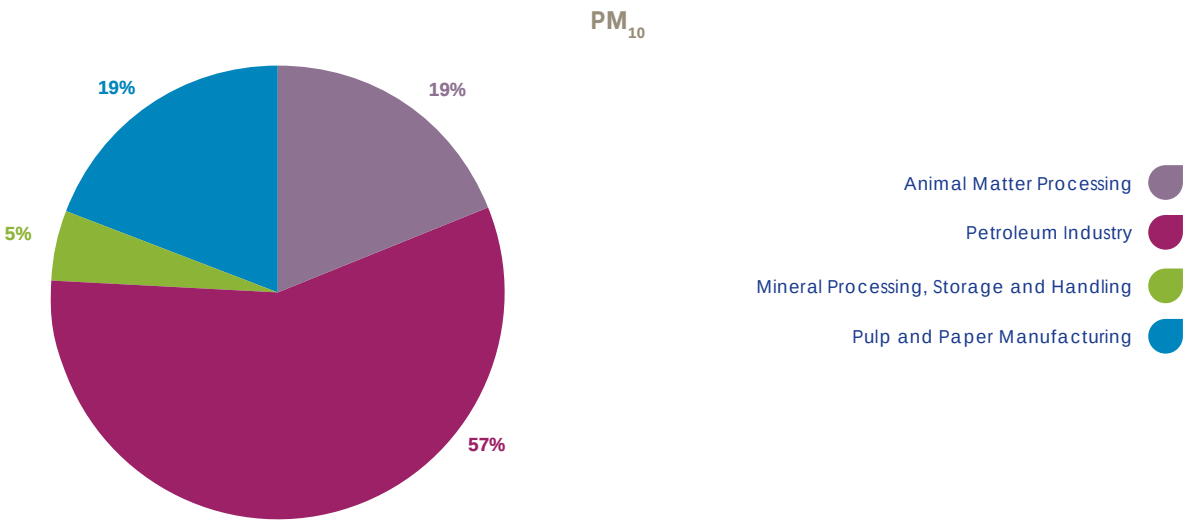


FIGURE 9-10: ESTIMATED PM_{10} EMISSIONS PER SECTION 21 LISTED ACTIVITY CATEGORY (%)

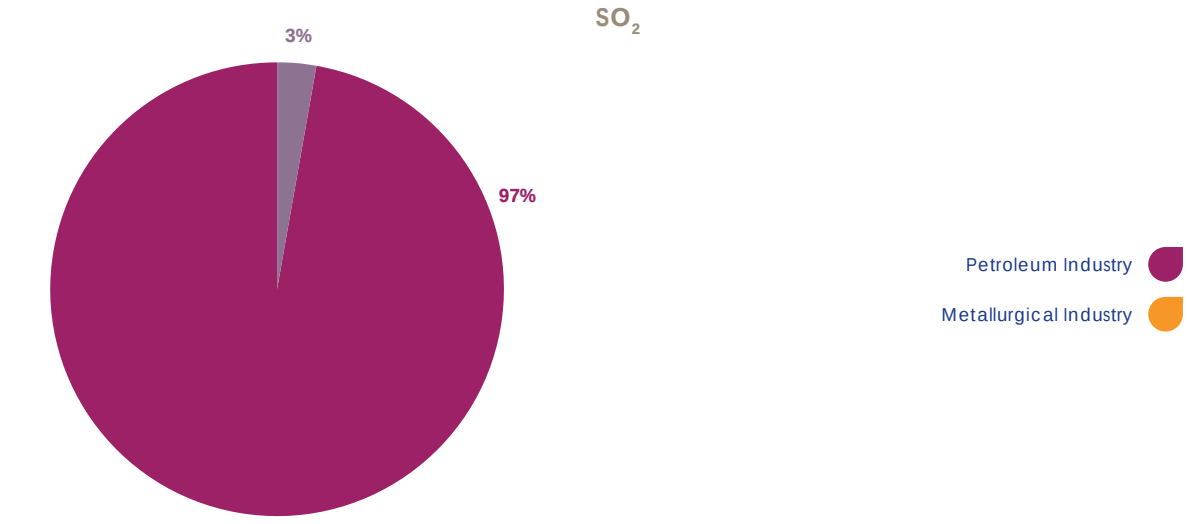


FIGURE 9-11: ESTIMATED SO_2 EMISSIONS PER SECTION 21 LISTED ACTIVITY CATEGORY (%)

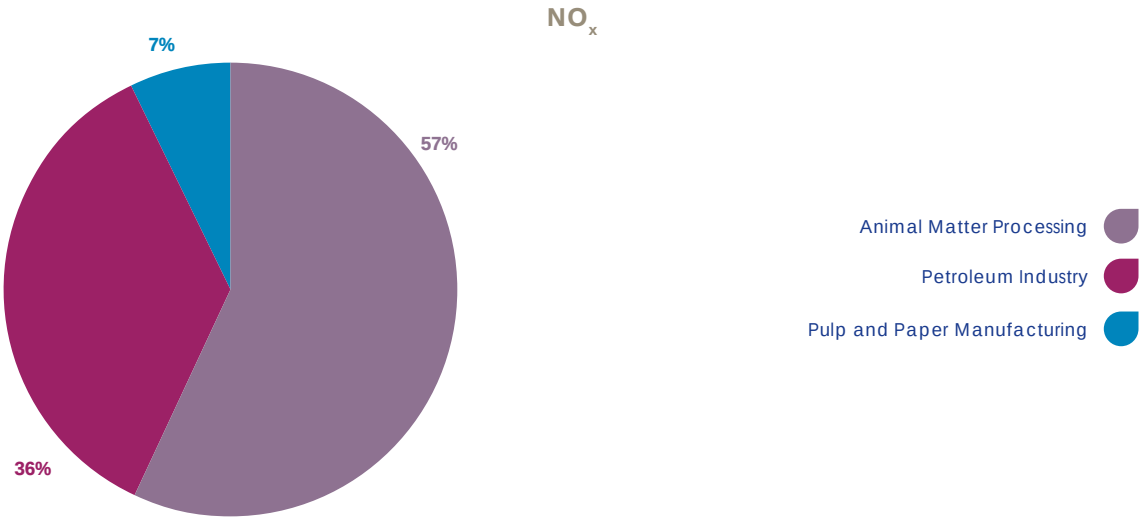


FIGURE 9-12: ESTIMATED NO_x EMISSIONS PER SECTION 21 LISTED ACTIVITY CATEGORY (%)

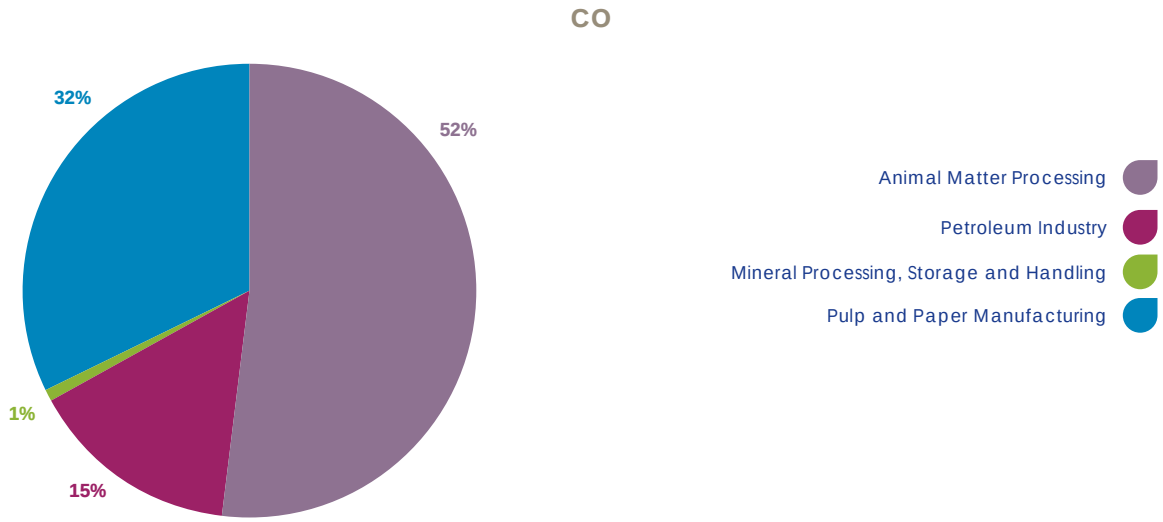


FIGURE 9-13: ESTIMATED CO EMISSIONS PER SECTION 21 LISTED ACTIVITY CATEGORY (%)

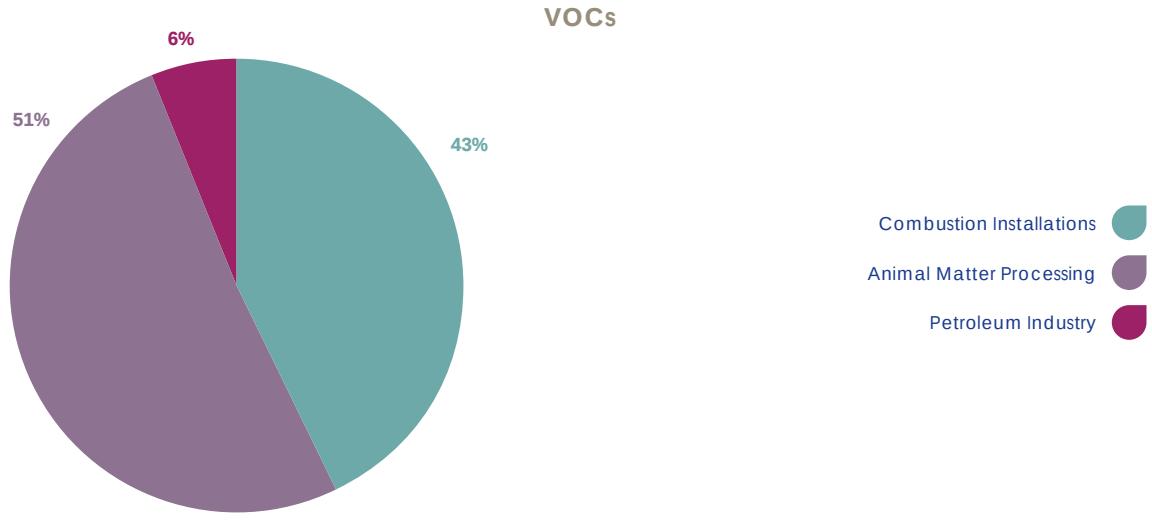


FIGURE 9-14: ESTIMATED VOC EMISSIONS PER SECTION 21 LISTED ACTIVITY CATEGORY (%)

WEST COAST DISTRICT MUNICIPALITY

During the development of the West Coast District Municipality AQMP, it was recommended that the Municipality's emissions inventory be updated on a continual basis. This, together with addressing human resource capacity to fulfil the air quality management function, were regarded as priority interventions; both have been addressed by the West Coast District Municipality.

Point and area sources for the West Coast District Municipality were reported in the Western Cape Air Pollutant and GHG Inventory. The total estimated emissions (kg / annum) of PM_{10}, SO_2, NO_x, CO and VOC from all Section 21 Listed Activities in the West Coast District Municipality are presented in Table 9-3. The estimated emissions of all pollutants, expressed as a percentage (%) per Section 21 Listed Activity category, are shown in Figures 9-15 to 9-19. Estimated emissions were negilible in some listed categories, viz. PM_{10}, NO_x and SO_2 emissions were neglible in all industries, except the mineral, metallurgical and animal matter processing industries (Figure 9-15 to Figure 9-17); while for CO and VOC, emissions were neglible in all industries, except the animal matter processing industry (Figure 9-18 and Figure 9-19).

The total estimated emissions (kg / annum) for CO_2, N_2O, CH_4, $PM_{2.5}$, PM_{10}, SO_2, NO_x, CO, Benzene and VOCs from unlisted activities are shown in Table 9-4. For the West Coast District Municipality, it is evident that CO_2 emissions were estimated to be the highest, followed by SO_2, NO_x, PM_{10}, CO, $PM_{2.5}$ and then VOC and other emissions.

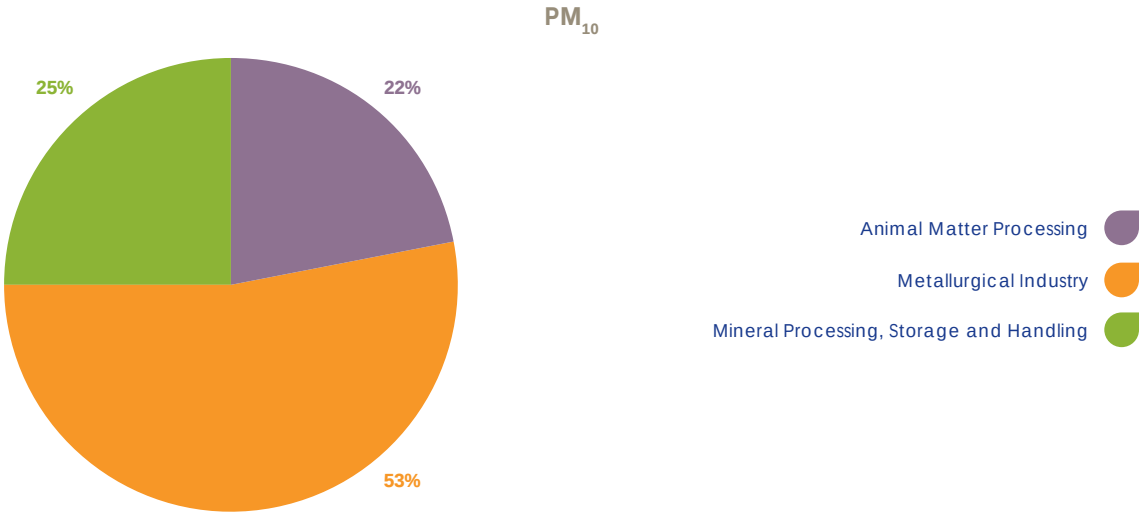


FIGURE 9-15: ESTIMATED PM_{10} EMISSIONS PER SECTION 21 LISTED ACTIVITY CATEGORY (%)

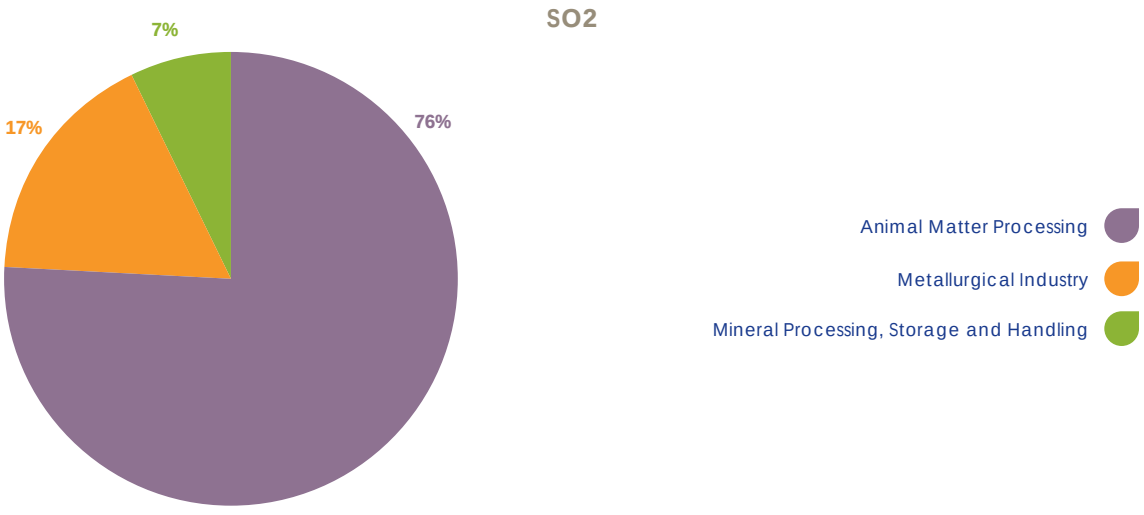


FIGURE 9-16: ESTIMATED SO2 EMISSIONS PER SECTION 21 LISTED ACTIVITY CATEGORY (%)

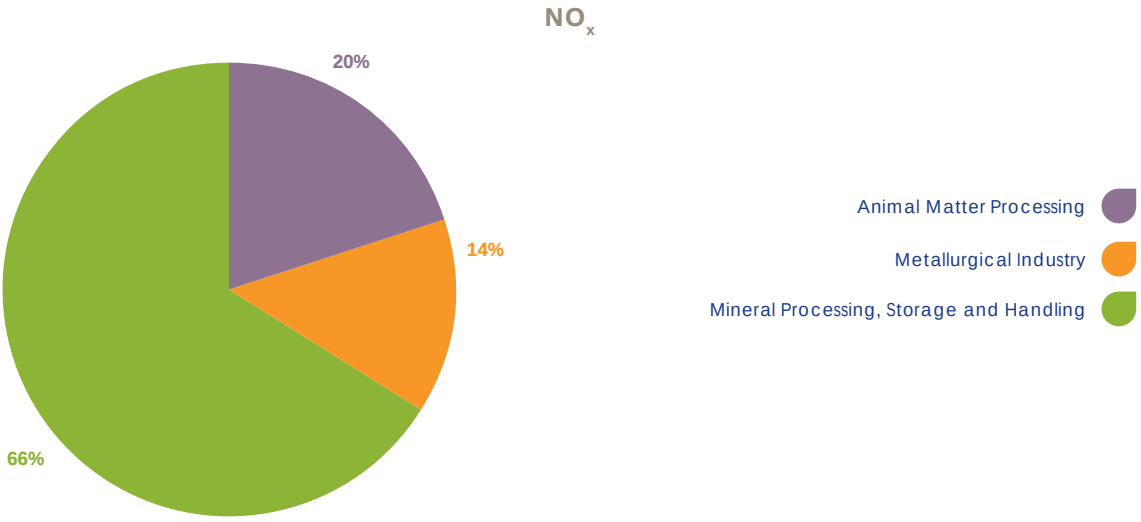


FIGURE 9-17: ESTIMATED NO_x EMISSIONS PER SECTION 21 LISTED ACTIVITY CATEGORY (%)

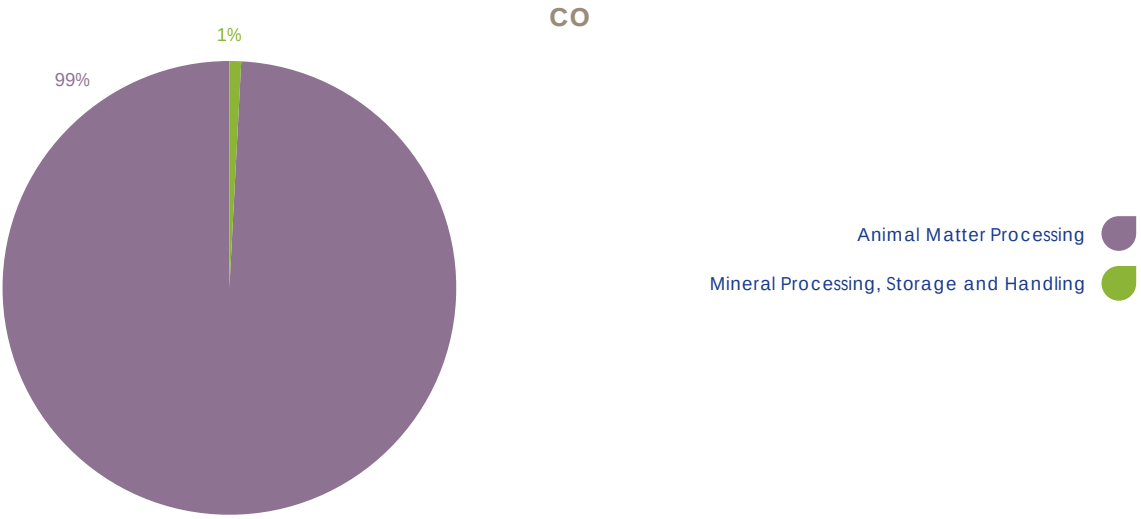


FIGURE 9-18: ESTIMATED CO EMISSIONS PER SECTION 21 LISTED ACTIVITY CATEGORY (%)

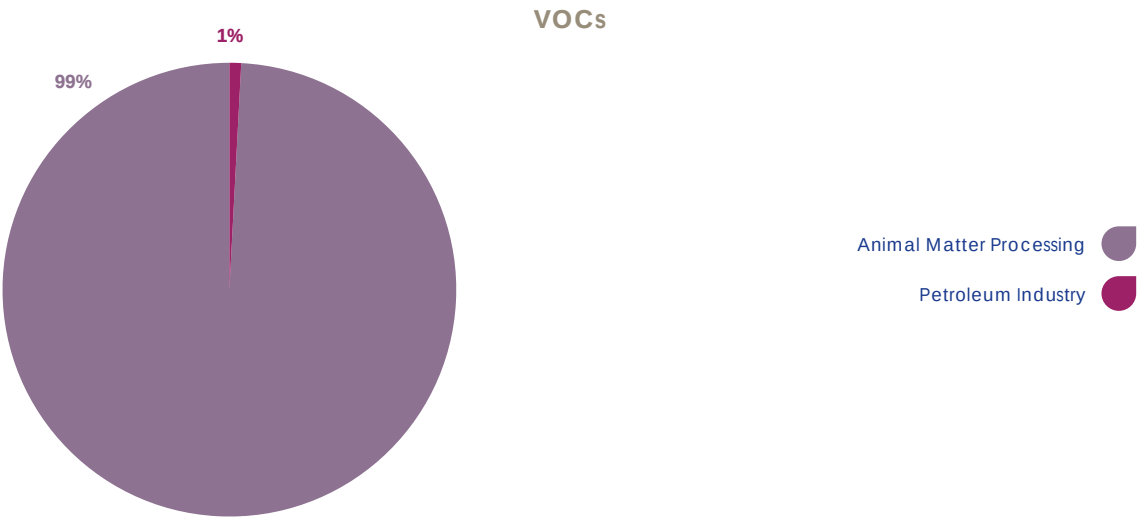


FIGURE 9-19: ESTIMATED VOC EMISSIONS PER SECTION 21 LISTED ACTIVITY CATEGORY (%)

CAPE WINELANDS DISTRICT MUNICIPALITY

The Cape Winelands District Municipality has a database of registered and non-registered Section 21 Listed Activities operating within the Cape Winelands. Not all fuel burning appliances, other than the listed activities, are included in the database.

The total estimated emissions (kg / annum) in respect of PM_{10}, SO_2, NO_x, VOC and CO from all Section 21 Listed Activities in the Cape Winelands District Municipality are presented in Table 9-3. The estimated emissions of pollutants, expressed as a percentage (%) per Section 21 Listed Activity category are presented in Figures 9-20 to 9-24. Estimated emissions were negligible in certain listed categories, viz. PM_{10}, SO_2, NO_x and CO emissions were negligible in all industries, except the animal matter processing and mineral industries (Figures 9-20 to 9-23); while for VOC, emissions were negligible in all industries, except the animal matter processing industry (Figure 9-23).

The total estimated emissions (kg / annum) in respect of CO_2, N_2O, CH_4, $PM_{2.5}$, PM_{10}, SO_2, NO_x, CO, Benzene and VOCs from unlisted activities are shown in Table 9-4. For the Cape Winelands District Municipality, it is evident that CO_2 emissions were estimated to be the highest, followed by SO_2, VOC, CO, NO_x, PM_{10} and then $PM_{2.5}$ and other emissions.

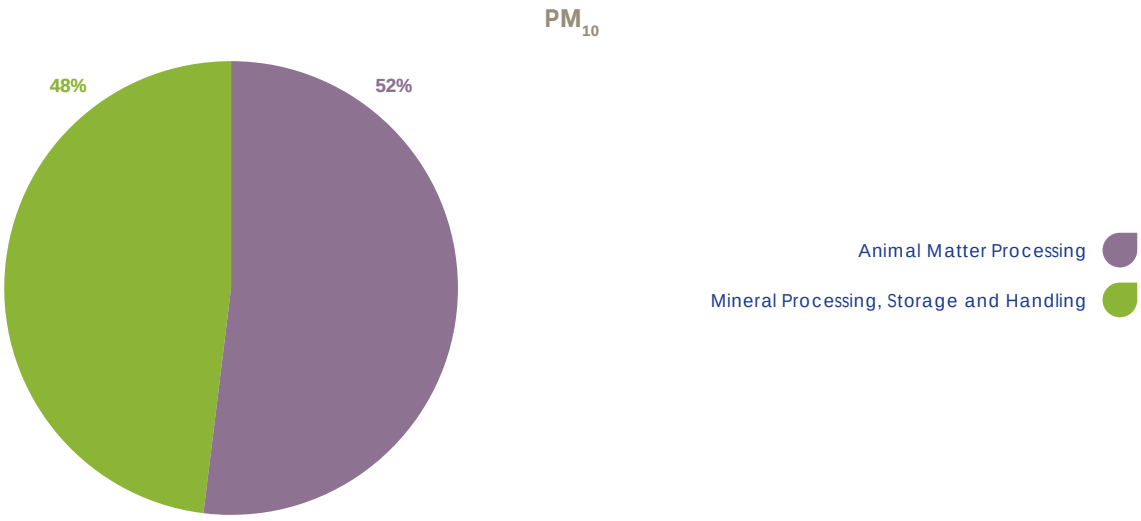


FIGURE 9-20: ESTIMATED PM_{10} EMISSIONS PER SECTION 21 LISTED ACTIVITY CATEGORY (%)

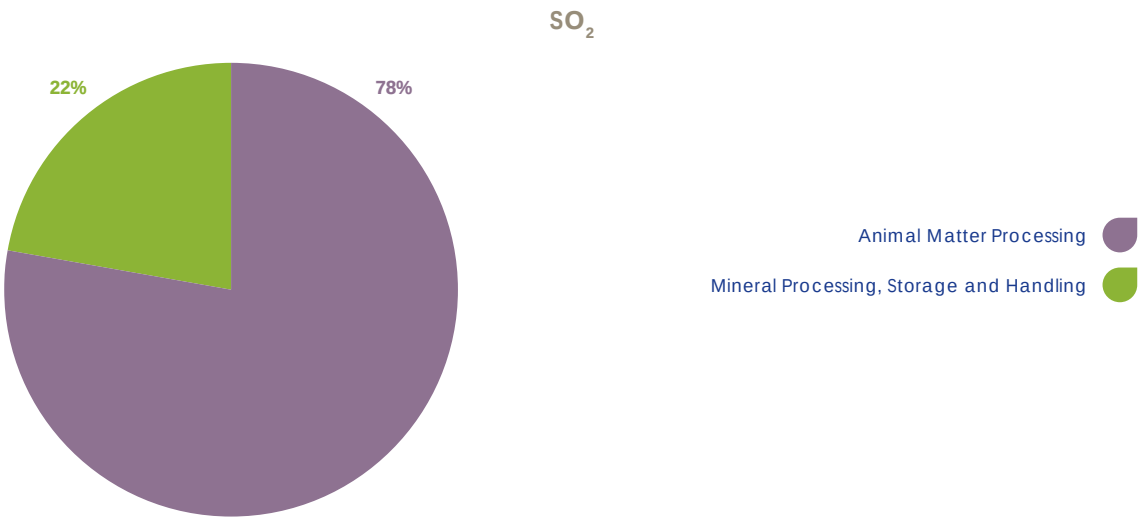


FIGURE 9-21: ESTIMATED SO_2 EMISSIONS PER SECTION 21 LISTED ACTIVITY CATEGORY (%)

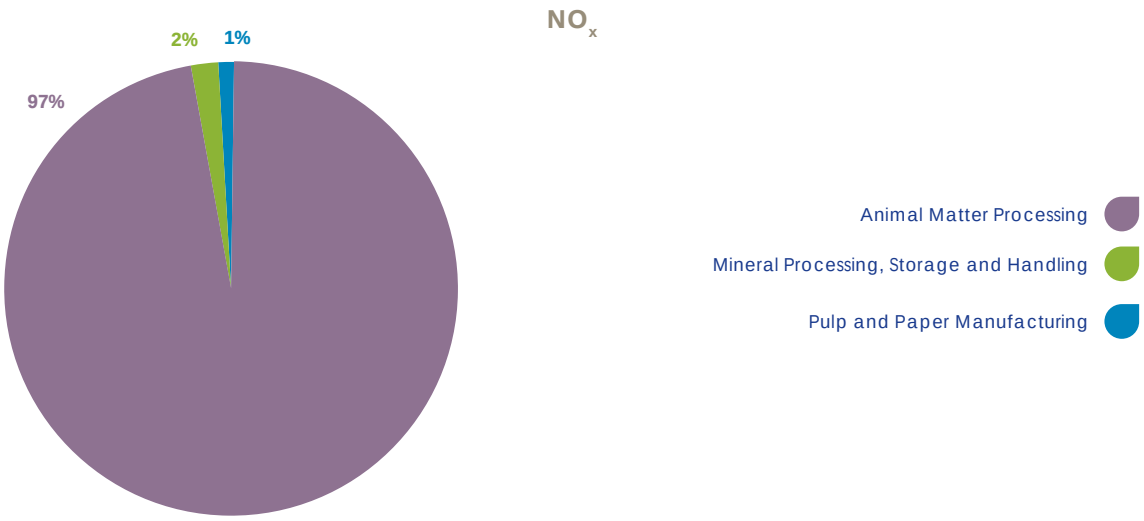


FIGURE 9-22: ESTIMATED NO_x EMISSIONS PER SECTION 21 LISTED ACTIVITY CATEGORY (%)

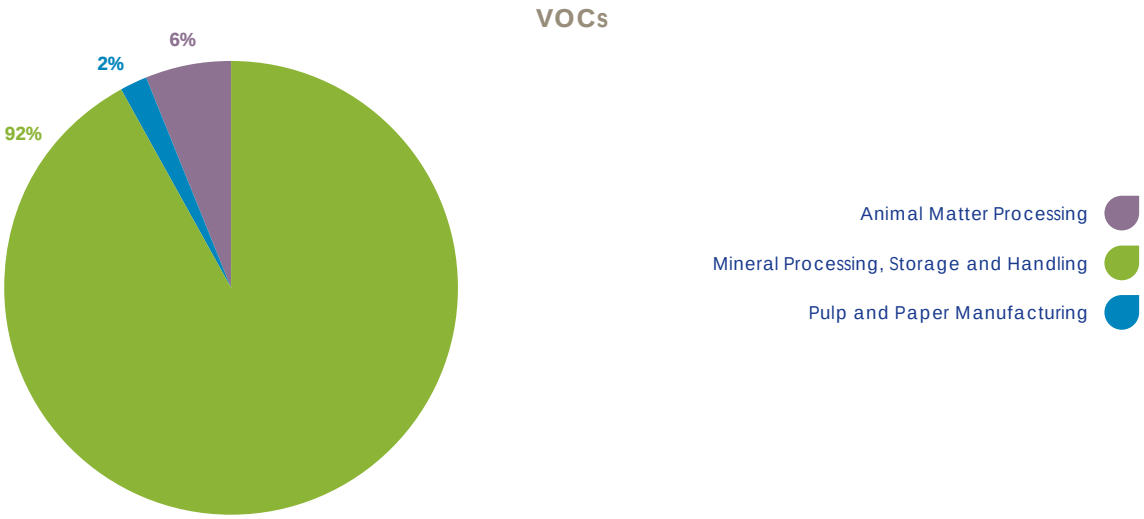


FIGURE 9-23: ESTIMATED CO EMISSIONS PER SECTION 21 LISTED ACTIVITY CATEGORY (%)

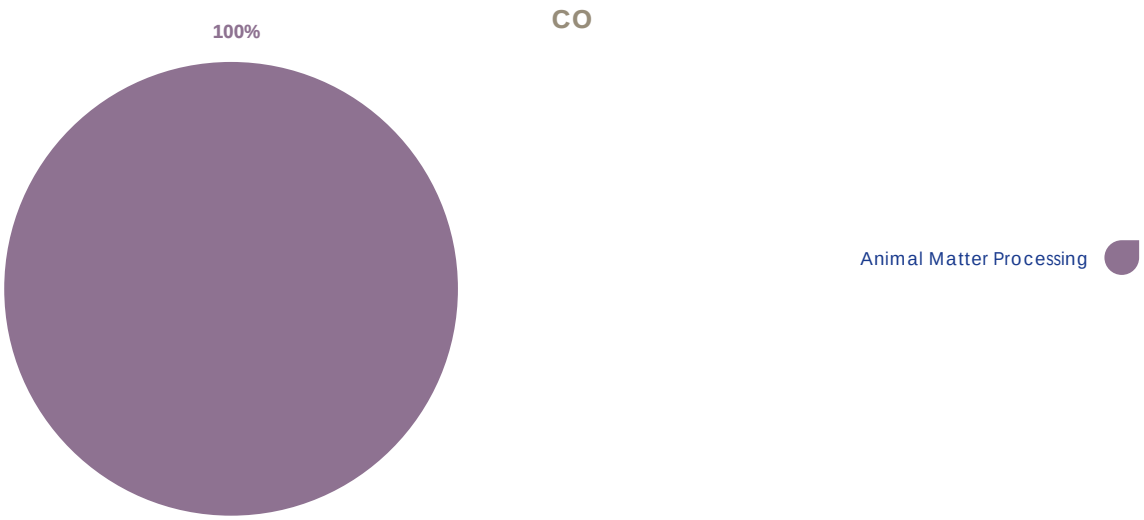


FIGURE 9-24: ESTIMATED VOC EMISSIONS PER SECTION 21 LISTED ACTIVITY CATEGORY (%)

- **OVERBERG DISTRICT MUNICIPALITY**

  The Overberg District Municipality has a list of point sources for inclusion in the Western Cape Air Pollutant and GHG Emissions Inventory. The PM_{10}, SO_2, NO_x, VOCs and CO emissions estimates per Section 21 Listed Activity category in the Overberg District Municipality are, however, not available as all Section 21 Listed Activities are currently being uploaded to the NAEIS system.

  The total estimated emissions (kg / annum) for CO_2, N_2O, CH_4, $PM_{2.5}$, PM_{10}, SO_2, NO_x, CO, Benzene and VOCs from unlisted activities are shown in Table 9-4. For the Overberg District Municipality, it is evident that CO_2 emissions were estimated to be the highest, followed by SO_2, CO, NO_x, PM_{10}, $PM_{2.5}$ and VOC emissions.

- **CENTRAL KAROO DISTRICT MUNICIPALITY**

  The Central Karoo District Municipality does not have any Section 21 Listed Activities.

  The total estimated emissions (kg / annum) for CO_2, N_2O, CH_4, $PM_{2.5}$, PM_{10}, SO_2, NO_x, CO, Benzene and VOCs from unlisted activities are shown in Table 9-4. For the Central Karoo District Municipality, it is evident that CO_2 emissions were estimated to be the highest, followed by SO_2, CO, NO_x, PM_{10}, $PM_{2.5}$ and VOC emissions.

Photograph by: S. Pearson

Photograph by: B. Parker

10. GAPS AND RECOMMENDATIONS

10.1 GAPS IDENTIFIED

10.1.1 INSTITUTIONAL FUNCTIONS

- The Western Cape Provincial Government plays a significant role in terms of the implementation of the NEM: AQA, as well as its oversight role with Municipalities in respect of air quality management. This oversight role is to ensure that all Municipalities within the Province fully accept their roles and responsibilities in terms of implementing the NEM: AQA.
- While the Metropolitan and all District Municipalities have appointed Air Quality Officers (AQOs), this function is often shared with other duties associated with Environmental Health. Further, at Local Municipal level, only the Oudtshoorn Local Municipality have not designated their AQO.
- All Municipalities, except Oudtshoorn, Breede Valley, Beaufort West and Langeberg Local Municipalities have adopted their Air Quality Management Plans (AQMPs), which have been included as sector plans in their Integrated Development Plans (IDPs).
- The roles and responsibilities in terms of implementing the NEM: AQA were often not fully understood, due to what were often perceived as "overlapping" functions. Furthermore, there is often limited financial and other resource provision made for air quality management, due to the current social and economic climate.
- Air quality management is extremely complex and require highly skilled individuals; as a result, it is also a scarce skill. The availability of suitably skilled human resources therefore remains a challenge.

10.1.2 EMISSIONS FROM MOBILE SOURCES

- Emissions from motor vehicles have been identified as a major air quality concern. Motor vehicles are sources of CO, NO_2, PM_{10} and VOC emissions, particularly during peak periods of idling and acceleration, which is consistent with the stop-start style of driving, as experienced in urban congested areas.
- The control and reduction of vehicle emissions is a Provincial and National challenge that needs to be addressed.

10.1.3 RESIDENTIAL AIR POLLUTION

- Poor indoor and ambient air quality often occurs in low income and informal settlements throughout the Province. Major sources are domestic fires and fuel burning, fires from informal meat trading, refuse burning, dust from unpaved roads and windblown dust from denuded areas. The burning of wood and paraffin is a common practice and produces SO_2, PM_{10} and VOCs.
- The low level of community awareness and its impacts, associated remedial measures and alternative cleaner fuel options, is a short-coming that needs to be addressed.

10.1.4 MINING ACTIVITIES

- The Central Karoo District Municipality is highly rich in minerals such as uranium, as well as shale gas. There has been increasing interest in mining of these minerals in the area recently, as is evident by the increase in the number of prospecting applications.
- Both prospecting and mining are associated with various environmental impacts, if not managed. The extraction of shale gas has been a matter of great controversy, both nationally and internationally due to the potential environmental impacts associated with it.
- Activities associated with mining will need to be managed, with clear goals and objectives to be identified in the 2nd Generation AQMP.

10.1.5 LICENSING OF LISTED ACTIVITIES

- Complexities between the AEL licensing function and the Environmental authorization processes exist. The integration of environmental authorisations, AELs and waste management licenses will need to be resolved and implemented, as well as linked to climate change response and spatial planning.

10.1.6 AMBIENT AIR QUALITY MONITORING AND CLIMATE CHANGE RESPONSE

- The financial costs associated with the purchasing, commissioning, operating and maintaining ambient monitoring equipment remains a challenge, particularly when competing with social priorities such as housing, education and health.
- In addition, the linkage between air quality management (monitoring and modelling) and climate change response needs to be made more explicit and addressed through identified activities in the 2nd Generation Western Cape AQMP, e.g. in airshed planning.

10.1.7 EMISSION INVENTORY AND CLIMATE CHANGE RESPONSE

- The emission inventories are limited to the NEM: AQA Section 21 Listed Activities. Emissions from landfill sites, Wastewater treatment works, transport and diffuse sources, such as emissions from residential and agricultural areas, as well as the total pollutant load from the various point, area and mobile sources needs to be identified and analysed.
- Emission inventories provide invaluable information that can be used for identifying activities linked to climate change response. Airshed planning can provide information on whether facilities would increase GHG emissions in an area, for example.

10.1.8 TOWN (REGIONAL AND SPATIAL) AND TRANSPORT PLANNING

- Town and transport planning do not always consider the impact of developments on the air quality of an area, e.g. the siting of developments in areas bordering industries and other sources of pollution.
- Such planning needs to be linked to airshed planning, which the 2nd Generation Western Cape AQMP will need to address.

10.1.9 AGRICULTURE

- Pesticide use in agriculture, particularly through aerial crop spraying, results in spray drift, which can distribute organo-chemicals in the vicinity and downwind of the spray area. Burning of crop residue, general waste and tyres to prevent frost damage on farms generates smoke and emissions, which may contribute to atmospheric particulate loading.

- Crop spraying will also need to be addressed in terms of reducing its impacts on the environment and human health. The Department of Agriculture, Fisheries and Forestry will need to be engaged in terms of identifying interventions in respect of implementing sustainable agricultural practices.

10.1.10 TRANS-BOUNDARY AIR POLLUTION

- Air pollutants can traverse over long distances via long-range transport. As such, trans-boundary air pollution is a factor that could influence the air quality of Municipalities in the Western Cape. The declaration of transboundary priority areas would need to be considered as a potential avenue to resolve any such matters, if required.

10.2 RECOMMENDATIONS

10.2.1 INSTITUTIONAL FUNCTIONS

- **INSTITUTIONAL FUNCTIONS: PROVINCE**
  - Communicate the roles and responsibilities of all three spheres of government, as per the NEM: AQA and the National Framework on Air Quality Management 2012, with Municipalities and the public;
  - Participate in events and large public gatherings to raise air quality management awareness through campaigns;
  - Update the DEA&DP's website with appropriate air quality management information and awareness raising campaigns; and
  - Engage with Municipal Managers and Councillors to further discuss and agree on the roles and responsibilities of Municipalities with regards to implementing the NEM: AQA and also to ensure that the associated implementation cost is motivated through the Municipal IDPs.
- **INSTITUTIONAL FUNCTIONS: MUNICIPALITIES**
  - Ensure sound co-operative governance in the implementation of the NEM: AQA within the respective District and Local Municipal jurisdictions;
  - Emphasise the importance of air quality management through awareness raising campaigns to dispel the preception that "the air is clean, so why is air quality management necessary?";
  - Motivate for the implementation of AQMPs and the associated cost through the Municipal IDPs to ensure adequate funding for air quality management and air quality monitoring;
- Promote clear responsibilities and functions for air quality management at the District and Local Municipalities, based on the requirements of the NEM: AQA and the National Framework for Air Quality Management 2012;
- Ensure good co-operative governance between District and Local Municipalities, at operational and top management levels;
- Explore and implement opportunities for Service Level Agreements / Memorandum of Understanding between the District and Local Municipalities;
- Acknowledge and support the role of the DEA&DP, including its oversight function, at the Municipal level;
- Capacitate all officials involved with administering the AQM functions within the Municipalities in terms of air quality management, air quality monitoring and the Atmospheric Emission Licensing (AEL) function; and
- Appoint and designate Environmental Management Inspectors at the relevant Municipalities to ensure that compliance and enforcement of legislation is effectively carried out within their areas of jurisdiction.

10.2.2 EMISSIONS FROM MOBILE SOURCES

- Consolidate the Western Cape Pollutant and Greenhouse Gas Emissions Inventory in the DEA&DP, inclusive of the following:
  - a regular emission testing program, in line with an Atmospheric Emission Licensing Renewal Programme;
  - legislation that supports roadside vehicle emission testing;
  - strategies to control vehicle emissions, in line with the National Ambient Air Quality Standards; and
  - strategies to effectively control VOC emissions.

10.2.3 RESIDENTIAL AIR POLLUTION

- Investigate and evaluate air pollution levels in all low-income residential areas across the Province;
- Apply lessons from the City of Cape Town's Khayelitsha Air Pollution Study on the control of particulate emissions at sources, throughout the Province, e.g. paving of unsurfaced areas to reduce windblown dust, regulations to control tyre burning and improved service delivery to reduce waste burning; and
- Conduct a survey and compile emission inventories at Municipal level, to determine the pollution levels within disadvantaged residential areas, inclusive of a Strategy to control emissions from identified sources.

10.2.4 MINING ACTIVITIES

- Address air quality related matters associated with all mining activities, across the Province; and
- Focus on the air quality related matters associated with uranium and shale gas mining activities, proposed in Beaufort West.

10.2.5 LICENSING OF LISTED ACTIVITIES

- Train officials with regards to air quality management and Atmospheric Emission Licensing;
- Streamline the atmospheric emission licensing process with the environmental authorization processes;
- Motivate for financial resources to administer the atmospheric emission licensing function; and
- Map Section 21 Listed Activities in relation to airshed planning, to inform climate change response and spatial planning.

10.2.6 AMBIENT AIR QUALITY MONITORING AND CLIMATE CHANGE RESPONSE

- Expand the passive sampling screening programmes, as conducted originally by the DEA&DP, and repeat the process at least every second year to facilitate the monitoring of air quality changes;
- Use the results from the passive sampling screening programme to identify areas of possible pair quality exceedances, where continuous monitoring should be implemented;
- Expand the current continuous ambient air quality monitoring undertaken by the DEA&DP to include potential areas of concern and areas that are identified in the passive screening programme to obtain a long-term record of air quality in the District Municipalities;
- Coordinate data obtained from all continuous air quality monitoring stations in the Province so as to provide a Provincial perspective on air quality;

- Perform airshed planning on all air quality data monitored, and link this to climate change response and spatial planning; and
- Develop a Provincial web-site where all information can be accessed via links, which then feeds into the South African Air Quality Information System (SAAQIS).

10.2.7 EMISSIONS INVENTORY AND CLIMATE CHANGE RESPONSE

- Expand the initial DEA&DP emissions inventory on fuel burning equipment to include all point sources in the Western Cape, as well as other key area and mobile sources, including greenhouse gases;
- Establish a linkage between the Provincial Emissions Inventory and that of all Municipalities in the Province, in order to better address and understand the cumulative effects of emission sources;
- Update the emissions inventory annually so as to ensure that the data remains current; and
- Link the emissions inventory to activities associated with climate change response.

10.2.8 TOWN (REGIONAL AND SPATIAL) AND TRANSPORT PLANNING

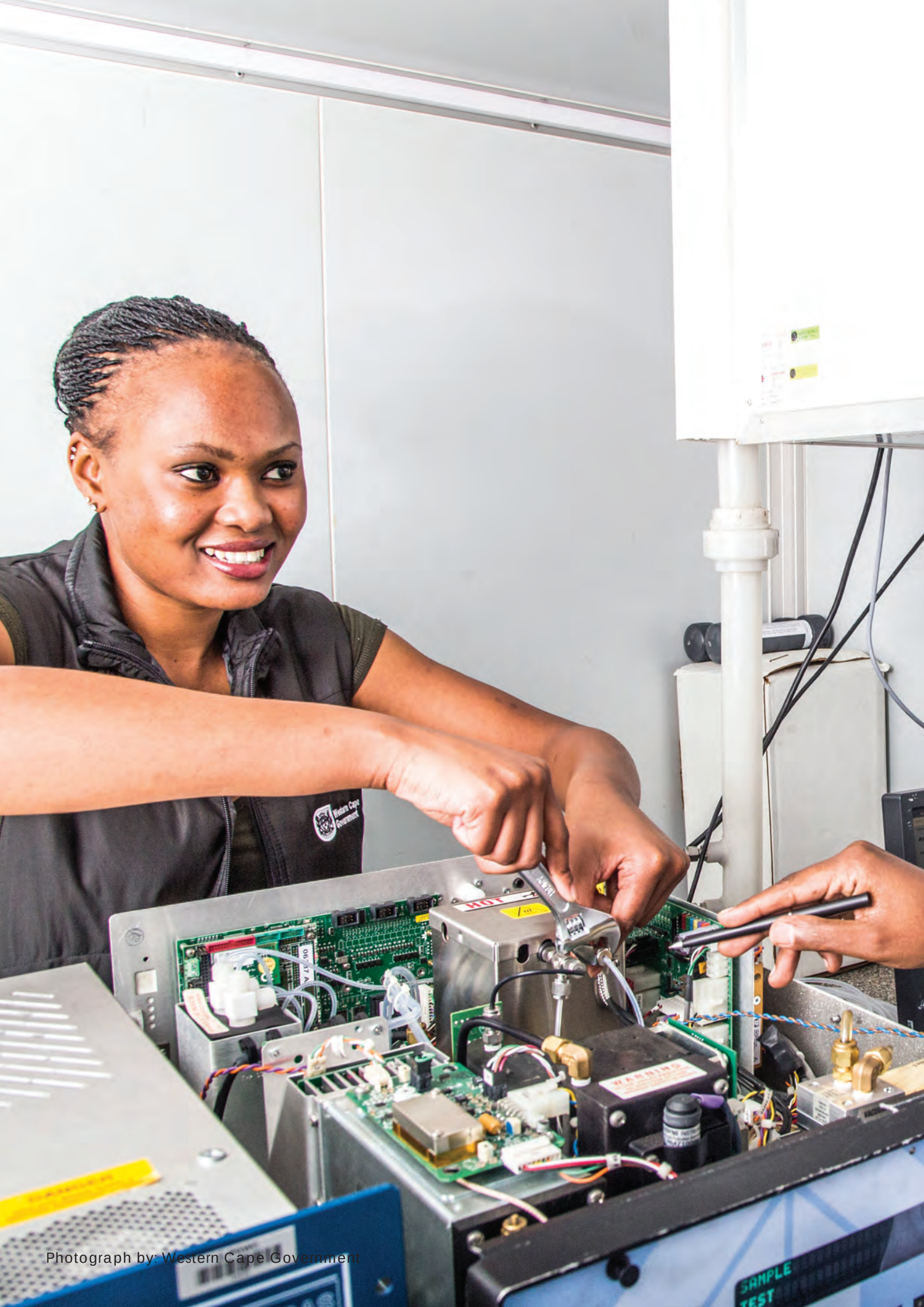
- Establish and foster sustainable relationships and communication channels between officials at all levels of government to address air quality and planning matters;
- Train town and regional planning officials in basic air quality management practices and create awareness to the synergies that exist between planning and air quality management; and
- Link airshed planning to town (regional and spatial) and transport planning.

10.2.9 AGRICULTURE

- Participate in agricultural union meetings to promote air quality on their agendas and to identify opportunities to address emissions control issues, within the respective District or Local Municipalities;
- Pursue greater co-operation with agricultural authorities to address shared environmental priorities that are related to air quality management;
- Encourage the Department of Agriculture to actively promote air quality management in their interaction with the farming community; and
- Train agricultural authorities in basic air quality management practices and create awareness to the synergies that exist between agriculture and air quality management.

10.2.10 TRANS-BOUNDARY AIR POLLUTION

- Intensify the role of National and Provincial Government and District Municipalities in terms of trans-boundary air pollution and explore efforts to reduce emissions from the contributing sources;
- Examine mechanisms at National, Provincial and Municipal level to manage trans-boundary air pollution; and
- Evaluate the merits of Priority Area declarations to manage trans-boundary air pollution impacts at both Provincial and Municipal level, where required.



Photograph by: Western Cape Government


Environmental Dust Monitor
GRIMM Aerosol Technik
lenovo
SO2= 2.6
CLR SETUP
SAMPLE
CAL
FAULT
Western Cape Government

CHAPTER 11

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