

A96566_Civil Aviation SSVR – Mulilo
Karoo Wind Power 2 development

**Civil Aviation Site Sensitivity
Verification Report – Mulilo Karoo
Wind Power 2 WTG**

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Zutari (Pty) Ltd

Reg No 1977/003711/07

Riverwalk Office Park
41 Matroosberg Road
Ashlea Gardens
Extension 6
Pretoria

South Africa





PO Box 74381
Lynnwood Ridge
0040

T +27 12 427 2000

F +27 86 556 0521

E tshwane@zutari.com

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Author signature		Reviewer signature	
Name	Preston Padayachee	Name	Wynand Schoeman
Title	Civil Engineer	Title	Technical Director, Airfields Lead
Approver signature			
Name	Patrick Killick		Wynand Schoeman
Title	Senior Environmental Practitioner		Technical Director, Airfields Lead

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1 Introduction

Mulilo Karoo Wind Power 2 (Pty) Ltd is proposing the development of a wind energy facility on the remainder of Farm Middle Kraal 98 and portions 1, 2, 3 and the remaining extent of the Farm Waterval 101, near Beaufort West, Beaufort West Local Municipality, Central Karoo District Municipality, Western Cape.

The proposed development will have total output capacity of 382.5 MW and the total Area of Influence associated with the proposed development will be up to 5 567 ha. The proposed development will consist of the following components: up to 45 Wind Turbines, proposed road infrastructure, internal electrical reticulation, operational and maintenance buildings, IPP Substation and Eskom Substation.

There are three phases for this project, each with a Wind Energy Farm (WEF) and associated facilities as mentioned above, illustrated in Figure 1 below. The purpose of this report is to provide a Site Sensitivity Verification Report in terms of Civil Aviation of the *PROTOCOL FOR THE SPECIALIST ASSESSMENT AND MINIMUM REPORT CONTENT REQUIREMENTS FOR ENVIRONMENTAL IMPACTS ON CIVIL AVIATION INSTALLATIONS in Terms of Government Gazette 43110 No. 320 20 March 2020 when applying for Environmental Authorisation (EA)*.

Government Notice 320 specifically includes a protocol that provides the criteria for the specialist assessment and minimum report content requirements for impacts on Civil Aviation for activities requiring EA. Where assessment is required, this protocol replaces the requirements of Appendix 6 of the 2014 NEMA Environmental Impact Assessment (EIA) Regulations (as amended). However, where the National Web-Based Environmental Screening Tool (Screening Tool) of the Department of Forestry, Fisheries and the Environment (DFFE) identifies a site as having a **low** sensitivity in terms of Civil Aviation, then no further assessment is required unless the sensitivity of the site is disputed. The site sensitivity verification must be undertaken using:

- (a) a desktop analysis, using satellite imagery;
- (b) a preliminary on-site inspection; and
- (c) any other available and relevant information.

This report specifically focuses on **Mulilo Karoo Wind Power 2 development**, in particular the wind turbines generators (WTG).

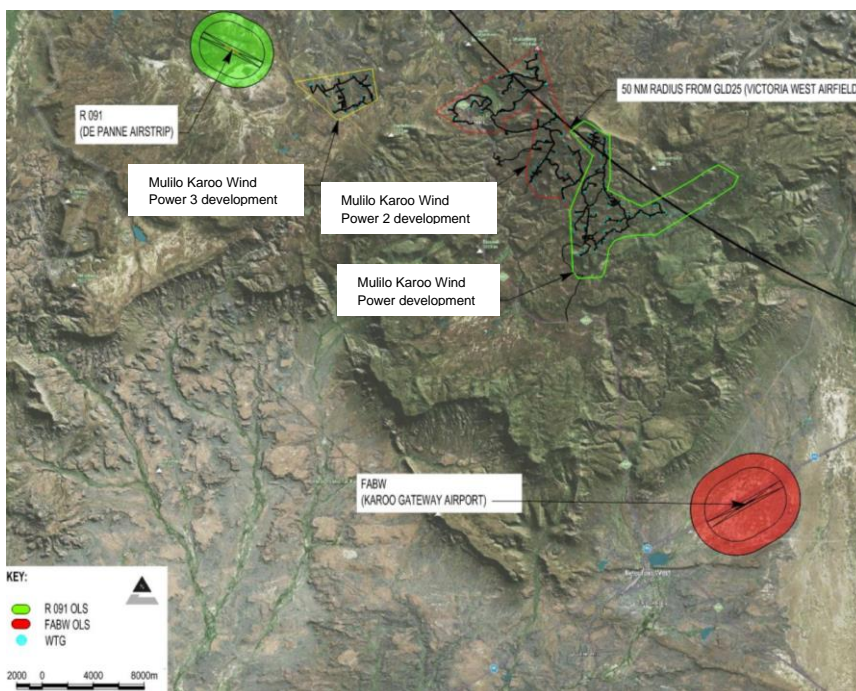


Figure 1: Locality map

2 Methodology

This Site Sensitivity Verification Report has been compiled based on the following methodology:

- The project site was plotted on the Screening Tool to identify the sensitivity allocated;
- A desktop assessment was undertaken to determine the location of Civil Aviation Aerodromes and other features potentially relevant to Aviation considerations within 8km of the project site extents utilizing the Air Traffic Navigation Services (ATNS) data which documents the South African airspace routes, aerodromes and navigation facilities;
- This desktop assessment primarily focused on the Obstacle Limitation Surfaces (OLS) as outlined in Sub-section 2.1 below. This step requires the determination of the Aerodrome Code outlined in ICAO Annex 14 Table 4-1. This assessment does not consider future airport upgrade requirements and the associated impact on OLS.
- A Site Sensitivity Verification Report was compiled (i.e. this report)

2.1 Obstacle Limitation Surface Assessment Introduction

The OLS are series of surfaces that define the limits to which objects may project into airspace around aerodromes that are required to be maintained free from obstacles. Defining and assessing the OLS ensure that the intended aeroplane operations at the aerodromes are conducted safely and prevent the aerodromes from becoming unusable by the growth of obstacles around the aerodromes. Figure 2 illustrates the different OLS surfaces.

There are ten variations of the OLS dimensions based on the Runway Classification (Aerodrome Reference Code (ARC)) and type of landing permitted at the airport. The sub-section below explains the ARC.

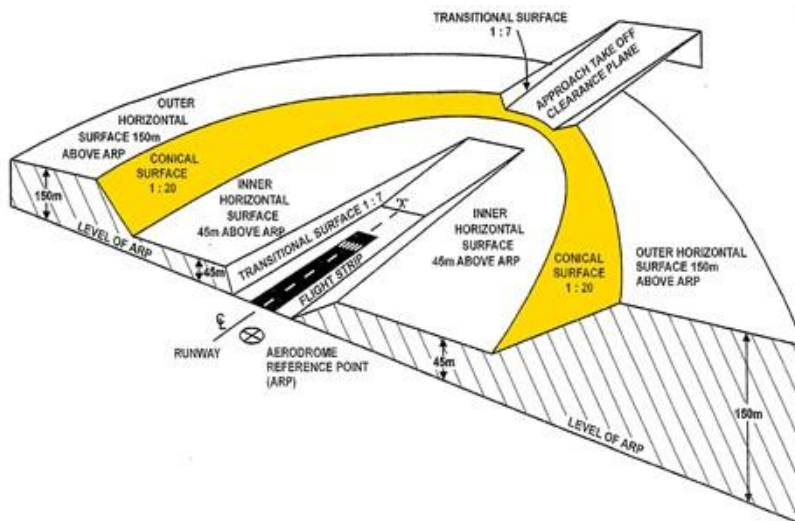


Figure 2: OLS illustration

2.1.1 Aerodrome Reference Code

The reference code provides a simple method to determine the interrelation of numerous specifications concerning the characteristics of the aerodrome. Consequently, providing a series of aerodrome facilities suitable for aeroplanes intended to operate at the aerodrome.

This code is comprised of two elements which are related to the aircraft performance characteristics and dimensions.

The first element is a number based on the aeroplane reference field length, which is defined as the minimum field length required by an aircraft to take-off at maximum certified field length, sea level, standard atmospheric temperature conditions, still air and zero runway slope.

The second element refers to a letter which is based on the design aircraft wingspan.

This code is illustrated in the excerpt from ICAO Annex 14 (ICAO, 2018) provided in Figure 3.

Table 1-1. Aerodrome reference code
(see 1.6.2 to 1.6.4)

Code element 1	
Code number	Aeroplane reference field length
1	Less than 800 m
2	800 m up to but not including 1 200 m
3	1 200 m up to but not including 1 800 m
4	1 800 m and over
Code element 2	
Code letter	Wingspan
A	Up to but not including 15 m
B	15 m up to but not including 24 m
C	24 m up to but not including 36 m
D	36 m up to but not including 52 m
E	52 m up to but not including 65 m
F	65 m up to but not including 80 m

Figure 3 Aerodrome Reference Code (ICAO, 2018)

2.2 OLS Assessment

Figure 4 illustrates the interaction of the Mulilo Karoo Wind Power 2 WTG site with the OLS for the Karoo Gateway Airport (FABW).

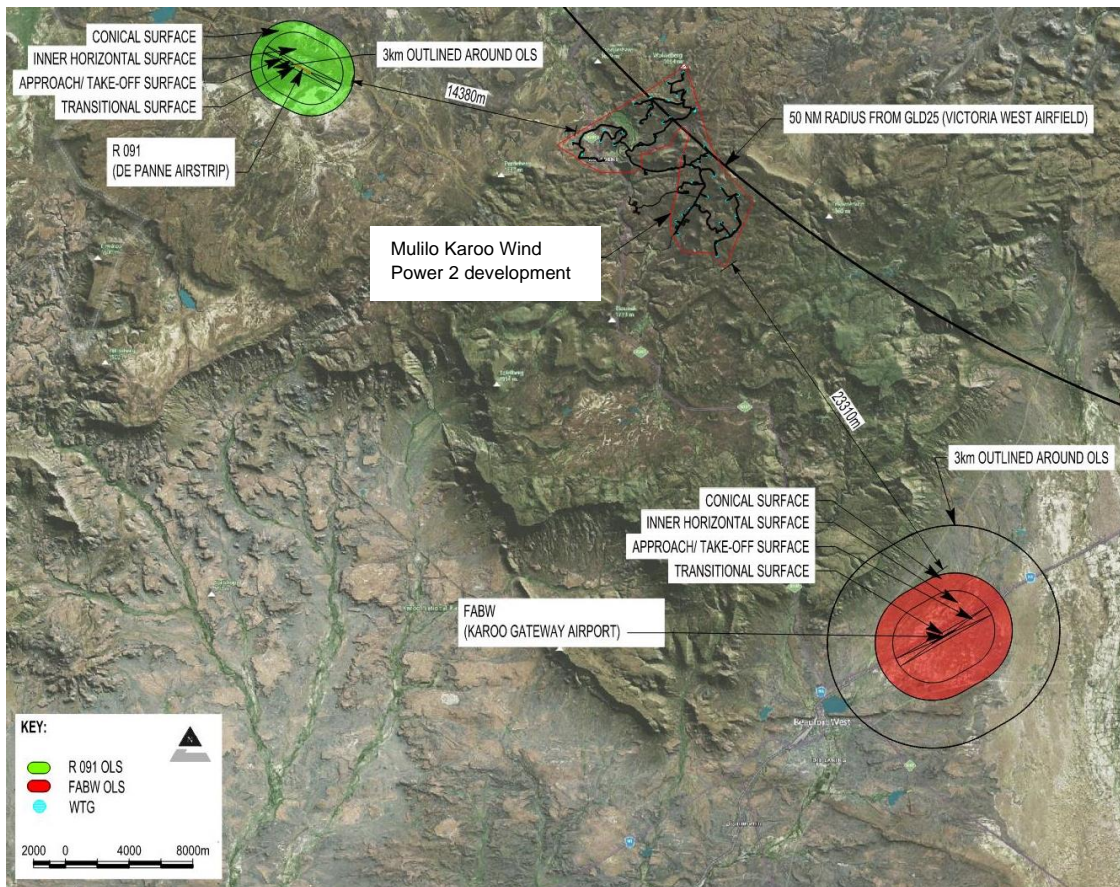


Figure 4: FABW and R091 Aerodrome Obstacle Limitation Surfaces

2.2.1 Assumptions and Considerations

The following assumptions and considerations were applied during the OLS assessment:

Table 1: Assessment assumptions and considerations (Karoo Gateway Airport)

Assumption/Consideration	Reference
Airfield operational status	Licensed Aerodrome (Operational) ATNS Airspace (RSA DATA – 28DEC2023.kmz)
Runway length	08/26 – 1485m Aeronautical Information Publication (AIP) South Africa AD 2-FABW-4
Runway width	30 m AIP South Africa AD 2-FABW-4
Aerodrome reference code	2 ICAO Annex 14
Aerodrome instrumentation category	Non-Instrument Visual observation - Bing Maps
Aerodrome reference elevation	893m AIP South Africa AD 2-FABW-4

Table 2: Assessment assumptions and considerations (De Panne Airstrip – R091)

	Assumption/Consideration	Reference
Airfield operational status	SACAA Registered Aerodrome (Operational)	ATNS Airspace (RSA DATA – 28DEC2023.kmz)
Runway length	14/32 – 1200m	https://www.caa.co.za/industry-information/airports/
Runway width	30 m	https://www.caa.co.za/industry-information/airports/
Aerodrome reference code	1	ICAO Annex 14
Aerodrome instrumentation category	Non-Instrument	Visual observation - Bing Maps
Aerodrome reference elevation	1430m	https://www.caa.co.za/industry-information/airports/

The ARC for the Karoo Gateway Airport and De Panne Airstrip was determined as Code 2 and Code 1 respectively by back calculating the actual runway length for the site conditions has mentioned in section 2.1.1.

According to ICAO Annex 14, paragraph 4.2.1, the following surfaces are considered for a non-instrument approach runway:

- Transitional Surfaces
- Approach Surfaces
- Inner Horizontal Surface
- Conical Surface

A brief description of each surface with assessment findings is presented in the following sections. The reader is referred to ICAO Annex 14 for more information.

2.2.2 Transitional Surfaces

A complex surface along the side of the strip and part of the side of the approach surface, that slopes upwards and outwards to the inner horizontal surface. The limits of a transitional surface comprise; a lower edge beginning at the intersection of the side of the approach surface with the inner horizontal surface and extending down the side of the approach surface to the inner edge of the approach surface and from there along the length of the strip parallel to the runway centre line and an upper edge located in the plane of the inner horizontal surface.

The Transitional surface slope is 20% for a code number 1 and 2, from the defined lower edge up to the Inner Horizontal Surface.

As illustrated in Figure 4, the proposed project sites is situated outside the Transitional Surfaces for R091 and FABW. Thus, no protrusions are anticipated in the Transitional Surfaces.

2.2.3 Approach and Take-off Climb Surfaces

This is an inclined plane or combination of planes, preceding the runway threshold. The limits of the approach surface comprise; an inner edge of specified length, horizontal and perpendicular to the extended centre line of the runway and located at a specified distance before the threshold, two sides

originating at the ends of the inner edge and diverging uniformly at a specified rate from the extended centre line of the runway, and an outer edge parallel to the inner edge.

For the code 1 and 2 non-instrument runway conditions, the Approach surface precedes both thresholds by 30m and 60 m respectively. The details of the surface are summarised below:

Table 3: Approach and take-off surface parameters

	Code 1		Code 2	
	Approach Surface	Take-Off Surface	Approach Surface	Take-Off Surface
Length of Inner Edge	30 m	30 m	60 m	60 m
Divergence (each side)	10%	10%	10%	10%
First Section Length	1600 m	1600 m	2500 m	2500 m
First Section Slope	5%	5%	4%	4%
Second Section Length	N/A	N/A	N/A	N/A
Second Section Slope	N/A	N/A	N/A	N/A
Horizontal Section Length	N/A	N/A	N/A	N/A
Horizontal Section Slope	N/A	N/A	N/A	N/A
Total length	1600 m	1600 m	2500 m	2500 m

As illustrated in Figure 4, the proposed site is situated outside the Approach and Take-off Climb Surfaces for R091 and FABW. Thus, no protrusions are anticipated in the Approach and Take-off Climb Surfaces.

2.2.4 Inner Horizontal Surface

The Inner Horizontal surface is a surface located in the horizontal plane at a specified height above an aerodrome, the radius of which is specified and measured from a reference point on the aerodrome. Code 1 has a radius of 2000m and code 2 a radius of 2500m. The elevation of the surface is measured 45 m from a defined elevation datum for such a purpose.

Figure 4 shows that the proposed site is situated outside the Inner Horizontal Surface for R091 and FABW. Thus, no protrusions are anticipated in the Inner Horizontal Surface.

2.2.5 Conical Surface

This surface slopes upwards and outwards from the periphery of the Inner Horizontal Surface. The upper limit is specified as a height above the Inner Horizontal Surface.

For a non-instrument approach code number 1 runway, the Conical Surface is at 35 m above the Inner Horizontal Surface. For a non-instrument approach code number 2 runway, the Conical Surface is at 55 m above the Inner Horizontal Surface. The divergence slope from the lower plane coincident with the Inner Horizontal Surface is 5% in both cases.

No protrusions to the Conical Surface are anticipated as there are no protrusions anticipated in the Inner Horizontal Surfaces for R091 and FABW.

2.2.6 Other Interactions

ICAO Annex 14 Clause 4.2.10 stipulates that new objects or extensions of existing objects shall not be permitted above an approach surface within 3000m of the inner edge or above a transitional surface except with authorization from the regulatory authority. The WTG are more than 14km and 23km away from the De Panne Airstrip and Karoo Gateway Airport OLSs hence no protrusion expected.

Furthermore, the Mulilo Karoo Wind Power 2 development lies within the 50 Nautical Mile (92.6km) radius of the Gliders flying around Victoria West Airport (GLD25). The height of the turbines may create obstacles for the gliders, however due to the turbines being on the outer edge of the gliders area and gliders only flying with Visual Flight Rules, it is deemed that the impact on gliders would be low. However, it is recommended that contact be made with the Vitoria West Airport Manager and Gliders – Soaring Society to inform them of the new installations.

2.3 Conclusions and Recommendations

The undertaking of this high-level concept OLS assessment indicate that the proposed Mulilo Karoo Wind Power 2 WTG does not protrude the OLS of the Karoo Gateway Airport (FABW) nor De Panne airstrip (R091). Contact with Victoria West Airport and Gliders – Soaring Society will need to be made to inform them of the installations.

3 Civil Aviation Site Sensitivity Verification

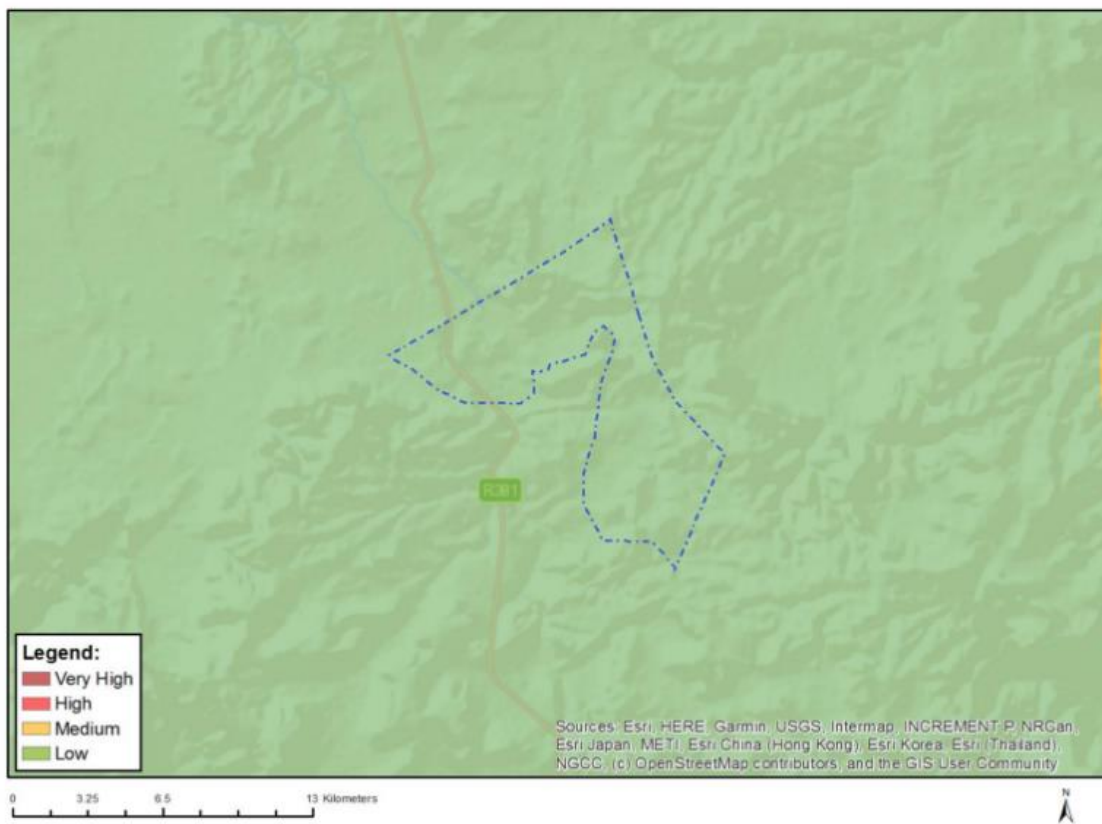
3.1 Introduction

An assessment was conducted from the information provided and from available aerial imagery to identifying possible nearby civil aviation installations with the potential of being impacted in line with the methodology outlined above.

3.2 DFFE Screening Tool & Findings

Figure 5 illustrate the planned infrastructure footprint overlaid on the civil aviation sensitivity map as generated by the DFFE screening tool.

MAP OF RELATIVE CIVIL AVIATION (WIND) THEME SENSITIVITY



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
			X

Sensitivity Features:

Sensitivity	Feature(s)
Low	Low sensitivity

Figure 5: Map of relative civil aviation theme sensitivity (WEF 2 2024-04-22 03-36)

Findings illustrated in Figure 5 indicate a low sensitivity feature of the planned infrastructure in relation to surrounding aerodromes being within 8km of the aerodrome. Our analysis shows agreement with the low sensitivity of the aerodromes due to the proximity of the OLS.

The OLS assessment conducted anticipates no interaction between the proposed site and the OLS of Karoo Gateway Airport nor De Panne airstrip.

3.3 Conclusions and Recommendations

The planned infrastructure for Mulilo Karoo Wind Power 2 WTG falls within the **low sensitivity** rating for the proposed site being within 8km of a civil aviation aerodrome, it is not foreseen that these civil aviation installations are impacted by the planned activities with consideration of the OLS of the Karoo Gateway Airport and De Panne Airstrip.

Furthermore, the analysis deems that the impact on gliders from Vitoria West Airport will be low. However, it is recommended that contact be made with the Vitoria West Airport Manager and Gliders – Soaring Society to inform them of the new installations.

This analysis does not include ATNS requirements or radar interference considerations. If deemed necessary by the CAA, the client should approach ATNS directly for the related evaluation

4 Qualifications and Expertise

This report was compiled and reviewed by the following professionals:

Roles	Names - Titles	Experience Summary	Qualification and Affiliations
Reviewer	Wynand Schoeman – <i>Aviation Expertise Lead</i>	Wynand is an aviation specialist with over 20 years of working experience. He has been involved in numerous diverse projects in South Africa, Angola, Mozambique, Lesotho, Zambia and the Philippines Islands; ranging from civil engineering infrastructure related projects to airports and urban areas, mass earthworks, water supply and reticulation, and supervision and project management for multi-level buildings. As the Airfield Lead, his role focuses on obtaining a better understanding of the complex system that forms airports. He has provided a master plan for a greenfields airport in Nigeria and various services to the Airports Company South Africa (ACSA) which included working with International Civil Aviation Organization (ICAO) Standards and Recommended Practices (SARPs), national aviation regulations and technical standards.	<ul style="list-style-type: none"> • Engineering Council of South Africa (ECSA) – Professional Engineer • Engineering Honours – Technology Management • Bachelor in Engineering - Civil
Author	Preston Padayachee – Airport Engineer	Preston is a civil engineer at Zutari with 4 years airport working experience. He has gained experience in airport master planning and design in South Africa, Nigeria and Rwanda. This includes geometric design of roads for windfarms and airport infrastructure according to the relevant standards. In addition, analysing the Obstacle Limitation Surfaces of airports according to the International Civil Aviation Organisation (ICAO) Annex 14.	<ul style="list-style-type: none"> • Engineering Council of South Africa (ECSA) – Candidate Engineer • Bachelor of Science in Engineering - Civil

Appendix A

Curriculum Vitae



Wynand Schoeman

Engineer

Summary

Wynand is a professional engineer in Zutari's Tshwane office, where he has been responsible for airports planning and design for the past four years. Prior to this, he worked on civil infrastructure projects for 10 years, of which two years were spent working in Angola. He focuses on obtaining a better understanding of the complex system that forms airports. He has provided a master plan for a greenfields airport in Nigeria and various services to the Airports Company South Africa (ACSA).

He has been involved in numerous diverse projects in South Africa, Angola, Mozambique, Lesotho, Zambia and the Philippines Islands; ranging from civil engineering infrastructure related projects to airports and urban areas, mass earthworks, water supply and reticulation, and supervision and project management for multi-level buildings. He has gained valuable experience across a wide range of civil engineering infrastructure aspects and the coordination requirements between the various aspects, while working on these projects. He has also been responsible for the verification of various projects in Australia and New Zealand.

Wynand was first exposed to geometrical and infrastructure design and supervision during various projects related to car parking areas, water infrastructure, roads and runway/taxiway geometric, earthworks and stormwater management design at an airport. Subsequently, he was involved with the upgrading of airside infrastructure for aprons at two other airports. Furthermore, he was responsible for the supervision and project management of two seven-storey buildings in Angola.

His civil infrastructure experience was gained during his involvement in residential and commercial developments. He handled the water, sewage and waste components of the strategic sanitation plans for four cities in Mozambique.

Wynand obtained a Bachelor of Engineering (Honours) in Technology Management in 2002 and a Bachelor of Engineering: Civil in 2000, both from the University of Pretoria in South Africa. He is also a registered professional engineer with the Engineering Council of South Africa (ECSA).

Relevant experience

Panel for built environment consultants for the Airports Company South Africa (ACSA), South Africa, Gauteng, Airports Company South Africa (ACSA), 05/2018 - 05/2021, Project Director

Aurecon has been appointed as part of a built environment engineering panel, to deliver consulting services for the Airports Company South Africa's (ACSA's) electrical, mechanical, structural and civil projects. Aurecon's appointments as part of the panel include a traffic impact assessment (TIA) for George Airport fuel station, the Cape Town International Airport (CTIA) car rental expansion project, and the CTIA international terminal building expansion project. To date, the instructions range from provision of A380 upgrade to an international departure lounge, access road and car rental reconfiguration, water supply and underground water studies as well as concepts for a new cargo precinct and structural assessment. Responsible for project management, client liaison, project scope definition, concept designs, and technical review.

Design review and construction supervision for the New Bugesera International Airport (NBIA), Rwanda, Bugesera Airport Company Limited (BAC), 08/2017 - 03/2020, Project Director/Project Leader

Aurecon is providing design review and construction supervision services on the greenfield New Bugesera International Airport (NBIA) project, with capacity for 1.44 million passengers per year using a terminal building of approximately 30 000 m². The shape of the roof of the new terminal building

Qualifications

BEng (Hons) Technology Management
BEng Civil Engineering

Professional registrations

Professional Engineer, Engineering Council of South Africa (ECSA)

Specialisation

Airport and municipal infrastructure

Years in industry

22

represents Rwanda and it has an undulated form. The runway and parallel taxiway length will be 3.8 km, with the Airbus A330 as design aircraft. The work involves using a drone to record the earthworks progress and using the footage to create a contour model to calculate volumes. Responsible for client liaison, design review coordination, supervising the team, and project coordination.

Rehabilitation of airside pavement at OR Tambo International Airport (ORTIA), South Africa, Gauteng, Airports Company South Africa (ACSA), 06/2012 - 10/2019, Project Director

Aurecon was appointed for a five-year period to provide professional civil engineering services for the rehabilitation of airside pavement infrastructure at OR Tambo International Airport (ORTIA). The project involved tender process and construction supervision of the 2013/2014 short-term rehabilitation project related to asphalt and concrete pavements; detailed pavement investigations and tender documentation for the short-term rehabilitation work for the airside asphalt and concrete pavements. Additional services entailed a study into paint marking and airfield ground lighting (AGL) positions for holding positions to confirm compliance with International Civil Aviation Organization (ICAO) Code F requirements. Responsible for client liaison and technical and project coordination.

Geometric reconfiguration of OR Tambo International Airport (ORTIA) cargo terminal access roads and unit load device (ULD) area, South Africa, Gauteng, Airports Company South Africa (ACSA), 10/2015 - 03/2019, Project Director

Aurecon has been appointed to, amongst others, gather and analyse data to understand the operational efficiency of the site, with a view to determine what needs to be done to address any issues in terms of lane capacity, traffic circulation, and parking and access issues. The design is currently at a conceptual stage. The project also comprises the preliminary and detailed design of a unit load device (ULD) storage area within the cargo yard. Responsible for the client liaison, project management, and design review.

Aeronautical study for the Abeokuta International Airport, Nigeria, Niger, Federal Airports Authority of Nigeria (FAAN), 01/2018 - 12/2018, Project Leader

Aurecon was appointed for the master planning, siting and conceptual master plan layout development for the new Abeokuta International Airport. The runways are designed for Code F/CAT II Instrumentation operations and the ultimate design includes two runways of 3.9 km each and cargo and passenger terminal facilities. The aprons allow for Multiple Aircraft Ramp System (MARS) configurations with a combination of contact and remote aircraft stands. The conceptual layout design includes carefully planned landside land use development together with considerations for a light rail link and freeway connections. The facilities include aviation rescue and firefighting service (ARFFS), air traffic control (ATC) and other airside support facilities. Responsible for client interaction, concept review and project coordination.

Advisory services during rehabilitation of airside infrastructure at Dundo Airport, Angola, Lunda Norte, Andrade Gutierrez Engenharia Angola, 04/2017 - 10/2018, Phase Leader

The project involved the upgrading and rehabilitation of Dundo Airport to allow for the operation of aircraft up to International Civil Aviation Organization (ICAO) Code 4D. The work included the reconstruction, extension and widening of the runway, the construction of two new link taxiways, the installation of a new stormwater drainage system, and the installation of airfield ground lighting (AGL) and precision approach path indicators (PAPIs). Aurecon was appointed to carry out audit services of the completed works, monitor the remainder of the works and investigate the compliance of the design with the relevant specifications. Responsible for review of assessment documentation for the compliance of the design of infrastructure according to ICAO Standards and Recommended Practices (SARPs).

Airside upgrading design works at the King Shaka International Airport (KSIA), South Africa, KwaZulu-Natal, BMK Consulting Engineers, 08/2017 - 08/2018, Project Director

The project involved airside upgrading design works at the King Shaka International Airport (KSIA) in Durban. Aurecon was appointed for the layout planning for Apron 2D, including stand and taxiway geometric designs as well as electrical services and airfield ground lighting (AGL) design input. Aurecon also reviewed the latest airport master plan layout in terms of spatial planning and provided the Airports Company South Africa (ACSA) with a feasibility study to assist with the A380/Code F Multiple Aircraft Ramp System (MARS) stand development planning and selection. This included multi-criteria analysis (MCA) to provide an unbiased approach to option selection. Responsible for providing certain geometric, paint marking and electrical design services to the main consultant, including liaison, technical review and project management.

Relocation of Tete Airport, Mozambique, Tete, Rio Tinto Benga Limited, 10/2012 - 10/2017, Project Director

The project comprised a site investigation study for the possible relocation of Tete Airport. This included a topographical, geotechnical and environmental assessment of three alternative sites. Responsible for project management, client liaison and team coordination.

Technical advisory services for the Mauritius Light Rapid Transit (MLRT) system, Mauritius, SMRT International Pte Ltd, 10/2012 - 08/2017, Engineer for Infrastructure Costing

The Government of Mauritius is committed to build a light rapid transit (LRT) system serving the city areas between Port Louis and Curepipe to relieve the main road arteries and to review its existing bus network with the aim of

achieving an efficient multi-modal public transport network. Aurecon was appointed, as a partner to lead agency Singapore Cooperation Enterprise (SCE) and the Singapore Mass Transit Corporation (SMRT), to provide technical advisory services for the development of the Mauritius LRT system. This included advisory services for transport and traffic planning, engineering and business case/financial planning. Responsible for the compilation of the estimated construction costs of the project.

Design for construction of a new runway at Calueque Airport, Phase 1, Angola, Cunene, Silvestre Tulumba e Investimentos (STI), 09/2016 - 05/2017, Project Leader

Aurecon was appointed for the planning, preliminary and detailed design, documentation and cost estimates for a proposed runway, taxiway and apron, capable of supporting flights using a Boeing 737 and the IL76, at Calueque Airport, including allowance for the installation of simple approach lights. The associated drainage and earthworks design, pavement layerworks, paint markings, signage and fencing were also included. Responsible for technical planning, design review and coordination, project management, and reporting.

Rehabilitation of runway, apron and taxiway at Ondangwa Airport, Namibia, Oshana Region, Namibia Airports Company (NAC), 05/2014 - 03/2017, Project Leader

Aurecon was appointed to undertake the design, tender documentation and contract supervision services for the reconstruction of 2 987 m runway at Ondangwa Airport. This included assessments of concrete and asphalt aprons and taxiways, and detailed visual assessments, material investigations and falling weight deflection (FWD) testing. The scope of work was further expanded to include the upgrading of the airport aprons as well as the major drainage systems linked hereto. Responsible for the technical review and project coordination of the geometric, stormwater, ordinary least squares (OLS) and related designs.

Construction supervision of Nova Vida Phase 2 Relançamento, Angola, Luanda, Imogestin, 03/2010 - 12/2016, Project Leader/Design Coordinator

The project involved the construction supervision for the re-launch of the Nova Vida housing project, Phase 2. This phase entailed the construction of 2 562 housing units including 168 houses, 382 villas, 30 four-storey apartment blocks, 55 six-storey apartment blocks, roads, and services in Nova Vida. Aurecon inspected works constructed by four Chinese contractors and a specialist piling contractor. The project was designed to provide military veterans with accommodation, but the scope of the project was subsequently extended to include other beneficiaries. Responsible for interacting with the town planner for the compilation of a master plan, guidance and input to water storage modellers, and pressurising, reticulation and sewer modelling. Also responsible for the technical coordination of the team designing the roads, stormwater drainage, water and sewer reticulation, and sewer and water augmentation as well as liaising with the electrical design team and Angolan staff.

Vertical alignment of the Mejametalana Airport runway, Lesotho, Lesotho Ministry of Public Works and Transport: Roads Directorate, 04/2013 - 09/2016, Project Director

Aurecon undertook the design and preparation of tender documents for the upgrading of the Mejametalana Airport. The Air Wing was operating CASA C-212 aircraft and was evaluating the procurement of a CASA CN-235 aircraft, which required the rehabilitation and upgrading of the airport airside pavements to accommodate the new aircraft. The project's primary objective was the design of the main runway for the proposed future operational requirements of the Air Force and working towards compliance of the International Civil Aviation Organization (ICAO) standards. Responsible for client liaison and project coordination.

Feasibility study for the improvement and upgrade of Selebi Phikwe Airport, Botswana, cent, Civil Aviation Authority of Botswana (CAAB), 05/2014 - 10/2015, Project Leader/Airport Planning Specialist

In 2001 a feasibility study was carried out for the Selebi Phikwe Airport to investigate future options for the airport, and to investigate their feasibility and recommend a preferred option. Aurecon was reappointed to carry out another study in 2014, which is aligned with other national strategic studies and initiatives aimed at economic diversification of the Selebi Phikwe Region, including the National Development Plan (NDP), Selebi Phikwe Polaris 2 and Regional Economic Development Strategy (REDS). Aurecon investigated the condition and structural capacity of the movement areas to accommodate the expected future traffic through field investigations as well as examined the adequacy of existing facilities such as movement areas, terminal building, control tower and water supply. A layout of the existing facilities and improvements was also developed along with a guide for the authority and other stakeholders on suitable land use around the airport. Lastly, the design of the aircraft was also examined to assess the existing navigation and surveillance equipment for suitability, as well as the identification of possible obstacles within the vicinity of the aerodromes that may render flight operations unsafe. Responsible for the assessment of airside infrastructure, including pavement conditions as inputs into updating of the master plan as well as reporting, proposing action and cost estimates.

Rehabilitation of the runway at Mahikeng Airport, South Africa, North West, North West Department of Public Works, Roads and Transport, 07/2012 - 07/2015, Project Director

The project entailed the provision of runway, taxiway and apron paint marking details as well as the conceptual design of earthworks and drainage to provide a 150 m safety area both sides of the runway. The design was carried out according to International Civil Aviation Organization (ICAO) standards. A construction cost estimate was also provided. Responsible for technical review and project management.

Upgrading of the South African Police Service's (SAPS's) K9 Academy at Roodeplaat, South Africa, Gauteng, Department of Public Works (DPW), 02/2008 - 12/2014, Project Leader

The South African Police Services (SAPS) and the Department of Public Works (DPW) initiated projects to upgrade the K9 Academy (canine school) at Roodeplaat. In order to support the upgrading and construction of buildings, infrastructure upgrades and additions were also required. The project addressed all civil infrastructure, including roads, stormwater management, earthworks platforms and noise prevention berms, water and sewer reticulation, an irrigation ring main, a pump station and sleeves. Aurecon carried out civil infrastructure design, tender documentation, construction supervision and project management. Responsible for heading the team appointed for developing designs and drawings for tender purposes and liaising with the client, the professional team and the Water Board.

Ad hoc engineering services for various Exxaro projects, South Africa, Limpopo, Exxaro Resources Limited, 06/2010 - 12/2014, Engineer/Client Representative

Aurecon was appointed to provide civil and structural engineering services on some of Exxaro's small projects on an ad hoc basis, including the design of infrastructure and assisting with project management and construction supervision. These projects included concrete structures, transport, water, geotechnical, buildings and project management related activities. The scope of each project varied, but the overall scope of services entailed design work for roads, water, sewer, stormwater management, pump stations, tailing dams and mine infrastructure; compiling specifications and bill of quantities (BoQ), and adjudication of tenders; construction supervision; project and construction management; and compiling as-built drawings on work done and signed off. Responsible for the finalisation of the access tunnel, and procurement and civil infrastructure integration at Grootegeluk Mine.

New Quattro 4th Eskom intake and related works, South Africa, Gauteng, City Power Johannesburg (SOC) Ltd, 08/2012 - 11/2014, Civil Design Engineer

The project involved the design for the construction of a new 4th Eskom intake named Quattro and related 88 kV overhead lines, the new Pennyville 88 kV switching station and Mondeor 88/11 kV substation works. Aurecon undertook feasibility studies for various load scenarios, network alternatives and financial analysis, which was necessitated by the shutting down of the Orlando power station. The studies indicated that the best solution was to construct a 400/88 kV substation with 4 x 315 MVA transformers south of the Orlando site. Responsible for liaising with electrical engineers, managing designers, and verifying drawings, quantities and specifications.

Port Harcourt township development, Phases 1 and 2, Nigeria, Niger, SVA Mauritius, 08/2012 - 10/2014, Concept Design Engineer

Aurecon was appointed for the detailed design of Phases 1 and 2 of a housing development in Port Harcourt for TAF Nigeria Homes Limited. The development includes 31 double-storey homes, servants' quarters, 38 light steel frame apartment blocks, a shopping centre, a gatehouse, a clubhouse, a golf course, service areas for electrical infrastructure, water storage and sewer treatment. The work involved the design of bulk earthworks, which was integrated into the stormwater design; as well as the design of roads and parking geometry; pavement layerworks for road and parking areas; road signage and paint markings. Responsible for civil engineering designs, reporting and costing, client liaison and liaising with electrical engineers.

Design and analysis for the Middelburg Water Reclamation Project (MWRP), South Africa, Mpumalanga, BHP Billiton Energy Coal South Africa Limited (BECSA), 05/2010 - 06/2014, Design Coordinator

The project comprised the establishment of a water treatment plant (WTP); water collection and distribution system; waste disposal system and bulk electrical supply for the treatment of water from the Middelburg Mine Services. Aurecon's services included engineering, procurement, and construction management (EPCM), project planning and project controls, option analysis and conceptual design. Responsible for the coordination of the pipeline and pump station hydraulic designs, quantity calculation and compiling bills of quantities (BoQs), and liaising with the structural designers of the pump stations.

Design of water supply infrastructure for Necuto, Angola, Cabinda, Camãe Lda, 11/2011 - 06/2014, Project Leader

The project entailed the design of an abstraction weir and pump station, pipeline to a storage facility, water treatment plant (WTP), pump stations to supply water to elevated storage and reticulation network to standpipes across the town of Necuto. The project scope entailed site visits; a topographical survey; geotechnical investigation; detailed design drawings and bills of quantities (BoQs); a storage facility; pump stations to elevated storage and the laboratory for the technician; reticulation network to connections and standpipes; electrical power supply at the treatment facility; electronic and instrumentation design for the pump stations and structural design. Responsible for conceptual layouts; coordination of hydraulic, structural, electrical and electronic designs, and liaising with Angolan staff.

Master plan for a leisure resort in Elephant Bay, Angola, Benguela, SVA Mauritius, 07/2011 - 06/2014, Civil Engineer

The project entailed the development of master plan for a leisure resort in Elephant Bay. Responsible for assessing site conditions; providing input and attending meetings with the client, architect and landscaper regarding the civil infrastructure.

Featherwood Residential Estate, South Africa, Gauteng, Featherwood Estate, 08/2004 - 05/2014, Team Leader

The project entailed civil engineering infrastructure for residential retirement development with 152 units in the east of Pretoria. Responsible for the provision of construction drawings for the fourth stage of development, including calculation of quantities.

Audit of the Principe International Airport runway's International Civil Aviation Organization (ICAO) compliance, São Tomé and Príncipe, HBD STP - Investimentos Turísticos, Unipessoal, Lda, 10/2010 - 05/2014, Project Director

Aurecon investigated possible upgrades to the airport to enable the safe landing and take-off of a Bombardier Global Express as per International Civil Aviation Organization (ICAO) standards. The project also entailed an investigation of the upgrading of 25 km of roads on the island. Aurecon also assisted with the logistics for the delivery of equipment to the island; as well as the procurement of temporary houses and the transportation of farming and other equipment to the island. A study to investigate the upgrading of an existing port/offloading facility was also conducted. Responsible for client liaison, project management, and the design review.

Nova Vida housing development, Phase II, Angola, Luanda, Ministério das Obras Públicas (MINOP) Projecto Nova Vida, 11/2006 - 04/2014, Project Leader

Phase 2 of the Nova Vida housing development consisted of two distinct contracts, namely housing and infrastructure. The housing portion constructed 1 862 units, and the infrastructure contract included a variety of aspects such as 22 km of completely new asphalt roads; a stormwater drainage system; 18.3 km sewerage network; a 4 MI concrete-activated sludge wastewater treatment works (WWTW); 17.8km of water reticulation lines and electrical installations. Responsible for managing the team of designers and draughtspersons for the provision of revised designs and drawings related to civil engineering infrastructure, and liaising with Angolan staff.

Design package DD6A for the Gautrain Rapid Rail Link (GRRL), South Africa, Gauteng, Bombela Civils Joint Venture, 07/2006 - 03/2014, Team Leader

The Gautrain Rapid Rail Link is a dedicated light rail line that supports the operation of a transit system capable of operating at speeds of 170 km/h. The 80 km high-speed rail link from central Johannesburg (Park Station) to Hatfield includes 18 km rail in a tunnel, resulting in 10 stations with parking facilities. Aurecon undertook the concept and detailed design of an 8.6 km section of railway, including the detailed design of Viaduct V5c and the associated Centurion Station. Most of the Centurion Station buildings are located underneath the viaduct with elevators providing access to the station platforms above. Prior to the design Aurecon was involved in route assessment and the assessment of station access roads and existing services along the rail route. In a separate contract Aurecon completed detailed design of the Marlboro Station, Rhodesfield Station and OR Tambo International Airport (ORTIA) Station. Responsible for the design of relocation routes for sewer infrastructure, issuing of drawings and liaising with the client.

Project management for King Mswati III International Airport, Swaziland, Swaziland Government - Ministry of Economic Planning and Development, 05/2010 - 03/2014, Project Leader

Aurecon was appointed as project managers to finalise the infrastructure construction process for the King Mswati III International Airport, originally named Sikhuphe International Airport. Aurecon's role was to manage the seven packages for the development of the airport behalf of the client. The scope of work included a review of the master plan previously developed by others, focusing on the suitability of existing infrastructure based on the expected air traffic and passengers. Responsible for coordination and assessment.

Rehabilitation and upgrading of Namibe Airport, Angola, Namibe, Construtora Norberto Odebrecht, 03/2013 - 12/2013, Design Engineer

Aurecon was appointed to undertake the evaluation and detailed design for the rehabilitation and upgrading of Namibe Airport airside movements and airfield ground lighting (AGL). The objective was to provide the client with an evaluation report with technical assessment of the conditions of the airfield and a detailed design and engineering solution for the rehabilitation and upgrading of the airfield in accordance with the standards and recommendations of the International Civil Aviation Organization (ICAO). The airport permits the aircraft B737-700 to serve the airport. Responsible for the design review and project coordination.

Vergunning Housing Development, South Africa, Limpopo, SeCo Construction Project Managers, 10/2010 - 02/2013, Civil Engineer

This was an affordable housing project on a 126 ha stand in Polokwane. Responsible for guiding and approving the compilation of the layout drawings and writing the engineering services report with estimates.

Alterations to the airside aprons and taxiways at OR Tambo International Airport (ORTIA), South Africa, Gauteng, Airports Company South Africa (ACSA), 06/1998 - 06/2012, Design Engineer

Aurecon was appointed for the project management of the Charlie and Lima Taxiways as well as the Echo Apron for the OR Tambo International Airport (ORTIA). The project's main aim was to create aircraft stands that can accommodate the Airbus A380 Passenger Aircraft. Six A380 aircraft stands were constructed as well as five new

B747-400 aircraft stands. The project was undertaken in phases and certain enablement work was undertaken to facilitate construction. This work included the construction of Lima Taxiway and the extension of Charlie Taxiway, the construction of new vehicle parking areas and the relocation of existing security fences. Responsible for geometric and earthworks design using ModelMaker software.

Expansion of Liqhobong Diamond Mine, Lesotho, Liqhobong Mining Development Company (Pty) Ltd (LMDC), 02/2008 - 06/2012, Project Leader

The project entailed the concept study for the upgrading of the supporting infrastructure at the Liqhobong Diamond Mine. Due to the challenging topography (mountainous), access roads, terraces and ponds/dams required careful study to assure safety, constructability and fitness for purpose. The infrastructure furthermore had to accommodate other disciplines such as the tailings facility, the bulk materials handling (BMH), and existing operations while under construction. Responsible for attending professional team workshops and meetings, conceptual infrastructure layouts, arranging an aerial survey and liaising with the access road designer.

Infrastructure engineering services for the Euphoria Golf Estate and Hydro development, South Africa, Limpopo, Euphoria Gold Estate, 08/2004 - 05/2012, Project Leader

The Euphoria Golf Estate and Hydro, a greenfields development in the heart of a cluster of surrounding golf estates in Limpopo. The 18-hole championship golf course is the first golf course in Africa to be designed by Annika Sorenstam. The estate is also distinguished by a cableway that links the club house to the mountain estate and Sundowner Deck Restaurant. Aurecon provided the full spectrum of infrastructure engineering services for this project, inclusive of bulk earthworks, stormwater management, roads, water, sewage and electrical services. Responsible for the design of the parking area and the road to the maintenance facility and the close-out of the construction stage.

Tourism resort master plan for Northern Mozambique, Mozambique, Arco Norte Tourism Development Company (ANTDC)/ Pattichides & Partners, 10/2009 - 05/2012, Design Coordinator

Aurecon was appointed to provide high-level conceptual planning for the development of an integrated tourism resort master plan with the aim of enabling the development of an internationally competitive tourism industry in Mozambique. The project was implemented in two phases; Phase 1 addressed the overall strategic context and resort development master plan, while Phase 2 addressed the detailed master plans, business plans and development briefs for three selected projects. Responsible for the assessment of focus areas based on previous reports and attending meetings with the client and architect.

Glevera Retirement Haven, South Africa, Gauteng, MEGA, 02/2008 - 04/2012, Team Leader

The project concerned the Glevera Retirement Haven consisting of three separate buildings, each with three levels, in Waterkloof. Responsible for revising of parking area layouts and levels and the sewer and stormwater reticulation around the buildings.

Freedom Park Development, Phases 1-3, South Africa, Gauteng, Freedom Park Trust, 02/2003 - 12/2011, Design Engineer

The project entailed the detailed design and contract documentation for the 52ha Freedom Park Development. Aurecon was appointed to assist with the design of bulk infrastructure comprising roads and parking areas, water and sewer connections and reticulation and electrical connections and reticulation. The access road through the Salvokop Township was also upgraded. Additional work carried out included the rehabilitation of a small Kaolin Mine on the Freedom Park site, including the securing of the site to prevent illegal ingress, while stormwater management was also undertaken. Responsible for the design of the car park areas and adjoining portions of the ring road, liaising with the design team and joint venture (JV) partners and ensuring that the existing indigenous flora was taken into consideration.

Structural design and pump specifications for the Itsoseng bulk water supply project, South Africa, North West, Ngaka Modiri Molema District Municipality (NMMDM), 06/2009 - 10/2011, Project Leader

The water reservoir in Itsoseng had become structurally unsound and a new water reservoir, tower and pump station were constructed in order to replace the existing facility. Aurecon was contracted for the structural designs and for the pump specifications for the installation of the pump and the connecting pipelines. Responsible for client liaison and attending meetings, head of team for the updating of the design drawings and quantities and liaising with structural engineers.

Design, project management and site supervision of the Aparthotel Baía, Angola, Luanda, Ouse Investments, 02/2005 - 06/2011, Contract Manager

The Aparthotel Baía in Luanda's central business district (CBD) consists of numerous small apartments, 57 suites, and parking for 20 vehicles. The hotel's surface area is 4 800m² and the building consists of one basement and eight storeys. Aurecon was appointed for the design review, project management and site supervision of this project. Due to unique challenges faced in Luanda, Aurecon had to allow for the provision of a power generator, water tanks and water pumps in the design to enable the hotel to provide its own water and power. Responsible for the construction supervision and project management, liaising with the client, and cost control.

Preliminary design for expansions at the western boundary of Nova Vida, Angola, Luanda, Ministério das Obras Públicas (MINOP), 01/2009 - 07/2010, Project Leader

The project entailed consultancy services for the preparation of a report on the factors influencing the proposed new extension on the Nova Vida township; making recommendations on the upgrading and improvements to existing infrastructure and the preparation of a provisional layout plan for the extensions. Additionally, the objectives also included the preparation of an initial cost estimate for budget purposes and the finalisation of the terms of reference (TOR) for the detailed design phase. Responsible for conceptual civil infrastructure layouts and inputs for the town plan, and liaising with the electrical engineers and Angolan staff.

Civil and electrical engineering infrastructure for Louwlandia Extensions 11, 22, 46 and 47, South Africa, Gauteng, Improvon, 05/2006 - 05/2010, Project Leader

The project involved civil and electrical engineering infrastructure for four commercial stands in the Centurion area. Responsible for the completion of the construction stage.

Shoprite Housing Project, Angola, Luanda, Shoprite Checkers, 01/2004 - 12/2009, Supervisor

The project entailed construction supervision of the first 13 houses out of the 56 for Shoprite staff. Aurecon's scope of services included infrastructure design, project management and contract supervision for the housing, pump station, substation, stormwater and sewerage systems and roads. Responsible for the inspections of house construction and liaising with the client and the architect.

Upgrading of the Riverview wastewater treatment works (WWTW), South Africa, Mpumalanga, eMalahleni Local Municipality, 10/2008 - 10/2009, Project Leader

Aurecon was appointed for the documentation and site supervision for the upgrading of the Riverview wastewater treatment works (WWTW) by retrofitting equipment with new and refurbished equipment to ensure that the works is functioning at full capacity. The project scope included work on the inlet screen, primary settling tanks, a sludge pump station, aerators, bio-filters, final clarifiers, a return pump station and a humus pump station. Responsible for close-out of the construction stage of the project.

Sanitation plans for Xai-Xai, Chokwe, Inhambane and Maxixe, Mozambique, National Directorate of Water/Direcção Nacional de Águas (DNA), 07/2008 - 03/2009, Team Leader

Aurecon was appointed for the provision of consultancy services for strategic sanitation plans for Xai-Xai, Chokwé, Inhambane and Maxixe to provide an inventory of existing sanitation infrastructures as well as to define a strategy for intervention. These strategic sanitation plans defined the investments needed to develop sanitation infrastructure, the extension of water supply systems and the necessary financial and institution/management arrangements to ensure the sustainability of the respective investments. Responsible for site visits; the assessment of water, sewer, stormwater and waste infrastructure; conceptual sewer reticulation and pumping systems; the provision of estimates for the economic model; and report writing.

Housing development project in Cabinda, Caio Verde, Angola, Cabinda, Ondjwo Yetu, 06/2005 - 02/2009, Project Leader

The aim of the project was to provide housing to an increasing number of locals and expats employed in the oil industry in Cabinda. Aurecon was involved from the project conceptualisation and master planning stage, including the execution of all the preliminary investigations such as geotechnical, geo-hydrological and environmental studies. Aurecon was also involved in the detailed engineering design of the first phase of the project, encompassing water, sewer, roads, stormwater and electrical services. Responsible for heading the team appointed for compiling final tender drawings and documentation for civil engineering infrastructure.

Expansion of Dwarsrivier Chrome Mine's north pit, South Africa, Mpumalanga, Assmang, 06/2008 - 10/2008, Project Leader

The project entailed the expansion of Dwarsrivier Chrome Mine's north pit through the provision of stormwater drainage and declining road and electrical supply for underground mining activity. Responsible for site visits, liaising with the project manager, and the provision of stormwater protection details and the decline road longitudinal section.

Conceptual and detailed design for the Moatize Coal Project, Mozambique, Tete, Vale Moçambique Limitada, 03/2008 - 10/2008, Design Coordinator

Aurecon was appointed for the conceptual and detailed design of the mine infrastructure components for the Moatize Coal Mine project, including maintenance and administration facilities, conveyors, bulk water and electrical supply, new access roads, a water treatment plant (WTP), a railway yard and coal loading facilities. The appointment also included geotechnical investigations and project management. Subsequently, Aurecon provided construction coordination support on site and a soils and concrete testing laboratory during construction of the mine. Responsible for responding to information requests relating to water pipe systems, including the impact of changes to the primary crusher dust control system.

Design, project management and site supervision for the Edifício Maianga, Angola, Luanda, Ouse Investments, 01/2005 - 12/2007, Contract Manager

Aurecon was appointed for the design, project management and site supervision of the Edifício Maianga, which consists of one basement and seven storeys and includes retail space, offices and apartments. Due to unique challenges faced in Angola, Aurecon also had to allow for the provision of a power generator, water tanks and water pumps in the design to enable the development to provide its own water and power. Responsible for the construction supervision and project management, liaising with the client, and cost control.

Construction of the Sunrise View Retirement Estate, South Africa, Gauteng, MEGA, 10/2007 - 12/2007, Team Leader

The project, carried out in multiple stages, involved the construction of the residential retirement development in Elarduspark, Pretoria. Responsible for the updating and provision of construction drawings for the remaining eight stands.

Façade engineering services for the Torres Atlantico building, Angola, Luanda, Pre-Plan, 05/2005 - 11/2007, Supervisor

Aurecon was appointed to provide façade engineering services for the new head office development for ExxonMobil, consisting of a commercial building of 20 storeys and an apartment complex of 10 storeys, both buildings linked by a four-level parking garage. Aurecon's role entailed the façade engineering for the curtain wall and aluminium cladding sub-contracting. Responsible for the inspection and supervision of the installation of the façade, and liaising with the designer.

Construction of the Lobatse-Kanye bypass roads, Botswana, South, Ministry of Works and Transport - Roads Department, 07/2001 - 03/2005, Design Engineer

The project consisted of the provision of bypasses on the Trans-Kgalagadi road for the towns of Lobatse (10 km) and Kanye (16.5 km). The new roads consisted of one carriageway of a future dual carriageway road. The cross section is typically two surfaced lanes of with a width of 3.7 m each and 1.5 m-wide surfaced shoulders. On the Lobatse section, climbing lanes were also constructed. A major road-over-river bridge was included, as well as several major drainage structures. Responsible for determining the expected runoff quantities and the design of culverts for the roads.

Nova Vida township development, Phase I, Angola, Luanda, Ministério das Obras Públicas (MINOP) Projecto Nova Vida, 08/2000 - 01/2005, Civil Engineer

Phase 1 of the Nova Vida housing project involved the design and construction of 1 600 flats, 500 three-bedroom houses and 300 four-bedroom houses. Apart from housing, the infrastructure facilities also provided for future community facilities, parks, schools, a university, clinics, shopping centres, retail complex, office accommodation, light industrial stands, churches and town management offices. A primary school, police station, convention centre and sport centre were constructed under separate contracts during Phase 1. Aurecon's role entailed the provision of a contract management and construction monitoring service and to supply resident engineers.

Upgrading of the apron and terminal building at Lanseria International Airport, South Africa, Gauteng, Lanseria International Airport, 01/2000 - 07/2004, Design Engineer/Supervisor

The project entailed earthworks, roads and civil engineering services for new terminal building and extension to apron parking areas for the aircraft at Lanseria International Airport. Responsible for part-time site supervision of the construction of airport infrastructure, including services for new building and asphalt and concrete pavement areas. Also responsible for the coordination and design of certain final drawings.

Upgrading of the Alpha taxiway at Lanseria International Airport, South Africa, Gauteng, Lanseria International Airport, 02/2003 - 07/2004, Design Engineer

The project entailed a 1 000 m upgrade of the taxiway from a 7.5 m width to 15 m width, with 5 m surfaced shoulders and an International Civil Aviation Organization (ICAO) compliant taxiway strip. Responsible for the geometric and drainage design of earthworks, modelling, and the calculation of quantities.

Upgrading of Livingstone Airport, Zambia, National Airports Corporation Ltd (NACL), 01/2003 - 06/2004, Assistant Design Engineer

Aurecon was appointed for the upgrading of electrical reticulation at Livingstone Airport. The upgrading included improvements to the runway lighting, apron elimination, emergency power supply and electrical reticulation. Responsible for the geometric design, drainage calculations, contract documentation, calculation of quantities, and cost estimates.

Construction of a car park extension at Lanseria Airport, South Africa, Gauteng, Lanseria International Airport, 03/2003 - 12/2003, Design Engineer

Lanseria Airport completed the construction of a car park area opposite the terminal building towards the end of 2000. Aurecon was appointed the geometric and pavement design of an extension to the existing car park, following indications that additional capacity was needed. The extension was constructed in two phases, with the first phase providing an additional 350 parking areas. Responsible for the coordination and design of the parking area layout and geometry as well as for the supervision of the mass earthworks contract for the construction of additional parking bays, which entailed moving 400 000 m³ of earth material.

Cut-off trench at OR Tambo International Airport (ORTIA), South Africa, Gauteng, Airports Company South Africa (ACSA), 07/2002 - 04/2003, Project Leader

Aurecon was appointed for the preliminary and detailed design as well as conducting surveys for a cut-off trench at the OR Tambo International Airport (ORTIA). As part of the remedial work on fuel spillages at the Delta Apron, two methods were considered by the Airports Company South Africa (ACSA). These methods included a cut-off trench to prevent flow into residential areas and a vacuum enhanced recovery (VER) system. Responsible for the design of the subsurface drain and the compilation of tender documentation.

Apron area, mass earthworks and appurtenant works for new Execujet facility, South Africa, Gauteng, Execujet South Africa, 01/2001 - 01/2002, Design Engineer

The project entailed the addition of a taxiway, apron and services to the office block and hangar at the Execujet facility, consisting of an office block, hangars, an apron and parking areas. Responsible for the coordination and design of certain final design drawings, and part-time supervision of the construction of civil works.

Western Cape visual calibration sections, South Africa, Western Cape, Provincial Administration of the Western Cape (PAWC), 01/1999 - 01/2000, Technician

The project involved visual condition assessments of pre-determined sections to assess management model calibrations. Responsible for assisting with the visual evaluation of the calibration sections in.

Philippines road centreline survey, Philippines, World Bank/Department of Public Works and Highways, 01/1999 - 01/2000, Technician

The project involved the collection of road centreline information using video, global positioning system (GPS), computer and specialised equipment of the entire national road network. Responsible for assisting with the installation, calibration and operation of survey equipment in vehicles and the processing of video, GPS and survey data.

Eastern Cape road centreline survey, South Africa, Eastern Cape, Eastern Cape Provincial Administration (ECPA), 01/2000 - Click or tap to enter a date., Technician

The project involved the collection of road centreline information using video, global positioning system (GPS), computer and specialised equipment. Responsible for assisting with the installation, calibration and operation of equipment in the vehicles for surveying purposes.

Design of various roads in Lesotho, Lesotho, Government of the Kingdom of Lesotho (GOL), 01/2001 - Click or tap to enter a date., Design Engineer

The project entailed the design of the Mophale feeder roads and the Mantoyane-Thaba Kholo plateau in Lesotho. Responsible for determining the expected run-off quantities, and the design of culverts for the roads.

Upgrade of airside at Lanseria International Airport, South Africa, Gauteng, Lanseria International Airport, 01/2003 - Click or tap to enter a date., Design Engineer

The project entailed the design of the final levels for the mass earthworks contract to comply with requirements for the International Civil Aviation Organization (ICAO) Category 3C non-instrument main runway, the design of related stormwater and sewer upgrading, the calculation of quantities, and liaising with the client regarding cost estimates prior to design work. Responsible for geometric design for the upgrading of the runway and taxiway infrastructure.

Steel fuel line at Johannesburg International Airport (JIA), South Africa, Gauteng, Airports Company South Africa (ACSA), 01/2002 - Click or tap to enter a date., Documentation Engineer

The project entailed a 400 mm steel fuel line for the Delta Apron at the airport, now known as the OR Tambo International Airport (ORTIA). Responsible for the compilation of tender documents, and the calculation of quantities.

Qualifications

MPhil (Environmental Management)

NDip (Forestry)

BTech (Forestry)

Professional registrations

Registered Environmental Assessment Practitioner (EAP), Environmental Assessment Practitioners Association of South Africa (EAPASA) (EAPASA Reg No 2021/4095).

Member, International Association for Impact Assessment, South Africa (IAIASa)

Specialisation

Project Leader/Senior Environmental Practitioner

18

years in industry



Patrick Killick

Environmental Practitioner

Patrick is based in Zutari's George office as a senior environmental practitioner and project leader with significant on-site experience in the supervision, hands-on management and monitoring of construction-related environmental impacts and occupational health and safety associated with the construction of dams, roads, pipelines, underground works, weirs, and residential villages whilst employed on the Berg Water Project.

Patrick entered the environmental field via construction phase environmental management on the Berg River Project, where his duties included the supervision and hands-on environmental management, site remediation, monitoring of construction-related environmental impacts and occupational health and safety. This experience was gained on a range of interrelated projects including dams, roads, pipelines, underground works, weirs, and residential villages, which includes four years of experience in a full-time environmental management officer role near Franschhoek, Western Cape. As a result, he is well-versed in the site management systems, processes and the practicalities of environmental site management. His duties as a practical environmental manager also included converting guidelines and policy into practice and procedure.

Patrick's impact assessment experience arose from a variety of projects and industries whilst undertaking various environmental impact studies and other regulatory and planning processes for various developments within South Africa, Angola, Mozambique, Tanzania and Namibia. His project experience runs deeper in the areas of municipal bulk water supply and wastewater treatment infrastructure, waste management facilities (including H:h landfill class), bulk thermal power generation (gas, HFO and coal), utility-scale renewable energy projects (wind and solar), seawater desalination (SWRO) including associated marine, estuarine and coastal issues, open pit mining (coal and uranium) and associated mining infrastructure. With a keen interest in the technical aspects of the job, Patrick enjoys exposure to each new industry and understanding the technologies, processes and environmental challenges associated with each.

Patrick also plays a role in the management and development of proposals for various prospects pursued throughout the African continent and contributes to the maintenance of several business planning databases in this regard. He also provides support and guidance to other environmental project leaders on project management-related matters.

Patrick obtained a Master's degree in Environmental Management in 2005 from the University of the Free State (UFS) and is a member of the International Association for Impact Assessment South Africa (IAIASa) and a Registered Environmental Assessment Practitioner (EAP) with the Environmental Assessment Practitioners Association of South Africa (EAPASA), EAPASA Reg No 2021/4095.

Experience

Namies and Wolf Wind farm environmental authorisation (EA) amendments, South Africa, juwi Renewable Energies (Pty) Ltd, 07/2017 - 08/2022, Project Leader

The project entailed the second part of the environmental authorisation (EA) amendment process to increase the size of the wind turbines that can be deployed on the Namies and Wolf Wind energy facilities. Responsible as Team Lead and EAP for all aspects of the project and overseeing the compilation of EA amendment application, associated amendment report and associated public participation process.

Environmental and social impact assessment (ESIA) and resettlement action plan (RAP) for the Zambeze Coal Mine, Tete, Mozambique, International Coal Ventures Private Limited (ICVL), 11/2015 - 12/2021, Project Manager

Zutari was appointed to develop the environmental and social studies that will enable the licensing of the Zambeze Coal Project. The aim of the project is to provide the client with a sound assessment of the potential impacts of the proposed Zambeze mine development and to demonstrate proposed mitigation or enhancement measures on these to the environmental authority, namely the Ministry of Land, Environment and Rural Development/Ministério da Terra, Ambiente e Desenvolvimento Rural (MITADER). Responsible for project contract and financial management.

Nuweveld Wind Farm Projects, Western Cape Province, South Africa, Red Cap Nuweland North (Pty) Ltd, 03/2019 - 12/2021, Project Leader

Red Cap Energy (Pty) Ltd is proposing three wind energy facilities (wind farms) approximately 65 km north of Beaufort West and 30 km south of Loxton along the R381 in the Beaufort West Local and Central Karoo District Municipalities, in the Western Cape. The project includes the development of an approximately ~120 km 132 kV or 400 kV (132/400 kV) transmission line (gridline) which will connect the proposed wind farms to the Eskom Droërivier substation located south-west of Beaufort West. Zutari has been appointed as the independent environmental assessment practitioner (EAP) to facilitate the requisite scoping and environmental impact reporting (S&EIR) processes for all four applications in accordance with the NEMA and associated legislation. The projects included a detailed pre-screening phase used to identify site sensitivities and no-go areas, which informed the preliminary project layout. The layout was then iteratively refined through ongoing specialists, public and authority inputs via a public participation process during the voluntary pre-application scoping phase, and the formal scoping and impact assessment phases. Responsible as Team Lead and EAP for all aspects of the project and overseeing the compilation of environmental impact assessment (EIA) and environmental management programmes (EMPrs) across the four applications, three social and environmental impact assessments (S&EIA) and one basic assessment.

Environmental amendment for the 200 MW Hotazel Solar Park, Northern Cape Province, South Africa, juwi Renewable Energies (Pty) Ltd, 04/2019 - 11/2021, Project Leader

The project entailed the environmental authorisation (EA) amendment to expand and split the 200 MW solar PV facility and associated infrastructure, including a 100 MWh grid-scale battery storage facility on a site near Hotazel in the Northern Cape into two discreet projects. Responsible as Team Lead and EAP responsible for all aspects of the project and overseeing the compilation of EA amendment application and associated amendment report.

Koeris dangerous goods basic assessment and environmental authorisation, Northern Cape Province, South Africa, SA Mainstream Renewable Power, 10/2018 - 11/2021, Project Leader

Zutari undertook a National Environmental Management Act (NEMA) Part 2 environmental authorisation (EA) amendment for the increase in turbine size and basic assessment (BA) for a temporary above-ground diesel storage tank. Responsible as Team Lead and EAP for all aspects of the project and overseeing the compilation of EA amendment application and associated amendment report.



Design of Mizingani seawall and promenade, Phase IIA, Zanzibar City, Zanzibar, Tanzania Ministry of Finance, 11/2013 - 03/2020, EMPr Specialist and ECO

The Revolutionary Government of Zanzibar (RGoZ), through its Zanzibar Urban Services Project (ZUSP), appointed Zutari to lead a consortium of six consultancy companies for the design of the 340 m-long vertical seawall, with a 5 m-wide sea reclamation, along Mizingani Road. Based on design work completed under the Aga Khan Trust for Culture's (AKTC's) technical support, Zutari's scope of work included detailed design of the seawall and promenade; the preparation of construction drawings, specifications, contract packages and tender documents; building condition assessment and review of the environmental and social management plan (ESMP). Responsible for the compilation of a detailed environmental management programme (EMPr) and later appointed to monitor and audit of the project performance against the conditions of authorisation and EMPr.

Water augmentation study for the Bitou Local Municipality, Western Cape Province, South Africa, Bitou Local Municipality, 10/2009 - 2020, Project Leader

The Wadrif 1E Dam scheme was for the augmentation of the bulk water supply to the Plettenberg Bay area. Zutari's project scope focused on the Wadrif 1E off-channel dam and included a basic assessment process for an emergency pipeline and the remainder of the pipeline in terms of the relevant environmental legislation. An application for a licence to store was made in terms of the National Water Act, 1997 (NWA) and a forestry permit application for a drilling site investigation for the Wadrif 1E Dam site and for dam construction. Responsible as Team Lead and EAP responsible for all aspects of the project and compilation of interim monitoring report need to allow for the continuation of the authority's stalled decision making process.

Table Mountain Group (TMG) Aquifer exploratory phase, Western Cape Province, South Africa, City of Cape Town, 12/2015 - 08/2019, EMPr Specialist

The Table Mountain Group (TMG) Aquifer is an aquifer system with significant storage volume which can provide large bulk water supply for local municipalities and irrigation water for agriculture in the Western Cape and Eastern Cape Provinces in South Africa. Zutari was appointed to manage the exploration of groundwater in the aquifer system in order to establish the potential of the TMG Aquifer as a long-term water resource for the Western Cape. Responsible for contributions to the environmental management programmes (EMPrs) and advisory support and quality management to ECOs.

Wallerawang Closure Project, New South Wales, Australia, EnergyAustralia NSW Pty Ltd, 09/2016 - 06/2019, Team Member

Energy Australia's Wallerawang Closure Project went underway to decommission, deconstruct and rehabilitate the site which formerly housed the Wallerawang Power Station, an ash disposal area and associated infrastructure. The 200 ha Wallerawang Ash Repository comprises Kerosene Vale Ash Repository (KVAR), Kerosene Vale Ash Dam (KVAD), Sawyers Swamp Creek Ash Dam (SSCAD), Lidsdale Cut landfill area, an asbestos repository and infrastructure that services these land uses including a pipeline easement, access tracks, haul roads and water management features. Responsible for the section dealing with assessment, management and mitigation of noise and vibration aspects.

Hotazel Solar Park, Northern Cape Province, South Africa, juwi Renewable Energies (Pty) Ltd, 05/2016 - 10/2017, Project Leader

Hotazel Solar Farm, owned by juwi Renewable Energies (Hotazel Solar 1 (Pty) Ltd), is proposing the construction of a solar photovoltaic (PV) park and associated grid connection infrastructure near Hotazel in the Northern Cape. Zutari has been appointed to undertake two separate applications for environmental authorisations from the Department of Environmental Affairs (DEA). Responsible as Team Lead and EAP for all aspects of the project and the compilation of all impact assessment documents, environmental management programme (EMPr) and associated public participation process.

Road materials supply strategy, Western Cape Province, South Africa, Provincial Government of the Western Cape (PGWC): Department of Transport and Public Works, 06/2008 - 07/2017, Team Member/EMPr Specialist/ECO Support and Review



The Western Cape Province initiated a proactive approach to identifying and legalising a network of approved pits. Zutari was responsible for prospecting suitable road making materials, sampling, testing, and identifying technically suitable sources to be used for both identified projects and as strategic pits and was responsible for getting all the required approvals. Responsible as Team Member and assisted with the compilation of application documentation, environmental management programmes (EMPrs) and provided ECO support and quality control functions.

Environmental authorisation (EA) amendment for the Kangnas and Koeris wind energy facilities, Northern Cape Province, South Africa, Mainstream Renewable Power (Pty) Ltd, 02/2016 - 09/2016, Project Leader

Zutari was appointed by Mainstream Renewable Power (Pty) Ltd to undertake two Part 2 amendment and one Part 1 amendment, in terms of the NEMA EIA Regulations, 2014, of an environmental Authorisation for the Kangnas and Koeris Wind Energy Facilities. The amendment centred on a change to the specifications of the proposed wind turbines to allow for a wider turbine specification envelope that permits the new modern turbines models. Responsible as Team Lead and EAP for all aspects of the project and the compilation of all EA amendment documentation and associated public participation process.

Optimisation of Kupferberg landfill site, Windhoek, Namibia, Jan Palm Consulting Engineers (JPCE), 08/2015 - 09/2016, Project Leader

The Kupferberg waste disposal site is currently the only waste disposal facility that serves the City of Windhoek and is one of two in Namibia with hazardous waste components. The City of Windhoek plans to expand the disposal site and service the City of Windhoek for up to 20 years. Zutari was engaged to undertake an environmental impact assessment (EIA) on the project. Responsible as Team Lead and EAP for all aspects of the project and the compilation of all impact assessment documents, environmental management programme (EMPr) and associated public participation process.

Environmental authorisation amendment for the 96 MW Wolf Wind Energy Farm, Eastern Cape Province, South Africa, juwi Renewable Energies (Pty) Ltd, 04/2016 - 08/2016, Project Leader

Zutari was appointed by juwi Renewable Energies (Pty) Ltd to undertake a Part 2 amendment, in terms of the NEMA EIA Regulations, 2014, of an environmental authorisation for the Wolf Wind Energy Facility near Wolwefontein in the Eastern Cape. The amendment centred on a change to the specifications of the proposed wind turbines, increasing blade tip and increasing generation power. Responsible as Team Lead and EAP for all aspects of the project and the compilation of all impact assessment documents, environmental management programme (EMPr) and associated public participation process.

Environmental processes for the Kronos Solar Park, Northern Cape Province, South Africa, juwi Renewable Energies (Pty) Ltd, 11/2014 - 11/2015, Project Leader

Zutari was appointed to undertake five individual environmental processes to assess the environmental impacts associated with the three proposed 75 MW photovoltaic (PV) facilities and two 132 kV overhead transmission lines at the Kronos Solar Park near Copperton. Responsible as Team Lead and EAP for all aspects of the project and the compilation of all impact assessment documents, environmental management programme (EMPr) and associated public participation process.

Kangnas Wind Energy Facility (WEF) and photovoltaic EIAs, Western Cape Province, South Africa, Mainstream Renewable Power, 03/2012 - 11/2015, Project Leader

The project involved updating the final environmental management programmes (EMPrs) and layouts for the approved 140 MW Kangnas Wind Energy Facility (WEF) and associated infrastructure as part of the project financial close ahead of construction for submission to the Department of Environmental Affairs (DEA). Responsible as Team Lead and EAP for all aspects of the project and the compilation of all impact assessment documents, environmental management programmes (EMPr) and associated public participation process.

Outeniqua Wind Farm, Western Cape Province, South Africa, Juwi Renewable Energies (Pty) Ltd, 03/2013 – 10/2015, Project Leader



The project involves conducting an environmental impact assessment process in terms of the National Environmental Management Act for a 39 MW wind energy facility (WEF). Responsible as Team Lead and EAP for all aspects of the project and the compilation of all impact assessment documents, environmental management programme (EMPr) and associated public participation process.

Wolf Wind Farm assessment, Eastern Cape Province, South Africa, Juwi Renewable Energies (Pty) Ltd, 08/2013 - 09/2015, Project Leader

This project involved a proposed wind energy facility (WEF) and associated infrastructure, with a generation capacity of 80MW on farms near Wolwefontein in the Eastern Cape with 132 kV or 220 kV overhead transmission lines for transmission and distribution. Responsible for conducting an environmental impact assessment (EIA).

Rössing Desalination Plant, Erongo Region, Namibia, Rio Tinto Rössing Uranium Limited, 07/2014 - 03/2015, Project Leader

This project consisted of a 10 Ml/d seawater desalination plant, north of Swakopmund to supply the water needs of Rössing Uranium Mine. Responsible as the Zutari Team Lead and EAP for some aspects of the project and the compilation of all impact assessment documents, environmental management programme (EMPr) and associated public participation process.

450 MW Khanyisa coal-fired power station, Mpumalanga Province, South Africa, AngloGold, 09/2010 - 01/2014, Consulting Team Member

Compilation of construction and operations phase environmental management programmes (MP's) for a 450 MW coal-fired power station and associated infrastructure, including ash disposal dumps. Responsible for the development of the environmental management programme (EMPr).

Mineral exploration environmental management plan (EMP) for License Areas No 3450L and 3451L, Tete Province, Mozambique, Coal India Africana Limitada, 02/2012 - 04/2013, Consulting Team Member

The project entailed the compilation of an environmental management plan (EMP) for mineral exploration drilling (diamond core and percussion drilling) in Licence Area no 3450L and 3451L of the Moatize coal fields. Responsible for compilation of the exploration drilling environmental management programme (EMPr).

Environmental and socio-economic impact assessment (ESIA) for a coal-fired power station, Erongo Region, Namibia, NamPower, 09/2011 - 04/2013, Consulting Team Member

To meet the increasing power demands and reduce Namibia's dependency on South Africa for electricity, the Namibia Power Corporation (NamPower) proposed an increase in its electricity-generating capacity. The national peak is approximately 550 MW, of which a significant portion is imported, especially during the dry season. This is when the flow of the Kunene River is far below what is needed to operate the Ruacana Power Station on full base load. The proposed power station, Erongo, is set to contribute to the base load supply and assist in stabilising the grid under load and supply fluctuations. The project aimed to assess the impact of a 150/300/800 MW coal-fired power station with an associated coal stockyard, an ash disposal facility and transport systems to deliver coal. This project aimed to investigate one of the alternative sites from the previous study in Walvis Bay and two new sites in the vicinity of Arandis, east of Swakopmund. Responsible for the development of the environmental management programme (EMPr).

Construction of a bulk water supply scheme to the town of Aussenkehr, Karas Region, Namibia, Namibian Water Corporation, 12/2011 - 03/2013, Consulting Team Member

The project comprised the compilation of a life-cycle environmental management plan for the bulk water supply scheme for the town of Aussenkehr. Responsible for the development of the environmental management programme (EMPr).

Upgrading the Keurbooms pump station, abstraction works and rising main, Western Cape Province, South Africa, Bitou Municipality, 11/2009 - 12/2011, Environmental Control Officer (ECO)

Zutari was appointed by the Bitou Municipality to compile an environmental management plan (EMP) associated with the proposed urgent upgrading of the Keurbooms Pump station, abstraction works and a 650



m length of 500 mm diameter steel rising raw water main. Responsible for compiling an EMP associated with the proposed urgent upgrading of the Keurbooms pump station, abstraction works and a 650 m length of 500 mm diameter steel rising raw water.

Mine life extension for Rössing Uranium Mine, Arandis, Namibia, Rio Tinto Rössing Uranium Mine Limited, 06/2007 - 12/2011, Consulting Team Member

The project comprised the compilation of a social and environmental management plan (SEMP) for various activities associated with the life extension of Rössing Uranium Mine. This included the extension of the open pit operations, acid manufacturing plant, ore sorting plant, extended waste rock disposal areas, and tailings facilities, as well as a bulk sulphur handling facility in the port at Walvis Bay. Responsible for the development of the environmental management programme (EMPr).

Decommissioning of the Sonae Novobord fibreboard factory, Western Cape Province, South Africa, Sonae Novobord (Pty) Ltd, 06/2009 - 06/2011, Consulting Team Member

Zutari was appointed by the Sonae Novobord to compile an environmental management plan (EMP) and act as the environmental control officer (ECO) for the decommissioning of their factory in George Industria, with a focus on the recovery and handling of salvageable materials and the lawful recovery and disposal of hazardous wastes and contaminated soil. Responsible for authoring various documents including the environmental impact assessment (EIA), public consultation materials and environmental management programmes (EMPRs). Also fulfilled the role of ECO overseeing the decommissioning process and ensuring compliance with the environmental authorisation (EA) and EMPr.

Pipeline for reclamation of water from wastewater treatment works (WWTW), Western Cape Province, South Africa, Beaufort West Municipality, 02/2007 - 06/2011, Consulting Team Member

Zutari was appointed for the facilitation of the required environmental authorisation and waste licence for the upgrading of the wastewater treatment works in Merweville. Responsible for routine environmental auditing to confirm compliance with the environmental authorisation (EA) and environmental management programme (EMPr) as required by the ECO role.

15 Ml/d Emergency desalination plant in Mossel Bay, Western Cape Province, South Africa, Mossel Bay Municipality, 05/2010 - 01/2011, Project Manager, Lead Consultant and Environmental Control Officer (ECO)

The project involved the compilation of a Section 24G application in terms of the National Environmental Management Act for an emergency 15 Ml/d seawater reverse osmosis plant as a result of more than 1:150 year drought situation in the Southern Cape, inclusive of a construction phase environmental management plan (EMP) and environmental control officer (ECO) services. Responsible as Team Leader and EAP for the compilation of a Section 24G retrospective environmental impact assessment (EIA) and also the ECO, auditing compliance against the provisional environmental management programme (EMPr).

A new sulphuric acid storage tank at the Rössing Uranium Mine, Arandis, Erongo, Namibia, Rio Tinto Rössing Uranium Mine Limited, 02/2010 - 06/2010, Consulting Team Member

Commissioned by Rössing Uranium to compile a social and environmental management plan (SEMP) for the proposed new 15 Kt sulphuric acid storage tank located within the mine precinct. Responsible for compilation of the impact assessment documentation and environmental management programme (EMPr).

Social and environmental management for mineral exploration drilling plan, Arandis, Erongo, Namibia, Rio Tinto Rössing Uranium Mine Limited, 11/2008 - 04/2010, Consulting Team Member

Commissioned by Rössing Uranium Limited to compile a social and environmental management plan (SEMP) for the proposed exploration drilling activities within the Namib-Naukluft Park and mine licence area. Responsible for compiling the exploration drilling environmental management programme (EMPr).



Creosote and CCA timber pole treatment facility, Groot Brak and Albertinia, South Africa, Outeniqua Pale (Pty) Ltd, 06/2007 - 03/2010, Consulting Team Member

Responsible for assisting with an environmental impact assessment (EIA) for the decommissioning of an Outeniqua Pale Creosote and CCA pole treatment facility in Groot Brak and re-establishing it on a new site in Albertinia. Appointed by Outeniqua Pale (Pty) Ltd to compile a construction, operation and decommission phase environmental management plan (EMP) for a Creosote and CCA pole treatment facility in conjunction with a basic assessment report (BAR).

2 MI/d Emergency desalination plant in Plettenberg Bay, Western Cape Province, South Africa, Bitou Municipality, 12/2009, Lead Consultant and Environmental Control Officer (ECO)

Compilation of a Section 24G application in terms of the National Environmental Management Act for an emergency 2 MI/d seawater reverse osmosis plant as a result of a 1:150 year drought situation in the Southern Cape, inclusive of a construction phase environmental management plan and environmental control officer services. Responsible as Team Leader and EAP for the compilation of a Section 24G retrospective environmental impact assessment (EIA) and also the ECO, auditing compliance against the provisional environmental management programme (EMPr).

Social and environmental management plan for a bulk sulphur handling facility, Erongo, Namibia, Rio Tinto Rössing Uranium Mine Limited, 04/2008 - 12/2009, Consulting Team Member

Commissioned by Rössing Uranium to compile a social and environmental management plan (SEMP) for the proposed bulk sulphur importation, stockpiling and handling facility in the port of Walvis Bay.

Emergency upgrading of Keurbooms rising main and pumps, Western Cape Province, South Africa, Bitou Municipality, 10/2009 - 11/2009, Lead Consultant

Appointed by the Bitou Municipality to undertake an Emergency application for the upgrading of a 295 m section of the perished pipeline, with 500 mm diameter steel pipe and the upgrading of pump impellers to increase abstractions from 100 l/s to 120 l/s out of the Keurbooms River. Responsible to compile an EMP and functioning as the ECO for the Emergency application and subsequent upgrading of a 295 m section of the perished pipeline, with 500 mm diameter steel pipe and the upgrading of pump impellers to achieve a greater abstraction rate.

Upgrading of the Merweville wastewater treatment works (WWTW), Western Cape Province, South Africa, Beaufort West Municipality, 05/2009 - 10/2009, Project Manager and Lead Consultant

Zutari was appointed by the Beaufort West Municipality to undertake a waste license application involving the compilation of a basic assessment report and a construction, operation and decommissioning phase environmental management plan (EMP) for the upgrading of the Merweville wastewater treatment works (WWTW). Responsible as Team Leader and EAP for the compilation of impact assessment and environmental management programme (EMPr) documents.

Environmental and socio-economic impact assessment (ESEIA) for a proposed NamPower coal-fired power station at Walvis Bay, Erongo, Namibia, NamPower, 04/2008 - 08/2009, Consulting Team Member

Responsible for acting as Lead Consultant on the ESEIA for the proposed NamPower coal-fired power station at Walvis Bay. This included a site screening and selection process, a scoping study, and an ESEIA, all supported by an environmental management plan (EMP).

40 MI off-channel reservoir in Karatara, Western Cape Province, South Africa, Knysna Municipality, 04/2008 - 07/2009, Principle Environmental Consultant/Environmental Control Officer

The project entailed the compilation of the construction phase environmental management plan (EMP) for a 40 000 m² off-channel reservoir, in-channel abstraction works, and associated pipe work. Responsible for acting as environmental control officer (ECO) to supervise the implementation of the environmental management plan (EMP), and undertake compliance monitoring and reporting.



Independent review of environmental impact assessment (EIA) applications, Eastern Cape Province, South Africa, Department of Environmental Affairs and Tourism (DEAT), 01/2007 - 02/2009, Consulting Team Member

Responsible for assisting with the review of various Section 22 EIA applications in terms of the Environmental Conservation Act (Act 73 of 1989) for the Department of Economic Affairs, Environment and Tourism (DEAET).

Paratus emergency generation facility in Walvis Bay, Erongo, Namibia, NamPower, 04/2008 - 08/2008, Consulting Team Member

Responsible for assisting with the environmental process management and compiling documentation in relation to a proposed 50 MW heavy fuel oil emergency generation facility located in the industrial port area.

Review of the biodiversity components of municipal spatial development frameworks in the Cape domain, Western Cape Province, South Africa, South African National Biodiversity Institute (SANBI), 09/2007 - 06/2008, Consulting Team Member

Zutari was appointed to provide an overview of the requirements for biodiversity in SDF's, and an assessment of the current status of biodiversity in these SDF's, as well as to undertake the review as Phase I of a process to improve the input of biodiversity priorities in spatial planning documents and processes. Responsible for reviewing the first phase of a process to improve the input of biodiversity priorities in spatial planning documents and processes.

Overhead power lines between Ha Lejone and the Liqhobong and Kao Diamond Mines, Lesotho, Liqhobong Mining Development Company and Kao Diamond Mine/Plantech Associates, 03/2007 - 02/2008, Consulting Team Member

Responsible for assisting with the compilation of an environmental impact assessment (EIA) for a 38 km, 132 kV overhead power line and associated step-up and step-down substations.

Timber treatment facility, Albertinia, South Africa, Outeniqua Pale (Pty) Ltd, 2008, Consulting Team Member

The project was concerned with the compilation of a construction, operation and decommission phase environmental management plan (EMP) for a Creosote and CCA pole treatment facility in conjunction with a basic assessment report. Responsible for contributions to the environmental management programme (EMPr) and assisting with air quality monitoring.

Relocation of Sedgefield's water treatment and supply infrastructure, Western Cape Province, South Africa, Knysna Municipality, 08/2007 - 12/2007, Consulting Team Member

The project consisted of a basic assessment report for the construction of a 4,5 MI water treatment works; a 1,8 km, 300 mm rising raw water pipeline; and the decommissioning and upgrading of the Ruigtevlei water treatment works into a pump station. Conduct a Basic Assessment process for the construction of a 4.5MI water treatment works, a 1,8 km, 300 mm rising raw water pipeline and the decommissioning and upgrading of the Ruigtevlei water treatment works into a pump station. Compilation of the construction, operational and decommissioning phase EMP's for the construction of a 4,5 MI water treatment works, a 1,8 km, 300 mm rising raw water pipeline and the decommissioning and upgrading of the Ruigtevlei water treatment works into a pump station. Responsible for assisting with the compilation of project documentation including impact assessment and environmental management programmes (EMPrs).

Chemical storage and distribution facility in George, Western Cape Province, South Africa, Metsi Chem Ikapa (Pty) Ltd, 06/2007 - 11/2007, Consulting Team Member

The project involved Section 24G retrospective applications for the authorisation of illegal activities relating to the storage of various hazardous chemicals used in the water purification industry, and the development of an associated operational phase environmental management plan (EMP) for incorporation into an ISO14001 environmental management system (EMS). Responsible for compilation of a section 24G retrospective environmental impact assessment (EIA) and environmental management programme (EMPr).



Alien vegetation eradication and rehabilitation, Fancourt Estate, George, Western Cape, South Africa, Fancourt Golf and Country Estate, 05/2006 - 06/2007, Consulting Team Member

Responsible for formulating an alien vegetation eradication and rehabilitation plan for Afromontane Forest for the estate's landholding on Malgas River.

Berg water project, Franschhoek, Western Cape Province, South Africa, Trans-Caledon Tunnel Authority (TCTA), 03/2004 - 03/2007, Environmental Monitor

The project entailed the construction of bulk water supply infrastructure to service the greater Cape Town metropolitan area which is comprised of the Berg River Dam, large diameter water transfer pipelines, two heavy-duty pump stations, a scheme control centre, a balancing dam, several gauging weirs, a diversion weir, an asphalt access road, and an 80-unit residential village with associated bulk services. Responsible for construction supervision, environmental monitoring and reporting, review and assistance with construction method statements, monitoring health and safety aspects and legal compliance, as well as investigating and advising on internal and external entities with regard to environmental issues.

A chemical storage facility, George, South Africa, Metsi Chem Ikapa (Pty) Ltd, 2007, Consulting Team Member

This project involved Section 24G retrospective applications for the authorisation of illegal activities relating to the storage of various hazardous chemicals used in the water purification industry, and the development of an associated operational phase environmental management plan (EMP) for incorporation into an ISO14001 environmental management system (EMS). Responsible for compilation of a section 24G retrospective environmental impact assessment (EIA) and environmental management programme (EMPr).

Keurbooms River raw water pipeline, Plettenberg Bay, South Africa, Bitou Municipality, 2007, Environmental Control Officer

The project consisted of the provision of ad hoc environmental planning, routine audits, and compliance monitoring of the implementation of the environmental management plan (EMP) and ROD conditions of approval for the installation of a 9 km raw water pipeline and the rehabilitation of the construction servitude on completion. Responsible for the monitoring and auditing of the project performance against the conditions of environmental authorisation (EA) and environmental management programme (EMPr).

Mine life extension for Rössing Uranium Mine, Arandis, Namibia, 2007, Consulting Team Member

Responsible for assisting with the compilation of a social and environmental impact assessment (SEIA) for various activities associated with the life extension of Rössing Uranium Mine, including the extension of the open pit operations, the acid manufacturing plant, the ore sorting plant, extended waste rock disposal areas, and tailings facilities.





Preston Padayachee

Civil Engineer

Summary

Preston is a civil engineer at Zutari and has gained experience in airport master planning and design in South Africa, Nigeria and Rwanda. This includes geometric design of roads for windfarms and airport infrastructure according to the relevant standards. In addition, analysing the Obstacle Limitation Surfaces of airports according to the International Civil Aviation Organisation (ICAO) Annex 14.

Master planning at airports across South Africa has allowed him to contribute to the visual representation of the airside infrastructure being cognizant of the spatial requirements of the airport whilst still taking into consideration the existing infrastructure and its impact.

His previous experience during his career includes design of a combo court, creating bill of quantities and producing tender documentation for building rehabilitation of a crematorium. Furthermore, his experience covers desktop studies and site visits to locate, prospect and secure hard rock material for future SANRAL contracts in KwaZulu-Natal, South Africa.

He is efficient in applying design software packages from MicroStation and AutoCAD to generate designs, this includes the use of Civil 3D, OpenRoads and AviPLAN as geometric and simulation tools for design. His programming skills include VBA Programming in Excel, Python and Generative Components in MicroStation.

Relevant experience

Apron repair: Toivo Ya Toivo Airport, Namibia, Namibia Airports Company (NAC), 01/2020 - 12/2022, Civil Engineer

The project entails maintenance work on taxiway and apron of the airport. Responsible for the simulation of the design aircraft tracking along the upgraded taxiways using AviPLAN.

Etihad Rail Civil 3D, South Africa, WSP Group Africa (Pty) Ltd, 02/2021 - 05/2022, Civil Engineer

Zutari provided Civil 3D support services for Etihad Rail. Responsible for 3D modelling and clash detection of various utilities along railway corridor.

Preliminary engineering designs for RD5 wind farms, South Africa, EDF Renewables (Pty) Ltd, 04/2021 - 05/2022, Civil Engineer

Zutari provided preliminary engineering design for four proposed wind energy facilities (WEF). Responsible for geometric designs of access roads to transport wind turbines to various sites. Including corridor modelling and extraction of quantities.

OR Tambo International Airport pavement rehabilitation, South Africa, Gauteng, Airports Company South Africa (ACSA), 06/2012 - 09/2021, Civil Engineer

Airports Company South Africa (ACSA) required professional engineering services for the rehabilitation of airside pavement infrastructure at airports nationwide. Zutari was appointed to provide professional civil engineering services for the rehabilitation work for a 5-year period at OR Tambo International Airport. Responsible for proposing a new alignment for electrical services to ensure that potential clashes are avoided. Also responsible for providing setting out details for the new alignments.

Jalingo Airport runway rehabilitation and upgrades, Nigeria, Taraba, Nigeria Taraba State: Ministry of Transport, 03/2020 - 04/2021, Civil Engineer

Zutari was appointed for the upgrade and rehabilitation of the Jalingo Airport Runway and design of a new parallel runway and related taxiways in Taraba State, Nigeria. The appointment includes airside infrastructure, drainage,

Qualifications

Bachelor of Science in Engineering

Professional registrations

Candidate Engineer, Engineering Council of South Africa (ECSA)

Associate Member, South African Institution of Civil Engineering (SAICE)

Member, Golden Key International Honour Society (GKIHHS)

Specialisation

Civil engineering

Years in industry

3

paint markings and aeronautical ground lighting (AGL). The project will still enable Code E aircraft operations and considers the phasing of construction, as the airport must remain operational during the construction activities. Responsible for high-level geometric designs for various runway alternatives, this included evaluation of the Obstacle Limitation Surface and consideration of resultant earthworks quantities. Also responsible for preparation of documentation for client submissions and presentations.

ACSA master plans, South Africa, Airports Company South Africa (ACSA), 02/2019 - 03/2021, Civil Engineer

Zutari was appointed to develop fully fledged airport master plans and development plans for Bram Fischer, George, Kimberley and Upington airports in order to address 21st century aviation trends such as commercialisation, globalisation and technological advances. Responsible for assisting the Project Director in developing various macro options for the airside development at the various airports incorporating standards stipulated by the International Civil Aviation Organization (ICAO). In addition, responsible for preparing relevant drawings to the Macro Options.

New Bugesera International Airport (NBIA), Rwanda, Bugesera District, Bugesera Airport Company Limited (BAC), 08/2017 - 12/2020, Civil Engineer

Zutari is providing design review and construction supervision services on the greenfield New Bugesera International Airport (NBIA) project, with capacity for 1.44 million passengers per year utilising a terminal building of approximately 30 000 m². The shape of the roof of the new terminal building represents Rwanda - land of a thousand hills and a million smiles and has an undulated form. The runway and parallel taxiway length will be 3.8 km, with the Airbus A330 as design aircraft. Responsible for reviewing and proposing a new road alignment for various sections of the airside perimeter road and landside access roads. Other duties included creating sketches on the spatial requirements and locality for various buildings; tracking the ARFF vehicle along the service roads using AviPLAN; preparing various sketches indicating services and utilities for review, and producing suggested changes/alternatives. Also responsible for carrying out checks and preparing relevant sketches on the impact of drainage structures on the airside utilities at intersections. Additionally, responsible for checking earthworks quantities.

In diversity there is beauty and
there is strength.

MAYA ANGELOU

Document Prepared by:

Zutari (Pty) Ltd
Reg No 1977/003711/07
Riverwalk Office Park
41 Matroosberg Road
Ashlea Gardens
Extension 6
Pretoria
South Africa
PO Box 74381
Lynnwood Ridge
0040

T +27 12 427 2000
F +27 86 556 0521
E tshwane@zutari.com
W zutari.com