PROPOSED HAVERFONTEIN WIND ENERGY PROJECT, CAROLINA, MPUMALANGA PROVINCE OF SOUTH AFRICA

ENVIRONMENTAL IMPACT ASSESSMENT
VOLUME 2: SPECIALIST REPORTS

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Volume 3:	Environmental Impact Assessment Report
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EXECUTIVE SUMMARY

This volume presents the specialist studies conducted for the Haverfontein Wind Energy Project. Seven potential impact areas were assessed, these being:

- Avifaunal Impacts
- Bat Impacts
- Heritage Impacts
- Palaeontology Impacts (exemption from further study only)
- Visual Impacts
- Noise Impacts
- Ecological Impacts

A geotechnical assessment was also conducted with the conclusion and recommendations of that study presented in this volume.

Tables A and B provide a summary of the construction and operation phase impacts associated with the proposed Havefontein Wind Energy Project, with and without mitigation. Table C shows impact significance assuming the No-Go option. Please note that detailed summaries of the specialist reports appear later in this volume.

Construction Phase Impacts

A total of 15 construction phase impacts were identified and assessed during the 6 specialist studies conducted. Without mitigation measures in place: 20% of the impacts were ranked of high negative significance, 33% of moderate negative significance and 47% of low negative significance.

Detailed mitigatory measures are proposed by the specialists. With mitigatory measures in place: 13% of the impacts were ranked of high negative significance, 26% of moderate negative significance, 47% of low negative significance; 7% of low positive significance (1 impact) and 7 % were rendered negligible.

With assessment of these impacts assuming the No-Go approach the following results were obtained: 7% of the impacts were ranked of high negative significance, 7% of moderate negative significance, 13% of low positive significance, 27% of moderate positive significance, 7% of high positive significance and 39% were not applicable. See Table A and C for a description of these impacts.

Operation Phase Impacts

For the operation phase 11 impacts were identified and assessed. Without mitigation measures in place: 27% of the impacts were ranked of high negative significance, 45% of moderate negative significance, 9% of low negative significance, 9% of negligible significance. For the assessment of one impact, the text is referred to.

With mitigatory measures in place during the operation phase: 27% of impacts were ranked of moderate negative significance, 27% of low negative significance, 9% of low positive significance and 27% were rendered nor applicable or negligible. For the assessment of one impact, the text is referred to.

Assuming the No-Go option, the following results were obtained: 9% of impacts were ranked of high negative significance, 9% of moderate negative significance, 36% of moderate positive

significance and 36% were rendered not applicable. For the assessment of one impact, the text is referred to.
See table B and C for a description of these impacts.

Of the 34 turbines being considered in this EIA, a geotechnical study found that two of them were placed in unfavourable positions. The definition of unfavourable is as follows: “Sites not expected to provide founding conditions that meet the conditions for a standard turbine foundation design without great modification thereto”. Ten of the turbines were found to be in moderately favourable positions, defined as follows: “Sites not expected to provide founding conditions that meet the conditions for a standard turbine foundation design without moderate modification thereto”. The remainder of the turbines were found to be situated in favourable locations. Further testing which will include drilling, excavation and laboratory testing will be conducted in the future.

Table A: Impacts identified and assessed for the construction phase of the project.

CONSTRUCTION PHASE				
Impact Study	Impact #	Impact type	Significance	
			Without mitigation	With mitigation
Ecological	1	Loss of Grassland	HIGH –	MODERATE -
	2	Loss of plant species of special concern	MODERATE -	MODERATE -
	3	Introduction of alien plant species	MODERATE -	LOW +
	4	Loss of faunal biodiversity	MODERATE -	LOW -
	5	Loss of animal species of special concern	LOW -	N/A
	6	Effect of fragmenting Vegetation types	LOW -	LOW -
Avifauna	1	Habitat Destruction	MODERATE -	MODERATE -
	2	Disturbance of birds	LOW -	LOW -
Bat	1	Destruction of bat foraging habitat	LOW -	LOW -
	2	Destruction of bat roosts	LOW -	LOW -
Noise	1	Potential Construction Noise Sources (General Equipment and Vehicles)	LOW -	LOW -
Visual	2	Intrusion on views of sensitive visual receptors	HIGH –	HIGH –
	3	Intrusion of large, highly visible wind turbines on the existing views of sensitive visual receptors	HIGH –	HIGH –
	4	Impact of night lights of a wind farm on existing nightscape	LOW (-) TO MODERATE (-)	LOW (-) TO MODERATE (-)
Heritage	1	Impact on heritage resources	LOW -	LOW -

Table B: Impacts identified and assessed for the operation phase of the project.

OPERATION PHASE				
Impact Study	**Impact #**	**Impact type**	**Significance**	
			Without mitigation	**With mitigation**
Ecological	3	Introduction of alien plant species	**HIGH –**	**LOW +**
Avifauna	3	Collision of Birds with Turbines	**HIGH –**	**MODERATE -**
	4	Disturbance of Avifauna During Operation	**MODERATE -**	**N/A**
	5	Disruption of Local Bird Movement Patterns	**MODERATE -**	**N/A**
	6	Collision and Electrocution of Birds with Power Lines	**Negligible**	
Bat	3	Bat mortalities during foraging by turbine blades	**MODERATE -**	**LOW -**
	4	Bat mortalities during migration by turbine blades	**HIGH –**	**MODERATE -**
Noise	2	Predicted noise levels for the Wind Turbines Generators	**LOW -**	**LOW -**
Visual	1	Potential landscape impact	**MODERATE -**	**MODERATE -**
	6	Impact of shadow flicker on residents in close proximity to wind turbines	**Refer to Text**	
Heritage	2	Impact on Heritage Resources	**MODERATE -**	**LOW -**

Table C: Significance of construction and operation phase impacts assuming the No-Go option.

NO-GO				
Phase	**Impact Study**	**Impact #**	**Impact type**	**Significance**
Construction	Ecological	1	Loss of Grassland	**MODERATE -**
		2	Loss of plant species of special concern	**LOW +**
		3	Introduction of alien plant species	**HIGH –**
		4	Loss of faunal biodiversity	**LOW +**
		5	Loss of animal species of special concern	**HIGH +**
		6	Effect of fragmenting Vegetation types	**N/A**
	Avifauna	1	Habitat Destruction	**N/A**
		2	Disturbance of birds	**N/A**
	Bat	1	Destruction of bat foraging habitat	**MODERATE +**
		2	Destruction of bat roosts	**MODERATE +**
	Noise	1	Potential Construction Noise Sources (General Equipment and Vehicles)	**MODERATE +**
	Visual	2	Intrusion on views of sensitive visual receptors	**N/A**
		3	Intrusion of large, highly visible wind turbines on the existing views of sensitive visual receptors	**N/A**
		4	Impact of night lights of a wind farm on existing nightscape	**N/A**
	Heritage	1	Impact on heritage resources	**MODERATE +**
Operation	Ecological	3	Introduction of alien plant species	**HIGH –**
	Avifauna	3	Collision of Birds with Turbines	**N/A**
		4	Disturbance of Avifauna During Operation	**N/A**
		5	Disruption of Local Bird Movement Patterns	**N/A**
		6	Collision and Electrocution of Birds with Power Lines	**N/A**
	Bat	3	Bat mortalities during foraging by turbine blades	**MODERATE +**
		4	Bat mortalities during migration by turbine blades	**MODERATE +**

	Noise	2	Predicted noise levels for the Wind Turbines Generators	**MODERATE +**
	Visual	1	Potential landscape impact	**MODERATE -**
		5	Impact of shadow flicker on residents in close proximity to wind turbines	**Text**
	Heritage	2	Impact on Heritage Resources	**MODERATE +**

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LIST OF ACRONYMS

BBBEE:	Broad Based Black Economic Empowerment
BID:	Background Information Document
BPEO:	Best Practice Environmental Option
CARA	Conservation of Agricultural Resources Act
CES:	Coastal and Environmental Services
CITES:	Committee for International Trade in Endangered Species
CR	Critically Endangered
DEA:	Department of Environmental Affairs
DEAT:	Department of Environmental Affairs and Tourism
DEM	Digital Elevation Model
DMS:	Degrees, Minutes, Seconds
DSR:	Draft Scoping Report
DWAF:	Department of Water Affairs and Forestry
DWEA:	Department of Water and Environmental Affairs
EAP:	Environmental Assessment Practitioner
ECO:	Environmental Control Officer
EIA:	Environmental Impact Assessment
EIR:	Environmental Impact Report
EMP:	Environmental Management Plan
EN	Endangered
ENPAT	Environmental Potential Atlas
EWEA	European Wind Energy Association
FSR:	Final Scoping Report
GIS	Geographic Information System
GLVIA	Guideline for Involving Visual and Aesthetic Specialists in EIA Processes
GNR:	Government Notice Regulation
ha:	Hectare
I&APs:	Interested and Affected Parties
IDP:	Integrated Development Plan
IPP:	Independent Power Producer
IUCN	International Union for Conservation of Nature
Kv:	Kilovolt
Ltd:	Limited
MAP	Mean Annual Precipitation
MW:	Mega Watts
NEMA:	National Environmental Management Act 107 of 1998 as amended in 2006
NERSA:	National Energy Regulator of South Africa
NT	NearThreatened
NWCC	National Wind Coordinating Committee
PoS:	Plan of Study
PPA:	Power Purchase Agreement
PPP:	Public Participation Process
PPWRA	Altamont Pass Wind Resource Area
RDB:	Red Data Book
REFIT:	Renewable Feed In Tarriff
REPA:	Renewable Energy Purchasing Agency
RPM	Repetitions per minutes
SABAP2	Southern Africa Bird Atlas Project 2

SARDB	South African Red Data Book
SDF	Spatial Development Framework
SSC:	Species of Special Concern
STEP	Subtropical Thicket Ecosystem Planning project
ToR:	Terms of Reference
VIA	Visual Impact Assessment
VU	Vulnerable
WfW	Working for Water
WT:	Wind Turbine
ZTV	Zone of Theoretical Visibility

HAVERFONTEIN WIND ENERGY PROJECT – SPECIALIST VOLUME

1 INTRODUCTION

1.1 Background to the Study

The proposed Haverfontein wind energy project is to be constructed on 1 400 hectares (ha) encompassing one farm found near the town of Carolina, located in the Albert Luthuli Local Municipality in the Mpumalanga Province, South Africa. The proposed wind energy project is planned to consist of the following:-

- Up to 33 wind turbines (340 MW) of 2.5MW each (mounted on 80-100m masts and nacelle; 100m diameter rotor – consisting of 3x50m blades).
- Concrete foundations to support the wind turbine towers.
- Internal access roads to each turbine - approximately 3.5meters wide.
- Underground cables connecting the wind turbines.
- 132 kilovolt (KV) overhead power lines linking the site to the nearest Sub-Station and/or the overhead power lines traversing the farms.
- Possible upgrading of existing roads for the transportation of the turbines to the Wind Energy Facility.
- Up to two sub-stations on the Wind Energy Facility to receive the generated power.
- A building to house the control instrumentation and backup power support. As well as a store room for the maintenance equipment.

The electricity will be fed into the national ESKOM grid. According to Terra Wind Energy-Haverfontein (Pty) Ltd, the motivation for the proposed project in general terms arose from the following potential benefits:

- *Climate change:* Due to concerns such as climate change, and the ongoing exploitation of non-renewable resources, there is increasing international pressure on countries to increase their share of renewable energy generation. The South African Government has recognised the country’s high level of renewable energy potential and has placed targets of 10 000 GWh of renewable energy by 2013. In order to kick start the renewable energy sector in South Africa, a Feed-in Tariff for various renewable energy technologies was established. This Feed-in tariff guarantees the price of electricity supply from the renewable energy installation. The resources on this planet are finite and will become more expensive as they get used up. We need coal for many derivative products in our society. As a responsible generation we need to develop technologies which can replace the existing technologies which use the finite fossil fuel resource.
- *Social upliftment:* The need to improve the quality of life for all, but especially the poor, is critical in South Africa. With the expected wind resources in the Carolina area, the proposed project will contribute directly to the upliftment of the individuals and the societies in which they live. Terra Wind Energy-Haverfontein (Pty) Ltd intends to identify community involvement, and projects will be implemented to the fundamental improvement in Carolina and the surrounding areas.
- *Electricity supply:* The establishment of the proposed Haverfontein Wind Energy Installation will contribute to strengthening the existing electricity grid for the area and will aid the government in achieving its goal of a 30% share of all new power generation being derived from Independent Power Producers (IPP).

In addition to the above-mentioned benefits, the proposed project site was selected due to:-

- Good wind resources suitable for the installation of a large wind energy facility.

- Proximity to connectivity opportunities such as the substation or the High Voltage (HV) overhead lines traversing the proposed development site. The specific substation that the electrical cables are connected to will be confirmed at a later stage.
- The surrounding area is not densely populated.

There is potential and appetite within the Albert Luthuli Local Municipality (ALLM) to engage with new technologies and industries.

In accordance with the requirements of the National Environmental Management Act No. 107 of 1998, and relevant Environmental Impact Assessment (EIA) regulations made in terms of this Act (Government Notice No R.385) and promulgated in 2006, the proposed project requires a full Scoping and EIA.

Coastal & Environmental Services (CES) have been appointed by Terra Power Solutions (Pty) Limited as Environmental Assessment Practitioner (EAP) to conduct the EIA.

1.2 Objectives of the Specialist Studies

The primary objective of the baseline specialist studies is to generate sufficient factual information on which to assess the significance and severity of environmental impacts. In order to achieve this, and in accordance with Regulation 33 of GNR 385:

1. An applicant or EAP managing an application may appoint a person who is independent to carry out a specialist study or specialised process.
2. A specialist report or a report on a specialised process prepared in terms of these Regulations must contain –
   a. Details of –
      i. The person who prepared the report; and
      ii. The expertise of that person to carry out the specialised study or specialised process;
   b. A declaration that the person is independent in a form as may be specified by the competent authority;
   c. An indication of the scope of, and the purpose for which, the report was prepared;
   d. A description of the methodology adopted in preparing the report or carrying out the specialised process;
   e. A description of any assumptions made and any uncertainties or gaps in knowledge;
   f. A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment;
   g. Recommendations in respect of any mitigation measures that should be considered by the applicant and the competent authority;
   h. A description of any consultation process that was undertaken during the course of carrying out the study;
   i. A summary of the copies of any comments that were received during any consultation process, and;
   j. Any other information requested by the competent authority.

1.3 Structure of the Report

The report has been divided into three main sections. The first section (chapters 1- 3) describes the project in detail and highlights the importance of the specialist study process. The second section (chapters 4 – 10) includes all the specialist studies with references and appendices specific to the particular specialist study appearing as the last chapters. The last section includes appendices applicable to the entire specialist volume.

2 PROJECT DESCRIPTION

2.1 Location and Site Description of the Proposed Development

2.1.1 Landowner Details

Details of the landowner are contained in Table 2.1 below.

Table 2.1 Landowner details

Landowner	Farm Name	Erf/ Farm Portion Number/s
Mr. Wilhelm Eckhardt Nieuhaus	Haverfontein	Haverfontein 7

2.1.2 Locality and General Area

The wind farm will be developed on the farm Haverfontein 7 (Portion 5 (Dawidsdal) (a Portion of Portion 2) of the Farm Haverfontein Nr. 7; The remaining Portion of Portion 2 of the Farm Haverfontein 7, Registration Division I.T; Portion 4 of the Farm Nooitgedacht Nr 411 Registration Division J.T.; Portion 4 (a portion of Portion 2), Registration Division I.T., all found around Carolina located in the Albert Luthuli Local Municipality (ALLM) in the Mpumalanga Province of South Africa (Figure 2.1).

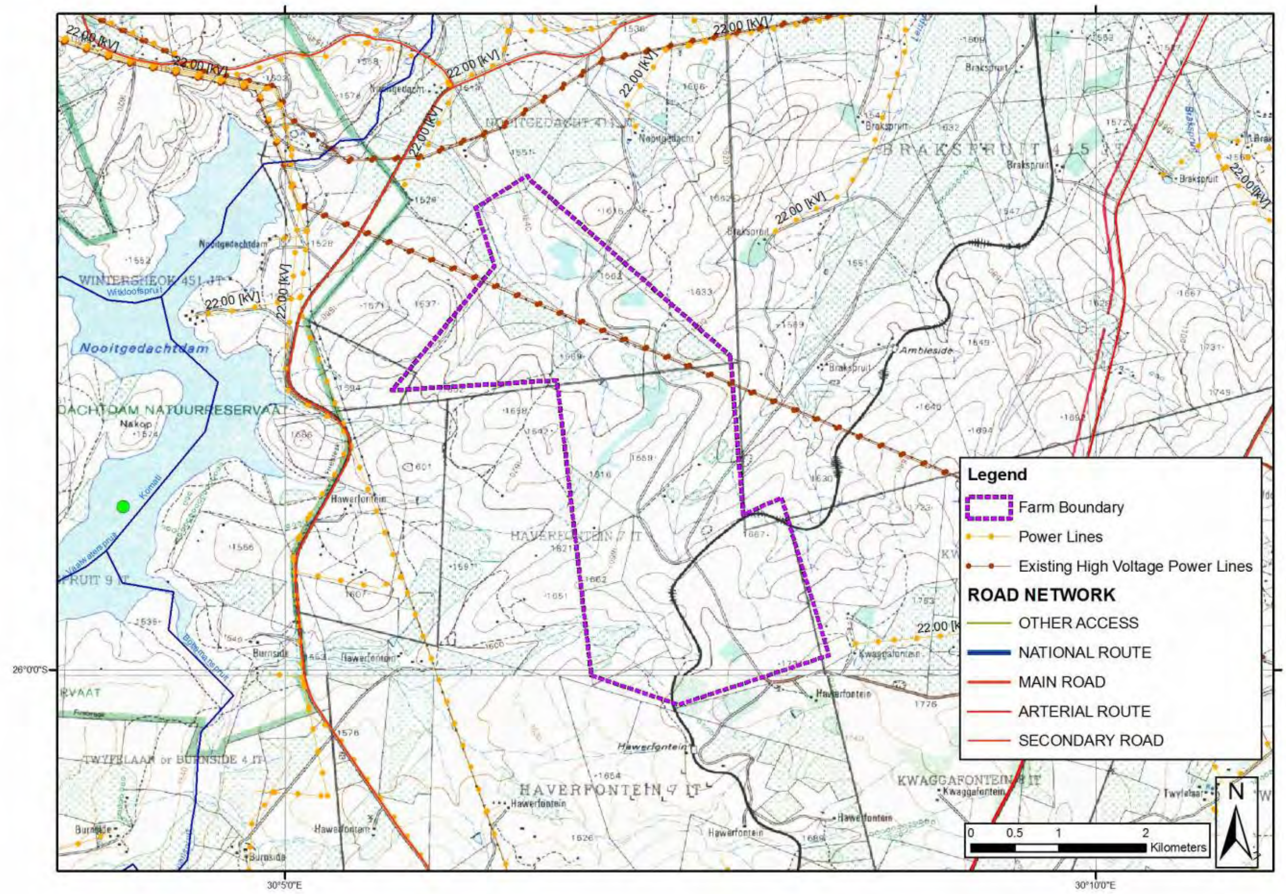

Figure 2.1: Locality Map with proposed site demarcated by the farm boundary illustrated in purple

2.2 Detailed Description of the Proposed Project

2.2.1 Production of electricity from wind

Wind energy is a form of solar energy. Winds are caused by: the uneven heating of the atmosphere by the sun, the irregularities of the earth's surface, and rotation of the earth. Wind flow patterns are modified by the earth's terrain, bodies of water, and vegetation. This wind flow or motion energy (kinetic energy) can be used for generating electricity. The term “wind energy” describes the process by which wind is used to generate mechanical power or electricity. Wind turbines convert the kinetic energy in the wind into mechanical power and a generator can then be used to convert this mechanical power into electricity. Typical wind turbine subsystems include (also refer to Figure 2.2):

A typical wind turbine consists of:

- A *rotor, with 3 blades*, which react with the wind and convert the energy into rotational motion.
- A *nacelle* which houses the equipment at the top of the tower
- A *tower*, to support the nacelle and rotor
- *Electronic equipment* i.e. controls, transformers, electrical cables and switchgear, ground support equipment, and interconnection equipment.

The amount of energy which the wind transfers to the rotor depends on the density of the air (the heavier the air, the more energy received by the turbine), the rotor area (the bigger the rotor diameter, the more energy received by the turbine), and the wind speed (the faster the wind, the more energy received by the turbine).

Provided in the sections that follow is a detailed discussion on the various components of the proposed Haverfontein Wind Energy Project.

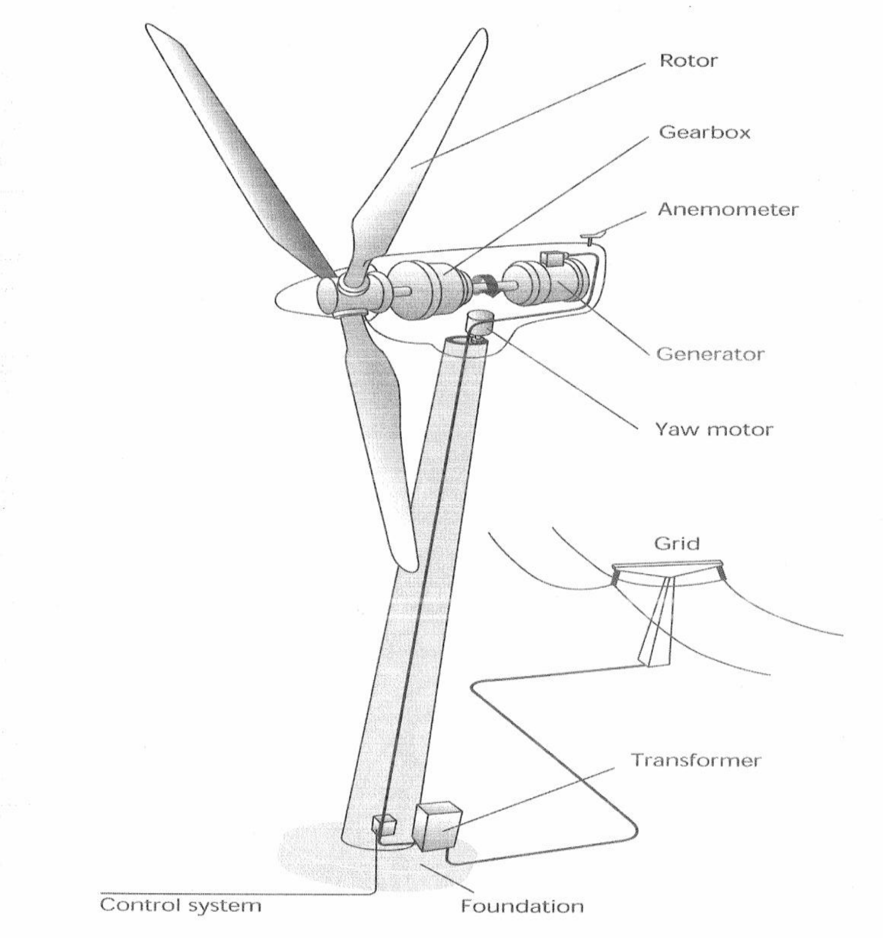

Figure 2.2: Illustration of the main components of a typical wind turbine
Note that the transformer in the figure above would normally be inside the tower (probably at the base).

2.2.2 Stages of windfarm development

Typically, the development of wind farm is divided into four phases namely:-

- Pre-feasibility
- Feasibility
- Wind Measurement
- Implementation

Each of the above-mentioned phases is described in detail in sections that follow.

2.2.2.1. *Pre-feasibility*
During the pre-feasibility Terra Wind Energy-Haverfontein (Pty) Ltd do surveys to ensure that obvious issues surrounding the project should not impact on the progress and the final acceptance of the project. This includes visits to local authorities, civil aviation authorities, identifying local community involvement, wind resources evaluation from existing data, general acceptance of wind energy, grid connectivity, environmental impacts, and logistical implications.

2.2.2.2. *Feasibility*
During the feasibility phase Terra Wind Energy-Haverfontein (Pty) Ltd will firm up and carry out thorough investigations to establish the actual costs, and economic viability of the project by designing the financial model with financial institutions, verifying wind resources by onsite measurement, ensuring grid connection is economical and feasible in the timeframes of the project, identifying possible off-takers for the electricity. Once the feasibility studies are complete Terra Wind Energy-Haverfontein (Pty) Ltd will identify which parts of the project will be constructed first. Then, in an organised fashion the project will be expanded according to the availability of grid capacity and turbines. There are 5 construction phases envisaged which will allow for economical implementation of the project.

2.2.2.3. *Wind Measurement*
Prior to the establishment of the full facility, it will be necessary to erect, a number of wind measurement masts to gather wind speed data and correlate these measurements with other meteorological data in order to produce a final wind model of the proposed project site. A measurement campaign of at least 12 months in duration is necessary to ensure verifiable data is used of the economics of the project and finalise the positions of the wind turbines. The proposed 80-meter mast is a guyed lattice tower designed specifically for wind resource measurements. The mast will have to be „marked' as per the requirements of the Civil Aviation Authority. Environmental Authorisation (12/12/20/1901) for the construction of the mast was obtained on 6 July 2010 and the mast has been erected.

2.2.2.4. Implementation

Building a wind farm is divided into three phases namely:-

- Civil works
- Construction
- Commissioning
- Operational

Preliminary civil works

A temporary „construction platform' is required at each turbine foundation site to ensure safe and stable access by heavy machinery and equipment (bulldozers, trucks, cranes etc.) during the construction phase. These platforms will be connected by access roads (if none existing) that must meet the following requirements:

- 4m width / 8m clearance
- 30cm pebble bed
- Maximum 10% slope
- Curve radius of at least 25m

Once the wind farm is operational, the construction platforms can be partially rehabilitated to reduce the final cumulative area of the total development footprint of the individual turbines.

Construction Phase

This phase comprises of the following sub phases:

(a) Geotechnical studies and foundation works

A geotechnical study of the area is always undertaken for safety purposes. This comprises drilling, penetration and pressure assessments. For the foundations 500m^3 would need to be excavated for each turbine. These excavations are then filled with steel-reinforced concrete (typically 13 tons of steel reinforcing rods per turbine). The foundations can vary according to the quality of the soil. The main dimensions for the foundation of a 3MW/100m high wind turbine are shown in figure 2.3.

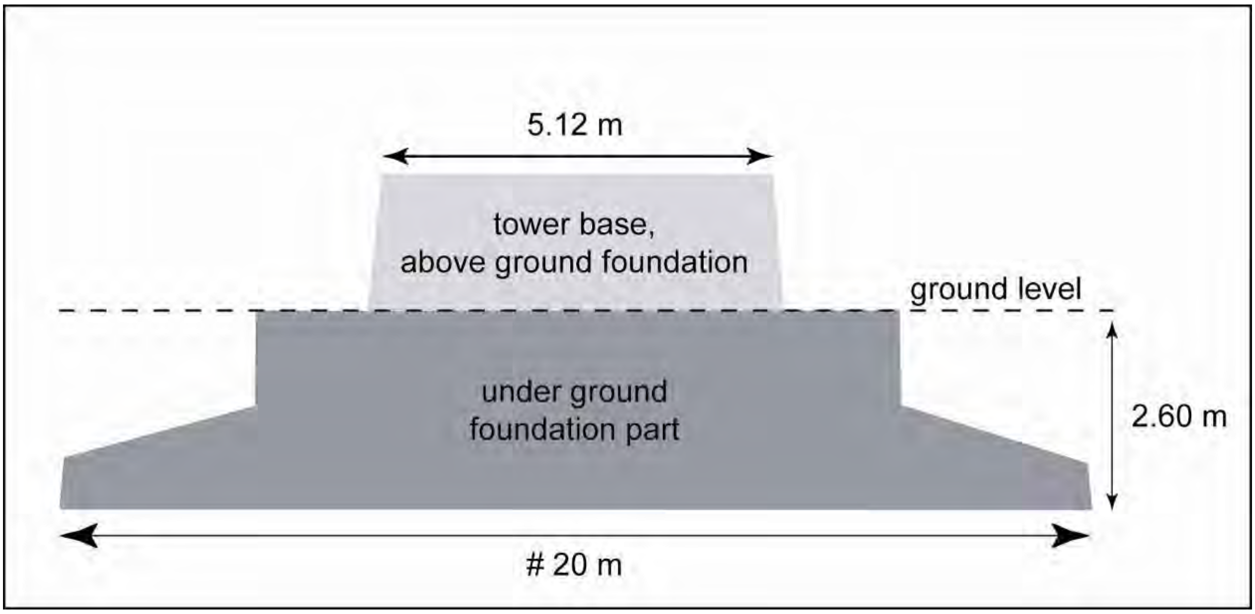

Figure 2.3: The main dimensions for the foundation of a 3MW/100m high wind turbine

(b) Electrical cabling

Electrical and communication cables are run approximately 1m deep, adjacent to the access roads.

(c) Turbine erection

The process is quick (around 3 days per turbine) if the weather conditions are ideal. This phase is the most complex and costly and utilises heavy lift cranes in the assembly process (Plate 2.1).

2.2.3 Timing estimation

Based on existing publications, the development, construction and implementation of a wind farm of these approximate dimensions would require the following construction sequencing per individual turbine:

Plate 2.1: Assembly and erection of the tower sections

- Preliminary phase = 12 weeks (including 8 weeks to let the foundation concrete dry)
- Wind turbines erection = 4 weeks (in good low wind weather conditions)
- Commissioning and electrical connection = 6 weeks

2.2.4 Operational phase

During the period when the turbines are up and running, on-site human activity drops to a minimum, and includes routine maintenance requiring only light vehicles to access the site. Only major breakdowns would necessitate the use of cranes and trucks.

2.2.5 Refurbishment and rehabilitation of the site after operation

Current wind turbines are designed to last for over 40 years and this is the figure that has been used to plan the life span of a modern wind farm. Terra Wind Energy-Haverfontein (Pty) Ltd undertakes to dismantle all wind turbines and foundations to a depth of 1 meter underground. The excavation is backfilled with soil, and grass is replanted in order restore the site’s appearance to its original state within a matter of weeks. The only residual material is the deeper concrete works below surface.