ENVIRONMENTAL AND SOCIAL ADVISORY SERVICES

DFFE REFERENCE: 14/12/16/3/3/2/655

10th August 2021

Attention: Ms Aniqah Misbach
Mainstream Renewable Power (Pty) Ltd
Email: Aniqah.Misbach@mainstreamrp.com

Dear Ms Misbach

WAAIHOEK WIND FARM - PART 2 AMENDMENT APPLICATION - SPECIALIST STUDY UPDATES

Mainstream submitted an application in 2014 to construct the Waaihoek Wind Energy Facility (WEF) south-east of Utrecht in the Emadlangeni Local Municipality, KZN. The WEF was to host a maximum of 93 wind turbines, each generating between 1.5 – 4 megawatts (MW) of power, with total combined potential power output of approximately 160MW.

The then Department of Environmental Affairs (DEA) approved 15 turbines in 2015, but this was increased to 68 turbines and a total installed capacity of 140MW, following an appeal process. A subsequent Part 2 Amendment reduced the number of turbines to 47 turbines with an individual turbine capacity of 3.0 MW.

Mainstream wishes to submit a Part 2 Amendment Application to:

- Reduce the number of turbines from 47 to 43 turbines
- Increase rotor diameter from 140 m to 170 m (30 m): and
- Remove the individual turbine generation capacity specification.

CES conducted the agricultural, socio-economic and tourism specialist studies as part of the Environmental Impact Assessment (EIA) for the proposed WEF in 2014. We have now been appointed to provide specialist inputs based on the proposed amendments, as part of the Part 2 EA Amendment Report:

- Agricultural Impact Assessment;
- Socio-economic Impact Assessment; and
- Tourism Impact Assessment.

The current report provides an update of the expected impact that the current proposed Part 2 Amendment will have on agricultural potential, and tourism and socio-economic conditions.

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1. Agricultural Impact Assessment

CES was appointed to conduct an agricultural and soil impact assessment as part of the initial EIA process in 2014 in order to predict and assess the significance of identified impacts associated with the proposed Waaihoek WEF on the agricultural potential of the affected land.

Potential impacts identified

The proposed WEF's primary impact on agricultural activities would involve the construction of the wind turbines and associated infrastructure (access roads and cables). The construction of these turbines and associated infrastructure would then only affect a total area of 3.0 ha of the total local agricultural portion of the affected land. It was also expected that the entire site would revert back to agricultural land during decommissioning of the Waaihoek WEF site.

Per impact assessment in Table 1 below, the study determined that the impact of the proposed Waaihoek WEF development on the study area's agricultural potential will be LOW, with the loss of agricultural land mostly being attributed to the creation of the service roads, wind turbine foundations and laydown area. The total loss of grazing land will be significantly less than 1 % of the total agricultural area of 15,353 ha. All post-mitigation impacts were also considered as LOW. The only high risk was the risk of fire which can be mitigated to a low risk with appropriate fire management controls in place.

Table 1: Summary of impacts of the proposed WEF on agricultural potential.

ISSUE	IMPACTS	SIGNIFICANCE PRE-MITIGATION	SIGNIFICANCE POST-MITIGATION
Construction Phase			
Management of hazardous chemicals	Soil contamination and a loss of fertile soils as a result of hazardous chemical spills.	**MODERATE**	**LOW**
Increased risk of fires from construction activities	Potential loss of crops, grazing and livestock as a result of fires originating from the construction site.	**HIGH**	**LOW**
Soil rehabilitation management	Incorrect or insufficient rehabilitation of soil will result in a decrease of agricultural viability/potential especially in Highland Sourveld.	**MODERATE**	**LOW**
Operation Phase			
Increase in erosion potential	An increase in hard surfaces (concrete foundations and roads) will increase run-off and potentially lead to soil erosion.	**MODERATE**	**LOW**
Establishment of renewable energy infrastructure on agricultural land	Loss of high potential agricultural land as a result of new WEF infrastructure development.	**LOW**	**LOW**
	Gradual reduction of available agricultural land as a consequence of an increase in renewable energy development in South Africa.	**LOW**	**LOW**
Soil profile disturbance and resultant decrease in soil agricultural capability	Excavations for the construction of the turbines and associated infrastructure will disturb the soil profile. If topsoil becomes buried, or subsoil and rock that is less suitable for root growth, remains at the surface, the agricultural suitability of the soil, that will become available for agriculture again after decommissioning of the WEF, will be reduced.	**MODERATE**	**LOW**

Figures 1 and 2 below show the location of the original 68 turbines and the current proposed 43 turbines with respect to agricultural potential. All 43 remaining turbines will still be located on high potential arable land, but since grazing and crop fields will still be permitted around and underneath turbines, the impact will be low.

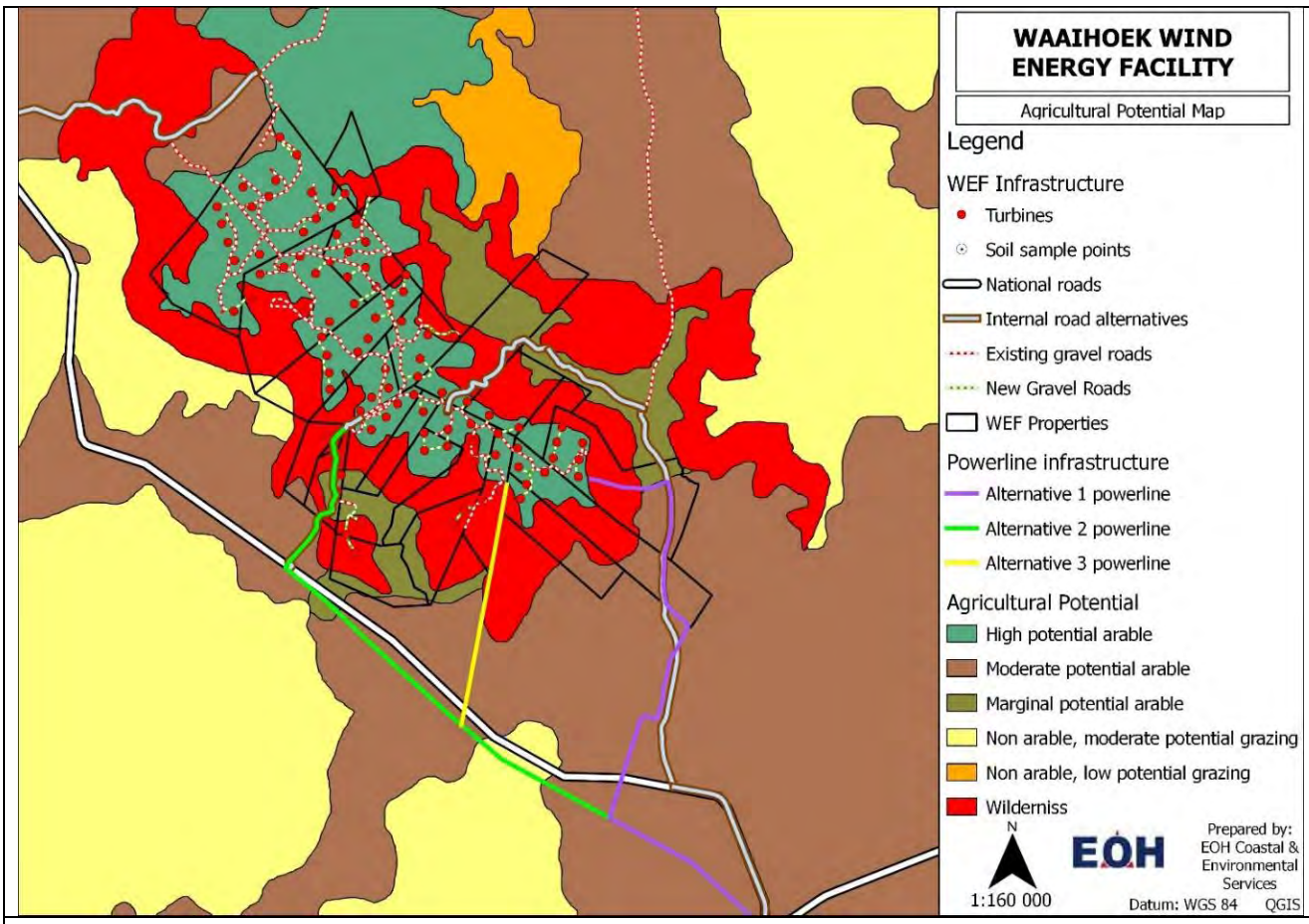

Figure 1: Location of original 68 approved turbines within areas of agricultural potential.

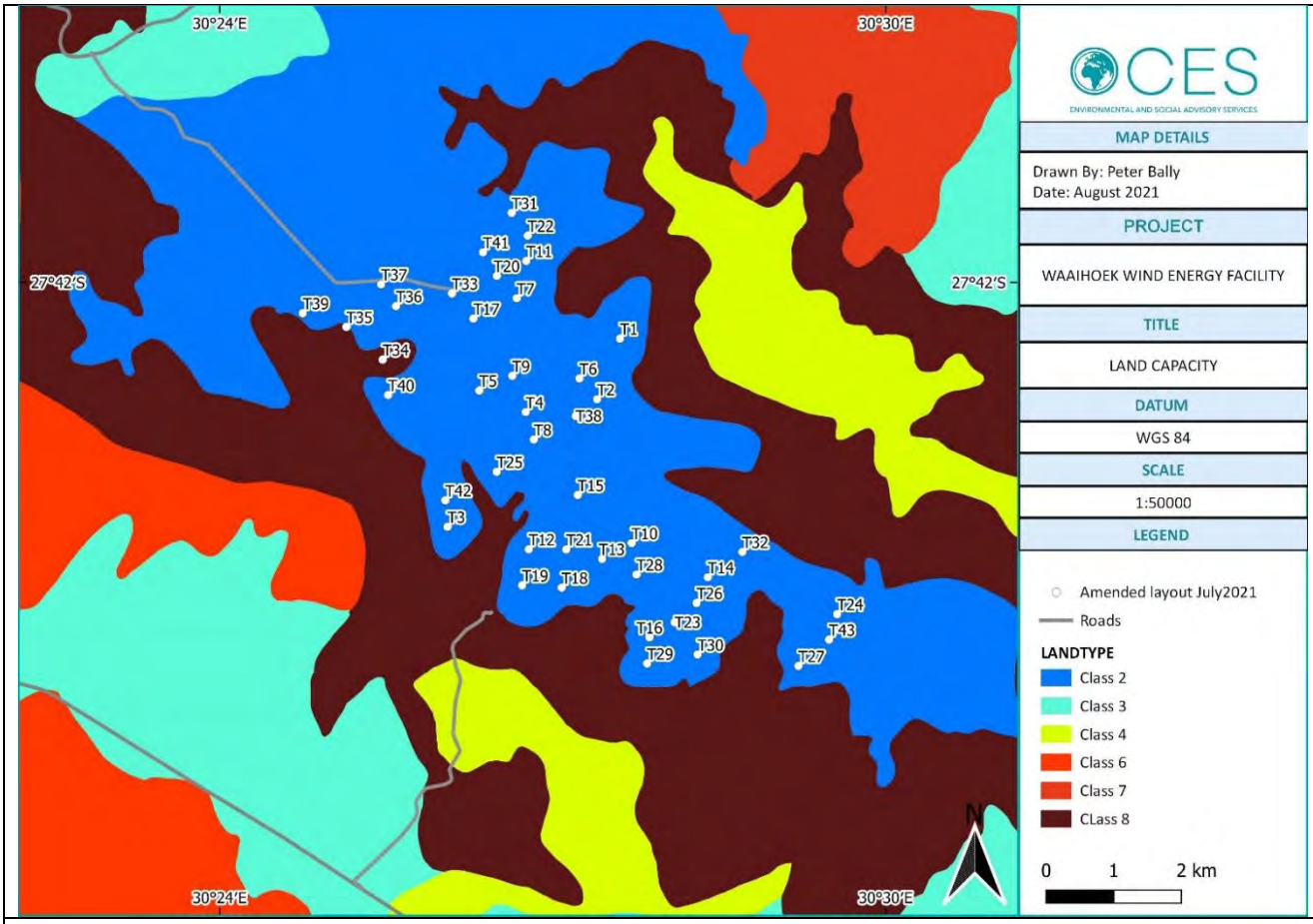

Figure 2: Location of proposed 43 turbines within areas of agricultural potential.

Conclusion

It is our conclusion, due to the reduced number of turbines and overall footprint, that the proposed amendments to the Waaihoek WEF will not increase the risks to the agricultural potential of the affected area and the impacts remain LOW with the proposed mitigation measures. Due to the reduced number of turbines, the risk of impacts to the agricultural potential of the affected area will likely decline.

2. Socio-economic Impact Assessment

CES was appointed to conduct a socio-economic impact assessment (SIA) as part of the initial EIA process in 2014. The SIA largely focused on the direct and indirect project-affected farms (PAFs). The direct PAFs refer to farms on which the turbines and power lines will be constructed, whereas the indirect PAFs refer to the adjacent farms. Moreover, the report assesses the social impacts of the project on the traditional occupiers of the land, as well as on the project-affected communities (PACs). In so-doing, it provided guidelines for limiting or mitigating negative impacts and optimising project benefits.

Potential impacts identified

Per impact assessment in Table 2 below, the study determined that the impact of the proposed Waaihoek WEF development on the socio-economic environment of the affected area will be LOW with mitigation. Some benefits will accrue locally, such as stimulation of the local economy.

The following four broad issues and 19 impacts are discussed in this section (in no particular order). Mitigation measures are provided for each issue.

Table 2: Summary of socio-economic related impacts associated with the proposed WEF.

ISSUE	IMPACTS	SIGNIFICANCE PRE-MITIGATION	SIGNIFICANCE POST-MITIGATION
Construction and Upgrading of Roads	1.1: Influx of people and expansion of hamlets	Moderate	Low
	1.2: An increase in subsistence farmers	Moderate	Low
	1.3: Easing access onto farms for unrestricted vehicles	High	Low
	1.4: Increase in crime	Low	Low
Health and Safety	2.1: Risk to aircraft navigation safety	High	Low
	2.2: Increased traffic and related security risks	Moderate	Low
	2.3: Water pollution and changes in the water table or water flow regime	Moderate	Low
	2.4: Nuisance impacts (ambient noise and shadow flickering)	Moderate	Low
	2.5: Fire	Moderate	Low
	2.6: Turbine malfunctioning (blade throw and gearbox failure)	High	Low
	2.7: Electromagnetic interference	Low	Low
	3.1: Employing local labour	Low	Low

Table 2: Summary of socio-economic related impacts associated with the proposed WEF.

ISSUE	IMPACTS	SIGNIFICANCE PRE-MITIGATION	SIGNIFICANCE POST-MITIGATION
Stimulation of Economic Growth	3.2: Skills training and further training opportunities	Low +	High +
	3.3: Contributing to local and regional businesses	Moderate +	High +
	3.4: Capital investment for farmers to expand their farms	High +	High +
Altering the Landscape Features	4.1: Soil erosion	Moderate	Low
	4.2: Visual impact: changes to farm-owners' place attachment	Moderate	Moderate
	4.3: Effects on the area's tourism potential	Moderate	Low
	4.4: Effects on cattle grazing	Low	Low

Conclusion

It is our conclusion, due to the reduced number of turbines and overall footprint, that the proposed amendments to the Waaihoek WEF will not increase the risks to the socio-economic conditions of the affected area and the impacts remain LOW with the proposed mitigation measures.

3. Tourism Impact Assessment

CES was appointed to conduct a tourism impact assessment as part of the initial EIA process in 2014. This was be done by describing and identifying the impact of the WEF on local tourism in and around the town of Utrecht. In order to assess the impacts and to take a broad range of possible tourism developments into consideration, tourism activities were divided into Eco-tourism and Heritage tourism. The report also drew on previous studies that assessed the perceptions of tourists towards wind turbines, globally.

Potential impacts identified

As per the impact assessment in Table 3 below, the study determined that the impact of the proposed Waaihoek WEF development on local tourism will range between MODERATE to LOW with mitigation. The impacts mostly relate to impacts on local heritage and ecotourism and are probably linked to the visual impact of the WEF on these local tourism products.

Table 3: Summary of tourism related impacts associated with the proposed WEF.

ISSUE	IMPACTS	SIGNIFICANCE PRE-MITIGATION	SIGNIFICANCE POST-MITIGATION
PLANNING & DESIGN PHASE			
Ecotourism	Ecotourism in the area may be negatively / positively impacted by the WEF development through the introduction of manmade features to the natural environment.	**MODERATE**	**MODERATE (Can be negative or positive depending on the individual)**
Heritage tourism	The development of the WEF within close proximity of the battlefields memorial sites could negatively affect tourism related to these memorials.	**MODERATE**	**LOW**
CONSTRUCTION PHASE			
Ecotourism	Ecotourism in the area may be negatively impacted by the WEF through the increase in activity and noise which could chase away birds and animals in the area.	**MODERATE**	**MODERATE**
Heritage tourism	The development of the WEF within close proximity of the battlefields memorial sites could negatively affect tourism related to these memorials.	**MODERATE**	**LOW**
OPERATIONAL PHASE			
Ecotourism	Ecotourism in the area may be positively / negatively impacted by the WEF through the introduction of a new possible tourist attraction / detraction to the area. The impact depends on the perceptions of the individual tourist.	**MODERATE**	**MODERATE (Can be negative or positive depending on the individual)**
DECOMMISSIONING PHASE			
Ecotourism	Ecotourism in the area may be negatively impacted by the deconstruction of the WEF because of the increase in activity and noise which could chase away birds and animals in the area.	**MODERATE**	**MODERATE**
Heritage tourism	The deconstruction of the WEF within close proximity of the battlefields memorial sites could negatively affect tourism related to these memorials.	**MODERATE**	**LOW**

In some cases, the proposed WEF could make a positive contribution to the LED activities. Examples would be tourists and locals who have an interest in viewing the turbines and the media attention that the proposed development may attract.

The impacts identified were predominantly rated as MODERATE without mitigation, due to the fact that the effects of the proposed WEF on tourism will differ from individual to individual, and it is unclear whether the proposed mitigation measures will result in a low-moderate impact on tourism.

In the context of the current assessment, the ability to predict with accuracy if and to what degree tourism will be affected by the WEF, is limited. The impacts of the proposed Waaihoek WEF could be positive or negative; positive due to the wind farm being a tourist attraction in itself or negative due to the alteration of the natural landscape.

Conclusion

It is our conclusion, due to the reduced number of turbines and overall footprint, that the proposed amendments to the Waaihoek WEF will not increase the risks to the tourism industry in the study area.

Yours faithfully

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08 July 2021

Amendment application to the Environmental Authorisation (EA) for the Waaihoek wind energy facility (WEF), and the impacts on bats: Turbine rotor diameter increase

Animalia Consultants (Pty) Ltd) undertook the bat EIA impact assessment and preconstruction monitoring completed in 2015 for the Waaihoek WEF. The original EA has approval for a maximum of 68 turbines with an individual generation capacity of between 1.5MW to 4MW. In January 2020 an amendment has been approved to reduce turbine numbers for allowing a maximum of 47 with a minimum generation capacity of 3MW each, with a rotor diameter of 140m and a hub height of 140m.

The applicant wishes to apply for an amendment to change the rotor diameter from 140m to 170m, the turbine hub height remains at the authorised 140m. Although authorisation is granted for 47 turbines, the increased rotor diameter will allow for efficient turbine models to be used, allowing the applicant to use approximately 43 turbines. The current planned layout, indicated in **Figure 1** is based on using 43 turbines.

Figure 1 also indicates the bat sensitivity map, the High bat sensitivities and their buffers are no-go zones for turbines, as well as turbine blades. Considering the proposed turbine rotor diameter of 170m, the centre of turbine base points may not be closer than 85m to the edge of the High bat sensitivity buffers. Therefore, the layout indicated in **Figure 1** will require the movement of certain proposed turbine locations to allow for turbine blade length to remain outside the High bat sensitivity buffers. The affected turbines as well as the approximate distances by which they should be moved, are indicated in **Table 1**.

Turbine's may be placed in Moderate sensitivity areas and their buffers, but where technically feasible these areas should preferably be avoided since may possibly pose a higher likelihood of impacts on bats.

The proposed amendment will also decrease the minimum rotor swept height above ground from 70m to 55m. During the original bat preconstruction study, bat activity was approximately 3 times higher at 10m above ground compared to 50m above ground, indicating a clear increase in bat activity closer to ground level. However, bat activity at 50m was within acceptable levels during the preconstruction study, implicating that a minimum rotor swept height of 55m may display acceptable bat activity levels.

Table 1: The turbines that require movement to avoid the proposed increased blade lengths form intruding into High bat sensitivity buffers, as well as the approximate distances by which they should be moved away from the High sensitivity buffers.

Turbine number	**Approximate distance to be moved away from High bat sensitivity buffer (meters)**
T9	5m
T16	5m
T18	5m
T19	5m
T28	5m
T29	10m
T30	5m
T40	5m
T42	5m

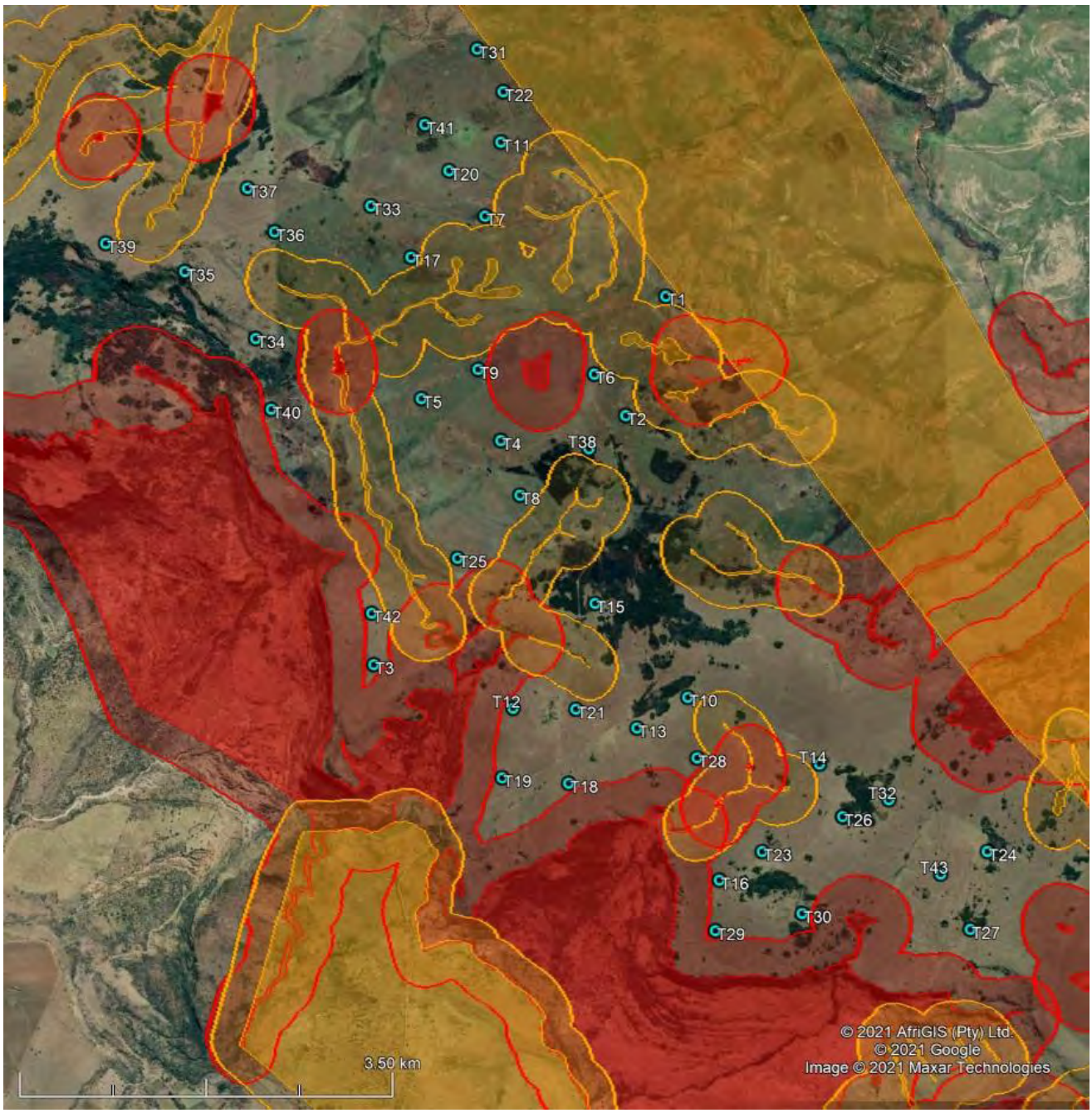

Figure 1: The planned 43 turbine layout in relation to the bat sensitivity map. Red = High bat sensitivities and their buffers; Orange = Moderate bat sensitivities and their buffers.

Animalia has reviewed the proposed amendment, and all the assessment of impacts as well as the mitigation measures specified in the EIA phase bat assessment and preconstruction study remain unchanged by the proposed amendment.

In summary, the proposed amendment is acceptable from a bat sensitivity perspective, under condition that the recommended mitigation measures are adhered to and a bat mortality study are conducted for a minimum of 2 years commencing form the date the commercial operation date of the facility.

If there are any queries, please do not hesitate to contact me.

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Mainstream
Waaihoek Wind Farm

Avifauna
Nest Searches, Survey and Impact Assessment
Findings & Recommendations

Chris van Rooyen & Albert Froneman

July 2021

1. Introduction

Waaihoek Wind Farm (Pty) Ltd ("Mainstream") is proposing the development of a 140 MW Wind Energy Facility ("WEF") located approximately 7 km south-east of the town of Utrecht in the eMadlangeni Local Municipality (Amajuba District), Kwa-Zulu Natal.

Additional pre-construction avifaunal surveys and nest searches were performed at the Waaihoek Wind Farm site by two field specialists from the 2nd – 10th of June 2021.

The below is a concise summary of the recommendation based on the findings that emerged following the survey and nest searches.

2. Findings and recommendations

2.1 Wind Energy Facility

- Secretarybird (*Sagittarius serpentarius*) Red Data status – Endangered (Regional and Global) nest (-27.749269°, 30.481961°)
    - A 1km turbine free buffer zone is recommended around the nest.
    - Turbines located outside the 1km buffer but within 2.5km from the nest be subjected to pro-active Shut-Down-on-Demand (SDoD) mitigation to prevent collisions with the turbines. SDoD can be achieved either through the deployment of an artificial intelligence camera system e.g. IdentiFlight® or a by means of a team of bio-monitors that are stationed at vantage points to look out for target priority species and then issues a warning followed by shut down command if a bird approaches a turbine risk zone. The SDoD programme should be implemented and operational by the time the first turbines start turning.
- Southern Bald Ibis (*Geronticus calvus*) Red Data status – Vulnerable (Regional and Global) roost / potential breeding sites
    - A 2km turbine free buffer zone is recommended around the roost sites.
- Escarpment edge / cliff line buffer – turbine setback
    - A minimum of 400m buffer – turbine setback zone should be implemented to minimise the risk for soaring priority species which are likely to use the cliffs and ridge lines for most of their flight activity.
- Internal medium voltage cables that connect the respective wind turbines to the onsite substation should be buried.

See Figure 2 below for a delineation of the above buffer zones.

2.2 132kV Grid connection powerline:

- The grid connection overhead powerline should be marked with Bird Flight Diverters (BFDs) for its entire length according to the applicable Eskom standard. This is required to reduce the risk of collisions of slope soaring species with the proposed powerline along the escarpment e.g. the Southern Bald Ibis and Black Stork (*Ciconia nigra*) Red Data status – Vulnerable (Regional), and for the Endangered Grey-crowned Crane (*Balearica regulorum*) Red Data status –

Endangered (Regional and Global) and Blue Crane (*Grus paradisea*) Red Data status - Vulnerable (regional) in the low lying grassland and agricultural areas below the escarpment.

- It is recommended that the 7649 pole design is used for the 132kV grid connection to eliminate any risks of electrocution to large raptors and vultures (see Figure 1).

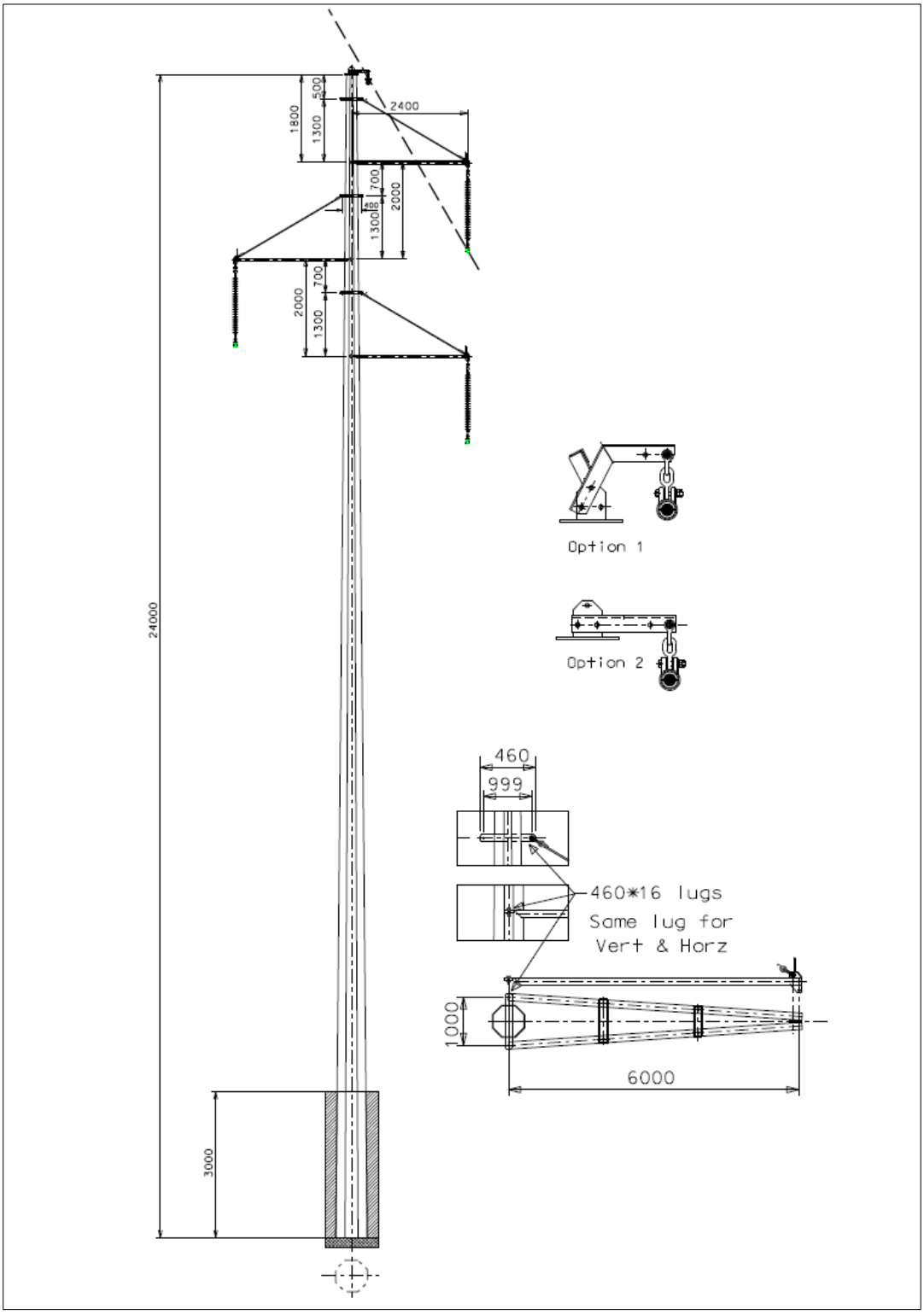

Figure 2: The vulture friendly 7649 structure.

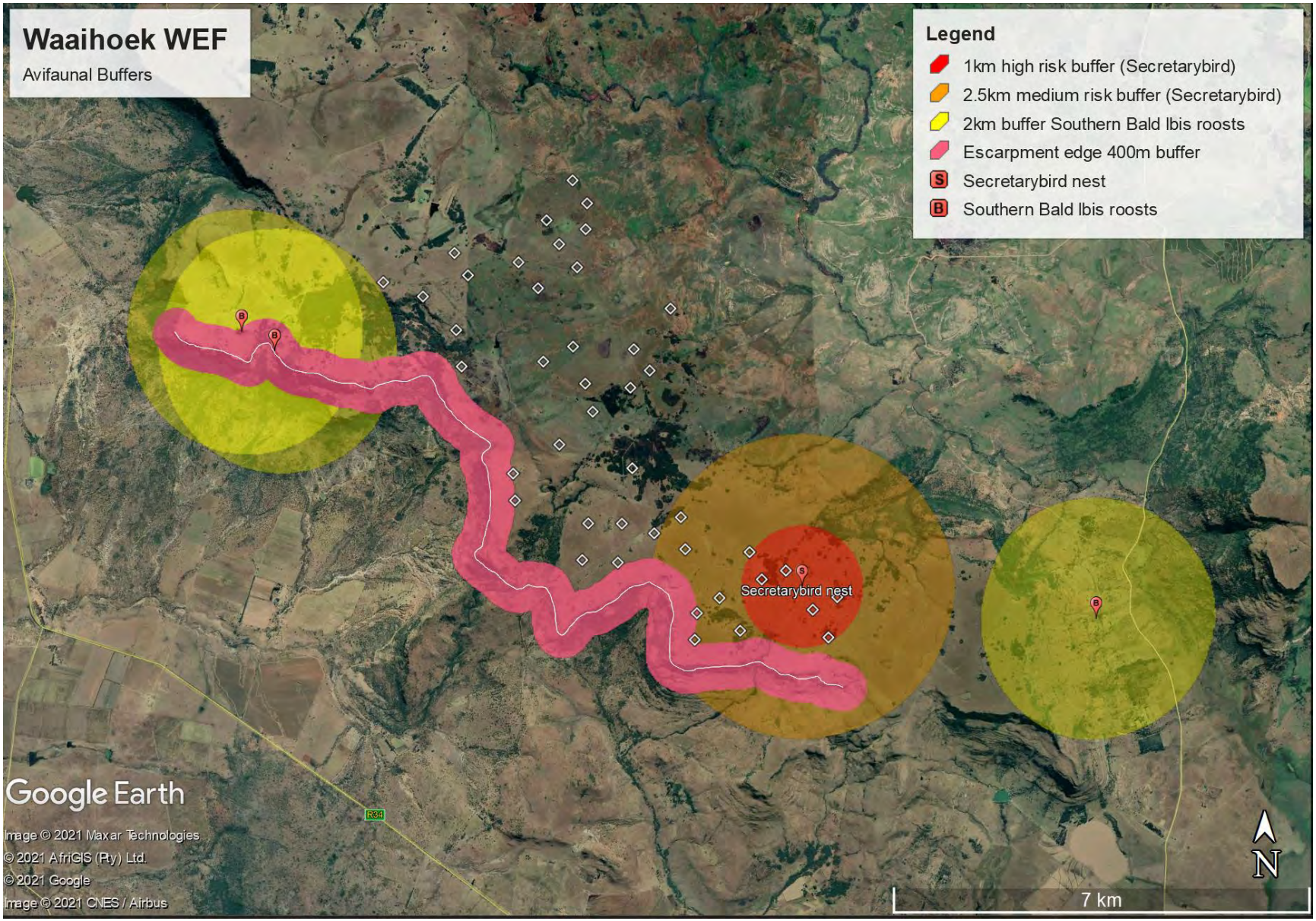

Figure 2: Avifaunal buffer zones.

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11 August 2021

Attention: Alan Carter
Project Manager
Coastal and Environmental Services

WAAIHOEK WIND ENERGY FACILITY, KWA-ZULU NATAL: TERRESTRIAL AND AQUATIC ECOLOGICAL SPECIALIST ASSESSMENT OF AMENDED LAYOUT

Dear Alan

An amendment in the layout and turbine technology and associated infrastructure associated with the Waaihoek Wind Energy Facility refers. The project history and proposed amendments are listed below:

- The EA was amended in 2019 to reduce the number of turbines from **68 to 43**. This amendment did not specify which turbines would be removed and the layout remained the same.
- Waaihoek Wind Farm (Pty) Ltd wishes to amend the scope of the facility to:
    - increase the rotor diameter by 30m (from 140m to 170m); and
    - Make adjustments to turbine locations to make the most efficient use of wind resources on the site.
- The reduction in the number of turbines will not reduce the total power output of the WEF (i.e. 140MW).

The purpose and scope of this assessment is to:

1) Review recent published terrestrial and aquatic environmental information for the study area and provide comment with respect to the proposed Waaihoek WEF;
2) Revisit the wetland layer and update this where necessary;
3) Assess the new layout (Turbines and access road/cable routes) against the ecological sensitivity; and
4) Provide comment on the new proposed turbine and infrastructure (roads and cables) layout with regards to the anticipated impacts.

The assessment is structured as follows:

1) Terrestrial Ecology
    a. Review of the South African Vegetation Map 2006-2018
    b. Review of the KZN Biodiversity Sector Plan 2014
2) Aquatic Ecology
    a. Revise wetland mapping (Wet5 and aerial digitising)
3) Conclusions and Recommendations
    a. Amended Waaihoek WEF layout and implications for the terrestrial ecology
    b. Amended Waaihoek WEF layout and implications for the aquatic ecology
    c. Concluding remarks

1) Terrestrial Ecological Assessment

The Vegetation Map of South Africa 2018 (VEGMAP, 2006-2018)

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According to the most recent publication of the South African vegetation map (VEGMAP, 2006-2018) the previous and amended layout of the Waaihoek WEF is located primarily on Wakkerstroom Montane Grassland (Figure 1). The vegetation comprises of short montane grasslands on the relatively flat plateaus, with short forest and *Leucosidea* thickets occurring along steep, east-facing slopes and drainage areas. *L. sericea* is the dominant woody pioneer species that invades areas as a result of grazing mismanagement. Wakkerstroom Montane Grassland (Gm14) is classified as **LEAST CONCERN**.

A short length of access road transverse across Northern KwaZulu-Natal Moist Grassland. This grassland predominates hilly and rolling landscapes and supports tall tussock grassland, generally dominated by *Themeda triandra* and *Hyparrhenia hirta*. On strongly eroded sites, open *Acacia siberiana* var. *woodii* savannoid woodlands tend to encroach up the valleys. This vegetation type is classified as **LEAST CONCERN**.

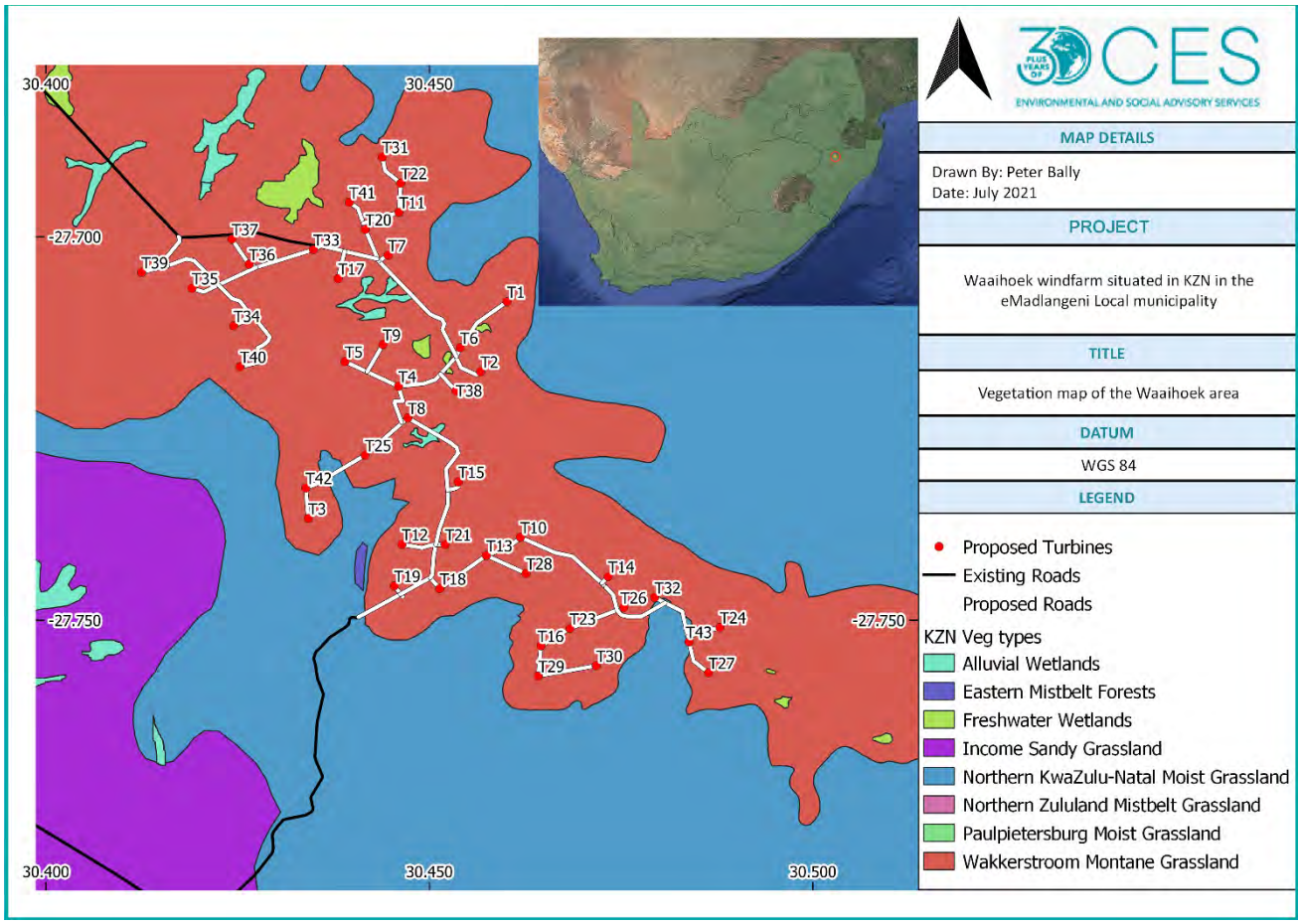

Figure 1 South African Vegetation Map (Mucina *et al*., 2006-2018)

<u>KZN Amajuba District Biodiversity Sector Plan (2014)</u>

The revision of the KZN Amajuba District Biodiversity Sector Plan in 2014 is a comprehensive integration of important data, including the Northern Interior Corridor. The Amajuba Biodiversity Sector Plan (BSP, 2014) provides the following subcategories of CBA and ESAs:

Critical Biodiversity Areas (CBAs) - Natural or near-natural landscapes that include terrestrial and aquatic areas that are considered critical for meeting biodiversity targets and thresholds, and which safeguard areas required to ensure the persistence of viable populations of species, and the functionality of ecosystems and Ecological Infrastructure

Critical Biodiversity Areas: Irreplaceable	Areas which are required to meet biodiversity conservation targets, and where there are no alternative sites available. (Category driven by species and feature presence) - Maintain in a natural state with limited to no biodiversity loss.
Critical Biodiversity Areas: Optimal	Areas that are the most optimal solution to meet the required biodiversity conservation targets while avoiding high cost areas as much as possible (Category driven primarily by process) - Maintain in a natural state with limited to no biodiversity loss.
Ecological Support Areas (ESAs) - Functional but not necessarily entirely natural terrestrial that are largely required to ensure the persistence and maintenance of biodiversity patterns and ecological processes within the Critical Biodiversity Areas.	
Terrestrial Ecological Support Areas (ESAs)	The area also contributes significantly to the maintenance of Ecological Infrastructure (Ecological Infrastructure) - Maintain ecosystem functionality and connectivity allowing for some loss of biodiversity.

With respect to the amended Waaihoek WEF layout (Figure 2), a single turbine (T36) is located in a 'CBA optimal' and 11 turbines are located within an Ecological Support Area which is known as the Northern Interior Corridor which connects. In the original layout, 3 turbines were located in 'CBA optimal' and 32 turbines located in the Northern Interior Corridor. Recommendations for moving T36 outside of the CBA optimal area and comment on the Ecological Impact of the amended layout on the Northern Interior Corridor is made in the Conclusion section.

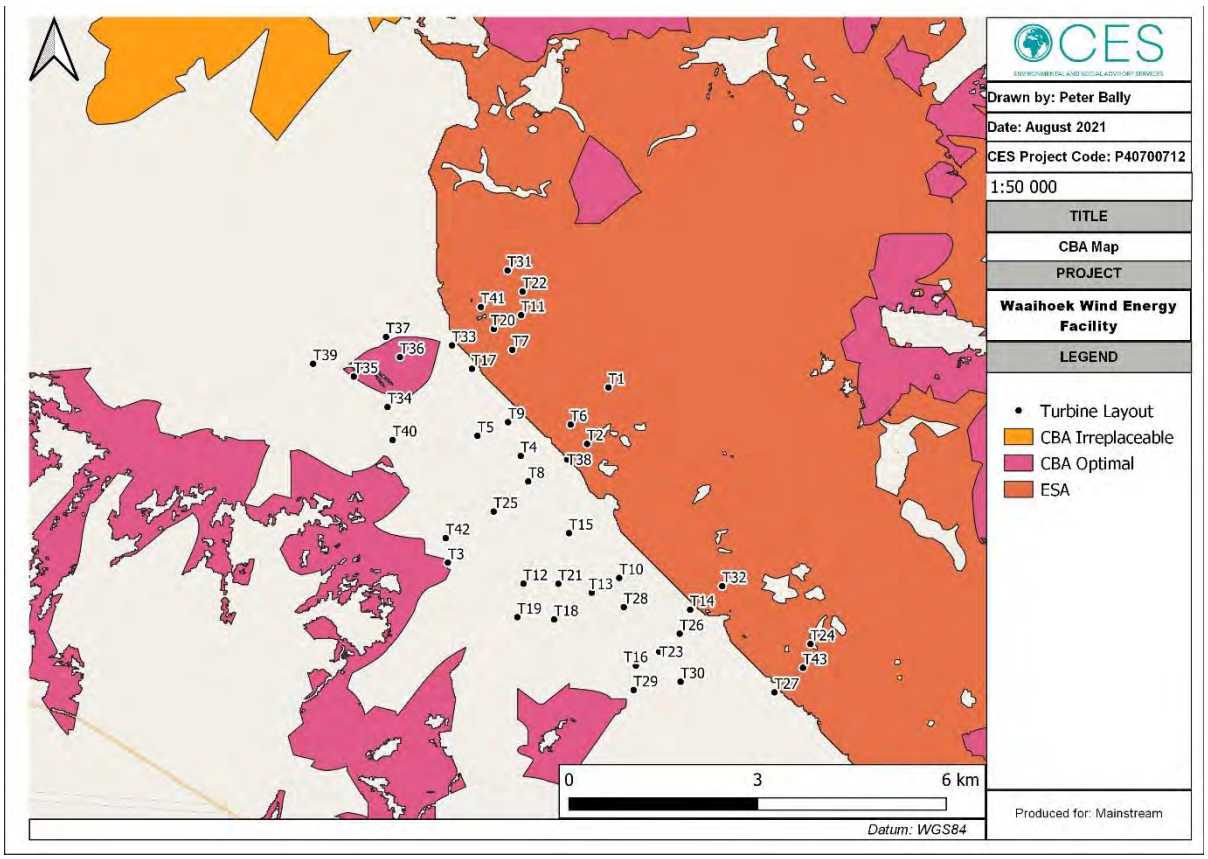

Figure 2 KwaZulu-Natal – Amajuba District CBA map.

2) Aquatic Ecological Assessment

The wetland layer developed in 2013/14 has been updated and revised in this assessment based on the Wetland Inventory V5 (Wet5, 2019) and digitising from Google Earth Pro aerial imagery. A number of additional wetlands, which were previously indicated as water courses, have been incorporated into the wetland layer (Figure 3). No turbines are located within a wetland, but most fall within the 500 m buffer, for which WULAs will be required.

It is also important to note that all the slope-wetlands in the study area that were delineated in the Wet5 layer were assessed as **CRITICALLY ENDANGERED** (CR), and depression wetlands as **LEAST CONCERN** (LC). Only one wetland is considered as a depression wetland and, therefore, by extrapolation, the wetlands delineated in this report have been classified as Critically Endangered. Recommendations for micro-siting turbines and re-routing the access roads and cables are made in the Conclusion section.

Access roads and underground electric cables are associated infrastructure which will also impact on the wetlands. A draft layout for this infrastructure was provided. Where practical, recommendations to move infrastructure outside the ambit of wetlands and water courses have been provided in the Conclusion section.

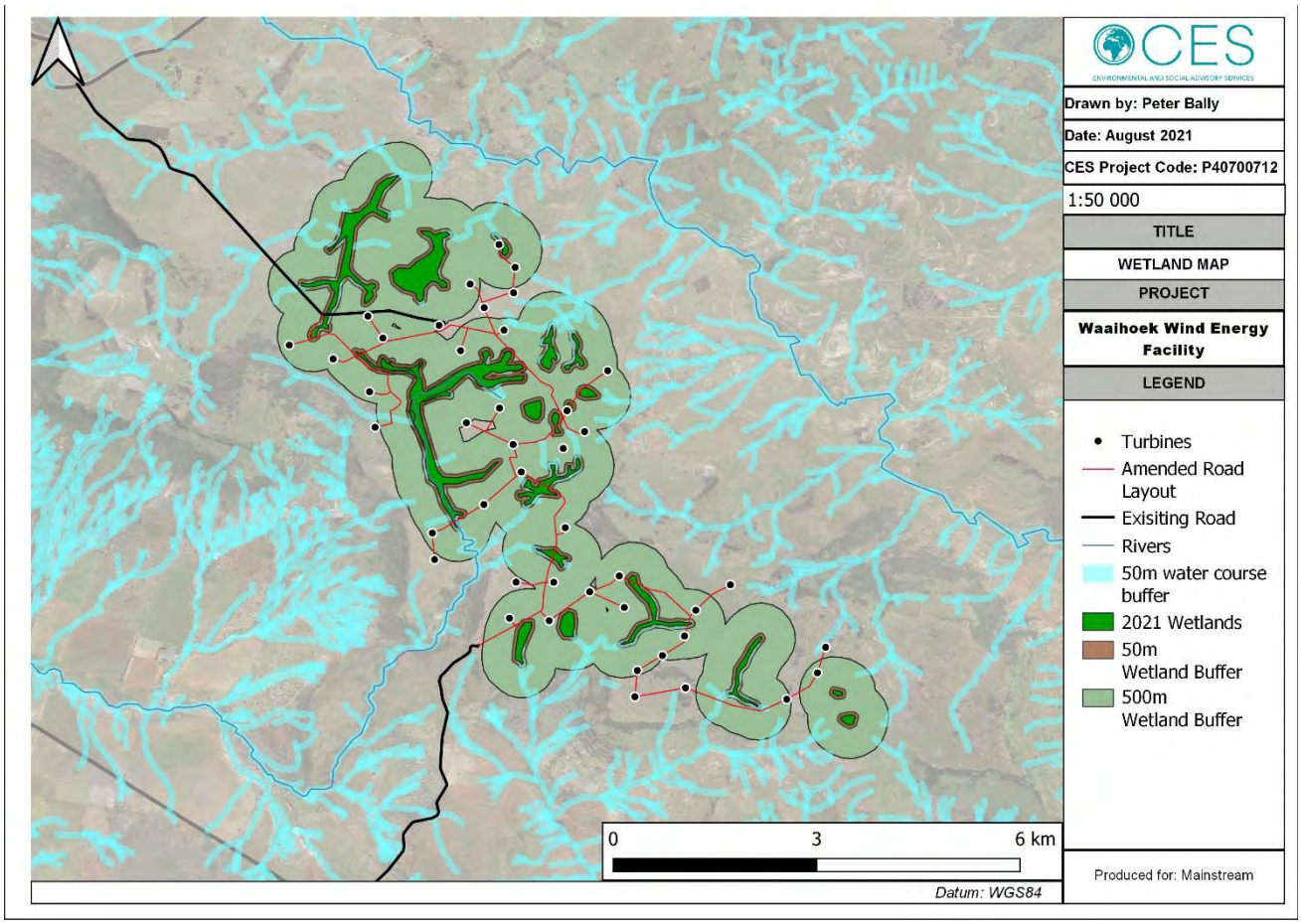

Figure 3 Wetlands in the study area of the Waaihoek WEF.

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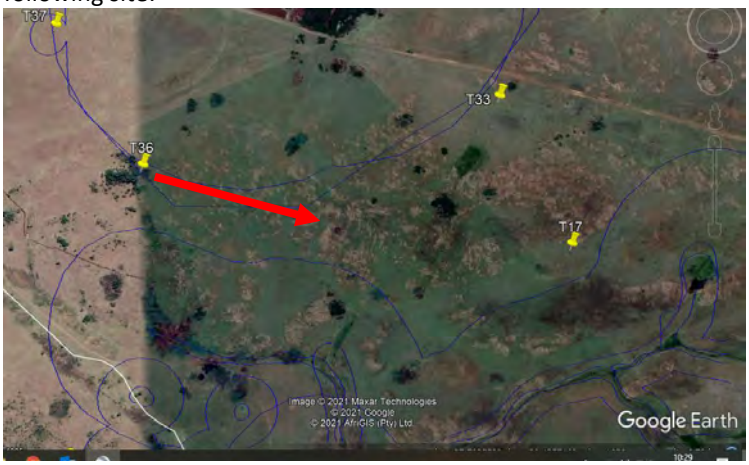
3) Conclusions and Recommendations

This assessment considered the new layout of the turbines and associated road and cable infrastructure in relation to biodiversity and wetland sensitivity. The following observations were made when comparing the new layout in terms of the mapped sensitive areas:

Amended Waaihoek WEF layout and implications for the terrestrial ecology

The following observations relating to the terrestrial ecological impact of the original and the amended Waaihoek WEF layout were made:

2014 Waaihoek WEF layout	2021 Waaihoek WEF layout
The Ecological Impact Assessment identified the following key impacts in the planning and design, construction and operation phases: • Loss of indigenous vegetation • Disturbance of sensitive areas • Spread of Alien Invasive Plants • Loss/displacement of fauna • Fragmentation of ecosystem The impacts could all be mitigated to an acceptable level by implementing appropriate measures.	The 2012 layout involved the assessment of 68 turbines, which have now been reduced to 43. The current layout amendment proposes the elimination of 25 turbines. The implication of this amendment is a reduced footprint of both turbine and access road and is, therefore, an ecologically favourable amendment. The impact assessment and mitigation measures prepared for the Ecological Impact Assessment in 2014 is still relevant and the findings/conditions thereof are still appropriate.
The original layout located 3 turbines in what is now classified as a CBA Optimal area.	In the amended layout, one (1) turbine is located in the CBA optimal area. This small patch is clearly demarcated for a particular species feature and even though T36 is placed on an area covered by Black Wattles, the site may (or will) constitute the required habitat for the population. The turbine, therefore, needs to be moved to the following site: 
The original layout located 32 turbines in Northern Interior Corridor.	In the amended layout, 11 turbines are located in the Northern Interior Corridor. This is a favourable amendment towards achieving the goals of the corridor.

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Amended Waaihoek WEF layout and implications for the aquatic ecology

The following observations relating to the aquatic ecological impact of the amended Waaihoek WEF layout were made:

Development activity	**2021 Assessment of impacts on wetlands**
Turbines and wetlands	No turbines are located in any wetlands, however some are still within 100 m. Minor micro-siting of the turbine layout needs to ensure that turbines are outside of the 100 m buffer. This should be conducted through the WULA process and will be subject to conditions of the WUL, the process of which will determine the impact risk to the respective wetland.
Access roads and underground cables and wetlands.	Numerous recommendations to realignment of the road (and hence underground cable) have been provided (Figure 4). The realignment recommendations seek to avoid crossing wetlands. There is one instance (T13-T14) where an existing track is routed through a wetland/water course (see insert below). This assessment proposes that the existing track (green line) is used instead of constructing an additional road upstream of the same wetland (red line) to prevent cumulative impact and degradation of the wetlands/water course. It is also a recommendation of this assessment that the wetland crossing is formalised and designed to minimise impact on the wetland. 

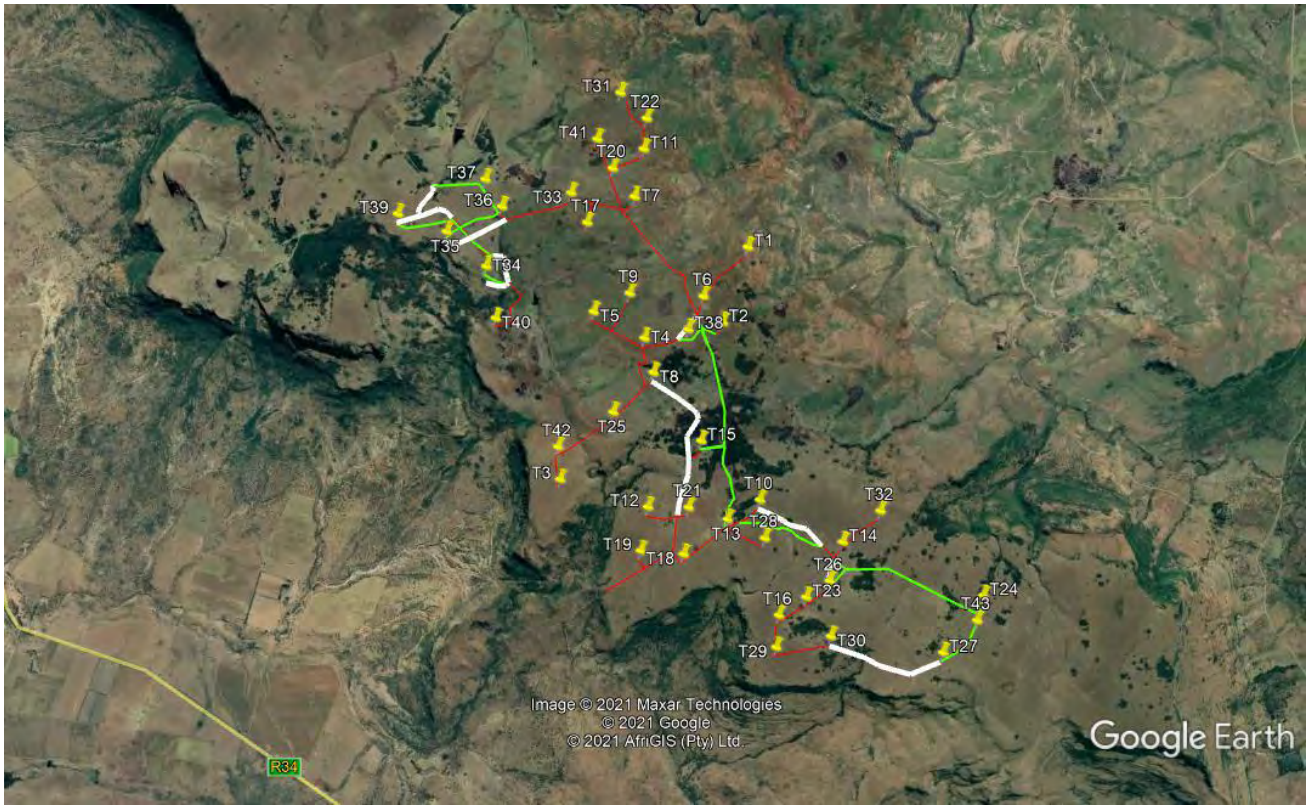

Figure 4 Recommended road and cable realignment (Red = amended road alignment; green = recommended revision of road alignment, white = recommended removal of road alignment)

<u>Concluding remarks</u>

- The new layout constitutes a better outcome in terms of overall ecological impacts due a reduced physical footprint of the WEF and associated infrastructure;
- The amended layout and reduced number of turbines (25 fewer turbines) reduces the need for connecting roads and therefore reduces the requirement for, and footprint of, road construction;
- One turbine in the amended layout falls within a CBA Optimal area and should be moved eastwards to avoid this area;
- Some turbines and access road/cable routes fall within 500 m of a wetland and WULAs will be necessary to permit these;
- The access road and cable routes have been realigned in this assessment to avoid wetlands. There is one instance where it is desirable to formalise an existing wetland crossing (as described above). This will require and WUL from the Department of Water Affairs and Sanitation.

The following concluding comments are made to the amended layout as are relevant to the Ecological Impact Assessment:

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Table 1. Comments on the proposed specification changes to the Waaihoek WEF

Proposed new specifications	Effect on impacts and mitigation measures	Effect on current EA conditions	Effect on cumulative impacts	Notes on land-use changes
Number of turbines:				
The number of turbines will decrease from 68 to 43. Some of the turbine positions have changed or been removed completely.	All mitigation measures identified in the original Ecological Report are still valid for this change. **One additional change must include the re-positioning of T36 to be located outside of the CBA optimal area.**	All conditions listed in the EA are still valid for this change. There are no additional conditions proposed for this change.	The proposed amendment will have no additional cumulative impact on the ecological landscape and therefore no additional cumulative issues were identified.	There have been no changes in land use that affect the impact assessment of the original or amended turbine layout.
Access road alignment and underground cables:				
Terrestrial Ecological Impact	All mitigation measures identified in the original Ecological Report are still valid for this change. There are no additional mitigations proposed for this change.	All conditions listed in the EA are still valid for this change. There are no additional conditions proposed for this change.	The cumulative impacts of ecosystem fragmentation is reduced by the lower number of turbines and a reduced road footprint.	There have been no changes in land use that affect the impact assessment of the original or amended turbine layout.
Aquatic Ecological Impact	All mitigation measures identified in the original Ecological Report are still valid for this change. **There is a requirement to realign the access roads and underground cable to avoid sensitive wetlands. This realignment has been provided.**	All conditions listed in the EA are still valid for this change. **One additional condition for the proposed change is that the access road alignment is revised to avoid wetlands as per recommendations in this report.**		

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The proposed amendments to the Waaihoek Wind Energy Facility will have no additional impact (direct, indirect or cumulative) on the ecology and ecosystems associated with the Waaihoek WEF site. Rather, the amended layout it will achieve a better outcome in terms of a reduced turbine and road footprint. In conjunction with the recommendations laid out above, the recommendations and mitigation measures contained in the Ecological and Wetland Impact Assessments (2014) are still applicable, remain valid, and should be included as conditions for approval.

This Letter of Opinion is not a standalone document and the conclusions made must be read in conjunction with the findings of the original Ecological Impact Assessment (2014).
Yours faithfully

Greer Hawley
Ecological Specialist

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Dr Greer Hawley-McMaster has a BSc degree in Botany and Zoology, a BSc (Honours) in Botany from the University of Cape Town and a PhD (Microbiology) from Rhodes University. Greer has a diverse skill set including biodiversity surveys and assessments (plants, fungi and terrestrial ecosystems), developing environmental management policy (EMP's and EMF's), analysis and interpretation of environmental and biodiversity spatial datasets, training, feasibility assessments, environmental impact assessments for a wide range of land use activity proposals, aquaculture feasibility assessments, alien invasive management planning and conservation management planning. Greer has undertaken work in a number of African countries and has specifically surveyed many parts of the Eastern Cape. Greer has managed large projects and has experience with co-ordinating big specialist teams. Greer has recently completed the review of the Eastern Cape Biodiversity Conservation Plan (2019) and continues to develop the Eastern Cape Biodiversity strategy and Action Plan.

Declaration:

I, Greer Hawley, declare that I am an independent consultant and have no business, financial, personal or other interest in the proposed development, application or appeal in respect of which I was appointed other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of my performing such work.

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12 August 2021

WAAIHOEK WIND FARM AMMENDMENTS

Umlando undertook the heritage survey for the proposed. Waaihoek wind farm in 2014. A total of 90 masts were initially proposed. A total of 61 heritage sites were recorded of which several would be affected by the masts and/or roads. A management plan was submitted for each suite and accepted by KZNARI.

Subsequently, after various Impact assessments they number of masts has been reduced to 43 masts, and some of the locations have been moved. Umlando was supplied with the new maps and road infrastructures, as well as a buffer zones around each recorded site.

Fig. 1 shows the new mast positions in relation to the recorded heritage sites and the access roads. Only three site fall within the 50m buffer zone for the roads: WAA03, WAA05 and WAA06 (fig. 2). They are as follows:

- WAA03 contains human graves and Late Iron Age walling.
- WAA05 is a stone walled byre
- WAA06 is a stone walled byre.

The mitigation for each remains the same:

- **WAA03:**
    - Significance: The site is of high significance. The walling and archaeological deposit is of low significance; however, the grave is of high significance.

- Mitigation: The road access will need to be re-aligned to avoid stone walls and grave. I would not support the excavations of the grave and the site if the road can be moved. The road margins will need to be at least 20m from the site and the site will need to be demarcated before construction. Fig. 16 shows an alternative route.
- SAHRA Rating: 3A

- **WAA05**
  - Significance: The site is of low significance.
  - Mitigation: The site should not be affected by the road upgrade. The site will need to be clearly demarcated before construction begins and a buffer zone of 20m will be required between the edge of the site and the road upgrade.
  - SAHRA Rating: 3C

- **WAA06**
  - Significance: The site is of low significance.
  - Mitigation: No further mitigation is required if the access road does not occur within 50m of the site.
  - SAHRA Rating: 3C

All masts and roads need to be ground truthed in relation to the heritage sites before construction begins. Ground truthing will record the outskirts of the sites, and confirm if they will be affected.

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Fig. 1: Location Of New Masts And Roads In Relation To Heritage Sites

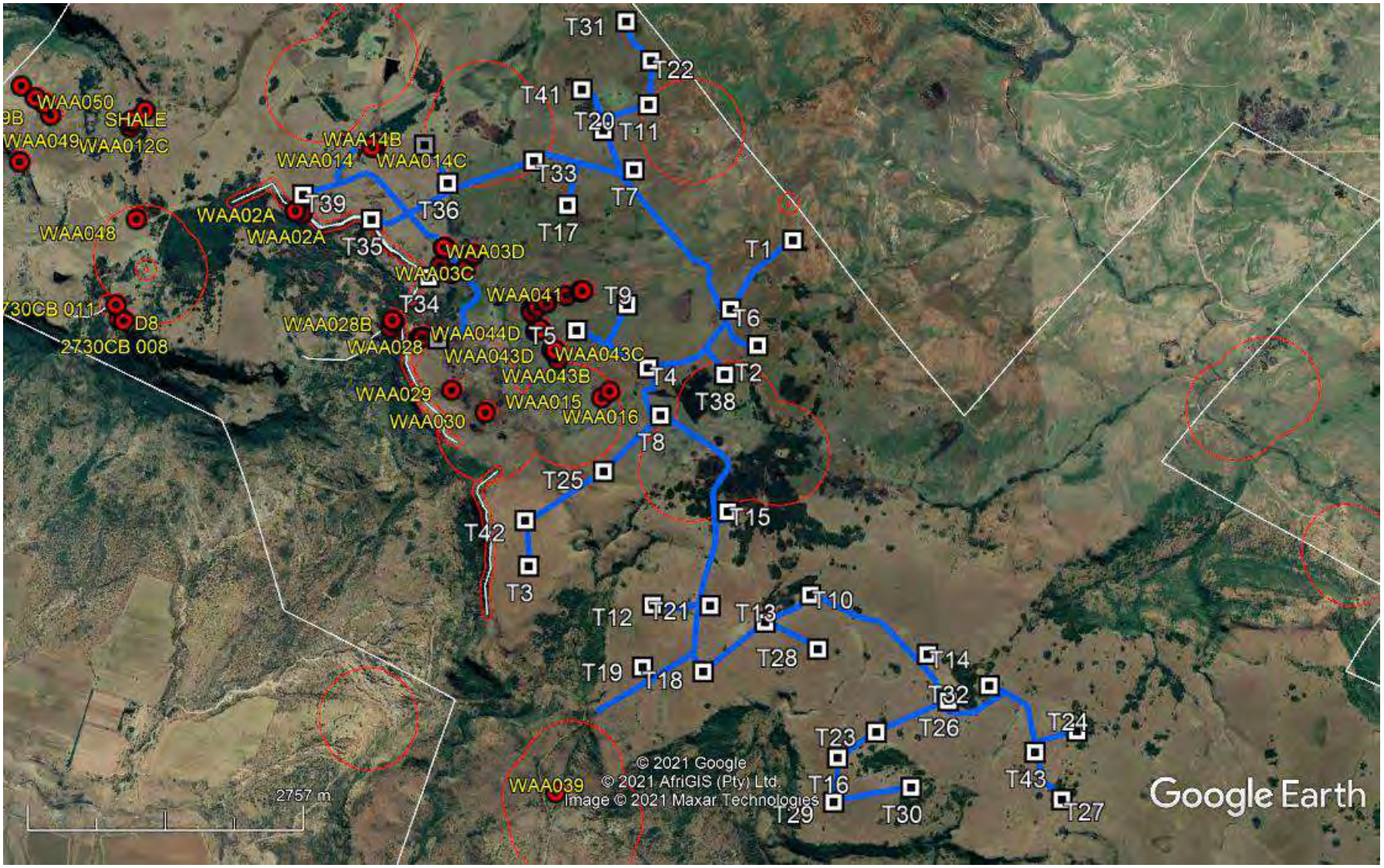

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Fig. 2: New Road In Relation To WAA03, WAA05 & WAA06

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There is a possibility that the graves at WAA03 could be moved. However, this will involve a PPP as the current community may lay claim to the ancestral remains.

Umlando supports the new alignments and locations of the roads and masts provided the correct mitigation is undertaken.

Yours Sincerely

Gavin Anderson

28th June 2021

Dr Alan Carter
Coastal and Environmental Services
P O Box 8145
Nahoon
East London
5210

Dear Dr Carter

RE-MODELLING OF NOISE IMPACT ASSESSMENT – WAAIHOEK WIND ENERGY FACILITY

As per our recent correspondence, please find attached the re-modelling report for the Waaihoek Wind Energy Facility near Utrecht, Kwazulu-Natal.

This report is to be viewed as an addendum to the main Noise Impact Report that was issued by Coastal and Environmental Services in November 2014 (DEA Reference: 14/12/16/3/3/2/655). The methodologies used to conduct the remodelling, identification of noise sensitive areas and the project description is described in the main report and is not repeated here.

The purpose of this report is to determine if the revised turbine specifications for the proposed 43 turbines will comply with the noise emission limits as contained in the Department of Environmental Affairs - Environmental Authorisation (14/12/16/3/3/2/655) issued in 2015. The reduction in number and revised turbine specification has necessitated a remodelling of the layout. The results of the modelling are presented below.

Yours sincerely

Dr Brett Williams

Noise Sensitive Areas (NSA)

The following noise sensitive areas have been identified during the November 2014 noise assessment and reused in the remodelling:

Table 1 – Noise Sensitive Areas

Name	Latitude	Longitude	Nearest WTG	Distance to nearest WTG	Within 500m Buffer
NSA 1	27° 39' 35.72" S	30° 24' 53.40" E	37	4569	No
NSA 2	27° 39' 48.83" S	30° 25' 41.98" E	31	3265	No
NSA 3	27° 39' 25.87" S	30° 25' 03.88" E	31	4418	No
NSA 4	27° 39' 41.03" S	30° 26' 02.94" E	31	3267	No
NSA 5	27° 39' 20.17" S	30° 25' 03.15" E	31	4574	No
NSA 6	27° 40' 10.34" S	30° 24' 32.76" E	37	3722	No
NSA 7	27° 39' 50.82" S	30° 23' 43.43" E	39	4795	No
NSA 8	27° 40' 20.24" S	30° 23' 18.99" E	39	4289	No
NSA 9	27° 40' 39.04" S	30° 25' 26.70" E	37	2525	No
NSA 10	27° 40' 49.63" S	30° 25' 16.62" E	37	2219	No
NSA 11	27° 40' 57.42" S	30° 25' 08.98" E	37	2022	No
NSA 12	27° 41' 04.51" S	30° 25' 07.34" E	37	1825	No
NSA 13	27° 41' 33.39" S	30° 25' 05.95" E	37	1033	No
NSA 14	27° 41' 44.39" S	30° 24' 49.33" E	39	1001	No
NSA 15	27° 42' 36.29" S	30° 23' 48.91" E	39	1650	No
NSA 16	27° 42' 41.18" S	30° 23' 53.69" E	39	1594	No
NSA 17	27° 41' 51.29" S	30° 25' 47.70" E	37	635	No
NSA 18	27° 41' 56.12" S	30° 25' 54.17" E	33	437	Yes
NSA 19	27° 41' 58.11" S	30° 25' 44.89" E	36	524	No
NSA 20	27° 41' 53.79" S	30° 25' 49.63" E	33	577	No
NSA 21	27° 41' 56.73" S	30° 27' 00.77" E	11	484	Yes
NSA 22	27° 43' 15.30" S	30° 25' 39.88" E	40	503	No
NSA 23	27° 43' 30.08" S	30° 25' 48.16" E	42	936	No
NSA 24	27° 43' 25.33" S	30° 26' 17.63" E	25	624	No
NSA 25	27° 43' 24.45" S	30° 27' 13.07" E	38	374	Yes
NSA 26	27° 43' 42.48" S	30° 26' 59.83" E	15	539	No
NSA 27	27° 43' 36.04" S	30° 27' 16.65" E	15	590	No
NSA 28	27° 43' 37.38" S	30° 27' 30.95" E	15	722	No
NSA 29	27° 43' 23.40" S	30° 30' 17.07" E	24	3495	No
NSA 30	27° 43' 16.21" S	30° 30' 27.68" E	24	3831	No
NSA 31	27° 45' 20.49" S	30° 32' 04.03" E	24	4621	No
NSA 32	27° 45' 38.37" S	30° 32' 01.58" E	24	4651	No

Name	Latitude	Longitude	Nearest WTG	Distance to nearest WTG	Within 500m Buffer
NSA 33	27° 46' 09.04" S	30° 32' 21.71" E	27	5396	No
NSA 34	27° 47' 04.62" S	30° 31' 44.19" E	27	5200	No
NSA 35	27° 47' 10.96" S	30° 30' 35.74" E	27	4010	No
NSA 36	27° 47' 33.99" S	30° 26' 42.82" E	29	4358	No
NSA 37	27° 47' 28.35" S	30° 26' 34.19" E	29	4312	No
NSA 38	27° 47' 25.74" S	30° 26' 24.19" E	29	4384	No
NSA 39	27° 47' 25.32" S	30° 26' 19.94" E	29	4438	No
NSA 40	27° 47' 22.96" S	30° 26' 11.97" E	29	4506	No
NSA 41	27° 47' 03.74" S	30° 25' 44.17" E	19	4604	No
NSA 42	27° 46' 53.96" S	30° 25' 45.45" E	19	4310	No
NSA 43	27° 46' 24.39" S	30° 26' 22.82" E	19	3148	No
NSA 44	27° 46' 23.67" S	30° 26' 14.48" E	19	3175	No
NSA 45	27° 46' 10.14" S	30° 26' 32.60" E	19	2674	No
NSA 46	27° 46' 05.62" S	30° 26' 16.60" E	19	2624	No
NSA 47	27° 46' 27.04" S	30° 25' 01.73" E	19	4227	No
NSA 48	27° 45' 40.20" S	30° 26' 22.46" E	19	1829	No
NSA 49	27° 45' 35.77" S	30° 26' 13.01" E	19	1804	No
NSA 50	27° 45' 33.21" S	30° 26' 24.80" E	19	1605	No
NSA 51	27° 45' 26.70" S	30° 26' 10.75" E	19	1596	No
NSA 52	27° 45' 17.73" S	30° 26' 17.99" E	19	1257	No
NSA 53	27° 45' 02.06" S	30° 25' 03.83" E	3	2237	No
NSA 54	27° 42' 15.51" S	30° 21' 49.46" E	39	4808	No
NSA 55	27° 46' 50.64" S	30° 27' 45.56" E	29	2607	No
NSA 56	27° 44' 25.61" S	30° 31' 52.52" E	24	4430	No
NSA 57	27° 44' 09.80" S	30° 30' 58.10" E	24	3236	No
NSA 58	27° 40' 40.76" S	30° 26' 44.55" E	31	1298	No

Wind Turbine Generators (WTG)

The wind turbine generator that was modelled is described in Table 2 below. Several turbines are being considered for the project, however not all data was available for each specific model. Therefore, the turbine that was chosen to represent the worst-case scenario is a wind turbine up to 6.2 MW and 160m hub height. This model of turbine was chosen as it has published noise data in the WindPro catalogue of wind turbines. Furthermore, the noise data has been tested according to the methods described in IEC 61400-11 and are thus traceable. If a lower final hub height or lower power output is chosen, the noise impacts could be reduced. Furthermore, if the final turbine that

is chosen has a maximum sound power level that is similar or lower than the turbine modelled in this report, it can be assumed that the noise impacts will be similar or lower, irrespective of the turbine manufacturer.

Table 2 - Proposed Turbine Specifications

Manufacturer	Siemens Gamesa
Type / Version	SG 6.0-170
Rated Power	6.2 MW
Rotor Diameter	170m
Tower	Tubular
Grid Connection	50/60 Hz
Maximum Sound Power Level	106.0 dB(A)
Hub Height	115m

*Sound Power Level dB(A) reference to 1pW from WindPro 3.2 Catalogue

*The specifications of this turbine model were used as the data is available in WindPro. This does not bind the applicant to this specific model, but allows the developer to choose any turbine model with similar turbine specifications. An equal or lower maximum sound power level would be acceptable for the site.

The sound power levels at lower and higher wind speeds as stated above were interpolated from the published data. **The actual sound power levels may thus be less than those stated when the final turbine is selected. The levels used in the re-modelling are thus a worst-case scenario.**

The turbine positions are recorded in Annexure A are a record of what informed the noise modelling assessment.

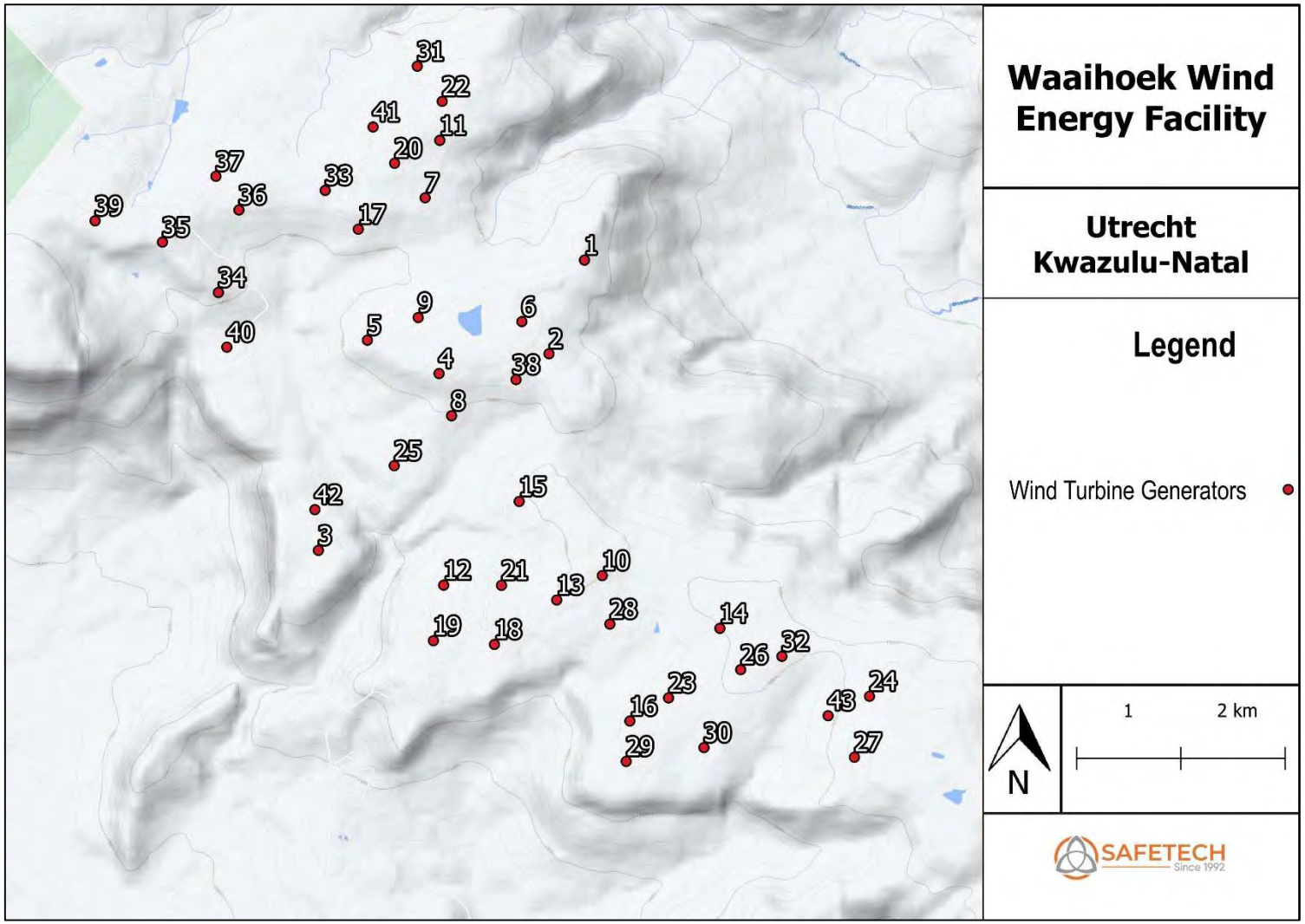

Figure 1: Amended WTG Layout.

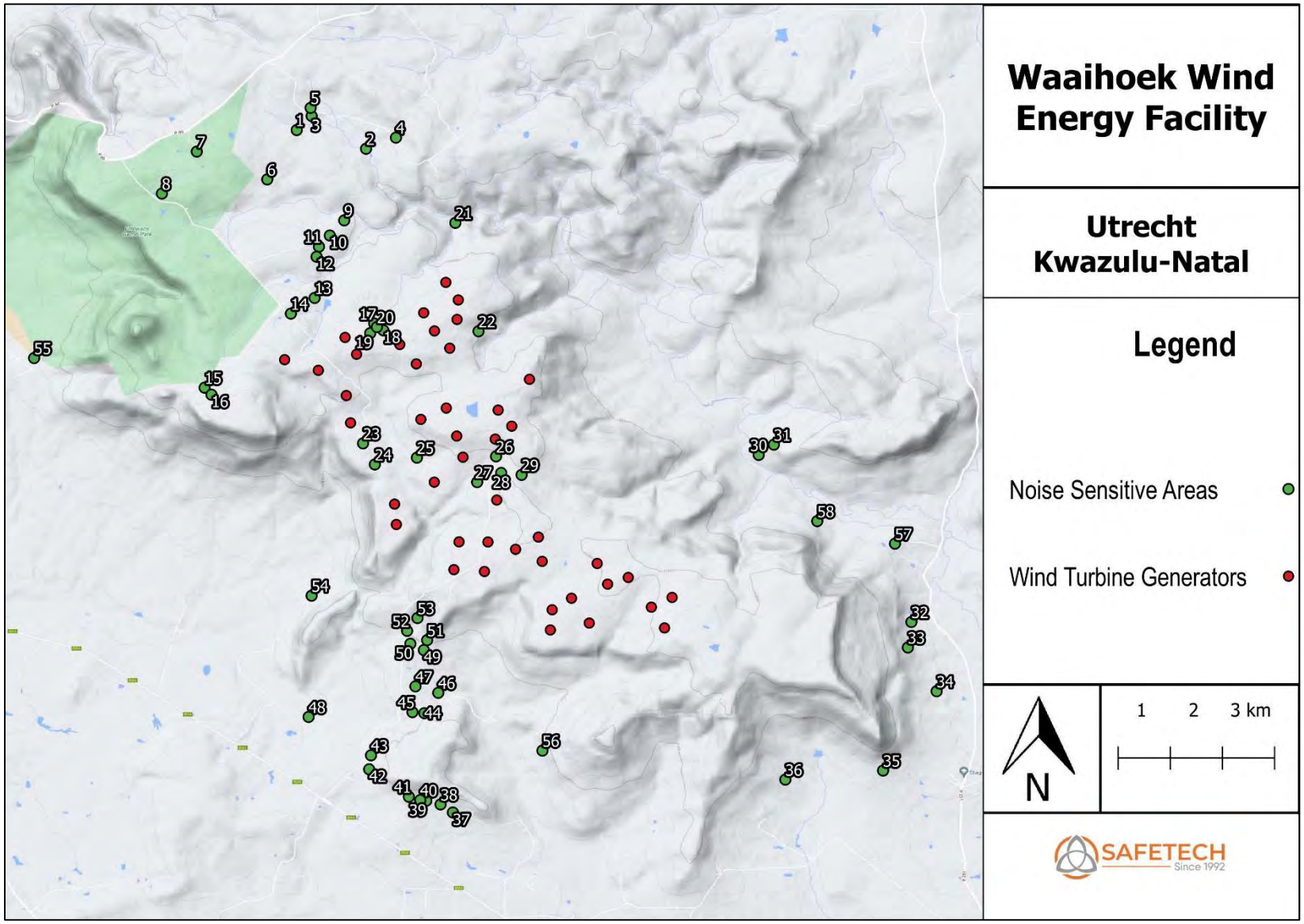

Figure 2: Noise Sensitive Areas

Modelling Results

The masking effect of the wind noise will mitigate the noise impact. The results are based on NO wind noise masking, which in reality rarely occurs when the turbines are operational. The maximum noise rating limit as the DEA Environmental Authorisation is 45 dB(A). The noise impacts were modelled in WindPro Version 3.2 using the above data. The results are presented in Table 3 below.

Table 3 - Modelling Results

Sensitive Receptor	Wind Speed (m/s)	Noise from WTGs (dB[A])
NSA 1	3,0	8,6
	4,0	13,5
	5,0	18,4
	6,0	21,4
	7,0	21,7
	8,0	21,7
	9,0	21,7
	10,0	21,7
	11,0	21,7
	12,0	21,7
NSA 2	3,0	12,3
	4,0	17,2
	5,0	22,0
	6,0	25,0
	7,0	25,3
	8,0	25,3
	9,0	25,3
	10,0	25,3
	11,0	25,3
	12,0	25,3
NSA 3	3,0	8,5
	4,0	13,4
	5,0	18,2
	6,0	21,2
	7,0	21,5
	8,0	21,5
	9,0	21,5
	10,0	21,5
	11,0	21,5
	12,0	21,5
NSA 4	3,0	11,9
	4,0	16,8
	5,0	21,7
	6,0	24,7
	7,0	25,0
	8,0	25,0
	9,0	25,0
	10,0	25,0
	11,0	25,0
	12,0	25,0
NSA 5	3,0	7,9
	4,0	12,8

Sensitive Receptor	Wind Speed (m/s)	Noise from WTGs (dB[A])
	5,0	17,7
	6,0	20,7
	7,0	21,0
	8,0	21,0
	9,0	21,0
	10,0	21,0
	11,0	21,0
	12,0	21,0
NSA 6	3,0	11,6
	4,0	16,5
	5,0	21,4
	6,0	24,4
	7,0	24,7
	8,0	24,7
	9,0	24,7
	10,0	24,7
	11,0	24,7
	12,0	24,7
NSA 7	3,0	6,6
	4,0	11,5
	5,0	16,3
	6,0	19,3
	7,0	19,6
	8,0	19,6
	9,0	19,6
	10,0	19,6
	11,0	19,6
	12,0	19,6
NSA 8	3,0	7,3
	4,0	12,2
	5,0	17,0
	6,0	20,0
	7,0	20,3
	8,0	20,3
	9,0	20,3
	10,0	20,3
	11,0	20,3
	12,0	20,3
NSA 9	3,0	17,8
	4,0	22,7
	5,0	27,5
	6,0	30,5
	7,0	30,8
	8,0	30,8
	9,0	30,8
	10,0	30,8
	11,0	30,8
	12,0	30,8
NSA 10	3,0	18,6
	4,0	23,5
	5,0	28,3
	6,0	31,3
	7,0	31,6
	8,0	31,6
	9,0	31,6
	10,0	31,6

Sensitive Receptor	Wind Speed (m/s)	Noise from WTGs (dB[A])
	11,0	31,6
	12,0	31,6
NSA 11	3,0	19,1
	4,0	24,0
	5,0	28,9
	6,0	31,9
	7,0	32,2
	8,0	32,2
	9,0	32,2
	10,0	32,2
	11,0	32,2
	12,0	32,2
NSA 12	3,0	19,9
	4,0	24,8
	5,0	29,7
	6,0	32,7
	7,0	33,0
	8,0	33,0
	9,0	33,0
	10,0	33,0
	11,0	33,0
	12,0	33,0
NSA 13	3,0	24,6
	4,0	29,5
	5,0	34,3
	6,0	37,3
	7,0	37,6
	8,0	37,6
	9,0	37,6
	10,0	37,6
	11,0	37,6
	12,0	37,6
NSA 14	3,0	25,0
	4,0	29,9
	5,0	34,7
	6,0	37,7
	7,0	38,0
	8,0	38,0
	9,0	38,0
	10,0	38,0
	11,0	38,0
	12,0	38,0
NSA 15	3,0	17,6
	4,0	22,4
	5,0	27,3
	6,0	30,3
	7,0	30,6
	8,0	30,6
	9,0	30,6
	10,0	30,6
	11,0	30,6
	12,0	30,6
NSA 16	3,0	17,7
	4,0	22,6
	5,0	27,5
	6,0	30,5

Sensitive Receptor	Wind Speed (m/s)	Noise from WTGs (dB[A])
	7,0	30,8
	8,0	30,8
	9,0	30,8
	10,0	30,8
	11,0	30,8
	12,0	30,8
NSA 17	3,0	31,5
	4,0	36,4
	5,0	41,2
	6,0	44,2
	7,0	44,5
	8,0	44,5
	9,0	44,5
	10,0	44,5
	11,0	44,5
	12,0	44,5
NSA 18	3,0	33,7
	4,0	38,6
	5,0	43,4
	6,0	46,4
	7,0	46,7
	8,0	46,7
	9,0	46,7
	10,0	46,7
	11,0	46,7
	12,0	46,7
NSA 19	3,0	33,7
	4,0	38,5
	5,0	43,4
	6,0	46,4
	7,0	46,7
	8,0	46,7
	9,0	46,7
	10,0	46,7
	11,0	46,7
	12,0	46,7
NSA 20	3,0	32,2
	4,0	37,1
	5,0	42,0
	6,0	45,0
	7,0	45,3
	8,0	45,3
	9,0	45,3
	10,0	45,3
	11,0	45,3
	12,0	45,3
NSA 21	3,0	20,8
	4,0	25,7
	5,0	30,5
	6,0	33,5
	7,0	33,8
	8,0	33,8
	9,0	33,8
	10,0	33,8
	11,0	33,8
	12,0	33,8

Sensitive Receptor	Wind Speed (m/s)	Noise from WTGs (dB[A])
NSA 22	3,0	32,2
	4,0	37,1
	5,0	41,9
	6,0	44,9
	7,0	45,2
	8,0	45,2
	9,0	45,2
	10,0	45,2
	11,0	45,2
	12,0	45,2
NSA 23	3,0	30,8
	4,0	35,6
	5,0	40,5
	6,0	43,5
	7,0	43,8
	8,0	43,8
	9,0	43,8
	10,0	43,8
	11,0	43,8
	12,0	43,8
NSA 24	3,0	27,9
	4,0	32,7
	5,0	37,6
	6,0	40,6
	7,0	40,9
	8,0	40,9
	9,0	40,9
	10,0	40,9
	11,0	40,9
	12,0	40,9
NSA 25	3,0	31,1
	4,0	36,0
	5,0	40,8
	6,0	43,8
	7,0	44,1
	8,0	44,1
	9,0	44,1
	10,0	44,1
	11,0	44,1
	12,0	44,1
NSA 26	3,0	34,6
	4,0	39,5
	5,0	44,3
	6,0	47,3
	7,0	47,6
	8,0	47,6
	9,0	47,6
	10,0	47,6
	11,0	47,6
	12,0	47,6
NSA 27	3,0	32,6
	4,0	37,5
	5,0	42,4
	6,0	45,4
	7,0	45,7
	8,0	45,7

Sensitive Receptor	Wind Speed (m/s)	Noise from WTGs (dB[A])
	9,0	45,7
	10,0	45,7
	11,0	45,7
	12,0	45,7
NSA 28	3,0	31,6
	4,0	36,5
	5,0	41,4
	6,0	44,4
	7,0	44,7
	8,0	44,7
	9,0	44,7
	10,0	44,7
	11,0	44,7
	12,0	44,7
NSA 29	3,0	29,3
	4,0	34,2
	5,0	39,0
	6,0	42,0
	7,0	42,3
	8,0	42,3
	9,0	42,3
	10,0	42,3
	11,0	42,3
	12,0	42,3
NSA 30	3,0	12,5
	4,0	17,4
	5,0	22,2
	6,0	25,2
	7,0	25,5
	8,0	25,5
	9,0	25,5
	10,0	25,5
	11,0	25,5
	12,0	25,5
NSA 31	3,0	11,6
	4,0	16,5
	5,0	21,4
	6,0	24,4
	7,0	24,7
	8,0	24,7
	9,0	24,7
	10,0	24,7
	11,0	24,7
	12,0	24,7
NSA 32	3,0	5,5
	4,0	10,4
	5,0	15,3
	6,0	18,2
	7,0	18,6
	8,0	18,6
	9,0	18,6
	10,0	18,6
	11,0	18,6
	12,0	18,6
NSA 33	3,0	5,4
	4,0	10,3

Sensitive Receptor	Wind Speed (m/s)	Noise from WTGs (dB[A])
	5,0	15,2
	6,0	18,2
	7,0	18,5
	8,0	18,5
	9,0	18,5
	10,0	18,5
	11,0	18,5
	12,0	18,5
NSA 34	3,0	2,8
	4,0	7,7
	5,0	12,6
	6,0	15,6
	7,0	15,9
	8,0	15,9
	9,0	15,9
	10,0	15,9
	11,0	15,9
	12,0	15,9
NSA 35	3,0	3,2
	4,0	8,1
	5,0	13,0
	6,0	16,0
	7,0	16,3
	8,0	16,3
	9,0	16,3
	10,0	16,3
	11,0	16,3
	12,0	16,3
NSA 36	3,0	7,4
	4,0	12,3
	5,0	17,1
	6,0	20,1
	7,0	20,4
	8,0	20,4
	9,0	20,4
	10,0	20,4
	11,0	20,4
	12,0	20,4
NSA 37	3,0	8,1
	4,0	13,0
	5,0	17,9
	6,0	20,9
	7,0	21,2
	8,0	21,2
	9,0	21,2
	10,0	21,2
	11,0	21,2
	12,0	21,2
NSA 38	3,0	8,4
	4,0	13,3
	5,0	18,1
	6,0	21,1
	7,0	21,4
	8,0	21,4
	9,0	21,4
	10,0	21,4

Sensitive Receptor	Wind Speed (m/s)	Noise from WTGs (dB[A])
	11,0	21,4
	12,0	21,4
NSA 39	3,0	8,3
	4,0	13,2
	5,0	18,0
	6,0	21,0
	7,0	21,3
	8,0	21,3
	9,0	21,3
	10,0	21,3
	11,0	21,3
	12,0	21,3
NSA 40	3,0	8,2
	4,0	13,1
	5,0	17,9
	6,0	20,9
	7,0	21,2
	8,0	21,2
	9,0	21,2
	10,0	21,2
	11,0	21,2
	12,0	21,2
NSA 41	3,0	8,1
	4,0	13,0
	5,0	17,8
	6,0	20,8
	7,0	21,1
	8,0	21,1
	9,0	21,1
	10,0	21,1
	11,0	21,1
	12,0	21,1
NSA 42	3,0	8,8
	4,0	13,7
	5,0	18,6
	6,0	21,6
	7,0	21,9
	8,0	21,9
	9,0	21,9
	10,0	21,9
	11,0	21,9
	12,0	21,9
NSA 43	3,0	9,9
	4,0	14,8
	5,0	19,7
	6,0	22,7
	7,0	23,0
	8,0	23,0
	9,0	23,0
	10,0	23,0
	11,0	23,0
	12,0	23,0
NSA 44	3,0	15,1
	4,0	20,0
	5,0	24,9
	6,0	27,9

Sensitive Receptor	Wind Speed (m/s)	Noise from WTGs (dB[A])
	7,0	28,2
	8,0	28,2
	9,0	28,2
	10,0	28,2
	11,0	28,2
	12,0	28,2
NSA 45	3,0	14,7
	4,0	19,6
	5,0	24,4
	6,0	27,4
	7,0	27,7
	8,0	27,7
	9,0	27,7
	10,0	27,7
	11,0	27,7
	12,0	27,7
NSA 46	3,0	17,0
	4,0	21,9
	5,0	26,8
	6,0	29,8
	7,0	30,1
	8,0	30,1
	9,0	30,1
	10,0	30,1
	11,0	30,1
	12,0	30,1
NSA 47	3,0	16,6
	4,0	21,4
	5,0	26,3
	6,0	29,3
	7,0	29,6
	8,0	29,6
	9,0	29,6
	10,0	29,6
	11,0	29,6
	12,0	29,6
NSA 48	3,0	9,8
	4,0	14,7
	5,0	19,6
	6,0	22,6
	7,0	22,9
	8,0	22,9
	9,0	22,9
	10,0	22,9
	11,0	22,9
	12,0	22,9
NSA 49	3,0	19,4
	4,0	24,3
	5,0	29,2
	6,0	32,2
	7,0	32,5
	8,0	32,5
	9,0	32,5
	10,0	32,5
	11,0	32,5
	12,0	32,5

Sensitive Receptor	Wind Speed (m/s)	Noise from WTGs (dB[A])
NSA 50	3,0	19,3
	4,0	24,2
	5,0	29,0
	6,0	32,0
	7,0	32,3
	8,0	32,3
	9,0	32,3
	10,0	32,3
	11,0	32,3
	12,0	32,3
NSA 51	3,0	20,4
	4,0	25,2
	5,0	30,1
	6,0	33,1
	7,0	33,4
	8,0	33,4
	9,0	33,4
	10,0	33,4
	11,0	33,4
	12,0	33,4
NSA 52	3,0	20,0
	4,0	24,8
	5,0	29,7
	6,0	32,7
	7,0	33,0
	8,0	33,0
	9,0	33,0
	10,0	33,0
	11,0	33,0
	12,0	33,0
NSA 53	3,0	21,9
	4,0	26,7
	5,0	31,6
	6,0	34,6
	7,0	34,9
	8,0	34,9
	9,0	34,9
	10,0	34,9
	11,0	34,9
	12,0	34,9
NSA 54	3,0	16,7
	4,0	21,6
	5,0	26,5
	6,0	29,5
	7,0	29,8
	8,0	29,8
	9,0	29,8
	10,0	29,8
	11,0	29,8
	12,0	29,8
NSA 55	3,0	4,3
	4,0	9,2
	5,0	14,1
	6,0	17,1
	7,0	17,4
	8,0	17,4

Sensitive Receptor	Wind Speed (m/s)	Noise from WTGs (dB[A])
	9,0	17,4
	10,0	17,4
	11,0	17,4
	12,0	17,4
NSA 56	3,0	14,8
	4,0	19,7
	5,0	24,6
	6,0	27,6
	7,0	27,9
	8,0	27,9
	9,0	27,9
	10,0	27,9
	11,0	27,9
	12,0	27,9
NSA 57	3,0	6,4
	4,0	11,3
	5,0	16,2
	6,0	19,2
	7,0	19,5
	8,0	19,5
	9,0	19,5
	10,0	19,5
	11,0	19,5
	12,0	19,5
NSA 58	3,0	11,1
	4,0	16,0
	5,0	20,9
	6,0	23,8
	7,0	24,2
	8,0	24,2
	9,0	24,2
	10,0	24,2
	11,0	24,2
	12,0	24,2

Environmental Authorisation Limit = 45dB(A)

Discussion

The modelling results indicate that the Environmental Authorisation Limit of 45 dB(A) limit will be exceeded at NSA 18, NSA 19, NSA 22, and NSA 26. The exceedances will only occur from 6-7m/s. It is highly likely that the wind noise will provide a masking effect, thereby decreasing any potential impacts on sensitive receptors. Furthermore, the modelling assumes the receiver is outdoors at all times.

Three turbines are closer than 500m to NSA 18, NSA 21 and NSA 25. These turbines (WTG 11, 33 and 38) should be relocated in order to comply with the Environmental Authorisation.

Conclusion

The overall environmental noise impact significance remains low considering the changes to the turbine specifications. The amended project description will in all likelihood not exceed the current Environmental Authorisation limit of 45 dB(A) at the noise sensitive receptors using the data that was modelled. It is my recommendation that based on the results and information presented here and if the three turbines that are too close to NSA 18, 21 and 25 are moved, then the granting of an amended Environmental Authorisation with respect to the noise impacts is recommended.

Please feel free to contact us should you have any further requirements. Assuring you of our best attention at all times.

Yours sincerely

Dr Brett Williams

Annexure A – WTG Positions

WTG #	Latitude	Longitude
WTG 1	27° 42' 30.45" S	30° 27' 36.46" E
WTG 2	27° 43' 03.25" S	30° 27' 24.04" E
WTG 3	27° 44' 12.15" S	30° 26' 03.22" E
WTG 4	27° 43' 10.20" S	30° 26' 45.49" E
WTG 5	27° 42' 58.49" S	30° 26' 20.40" E
WTG 6	27° 42' 51.98" S	30° 27' 14.54" E
WTG 7	27° 42' 08.60" S	30° 26' 40.63" E
WTG 8	27° 43' 24.99" S	30° 26' 49.88" E
WTG 9	27° 42' 50.58" S	30° 26' 38.18" E
WTG 10	27° 44' 21.01" S	30° 27' 42.73" E
WTG 11	27° 41' 48.47" S	30° 26' 45.74" E
WTG 12	27° 44' 24.36" S	30° 26' 47.14" E
WTG 13	27° 44' 29.54" S	30° 27' 26.74" E
WTG 14	27° 44' 39.47" S	30° 28' 23.91" E
WTG 15	27° 43' 55.02" S	30° 27' 13.57" E
WTG 16	27° 45' 11.95" S	30° 27' 52.37" E
WTG 17	27° 42' 19.61" S	30° 26' 17.19" E
WTG 18	27° 44' 45.09" S	30° 27' 04.93" E
WTG 19	27° 44' 43.83" S	30° 26' 43.54" E
WTG 20	27° 41' 56.50" S	30° 26' 29.93" E
WTG 21	27° 44' 24.43" S	30° 27' 07.37" E
WTG 22	27° 41' 34.80" S	30° 26' 46.60" E
WTG 23	27° 45' 03.88" S	30° 28' 05.95" E
WTG 24	27° 45' 03.31" S	30° 29' 16.40" E
WTG 25	27° 43' 42.49" S	30° 26' 29.79" E
WTG 26	27° 44' 53.95" S	30° 28' 31.22" E
WTG 27	27° 45' 24.66" S	30° 29' 11.07" E
WTG 28	27° 44' 38.00" S	30° 27' 45.39" E
WTG 29	27° 45' 26.09" S	30° 27' 51.12" E
WTG 30	27° 45' 21.27" S	30° 28' 18.33" E
WTG 31	27° 41' 22.48" S	30° 26' 37.89" E
WTG 32	27° 44' 49.27" S	30° 28' 45.69" E
WTG 33	27° 42' 06.01" S	30° 26' 05.60" E
WTG 34	27° 42' 41.79" S	30° 25' 28.16" E
WTG 35	27° 42' 24.12" S	30° 25' 08.54" E
WTG 36	27° 42' 12.88" S	30° 25' 35.36" E
WTG 37	27° 42' 01.07" S	30° 25' 27.30" E
WTG 38	27° 43' 12.32" S	30° 27' 12.49" E
WTG 39	27° 42' 16.66" S	30° 24' 44.96" E
WTG 40	27° 43' 00.94" S	30° 25' 31.15" E
WTG 41	27° 41' 43.79" S	30° 26' 22.38" E
WTG 42	27° 43' 57.86" S	30° 26' 02.00" E
WTG 43	27° 45' 10.11" S	30° 29' 01.89" E

PALAEONTOLOGICAL IMPACT ASSESSMENT (PIA) (supplementary letter) for the proposed Waaihoek WEF EA Amendment Application, near Utrecht, within the Emadlangeni Local Municipality, KwaZulu Natal Province.

FOR

Coastal and Environmental Services

By

Dr Gideon Groenewald

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06 August 2021

EXECUTIVE SUMMARY

Dr Gideon Groenewald was appointed to undertake a Phase 1 Palaeontological Impact Assessment, assessing the potential palaeontological impact of the proposed amendment of the layout for the Waaihoek Wind Energy Facility near Utrecht, Kwa-Zulu Natal Province. The purpose of this Palaeontological Impact Assessment is to identify exposed and potential palaeontological heritage on the sites of the proposed changes to the development, to assess the impact the development may have on this resource, and to make recommendations as to how this impact might be mitigated.

1.1. Legal Requirements

This report forms part of the Part II Amendment for the proposed development of a wind farm and complies with the requirements for the South African National Heritage Resource Act No 25 of 1999. In accordance with Section 38 (Heritage Resources Management), a Palaeontological Impact Assessment is required to assess any potential impacts to palaeontological heritage within the development footprint of the proposed Waaihoek Wind Energy Facility.

Categories of heritage resources recognised as part of the National Estate in Section 3 of the Heritage Resources Act, and which therefore fall under its protection, include:

- geological sites of scientific or cultural importance;
- objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens; and
- objects with the potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage.

The development site for the proposed Waaihoek Wind Energy Facility is underlain by the Permian Vryheid and Volksrust Formations of the Ecca Group as well as a thick dolerite sill.

Outcrops of the Vryheid and Volksrust Formations are restricted to specific areas on the escarpment and in road cuttings. Extensive areas are underlain by dolerite.

It is recommended that:

- The PEA and CEO be made aware of the possibility of finding fossils in the Vryheid and Volksrust Formation sediments during excavation of the foundations for the turbines and other infrastructure.
- A professional palaeontologist be appointed to monitor possible palaeontological finds during excavation of turbine foundations and infrastructure where turbine positions and infrastructure fall on Vryheid and Volksrust Formation sediments.
- No further action is needed in all areas underlain by dolerite.

TABLE OF CONTENT

LIST OF TABLES

2. INTRODUCTION

Dr Gideon Groenewald was appointed to undertake a Phase 1 Palaeontological Impact Assessment, assessing the potential palaeontological impact of the proposed amendment of the layout for the Waaihoek Wind Energy Facility near Utrecht, Kwa-Zulu Natal Province. The purpose of this Palaeontological Impact Assessment is to identify exposed and potential palaeontological heritage on the sites of the proposed changes to the development, to assess the impact the development may have on this resource, and to make recommendations as to how this impact might be mitigated.

2.1. Legal Requirements

This report forms part of the Part II Amendment Application for the proposed development of a wind farm and complies with the requirements for the South African National Heritage Resource Act No 25 of 1999. In accordance with Section 38 (Heritage Resources Management), a Palaeontological Impact Assessment is required to assess any potential impacts to palaeontological heritage within the development footprint of the proposed Waaihoek Wind Energy Facility.

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- objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens; and
- objects with the potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage.

3. AIMS AND METHODOLOGY

This Phase 1 investigation only refers to possible changes to the recommendations of the Phase 1 PIA report of March 2014 (Groenewald, 2014, internal report).

The likely impact of the proposed development on local fossil heritage was determined on the basis of the palaeontological sensitivity of the rock units concerned and the nature and scale of the development itself, most notably the minimal extent of fresh bedrock excavation envisaged. The different sensitivity classes used are explained in Table 1 below.

The aim of this supplementary letter is to report on a site visit by Dr Gideon Groenewald, an experienced field worker, on 4 August 2021 and is only a supplementary comment on an existing report. The table referred to (Table 1) is however an upgraded version of the table used in the report of 2014 and gives a more definitive explanation of the colours used to indicate sensitivity for Palaeontological Heritage on site.

Table 1 Explanation of sensitivity classes used in this study as well as limitations for each colour code used

PALAEONTOLOGICAL SIGNIFICANCE/VULNERABILITY OF ROCK UNITS	
The following colour scheme is proposed for the indication of palaeontological sensitivity classes. This classification of sensitivity is adapted from that of Almond et al (2008, 2009) (Groenewald et al., 2014).	
RED	Very High Palaeontological sensitivity/vulnerability. Development will most likely have a very significant impact on the Palaeontological Heritage of the region. Very high possibility that significant fossil assemblages will be present in all outcrops of the unit. Appointment of professional palaeontologist, desktop survey, phase I Palaeontological Impact Assessment (PIA) (field survey and recording of fossils) and phase II PIA (rescue of fossils during construction) as well as application for collection and destruction permit compulsory.
ORANGE	High Palaeontological sensitivity/vulnerability. High possibility that significant fossil assemblages will be present in most of the outcrop areas of the unit. Fossils most likely to occur in associated sediments or underlying units, for example in the areas underlain by Transvaal Supergroup dolomite where Cenozoic cave deposits are likely to occur. Appointment of professional palaeontologist, desktop survey and phase I Palaeontological Impact Assessment (field survey and collection of fossils) compulsory. Early application for collection permit recommended. Highly likely that a Phase II PIA will be applicable during the construction phase of projects.
GREEN	Moderate Palaeontological sensitivity/vulnerability. High possibility that fossils will be present in the outcrop areas of the unit or in associated sediments that underlie the unit. For example, areas underlain by the Gordonia Formation or undifferentiated soils and alluvium. Fossils described in the literature are visible with the naked eye and development can have a significant impact on the Palaeontological Heritage of the area. Recording of fossils will contribute significantly to the present knowledge of the development of life in the geological record of the region. Appointment of a professional palaeontologist, desktop survey and phase I PIA (ground proofing of desktop survey) recommended.
BLUE	Low Palaeontological sensitivity/vulnerability. Low possibility that fossils that are described in the literature will be visible to the naked eye or be recognized as fossils by untrained persons. Fossils of for example small domal Stromatolites as well as micro-bacteria are associated with these rock units. Fossils of micro-bacteria are extremely important for our understanding of the development of Life, but are only visible under large magnification. Recording of the fossils will contribute significantly to the present knowledge and understanding of the development of Life in the region. Where geological units are allocated a blue colour of significance, and the geological unit is surrounded by highly significant geological units (red or orange coloured units), a palaeontologist must be appointed to do a desktop survey and to make professional recommendations on the impact of development on significant palaeontological finds that might occur in the unit that is allocated a blue colour. An example of this scenario will be where the scale of mapping on the 1:250 000 scale maps excludes small outcrops of highly significant sedimentary rock units occurring in larger alluvium deposits. Minimum requirement is a Phase 1 site inspection and/ or a "Chance Find Protocol" Report. Collection of a representative sample of potential fossiliferous material is recommended.

GREY	Very Low Palaeontological sensitivity/vulnerability. Very low possibility that significant fossils will be present in the bedrock of these geological units. The rock units are associated with intrusive igneous activities and no life would have been possible during emplacement of the rocks. It is however essential to note that the geological units mapped out on the geological maps are invariably overlain by Cenozoic aged sediments that might contain significant fossil assemblages and archaeological material. Examples of significant finds occur in areas underlain by granite, just to the west of Hoedspruit in the Limpopo Province, where significant assemblages of fossils and clay-pot fragments are associated with large termite mounds. Where geological units are allocated a grey colour of significance, and the geological unit is surrounded by very high and highly significant geological units (red or orange coloured units), a palaeontologist must be appointed to do a desktop survey and to make professional recommendations on the impact of development on significant palaeontological finds that might occur in the unit that is allocated a grey colour. An example of this scenario will be where the scale of mapping on the 1:250 000 scale maps excludes small outcrops of highly significant sedimentary rock units occurring in dolerite sill outcrops. It is important that the report should also refer to archaeological reports and possible descriptions of palaeontological finds in Cenozoic aged surface deposits. Minimum requirement is a Phase 1 field investigation and/or a "Chance Find Protocol" Report.

When rock units of moderate to high palaeontological sensitivity are present within the development footprint, palaeontological mitigation measures should be incorporated into the Environmental Management Plan.

3.1. Scope and Limitations of the Phase 1 Investigation

The scope of a phase 1 Investigation includes:

- an analysis of the area's stratigraphy, age and depositional setting of fossil-bearing units;
- a review of all relevant palaeontological and geological literature, including geological maps, and previous palaeontological impact reports;
- data on the proposed development provided by the developer (e.g. location of footprint, depth and volume of bedrock excavation envisaged) and
- where feasible, location and examination of any fossil collections from the study area (e.g. museums).
- do an on-site investigation to assess the identified palaeontological sensitive areas within the development footprint/study area rather than formal palaeontological collection. The investigation should focus on the sites where bedrock excavations would definitely require palaeontological monitoring.

The results of the field investigation are then used to predict the potential of buried fossil heritage within the development footprint. In some investigations this involves the examination of similar accessible bedrock exposures, such as road cuttings and quarries, along roads that run parallel to or across the development footprint.

4. PROPOSED DEVELOPMENT DESCRIPTION

South Africa Mainstream Renewable Power Developments (Pty) Ltd. (Mainstream) is applying for an amendment to the planning of a Wind Energy Facility (WEF), and this report must be read in conjunction with the report by the same author, dated March 2014.

5. GEOLOGY OF THE AREA

Extensive parts of the study area are underlain by a prominent Jurassic aged Dolerite Sill, with smaller areas underlain by sedimentary rocks of the Permian aged Vryheid and Volksrust Formations of the Ecca Group, Karoo Supergroup.

5.1. Vryheid Formation (Pv)

In the study area the Vryheid Formation consists mainly of interbedded coarse-grained sandstone and mudstone, interpreted as deltaic deposits. The Vryheid Formation contains numerous coal seams that are of economic importance (Johnson et al, 2006).

5.2. Volksrust Formation (Pvo)

The Volksrust Formation consists of a monotonous sequence of grey mudstone and it is interpreted as a deeper water deposit (Johnson et al, 2006; Groenewald, 1996).

5.3. Dolerite

A very prominent dolerite sill underlies a large part of the study area and represents magma intrusions into the Karoo Supergroup sediments during the Jurassic volcanic episode that occurred during the breakup of Gondwanaland.

The geology is discussed in the report of March 2014 and it is not necessary to repeat the information for this "supplementary letter".

The potential palaeontology of a rock unit relates directly to the geology of the area. The desktop survey includes the comparison of relevant referenced geological maps and locality maps and/or waypoints provided for the development project.

5.4. Vryheid Formation (Pv)

The Ecca Group is not known to contain body fossils of vertebrates, but trace and plant fossils have been described from the group. Fossils include plant fossils of the *Glossopteris* assemblage and trace fossils (Johnson et al, 2006). The Vryheid Formation is well-known for the occurrence of coal beds that resulted from the accumulation of plant material over long periods of time. Plant fossils described by Bamford (2011) from the Vryheid Formation are; *Azaniodendron fertile, Cyclodendron leslii, Sphenophyllum hammanskraalensis, Annularia sp., Raniganjia sp., Asterotheca spp., Liknopetalon enigmata, Glossopteris > 20 species, Hirsutum 4 spp., Scutum 4 spp., Ottokaria 3 spp., Estcourtia sp., Arberia 4 spp., Lidgetonnia sp., Noeggerathiopsis sp. and Podocarpidites sp.*

5.5. Volksrust Formation (Pvo)

The Volksrust Formation contains assemblages of trace fossils and the bivalve *Megadesmus* has been described from the Formation (Bamford 2011).

5.6. Karoo Dolerite (Jd)

Due to the igneous character of these rocks they do not contain fossils.

6. PRELIMINARY ASSESSMENT RESULTS

The palaeontological sensitivity was predicted after identifying potentially fossiliferous rock units; ascertaining the fossil heritage from the literature and evaluating the nature and scale of the development itself. The palaeontological sensitivity can be described as significant due to the potential abundance of Permian trace and plant fossils known to occur within the Vryheid and Volksrust Formations.

7. FIELD INVESTIGATION

Gideon Groenewald, an experienced fieldworker, visited the site of the proposed Waaihoek Wind Farm on 3 August 2021 to 5 August 2021. The topography of the area forms part of the escarpment and consists of hills and cliffs in regions where outcrops of Vryheid Formation sandstone and mudstone are intruded by a thick dolerite sill. The larger part of the study area is underlain by deeply weathered dolerite.

A survey of a representative sample of turbine points was done where a total of 17 observation sites were visited, to groundproof expected geological information. Turbine points that convincingly fell on dolerite outcrop from both the desktop study and field observations from a distance were not individually visited due to time constraints and the fact that dolerite will not yield fossils.

The data from the field visits to the turbine sites is contained in Table 2 below.

Table 2 Photographic record of observations at proposed tower localities

Obser-vation number	GPS Coordinates	Geology	Palaeontological significance	Photo
P1	27.665723° S 30.380920° E	Dolerite	No Fossils expected. No fossils observed.	
P2	27.669722° S 30.383611° E	Dolerite	General view of study area with sandstone of Vryheid Formation in the hillside	

T35 T36	27.706699° S 30.419043° E 27.703575° S 30.426490° E	Dolerite	No Fossils expected. No fossils observed	
T37	27.700299° S 30.424249° E	Vryheid	Fossils expected, no fossils observed but must be monitored during excavations	
T39	27.704632° S 30.412487° E	Dolerite	No Fossils expected. No fossils observed	
T34	27.711609° S 30.424492° E	Dolerite	No Fossils expected. No fossils observed	

T33	27.701671° S 30.434892° E	Vryheid	No Outcrop, fossils expected, no fossils observed. Monitoring during excavation.	
T17	27.705449° S 30.438112° E	Dolerite	No Fossils expected. No fossils observed	
T11 T20 T22 T31 T41	27.696800° S 30.446044° E 27.699027° S 30.441646° E 27.693001° S 30.446280° 27.689582° S 30.443857° E 27.695498° S 30.439551° E	Dolerite	No Fossils expected. No fossils observed.	
T40	27.716930° S 30.425315° E	Vryheid	No Outcrop, fossils expected, no fossils observed. Monitoring during excavation	

P5	27.702867° S 30.443263° E	Dolerite	No Fossils expected. No fossils observed	
P6	27.704804° S 30.444892° E	Dolerite	No Fossils expected. No fossils observed	
T1 T5 T9	27.708456° S 30.460134° 27.716255° S 30.438996° E 27.714049° S 30.443942° E	Dolerite	No Fossils expected. No fossils observed	
T6	27.714443° S 30.454037° E	Dolerite	No Fossils expected. No fossils observed	

T4	27.719497° S 30.445973° E	Dolerite	No Fossils expected. No fossils observed	
T2 T38	27.717572° S 30.456680° E 27.720089° S 30.453472° E	Dolerite	No Fossils expected. No fossils observed	
P9	27.717196° S 30.454203° E	Dolerite	No Fossils expected. No fossils observed	
P10	27.720100° S 30.455470° E	Dolerite and Volksrust shale at spring site	Trace fossils expected, no fossils observed but monitoring at excavations compulsory	

T8 T25	27.723608° S 30.447192° E 27.728468° S 30.441610° E	Vryheid and Volksrust	No Outcrop, fossils expected, no fossils observed. Monitoring of excavations compulsory	
T15	27.731950° S 30.453775° E	Dolerite	No Fossils expected. No fossils observed	
T3 T42	27.736714° S 30.434227° E 27.732745° S 30.433887° E	Dolerite	No Fossils expected. No fossils observed	
T10 T13 T28	27.739168° S 30.461868° E 27.741544° S 30.457431° E 27.743888° S 30.462607° E	Dolerite	No Fossils expected. No fossils observed	

T12 T18 T19 T21	27.740097° S 30.446426° E 27.745864° S 30.451370° E 27.745505° S 30.445427° E 27.740118° S 30.452054° E	Dolerite	No Fossils expected. No fossils observed	
P14	27.739681° S 30.451795° E	Dolerite	No Fossils expected. No fossils observed	
P15	27.742026° S 30.450592° E	Dolerite	No Fossils expected. No fossils observed	
P16	27.744047° S 30.450381° E	Dolerite	No Fossils expected. No fossils observed	

T14 T16 T23 T24 T27	27.744302° S 30.473314° E 27.753323° S 30.464553° E 27.751075° S 30.468318° E 27.749840° S 30.492733° E 27.757618° S 30.486913° E	Dolerite	No Fossils expected. No fossils observed	
T29 T30 T32 T43	S27 44 45.2 E30 27 53.6	Dolerite	No Fossils expected. No fossils observed	

No fossils were observed at any of the visited turbine sites. This is either due to lack of exposure of Vryheid or Volksrust Formations or the presence of Dolerite. It is however important to note that where outcrops of the Vryheid and Volksrust Formations are present, fossils were observed. Exposures on the farm Paardepoort yielded well preserved trace fossils on mudstone bedding planes and stromatolites associated with carbonate concretions.

8. PALAEONTOLOGICAL SIGNIFICANCE AND RATING

The predicted palaeontological impact of the development is based on the initial mapping assessment and literature reviews as well as information gathered during the field investigation.

The palaeontological significance and rating as discussed in the comprehensive report of March 2014 (Groenewald, Phase 1 PIA report, 2014: Internal report at Mainstream) is upheld and the recommendations for further mitigation for Palaeontological Heritage is upheld.

9. PALAEONTOLOGICAL IMPACT AND MITIGATION

The predicted palaeontological impact of the development is based on the initial mapping assessment and literature reviews as well as information gathered during the field investigation. The field investigation confirms that the area is underlain by a prominent an extensive dolerite sill, with smaller areas underlain by Vryheid and Volksrust Formations of the Ecca Group.

The recommended mitigation for Palaeontological Heritage as reported in 2014 is therefor confirmed for this future development of the Waaihoek WEF.

10. CONCLUSION

The development site for the proposed Waaihoek Wind Energy Facility is underlain by the Permian Vryheid and Volksrust Formations of the Ecca Group as well as a thick dolerite sill.

Outcrops of the Vryheid and Volksrust Formations are restricted to specific areas on the escarpment and in road cuttings. Extensive areas are underlain by dolerite.

It is recommended that:

- The PEA and CEO be made aware of the possibility of finding fossils in the Vryheid and Volksrust Formation sediments during excavation of the foundations for the turbines and other infrastructure.
- A professional palaeontologist be appointed to monitor possible palaeontological finds during excavation of turbine foundations and infrastructure where turbine positions and infrastructure fall on Vryheid and Volksrust Formation sediments.
- No further action is needed in all areas underlain by dolerite.

11. REFERENCES

Bamford M. 2011. Desktop study Palaeontology Ermelo to Empangeni – Eskom powerline. Internal report Bernard Price Institute for Palaeontological Research, University of the Witwatersrand.

Groenewald GH 2014. P*alaeontological Impact* Assessment Report Waaihoek wind energy facility (WEF) Utrecht, KwaZulu Natal Province. Internal report (Mainstream).

Johnson MR, Anhaeusser CR and Thomas RJ (Eds), 2006. The Geology of South Africa. GSSA, Council for Geoscience, Pretoria, 691pp.

McCarthy, T. and Rubidge, B.S. 2005. The Story of Earth and Life. Struik Publishers, Cape T

Rubidge, B.S. (Ed.). 1995. Biostratigraphy of the Beaufort Group (Karoo Supergroup). SACS Biostratigraphic Series, vol. 1.

12. QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

Dr Gideon Groenewald has a PhD in Geology from the University of Port Elizabeth (Nelson Mandela Metropolitan University) (1996) and the National Diploma in Nature Conservation from Technicon RSA (the University of South Africa) (1989). He specialises in research on South African Permian and Triassic sedimentology and macrofossils with an interest in biostratigraphy, and palaeoecological aspects. He has extensive experience in the locating of fossil material in the Karoo Supergroup and has more than 20 years of experience in locating, collecting and curating fossils, including exploration field trips in search of new localities in the southern, western, eastern and north-eastern parts of the country. His publication record includes multiple articles in internationally recognized journals. Dr Groenewald is accredited by the Palaeontological Society of Southern Africa (society member for 25 years).

13. DECLARATION OF INDEPENDENCE

I, Gideon Groenewald, declare that I am an independent specialist consultant and have no financial, personal or other interest in the proposed development, nor the developers or any of their subsidiaries, apart from fair remuneration for work performed in the delivery of palaeontological heritage assessment services. There are no circumstances that compromise the objectivity of my performing such work.

Dr Gideon Groenewald
Geologist

AMENDMENT: COMPARATIVE VIEWSHED ANALYSIS AND VISUAL IMPACT ASSESSMENT FOR THE PROPOSED WAAIHOEK WIND ENERGY FACILITY, UTRECHT, KWAZULU-NATAL, SOUTH AFRICA

PREPARED BY:

Nuleaf Planning and Environmental (Pty) Ltd

PREPARED FOR:

CES - Environmental and social advisory services

APPLICANT:

Mainstream Renewable Power

DATE:

July 2021

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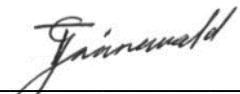
Report date:	27 July 2021
Report number:	01

DECLARATION

I, Tosca Grünewald, as an independent consultant compiled this Visual Impact Assessment and declare that it correctly reflects the findings made at the time of the report's compilation. I further declare that I, act as an independent consultant in terms of the following:

- Do not have any financial interest in the undertaking of the activity, other than remuneration for the work performed in terms of the National Environmental Management Act, 1998 (Act107 of 1998);
- Undertake to disclose, to the competent authority, any material information that has or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the National Environmental Management Act,1998 (Act 107 of 1998);
- Based on information provided to me by the project proponent, and in addition to information obtained during the course of this study, will present the results and conclusion within the associated document to the best of my professional judgement.



Tosca Grünewald
Landscape Architect & Environmental Assessment Practitioner
SACLAP Reg nr: 20421
EAPASA Reg nr: 2019/1582

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1. BACKGROUND

In 2014, a full scoping and environmental impact report, inclusive of specialist studies, was undertaken for the proposed Waaihoek Wind Energy Facility (WEF) near Utrecht in Kwa-Zulu Natal. The impact assessment entailed the construction of 70 wind turbines with rotor diameters of up to 140 m at maximum atop a 140 m (maximum height) steel/ hybrid tower. The potential power output was 140 megawatts. Environmental authorization (EA) was issued in 2015 for the construction of 15 of the 70 turbines applied for. The visual impact assessment (VIA) for the EIA was originally undertaken by EOH Coastal and Environmental Services in November 2014.

The applicant appealed this decision and in 2017 the appeal was upheld allowing 68 turbines between 1.5 to 4 megawatts to be constructed.

Owing to constant technology changes, an amendment was applied for and granted in 2020 to construct 47 turbines (with a rotor diameter of 140m and hub height of 140 m) of 3 megawatts each.

The applicant, Mainstream Renewable Power, now wishes to amend the specifications of their wind turbine generators (WTG) for the proposed Waaihoek WEF a second time.

The applicant is applying for a substantive amendment (Part II) towards amending the EA with the inclusion and amendment of the following:

i. Amendment of the turbine specifications are as follows:
    a. The increase of the rotor diameter from 140m (authorised in 2013) to 170m, with a resulting maximum blade tip height of 225m.
ii. A reduction in the authorised number of turbines from the currently authorised turbine number of 47, to reflect 43 turbines, as per the revised layout.
iii. Update the layout as required to accommodate and reflect the removal of the respective turbines from the total authorised turbine number in amendment no. 2 above.
iv. Removal of the specification of the wind turbine unit size

No additional properties will be affected by the amendments as the proposed amendments are within the original authorised development footprint and all other associated infrastructure will remain the same as originally assessed.

The primary relevance of this proposed increase in dimensions, from a visual impact perspective, is that the total maximum vertical dimension (height) of the wind turbine increases from the originally assessed 210m (140m hub-height + 140m blade length) to the proposed 225m (140m hub-height + 170m blade length) above ground level. This translates to a total of a 15m maximum increase in blade tip height per WTG.

The increase in turbine dimensions is expected to increase the area of potential visual exposure, and potentially the area of visual impact.

The proposed amendment will reduce the number of wind turbines by 4, a positive when considering the overall frequency of visual exposure of the WEF.

Nuleaf Planning and Environmental (Pty) Ltd have been appointed to undertake a review and amendment of the initial VIA. Please note that this report should be read in conjunction with the original VIA.

2. INTRODUCTION

2.1. QUALIFICATION AND EXPERIENCE OF THE PROFESSIONAL TEAM

Nuleaf Planning and Environmental (Pty) Ltd, specialising in Visual Impact Assessment, undertook the review and subsequent amendment to the visual assessment.

The team undertaking the review and amendment to the visual assessment has extensive practical knowledge in spatial analysis, environmental modelling and digital mapping, and applies this knowledge in various scientific fields and disciplines.

The expertise of these practitioners is often utilised in Environmental Impact Assessments, State of the Environment Reports and Environmental Management Plans.

The visual assessment team is familiar with the "Guidelines for Involving Visual and Aesthetic Specialists in EIA Processes" (Provincial Government of the Western Cape: Department of Environmental Affairs and Development Planning) and utilises the principles and recommendations stated therein to successfully undertake visual impact assessments. Although the guidelines have been developed with specific reference to the Western Cape Province of South Africa, the core elements are more widely applicable.

2.2. LEGAL FRAMEWORK

The following legislation and guidelines have been considered in the preparation of this report:

- The Environmental Impact Assessment Amendment Regulations, 2017;
- Guideline on Generic Terms of Reference for EAPs and Project Schedules (DEADP, Provincial Government of the Western Cape, 2011).
- Guideline for Involving Visual and Aesthetic Specialists in EIA Processes (DEADP, Provincial Government of the Western Cape, 2005).

2.3. INFORMATION BASE

This assessment was based on information from the following sources:

- The initial visual assessment conducted in November 2014 by EOH Coastal & Environmental Services;
- Topographical maps and GIS generated data were sourced from the Surveyor General, Surveys and Mapping in Mowbray, Cape Town;
- Professional judgement based on experience gained from similar projects; and
- Literature research on similar projects.

2.4. ASSUMPTIONS AND LIMITATIONS

This Report has been prepared by Nuleaf on behalf, and at the request, of CES to provide them with an independent specialist assessment and review. Unless otherwise agreed by Nuleaf in writing, Nuleaf does not accept responsibility or legal liability to any person other than the CES for the contents of, or any omissions from, this Report.

To prepare this Report, Nuleaf utilised only the documents and information provided by CES or any third parties directed to provide information and documents by CES. Nuleaf has not consulted any other documents or information in relation to this Report, except where otherwise indicated.

The findings, recommendations and conclusions given in this report are based on the author's best scientific and professional knowledge, as well as, the available information. This report is based on survey and assessment techniques which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken. Nuleaf and its staff reserve the right to modify aspects of the report including the recommendations if and when new information may become available from on-going research or further work in this field, or pertaining to this investigation.

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This report must not be altered or added to without the prior written consent of the author. This also refers to electronic copies of this report which are supplied for the purposes of inclusion as part of other reports. Similarly, any recommendations, statements or conclusions drawn from or based on this report must make reference to this report. If this report is used as part of a main report, the report in its entirety must be included as an appendix or separate section to the main report.

This report should be read in conjunction with the original VIA complied by EOH Coastal & Environmental Services in November 2014. This assessment was undertaken during the planning stage of the project and is based on information available at that time.

The only layout/coordinates for the previously authorised wind turbines are those for the 70 assessed (68 authorised) that were originally applied for in 2014, no layout was provided to the specialist for the 47 turbines currently authorised as part of the amendment undertaken in 2020. It is therefore assumed that the positioning and location of the 43 wind turbines proposed in this amendment are that of the 47 authorised in the first amendment undertaken in 2020. The comparative assessment and viewshed assessment undertaken in this report has therefore been based on the information provided at the time of writing this report, namely the layout of the proposed 43 turbines.

This Visual Impact Assessment and all associated mapping has been undertaken according to the worst-case scenario.

2.5. LEVEL OF CONFIDENCE

Level of confidence[1] is determined as a function of:

- The information available, and understanding of the study area by the practitioner:
    - 3: A high level of information is available of the study area and a thorough knowledge base could be established during site visits, surveys etc. The study area was readily accessible.
    - 2: A moderate level of information is available of the study area and a moderate knowledge base could be established during site visits, surveys etc. Accessibility to the study area was acceptable for the level of assessment.
    - 1: Limited information is available of the study area and a poor knowledge base could be established during site visits and/or surveys, or no site visit and/or surveys were carried out.
- The information available, understanding of the project and experience of this type of project by the practitioner:
    - 3: A high level of information and knowledge is available of the project and the visual impact assessor is well experienced in this type of project and level of assessment.
    - 2: A moderate level of information and knowledge is available of the project and the visual impact assessor is moderately experienced in this type of project and level of assessment.
    - 1: Limited information and knowledge is available of the project and the visual impact assessor has a low experience level in this type of project and level of assessment.

These values are applied as follows:

	Information on the project & experience of the practitioner			
Information on the study area		3	2	1
	3	9	6	3
	2	6	4	2
	1	3	2	1

Table 1: Roles and responsibilities outlined for each applicable party on site

The level of confidence for this assessment is determined to be 9 and indicates that the author's confidence in the accuracy of the findings is Moderate to High:

- The information available, and understanding of the study area by the practitioner is rated as 3
- The information available, understanding and experience of this type of project by the practitioner is rated as 3

[1] Adapted from Oberholzer (2005).

3. SCOPE OF WORK

The scope of work includes a comparative viewshed analysis, a visual impact analysis and identification of potential sensitive visual receptors that may be influenced by the increase in dimensions of the WTGs. This is done in order to determine:

- If there are any additional visual receptors that may be negatively influenced by the amendment
- Whether the increase in dimensions would significantly aggravate the potential visual impact on identified receptors (identified during the EIA phase)
- If there are any potentially affected receptors that may benefit from the revised layout and the reduction in the number of wind turbines
- If additional impact mitigation measures are relevant
- To suggest amendments or additions to the Environmental Management Programme (EMPr) (if applicable)

4. METHODOLOGY

The study was undertaken using Geographic Information Systems (GIS) software as a tool to generate viewshed analyses and to apply relevant spatial criteria to the proposed development. A detailed Digital Terrain Model (DTM) for the study area was created from 5m interval contours from the National Geo-spatial Information data supplied by the Department: Rural Development and Land Reform.

The approach utilised to identify potential issues related to the visual impact included the following activities:

- The creation of a detailed digital terrain model (DTM) of the potentially affected environment;
- The sourcing of relevant spatial data. This includes cadastral features, vegetation types, land use activities, topographical features, site placement, etc.;
- The identification of sensitive environments upon which the proposed Waaihoek Wind Energy Facility (WEF) could have a potential visual impact;
- The creation of viewshed analyses from the proposed amended area in order to determine the visual exposure and the topography's potential to absorb the potential visual impact. The viewshed analyses take into account the dimensions of the proposed structures.
- A comparative viewshed analysis in order to determine the visual exposure (visibility) of the original authorised turbine dimensions compared to the potential exposure of the increased turbine dimensions as proposed in the amendment.

This report (visual impact assessment) sets out to identify and quantify the possible visual impacts related to the proposed amendment of the WTG's blade lengths, as well as, offer potential mitigation measures, where required.

The following methodology has been followed for the assessment of visual impact:

- Determine the comparative viewshed

The visual assessment includes a comparative viewshed analysis in order to determine the visual exposure (visibility) of the currently authorised turbine dimensions compared to the potential exposure of the increased turbine dimensions as proposed in the amendment.

- Determine potential visual exposure

The visibility or visual exposure of any development is the point of departure for the visual impact assessment. It stands to reason that if the proposed development were not visible, no impact would occur.

Viewshed analyses of the proposed development indicates the potential visibility.

- Determine visual distance and observer proximity to the development

In order to refine the visual exposure of the development on surrounding areas/receptors, the principle of reduced impact over distance is applied in order to determine the core area of visual influence.

Proximity radii for the proposed alignment corridors are created in order to indicate the scale and viewing distance of the development and to determine the prominence thereof in relation to their environment.

The visual distance theory and the observer's proximity to the development are closely related, and especially relevant, when considered from areas with a high viewer incidence and a predominantly negative visual perception of the proposed development.

- Determine viewer incidence, perception and sensitivity

The number of observers and their perception of a development determine the concept of visual impact. If there are no observers, then there would be no visual impact. If the visual perception of a structure is favourable to all observers, then the visual impact would be positive.

It is therefore necessary to identify areas of high viewer incidence and to classify certain areas according to the observer's visual sensitivity towards the proposed development and its related infrastructure.

It would be impossible not to generalise the viewer incidence and sensitivity to some degree, as there are many variables when trying to determine the perception of the observer; regularity of sighting, cultural background, state of mind, and purpose of sighting which would create a myriad of options.

- Determine the visual absorption capacity

This is the capacity of the receiving environment to absorb the potential visual impact of the proposed development. The digital terrain model utilised in the calculation of the visual exposure of the development does not incorporate the potential visual absorption capacity (VAC) of the natural vegetation of the region. It is therefore necessary to determine the VAC by means of the interpretation of the vegetation cover and other landscape characteristics.

- Determine the visual impact index

The results of the above analyses are merged in order to determine where the areas of likely visual impact would occur. These areas are further analysed in terms of the previously mentioned issues (related to the visual impact) and in order to judge the magnitude of each impact.

- Determine impact significance

The potential visual impacts identified and described are quantified in their respective geographical locations in order to determine the significance of the anticipated impact. Significance is determined as a function of extent, duration, magnitude and probability.

5. COMPARATIVE VIEWSHED ANALYSIS

5.1. RESULTS OF THE COMPARATIVE ASSESSMENT

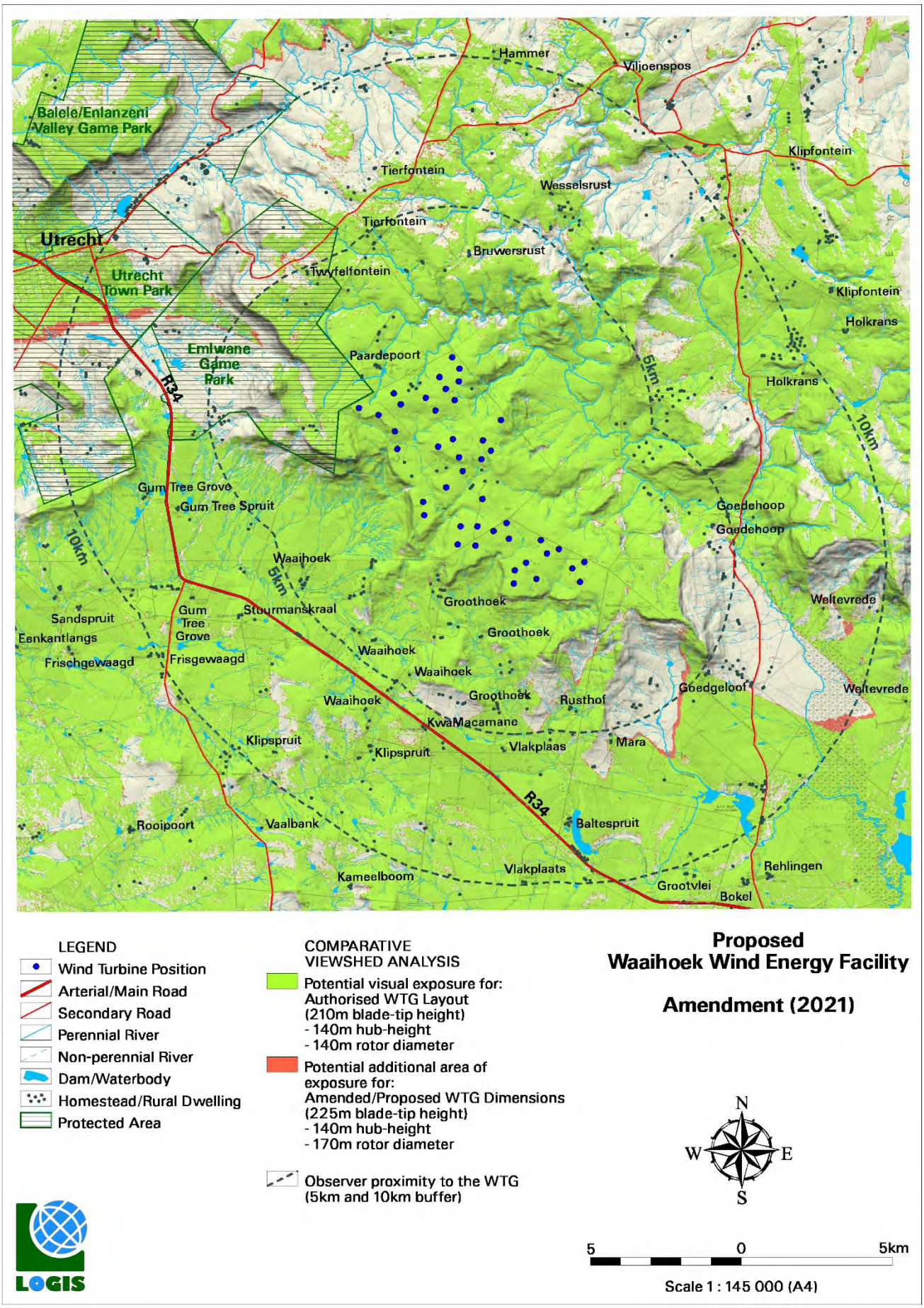
A visibility analysis was undertaken from each of the wind turbine positions (43 in total) at an offset of 210m (maximum blade tip height) above ground level. The result of this analysis represents the potential total visual exposure of the original turbine dimensions (indicated in green). The viewshed analysis was repeated at an offset of 225m to indicate the visual exposure (shown in red) of the increased turbine dimensions and reduced number of turbines (43 in total). The results of the visibility analyses are displayed on Map 1 below.

It is clear that the approximately 10% increase in turbine dimensions would have a relatively small influence on the overall visual exposure, due to the already tall turbine structures previously approved and the elevated positions of the turbines within the landscape. The surface area (within the study area) of the currently authorised turbine exposure is approximately 599km^2, compared to the 611km^2 of the increased dimensions of the wind turbine exposure. This is an increase of 11km^2, or alternatively, an increase of less than 2% in potential visual exposure.

There are no additional sensitive visual receptors located within the area of increased visual exposure.

Potential sensitive visual receptors within an approximately 5km radius (identified during the EIA phase) include:

- Bruwersrust
- Emlwane Game Park
- Groothoek
- Paardepoort



Map 1: Comparative Viewshed Analysis Map

- Rusthof
- Twyfelfontein
- Waaihoek

The increased area of visual exposure does not include any additional exposure to the arterial, main or secondary roads within the study area.

5.2. COMPARATIVE ASSESSMENT STATEMENT

In consideration of the proposed amendments, there is no (zero) change to the significance rating compared with the currently authorized layout (47 Turbines). It is expected that the wind turbine structures, both the original dimensions and the proposed increased dimensions, would be equally visible and noticeable from both the roads, conservation areas and homesteads identified above, therefore signifying a negligible change to the potential visual impact from the currently authorised development of the 47 WTG's

However, since the last visual assessment was undertaken for the originally applied for 70 turbines layout a number of years ago (2014), it was deemed necessary to undertake a basic visual assessment of the impacts of the proposed amended facility (43 turbines) to align the visual impact assessment to current best practices and updated land uses / users, as well as, assess whether the visual impacts have changed significantly since the original VIA report determined that receptors, where visible, may experience a *moderate* visual impact. Additionally, new sensitive visual receptors have been identified that were previously not assessed in the original VIA.

6. ANTICIPATED ISSUES RELATED TO VISUAL IMPACT

Anticipated issues related to the potential visual impact of the proposed amended Waaihoek WEF include the following:

- The visibility of the facility to, and potential visual impact on sensitive visual receptors (i.e., users of roads and observers residing in the area) in close proximity to the proposed facility and within the region.
- Potential visual impacts associated with the construction phase on observers in close proximity to the proposed facility.
- The visibility of the proposed facility to, and potential visual impact on residents of built-up centres and populated places (i.e., Utrecht) within the study area.
- The potential visual impact of operational, safety and security lighting of the facility at night on observers in close proximity to the facility.
- The potential visual impact of the development on conservation areas within the region
- The potential visual impact of the development on the visual character of the landscape and sense of place of the region.
- The potential visual impact on tourist access routes and tourist destinations within the region.

It is envisaged that the issues listed above may constitute a visual impact at a local and/or regional scale.

7. VIEWSHED ANALYSIS

7.1. VISUAL DISTANCE AND OBSERVER PROXIMITY

Nuleaf Planning and Environmental determined proximity offsets based on the anticipated visual experience of the observer over varying distances. In general, the severity of the visual impact on visual receptors decreases with increased distance from the proposed infrastructure. Therefore, in order to refine the visual exposure of the facility on surrounding areas/receptors, the principle of reduced impact over distance is applied in order to determine the core area of visual influence for the WTG's. Proximity offsets for the proposed development footprint are thus established in order to indicate the scale and viewing distance of the facility and to determine the prominence of the structures in relation to their environment.

These proximity offsets are based on the anticipated visual experience of the observer over varying distances. The distances are adjusted upwards for larger facilities and downwards for smaller facilities (i.e., depending on the size and nature of the

proposed infrastructure). This rationale was developed in the absence of any known and/or acceptable standards for South African WEF's.
Therefore, for the purpose of this study, proximity offsets have been calculated from the expected boundary of the site as follows:

- 0 – 5km. Short distance view where the facility would dominate the frame of vision and constitute a very high to high visual prominence.
- 5 - 10km. Medium distance view where the structures would be easily and comfortably visible and constitute a high to moderate visual prominence.
- Greater than 10km. Longer distance view where the facility would become part of the visual environment, but would still be visible and recognisable. At this distance the WTG's would generally constitute a low to moderate visual prominence.

The figure below helps to place the above explanations in context, illustrating what scale a turbine structure will be perceived at different viewing distances.

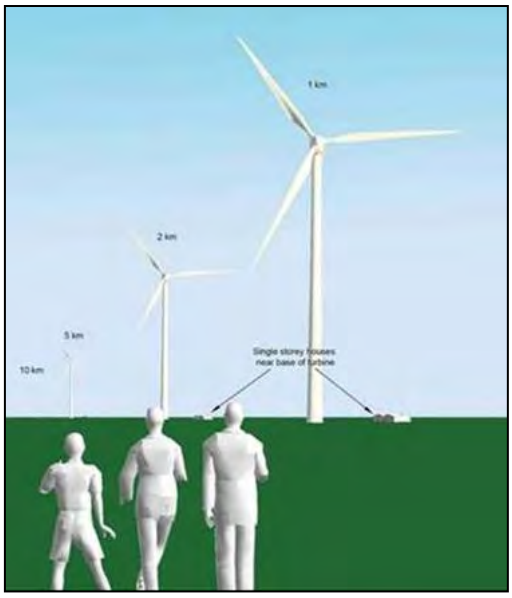


Figure 1: Visual experience of a 100m high wind turbine structure at a distance of 1km, 2km, 5km and 10km

7.2. VIEWER INCIDENCE, PERCEPTION AND SENSITIVITY

It is necessary to identify areas of high viewer incidence and to classify certain areas according to the observer's visual sensitivity towards the proposed Waaihoek WEF.

Homesteads and conservation areas (i.e., Emlwane Game Park, Utrecht Town Park, etc.), by virtue of their visually exposed nature, are considered to be sensitive visual receptors. Viewer incidence is calculated to be the highest for the homesteads and tourism facilities within these conservation areas closest to the facility, as well as, within the local built-up areas (i.e., the town of Utrecht). Second to these are the users along the provincial (i.e., R34) and secondary roads within the study area. Commuters and possible tourists using these roads may be negatively impacted upon by visual exposure to the proposed infrastructure.

Residential receptors in natural contexts are more sensitive than those in more built-up contexts, due to the absence of visual clutter in these undeveloped and undisturbed areas. Receptors within built up areas are less sensitive to potential visual impact due to the presence of structures, infrastructure and general visual clutter. Those dwelling on the periphery may be more aware of visual intrusion and may thus be considered somewhat more sensitive.

No specific report can be made on viewer perception regarding the proposed Waaihoek WEF, as no reported stakeholder feedback has been received by the specialist. However, considering the proximity of the proposed facilities to the town of Utrecht and the undeveloped nature of the surrounding area, it is expected that any potential visual impact would be viewed

in a negative light. Therefore, overall viewer perception of receptors within the study area will be assumed to be mostly negative.

7.3. VISUAL ABSORPTION CAPACITY

Visual Absorption Capacity (VAC) is the capacity of the receiving environment to absorb the potential visual impact of the proposed development. VAC is primarily a function of the vegetation and will be high if the vegetation is tall, dense and continuous. Conversely, low growing sparse and patchy vegetation will have a low VAC. The VAC would also be high where the environment can readily absorb the development in terms of texture, colour, form and light / shade characteristics. On the other hand, the VAC for a development contrasting markedly with one or more of the characteristics of the environment would be low. The VAC also generally increases with distance, where discernible detail in visual characteristics of both environment and development decreases.

Overall, the Visual Absorption Capacity (VAC) of the receiving environment of the Waaihoek WEF is deemed to be low by virtue of the low-growing vegetation and sparsely populated/limited development overall. Where homesteads do occur, some more significant vegetation and trees may have been planted, which would contribute to the visual absorption. As this is not a consistent occurrence, however, VAC will not be taken into account for any of the homesteads or settlements, again assuming a worst-case scenario. VAC will therefore not be taken into account for the visual impact assessment of the amended Waaihoek WEF.

7.4. POTENTIAL VISUAL EXPOSURE

The result of the viewshed analyses for the proposed amended Waaihoek WEF is shown on Map 2 that follows. The analyses have been undertaken from each proposed turbine position as indicated within the proposed development area in order to determine the general visual exposure (visibility) of the area under investigation. A height of 225m was used in order to illustrate the anticipated visual exposure of the WTG's (i.e., the maximum tip height). The analysis does not include the potential shielding effect of vegetation cover of the existing environment (i.e., VAC) or existing structures on the exposure of the proposed WTG's and does not take into consideration the limitations of the human eye, therefore signifying a worst-case scenario.

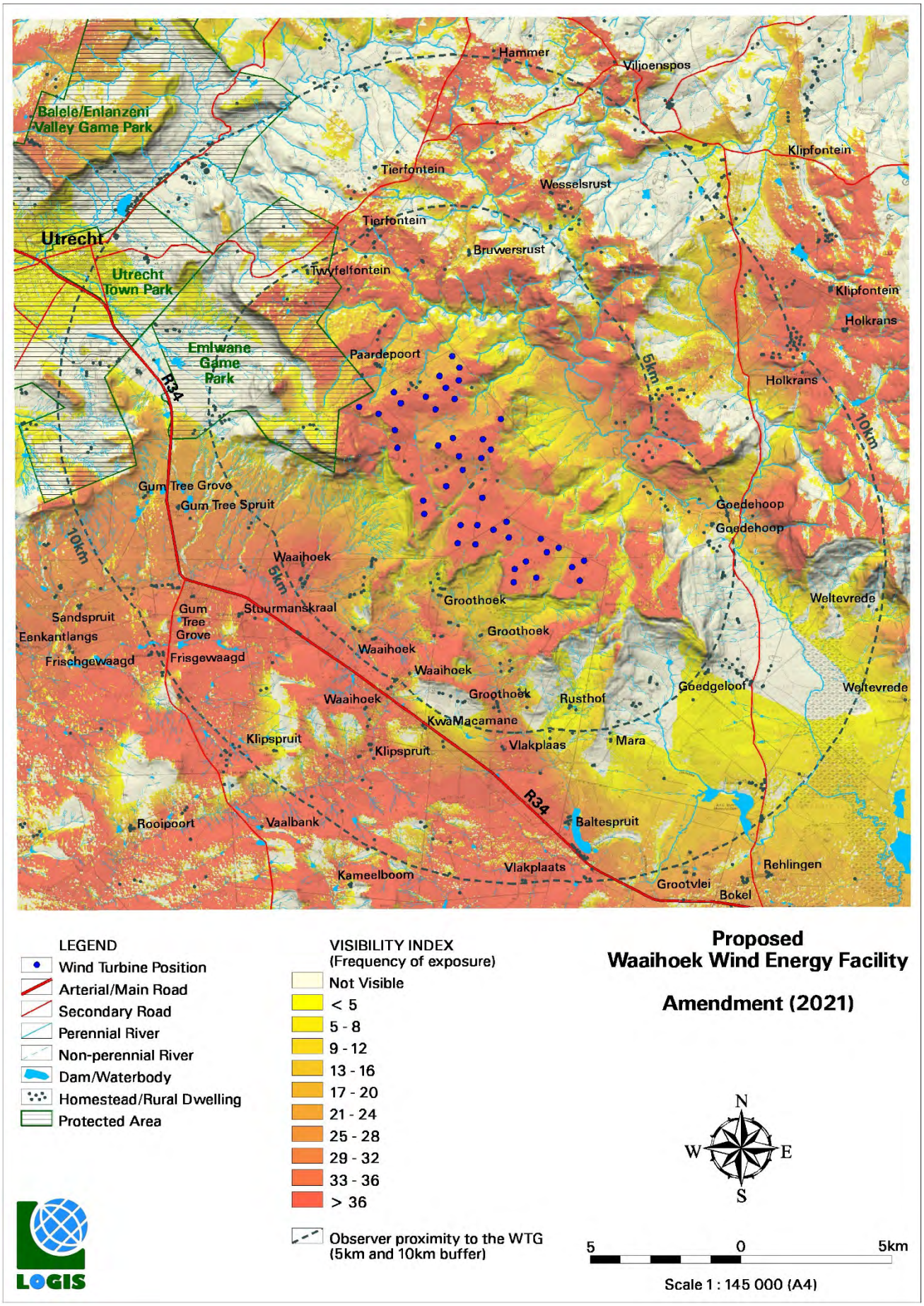
Map 2 indicates areas from which any number of turbines, with a minimum of one turbine (shaded in lighter yellow) to a maximum of 43 turbines (shaded in a darker red), could potentially be visible. The following is an overview of the findings of the viewshed, based on the provided amended layout illustrated on the Map provided:

- The proposed facility will have a large core area of potential visual exposure on the project site itself, and within a 5km radius thereof, where the probability of seeing all 43 WTG's is likely. The mountain slopes and valleys surrounding the project site will offer some visual screening to the areas just beyond the project site itself, less than 8 WTG's is expected to be visible in these valleys. However, the potential for visual exposure increases exponentially the higher up the surrounding mountain peaks potential sensitive receptors are located. Potential sensitive visual receptors within this visually exposed zone include residents of homesteads and Guest / Tourists of the Emlwane Game Park.

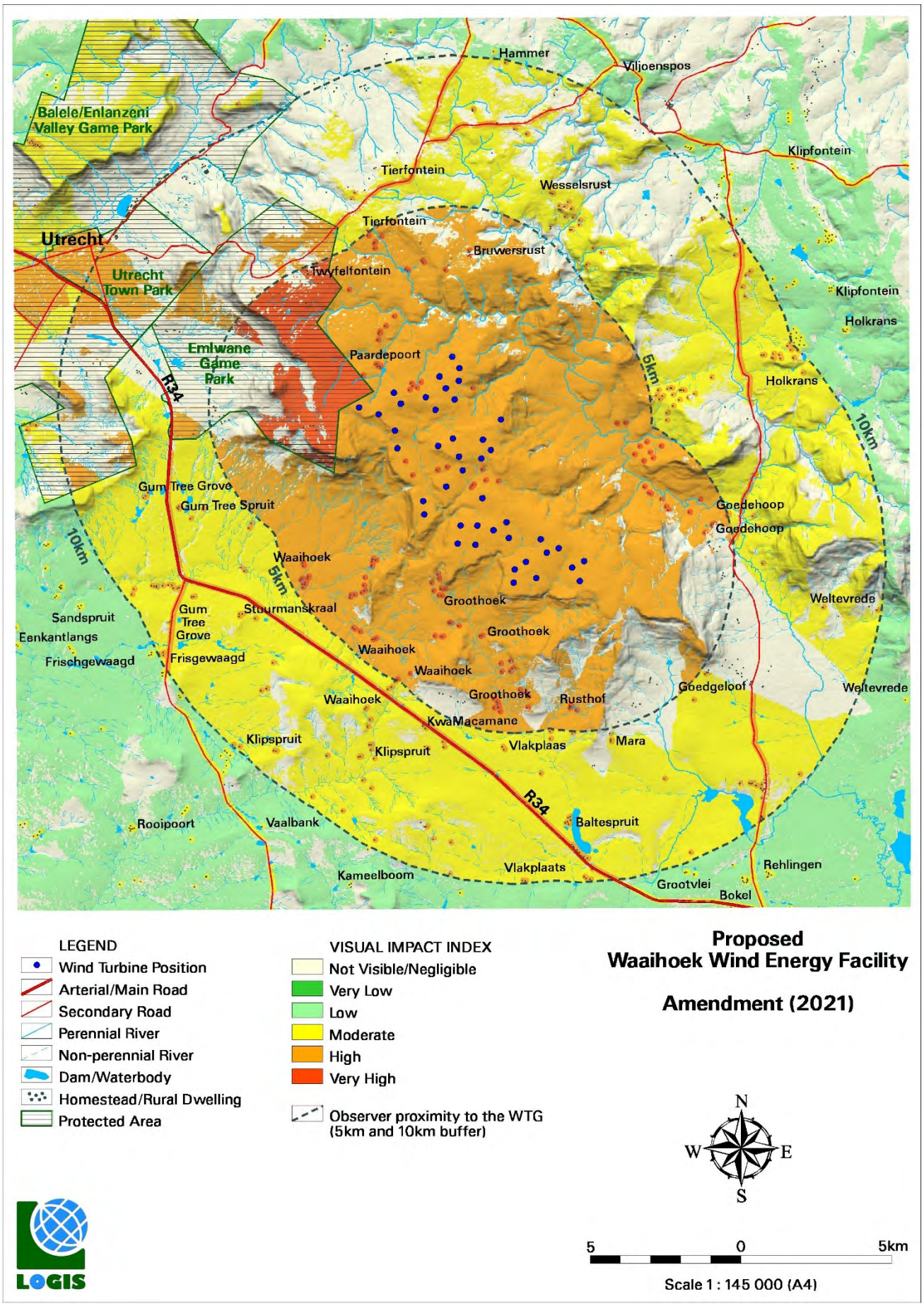
- Potential visual exposure remains high between 5 and 10km, with visually screened areas in the north east, east, south east and north west (beyond the low mountains). Sensitive visual receptors comprise of users traveling on the R34, tourist / guests to the Utrecht Town Park, as well as, residents of homesteads located on the elevated topography in the west, south west, north and east. It is anticipated that in these areas majority of the WTG's will be visible.

- Beyond the 10km offset, the extent of potential visual exposure is slightly reduced and incidences of potential exposure are more scattered, especially in the north west and north east of the study area. Visually exposed areas tend to be concentrated in the south and south east and to the far west and north east. Sensitive visual receptors include the residents of the town of Utrecht in the north west, and tourist / guests to the Utrecht Town Park, as well as, the Balele / Enlanzeni Valley Game Park. In addition, users of secondary roads within the study area and residents of homesteads, particularly in the east and south west, may be visually exposed.

In general, despite the lower population density of the study area, the Waaihoek WEF may constitute a high visual prominence, potentially resulting in a high visual impact.



Map 2: Visibility Index illustrating the frequency of exposure of the proposed amended Waaihoek WEF layout



Map 3: Visual Impact Index Map of the Waaihoek WEF

7.5. VISUAL IMPACT INDEX

The combined results of visual exposure, viewer incidence / perception and visual distance of the proposed facility are displayed on Map 3. Here the weighted impact and the likely areas of impact have been indicated as a visual impact index.

Values have been assigned for each potential visual impact per data category and merged in order to calculate the visual impact index. An area with short distance, a high viewer incidence and a predominantly negative perception would therefore have a higher value (greater impact) on the index. This helps in focussing the attention to the critical areas of potential impact when evaluating the issues related to the visual impact.

The visual impact index for the proposed facility is further described as follows.

- The visual impact index map indicates a core zone of high visual impact within 5 km of the proposed facility. Small areas located on the southern outskirts of this zone will be screened from any visual impact occurring. These are areas where screening is as a result of high lying topography and low mountains.

  Sensitive visual receptors within this zone comprise mainly of residents of homesteads, as well as, guests / tourists to the Emlwane Game Park. The homesteads on the following farms are likely to be affected:
  - Bruwersrust
  - Twyfelfontein
  - Paardepoort
  - Waaihoek
  - Groothoek
  - Rusthof

  These receptors are likely to experience very high visual impact.

- Visual impact is prominently moderate between 5 km and 10 km of the proposed facility. Screened areas within this zone are located mainly to the north west and south east of the site.

  Sensitive visual receptors within this zone comprise mainly of users of the R34 arterial road and assorted secondary roads surrounding the site, guests / tourists visiting Utrecht Town Park, as well as, residents of homesteads. The homesteads on the following farms likely to be affected:
  - Baltespruit
  - Goedehoop
  - Goedgeloof
  - Gum Tree Grove
  - Gum Tree Spruit
  - Holkrans
  - Klipspruit
  - KwaMacamane
  - Mara
  - Stuurmanskraal
  - Tierfontein
  - Vlakplaas
  - Vlakplaats
  - Waaihoek
  - Weltevrede
  - Wesselsrust

  These receptors are likely to experience a high visual impact.

- Beyond 10 km of the proposed facility, the extent of potential visual impact is somewhat reduced, and the magnitude is predominantly low, with screened areas expected mostly in the north west and north east.

Sensitive visual receptors at this distance include users of the secondary roads, residents of Utrecht, guests / tourists visiting the Balele/Enlanzeni Valley Game Park as well as, residents of homesteads in the surrounding areas. The homesteads on the following farms likely to be affected:

- Bokel
- Eenkantlangs
- Frischgewaagd
- Frisgewaagd
- Grootvlei
- Hammer
- Holkrans
- Kameelboom
- Klipfontein
- Rehlingen
- Rooipoort
- Sandspruit
- Vaalbank
- Viljoenspos
- Weltevrede

Visual impacts on these sensitive receptors are likely to be moderate.

8. VISUAL IMPACT ASSESSMENT

8.1. METHODOLOGY

The previous section of the report identified specific areas where likely visual impacts would occur. This section will attempt to quantify these potential visual impacts in their respective geographical locations and in terms of the identified issues related to the visual impact.

The methodology for the assessment of potential visual impacts states the nature of the potential visual impact (e.g., the visual impact on users of major roads in the vicinity of the proposed infrastructure) and includes a table quantifying the potential visual impact according to the following criteria:

- Extent - international (very high = 5), national (high = 4), regional (medium = 3), local (low = 2) or site specific (very low = 1)
- Duration - very short (0-1 yrs. = 1), short (2-5 yrs. = 2), medium (5-15 yrs. = 3), long (>15 yrs. = 4), and permanent (= 5)
- Magnitude - None (= 0), minor (= 2), low (= 4), medium/moderate (= 6), high (= 8) and very high (= 10). This value is read off the Visual Impact Index maps.
- Probability – very improbable (= 1), improbable (= 2), probable (= 3), highly probable (= 4) and definite (= 5)
- Status (positive, negative or neutral)
- Reversibility - reversible (= 1), recoverable (= 3) and irreversible (= 5)
- Significance - low, medium or high

The significance of the potential visual impact is equal to the consequence multiplied by the probability of the impact occurring, where the consequence is determined by the sum of the individual scores for magnitude, duration and extent (i.e., significance = consequence (magnitude + duration + extent) x probability).

The significance weighting for each potential visual impact (as calculated above) is as follows:

- <30 points: Low (where the impact would not have a direct influence on the decision to develop in the area)
- 31-60 points: Medium/moderate (where the impact could influence the decision to develop in the area)
- >60: High (where the impact must have an influence on the decision to develop in the area)

8.2. PRIMARY IMPACTS

8.2.1. POTENTIAL VISUAL IMPACT ON SENSITIVE VISUAL RECEPTORS IN CLOSE PROXIMITY

The visual impacts on sensitive visual receptors (i.e., residents of homesteads and users of the Emlwane Game Park) in close proximity to the proposed mining activity (i.e., within 5km) is expected to be of high significance.

No mitigation is possible within this environment and for a facility of this scale, but measures have been included as best practice guidelines. The table below illustrates this impact assessment.

Nature of Impact: Visual impact on sensitive receptors within 5km (residents of homesteads and users of the Emlwane Game Park), in close proximity to the proposed facility		
	No mitigation	*Mitigation considered*
Extent	Regional (3)	N/a
Duration	Long (4)	N/a
Magnitude	Very High (10)	N/a
Probability	Definite (5)	N/a
Significance	High (85)	N/a
Status (positive or negative)	Negative	N/a
Reversibility	Recoverable (3)	N/a
Irreplaceable loss of resources?	No	N/a
Can impacts be mitigated?	No	
Mitigation / Management: Planning: ➢ Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint. ➢ Plan ancillary infrastructure (i.e., substation and workshop) in such a way and in such a location that clearing of vegetation is minimised. Consolidate existing infrastructure as much as possible, and make use of already disturbed areas rather than pristine sites wherever possible. ➢ Use existing roads wherever possible. Where new roads are required to be constructed, these should be planned carefully, taking due cognisance of the local topography. Roads should be laid out along the contour wherever possible, and should never traverse slopes at 90 degrees. Construction of roads should be undertaken properly, with adequate drainage structures in place to forego potential erosion problems. Construction: ➢ Rehabilitate all construction areas. ➢ Ensure that vegetation is not cleared unnecessarily to make way for infrastructure. Operations: ➢ Maintain the general appearance of the facility as a whole. ➢ Monitor rehabilitated areas, and implement remedial action as and when required. Decommissioning: ➢ Remove infrastructure not required for the post-decommissioning use of the site. ➢ Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications. ➢ Monitor rehabilitated areas post-decommissioning and implement remedial actions.		
Cumulative impacts: The construction of the amended Waaihoek WEF (43 turbines) together with its associated infrastructure, will certainly contribute to the increased cumulative visual impact of renewable energy facilities in the region.		
Residual impacts: The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.		

Table 2: Impact table summarising the significance of sensitive visual receptors in close proximity to the proposed Waaihoek WEF

8.2.2. POTENTIAL VISUAL IMPACT ON SENSITIVE VISUAL RECEPTORS WITHIN THE REGION

The visual impact on sensitive visual receptors (i.e., users of the R34, residents of homesteads and the town of Utrecht) within the region (i.e., beyond the 5km offset) is expected to be of **moderate** significance.

No mitigation is possible within this environment and for a facility of this scale, but measures have been included as best practice guidelines. The table below illustrates this impact assessment.

Nature of Impact: Visual impact on the users of the arterial R34 and residents of homesteads and the town of Utrecht on the periphery of the 5km offset and within the region beyond		
	No mitigation	*Mitigation considered*
Extent	Regional (3)	N/a
Duration	Long (4)	N/a
Magnitude	High (8)	N/a
Probability	Probable (3)	N/a
Significance	High (45)	N/a
Status (positive or negative)	Negative	N/a
Reversibility	Recoverable (3)	N/a
Irreplaceable loss of resources?	No	N/a
Can impacts be mitigated?	No	
Mitigation / Management: <u>Site development & Operation:</u> ➢ Retain / re-establish and maintain large trees, natural features and noteworthy natural vegetation in all areas outside of the activity footprint. ➢ Retain natural pockets (wetland, river and other sensitive vegetation zones) as buffers within the property and along the perimeter. ➢ Dust suppression techniques should be in place at all times during the site development and operational phases. ➢ Access roads will require an effective dust suppression management programme, such as regular wetting and/or the use of non-polluting chemicals that will retain moisture in the road surface. ➢ Downscaling of operations. ➢ Keeping infrastructure at minimum heights. ➢ Introducing landscaping measures such as vegetating berms. ➢ Avoid the use of highly reflective material. ➢ Metal surfaces, where they occur, should be painted in natural soft colours that would blend in with the environment. ➢ Maintain the general appearance of the site as a whole. <u>Lighting</u> ➢ Lighting should be kept to a minimum wherever possible. ➢ Install light fixtures that provide precisely directed illumination to reduce light "spillage" beyond the immediate surrounds of the activity – this is especially relevant where the edge of the activity is exposed to residential properties. ➢ Wherever possible, lights should be directed downwards to avoid illuminating the sky. ➢ Avoid high pole top security lighting along the periphery of the site and use only lights that are activated on movement. <u>Decommissioning:</u> ➢ Remove infrastructure not required for the post-decommissioning use of the site. ➢ Rehabilitate all areas as per the rehabilitation plan undertaken. Consult an ecologist regarding rehabilitation specifications. ➢ Monitor rehabilitated areas post-decommissioning and implement remedial actions as required.		
Cumulative impacts: The construction of the amended Waaihoek WEF (43 turbines) together with its associated infrastructure, will certainly contribute to the increased cumulative visual impact of renewable energy facilities in the region.		

Residual impacts: The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.

Table 3: Impact table summarising the significance of visual impacts on sensitive visual receptors within the region

8.2.3. POTENTIAL VISUAL IMPACT OF CONSTRUCTION ON SENSITIVE VISUAL RECEPTORS IN CLOSE PROXIMITY TO THE FACILITY

During the construction period, there will be an increase in heavy vehicles utilising the roads to the construction sites that may cause, at the very least, a visual nuisance to other road users and landowners in the area in close proximity.

Within the region, dust as a result of construction activities may also be visible, as such it will result in a visual impact occurring during construction. This impact is likely to be of moderate significance and may be mitigated to low.

Mitigation entails proper planning, management and rehabilitation of all construction sites to forego the visual impacts of the construction activities only.

Nature of Impact: Visual impact of construction on sensitive visual receptors in close proximity to the proposed facility		
	No mitigation	*Mitigation considered*
Extent	Local (2)	Local (2)
Duration	Short term (2)	Short term (2)
Magnitude	Moderate (6)	Moderate (6)
Probability	Highly Probable (4)	Probable (3)
Significance	Moderate (40)	Low (30)
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable (3)	Recoverable (3)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation / Management: <u>Construction:</u> ➢ Ensure that vegetation is not unnecessarily removed during the construction period. ➢ Reduce the construction period through careful logistical planning and productive implementation of resources. ➢ Plan the placement of lay-down areas and temporary construction equipment camps in order to minimise vegetation clearing (i.e., in already disturbed areas) wherever possible. ➢ Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads. ➢ Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed regularly at licensed waste facilities. ➢ Reduce and control construction dust using approved dust suppression techniques as and when required (i.e., whenever dust becomes apparent). ➢ Restrict construction activities to daylight hours whenever possible in order to reduce lighting impacts. ➢ Rehabilitate all disturbed areas immediately after the completion of construction works.		
Cumulative impacts: The construction of the amended Waaihoek WEF (43 turbines) together with its associated infrastructure, will certainly contribute to the increased cumulative visual impact of renewable energy facilities in the region.		
Residual impacts: N/a		

Table 4: Impact table summarising the significance of visual impact of construction on visual receptors in close proximity to the proposed infrastructure

8.2.4. POTENTIAL VISUAL IMPACT OF LIGHTING AT NIGHT ON SENSITIVE VISUAL RECEPTORS IN THE REGION

The receiving environment has a relatively small number of populated places, and it can be expected that the light trespass and glare from the security and after-hours operational lighting (flood lights) for the facility will have some significance. In addition, the remote sense of place and rural ambiance of the local area increases its sensitivity to such lighting intrusions. Another source of glare light, albeit not as intense as flood lighting, is the aircraft warning lights mounted on top of the hub of the wind turbines. While these lights are less aggravating due to the toned-down red colour, they do have the potential to be visible from a greater distance then general operational lighting. The Civil Aviation Authority (CAA) prescribes these warning lights and the potential to mitigate their visual impacts is low. As a result of the required CAA, lighting no mitigation is possible within this environment and for a facility of this scale in terms of lighting, but measures have been included as best practice guidelines for other general site lighting that may occur on the site. The possibility of limiting aircraft warning lights to the turbines on the perimeter according to CAA requirements, thereby reducing the overall impact, is also recommended to be investigated. Since the greatest contributor to the lighting impact would be from the CAA lighting no mitigations have been considered in the tables below.

Last is the potential lighting impact is known as sky glow. Sky glow is the condition where the night sky is illuminated when light reflects off particles in the atmosphere such as moisture, dust or smog. The sky glow intensifies with the increase in the number of light sources. Each new light source, especially upwardly directed lighting, contributes to the increase in sky glow. The general lighting of the facility may contribute to the effect of sky glow in an otherwise dark environment.

The visual impacts as a result of lighting at night on sensitive visual receptors in the regions is likely to be of high significance. The table below illustrates this impact assessment.

Nature of Impact: Visual impact of lighting at night on sensitive visual receptors in the region		
	No mitigation	*Mitigation considered*
Extent	Local (3)	N/a
Duration	Long term (4)	N/a
Magnitude	High (8)	N/a
Probability	Definite (5)	N/a
Significance	High (75)	N/a
Status (positive or negative)	Negative	N/a
Reversibility	Recoverable (3)	N/a
Irreplaceable loss of resources?	No	N/a
Can impacts be mitigated?	No	
Mitigation: <u>Planning & operation</u>: ➢ Aviation standards and CAA Regulations for turbine lighting must be followed. ➢ The possibility of limiting aircraft warning lights to the turbines on the perimeter according to CAA requirements, thereby reducing the overall impact, must be investigated. ➢ Shield the sources of light by physical barriers (walls, vegetation, or the structure itself). ➢ Limit mounting heights of lighting fixtures, or alternatively use foot-lights or bollard level lights. ➢ Make use of minimum lumen or wattage in fixtures. ➢ Make use of down-lighters, or shielded fixtures. ➢ Make use of Low-Pressure Sodium lighting or other types of low impact lighting. ➢ Make use of motion detectors on security lighting. This will allow the site to remain in relative darkness, until lighting is required for security or maintenance purposes.		
Cumulative impacts: The construction of the amended Waaihoek WEF (43 turbines) together with its associated infrastructure, will certainly contribute to the increased cumulative visual impact of renewable energy facilities in the region.		
Residual impacts: The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.		

Table 5: Impact table summarising the significance of visual impact of lighting at night on visual receptors in close proximity to the proposed facility

8.2.5. POTENTIAL VISUAL IMPACT ON CONSERVATION AREAS WITHIN THE REGION

The area is also rich in natural biodiversity areas. The town of Utrecht lies within the confines of the Balele / Enlanzeni Valley Game Park and the Utrecht Town Park, with a total Game Park area of 2500ha. All the mountains that surround the town are part of the Emlwane Game Park and have been stocked with various game species. Utrecht's game reserve association has, in the last few years, brought about a greater awareness of the natural surroundings of the town and has shifted the focus of the town from industry to tourism.

Utrecht and its surrounds is seen as the core of tourism development in the area. It creates many opportunities for rural tourism and for the manufacturing of arts and crafts in the more remote areas. The conservancy and district offers a variety of experiences that include hiking and horse trails, trout fishing in dams of the pristine Bivane River, birding as well as water sport at the recreation resort.

The anticipated visual impact of the proposed amended Waaihoek WEF on tourist access routes (i.e. the R34) and tourist destinations (i.e. Balele / Enlanzeni Valley Game Park, Utrecht Town Park and the Emlwane Game Park) within the region is therefore expected to be of high significance. No mitigation is possible within this environment and for a facility of this scale, but measures have been included as best practice guidelines. The table below illustrates the assessment of this anticipated impact.

Nature of Impact: Visual impact of the proposed development on conservation areas within the region		
	No mitigation	*Mitigation considered*
Extent	Regional (3)	N/a
Duration	Long (4)	N/a
Magnitude	High (8)	N/a
Probability	Highly Probable (4)	N/a
Significance	High (60)	N/a
Status (positive or negative)	Negative	N/a
Reversibility	Recoverable (3)	N/a
Irreplaceable loss of resources?	No	N/a
Can impacts be mitigated?	No	
Mitigation / Management: Planning: ➢ Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint. ➢ Plan ancillary infrastructure in such a way and in such a location that clearing of vegetation is minimised. ➢ Use existing roads wherever possible. Where new roads are required to be constructed, these should be planned carefully, taking due cognisance of the local topography. Roads should be laid out along the contour wherever possible, and should never traverse slopes at 90 degrees. Construction of roads should be undertaken properly, with adequate drainage structures in place to forego potential erosion problems. Construction: ➢ Rehabilitate all construction areas. ➢ Ensure that vegetation is not cleared unnecessarily to make way for infrastructure. Operations: ➢ Maintain the general appearance of the facility as a whole. ➢ Monitor rehabilitated areas, and implement remedial action as and when required. ➢ Decommissioning: ➢ Remove infrastructure not required for the post-decommissioning use of the site. ➢ Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications. ➢ Monitor rehabilitated areas post-decommissioning and implement remedial actions.		
Cumulative impacts: The construction of the amended Waaihoek WEF (43 turbines) together with its associated infrastructure, will certainly contribute to the increased cumulative visual impact of renewable energy facilities in the region.		

Residual impacts: The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.

Table 6: Impact table summarising the significance of visual impacts on conservation areas within the region

8.3. SECONDARY IMPACTS

8.3.1. POTENTIAL VISUAL IMPACT ON THE VISUAL CHARACTER OF THE LANDSCAPE AND SENSE OF PLACE OF THE REGION

Sense of place refers to a unique experience of an environment by a user, based on his or her cognitive experience of the place. Visual criteria and specifically the visual character of an area (informed by a combination of aspects such as topography, level of development, vegetation, noteworthy features, cultural / historical features, etc.) play a significant role.

A visual impact on the sense of place is one that alters the visual landscape to such an extent that the user experiences the environment differently, and more specifically, in a less appealing or less positive light.

In general, the landscape character of the greater study area and site itself presents as natural. The visual quality of the region is generally high and large tracts of intact vegetation characterise most of the visual environment. As such, the entire study area is considered sensitive to visual impacts due to its generally low levels of transformation. The key visual experience is linked to the use of the road network and associated views of the surrounding landscape.

The anticipated visual impact on the visual character and sense of place of the study area is expected to be of high significance. No mitigation is possible within this environment and for a facility of this scale, but measures have been included as best practice guidelines. The table below illustrates the assessment of this anticipated impact.

Nature of Impact: Visual impact of the proposed development on the visual quality of the landscape and sense of place of the region		
	No mitigation	*Mitigation considered*
Extent	Regional (3)	N/a
Duration	Long (4)	N/a
Magnitude	High (8)	N/a
Probability	Highly Probable (4)	N/a
Significance	High (60)	N/a
Status (positive or negative)	Negative	N/a
Reversibility	Irreversible (5)	N/a
Irreplaceable loss of resources?	No	N/a
Can impacts be mitigated?	No	
Mitigation / Management: Planning: ➢ Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint. ➢ Plan ancillary infrastructure in such a way and in such a location that clearing of vegetation is minimised. ➢ Use existing roads wherever possible. Where new roads are required to be constructed, these should be planned carefully, taking due cognisance of the local topography. Roads should be laid out along the contour wherever possible, and should never traverse slopes at 90 degrees. Construction of roads should be undertaken properly, with adequate drainage structures in place to forego potential erosion problems. Construction: ➢ Rehabilitate all construction areas. ➢ Ensure that vegetation is not cleared unnecessarily to make way for infrastructure. Operations: ➢ Maintain the general appearance of the facility as a whole. ➢ Monitor rehabilitated areas, and implement remedial action as and when required. ➢ Decommissioning:		

➢ Remove infrastructure not required for the post-decommissioning use of the site. ➢ Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications. ➢ Monitor rehabilitated areas post-decommissioning and implement remedial actions.
Cumulative impacts: The construction of the amended Waaihoek WEF (43 turbines) together with its associated infrastructure, will certainly contribute to the increased cumulative visual impact of renewable energy facilities in the region.
Residual impacts: The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.

Table 7: Impact table summarising the significance of visual impacts on landscape character and sense of place within the region

8.3.2. POTENTIAL VISUAL IMPACT ON TOURIST ACCESS ROUTES AND TOURIST DESTINATIONS WITHIN THE REGION.

The greater region is generally seen as having a high scenic value and tourism value potential. The landscape is characterised by wide-open spaces with a high visual quality and strong sense of place. The R34 is a primary road in the region and is thus considered to be a route that is likely to carry tourists.

In terms of tourist destinations and accommodation, according to the VIA undertaken by EOH in 2014 the project area forms part of the internationally renowned KwaZulu-Natal Battlefields area of South Africa. The area is rich in history, with names such as Shaka, Winston Churchill, Mahatma Gandhi and General Louis Botha associated with historical records and museums. The legacy of the Zulu Kingdom's critical, blood-soaked conflicts is reconciled in this fascinating region's myriad Battlefield sites, historic towns, national monuments and museums.

The anticipated visual impact of the proposed amended Waaihoek WEF on tourist access routes (i.e. the R34) and tourist destinations (i.e. accommodation and attracctions) within the region is therefore expected to be of moderate significance. No mitigation is possible within this environment and for a facility of this scale, but measures have been included as best practice guidelines. The table below illustrates the assessment of this anticipated impact.

Nature of Impact: Visual impact of the proposed development on the tourist access routes (R34) and tourist destinations within the region.		
	No mitigation	*Mitigation considered*
Extent	Regional (3)	N/a
Duration	Long (4)	N/a
Magnitude	Moderate (6)	N/a
Probability	Probable (3)	N/a
Significance	Moderate (39)	N/a
Status (positive or negative)	Negative	N/a
Reversibility	Recoverable (3)	N/a
Irreplaceable loss of resources?	No	N/a
Can impacts be mitigated?	No	
Mitigation / Management: Planning: ➢ Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint. ➢ Plan ancillary infrastructure in such a way and in such a location that clearing of vegetation is minimised. ➢ Use existing roads wherever possible. Where new roads are required to be constructed, these should be planned carefully, taking due cognisance of the local topography. Roads should be laid out along the contour wherever possible, and should never traverse slopes at 90 degrees. Construction of roads should be undertaken properly, with adequate drainage structures in place to forego potential erosion problems. Construction: ➢ Rehabilitate all construction areas.		

➢ Ensure that vegetation is not cleared unnecessarily to make way for infrastructure. Operations: ➢ Maintain the general appearance of the facility as a whole. ➢ Monitor rehabilitated areas, and implement remedial action as and when required. ➢ Decommissioning: ➢ Remove infrastructure not required for the post-decommissioning use of the site. ➢ Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications. ➢ Monitor rehabilitated areas post-decommissioning and implement remedial actions.
Cumulative impacts: The construction of the amended Waaihoek WEF (43 turbines) together with its associated infrastructure, will certainly contribute to the increased cumulative visual impact of renewable energy facilities in the region.
Residual impacts: The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.

Table 8: Impact table summarising the significance of visual impacts on tourist access routes and destinations within the region

8.4. THE POTENTIAL TO MITIGATE VISUAL IMPACTS

The primary visual impact, namely the appearance of the Wind Energy Facility (the wind turbines) is not possible to mitigate. The functional design of the turbines cannot be changed in order to reduce visual impacts.

Alternative colour schemes (i.e., painting the turbines sky-blue, grey or darker shades of white) are not permissible as the CAA's *Marking of Obstacles* expressly states, "*Wind turbines shall be painted bright white to provide the maximum daytime conspicuousness*".

Failure to adhere to the prescribed colour specifications will result in the fitting of supplementary daytime lighting to the wind turbines, once again aggravating the visual impact.

The overall potential for mitigation is therefore generally low or non-existent. The following mitigations are, in addition to the mitigations recommended in the original VIA undertaken by EOH in 2014, are however possible:

- Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint.
- Plan ancillary infrastructure (i.e., substation and workshop) in such a way and in such a location that clearing of vegetation is minimised. Consolidate existing infrastructure as much as possible, and make use of already disturbed areas rather than pristine sites wherever possible.
- Use existing roads wherever possible. Where new roads are required to be constructed, these should be planned carefully, taking due cognisance of the local topography. Roads should be laid out along the contour wherever possible, and should never traverse slopes at 90 degrees. Construction of roads should be undertaken properly, with adequate drainage structures in place to forego potential erosion problems.
- Access roads, which are not required post-construction, should be ripped and rehabilitated.
- No mitigation is possible for visual impacts associated with the on-site monitoring and telecommunications masts.
- The Civil Aviation Authority (CAA) prescribes that aircraft warning lights be mounted on the turbines. However, it is possible to obtain permission to mount these lights on the turbines representing the outer perimeter of the facility. In this manner, fewer warning lights can be utilised to delineate the facility as one large obstruction, thereby lessening the potential visual impact. It is therefore recommended that the possibility of this be investigated.

- Mitigation of visual impacts associated with the construction phase, albeit temporary, entails proper planning, management and rehabilitation of all construction sites. Construction should be managed according to the following principles:

    - ➢ Ensure that vegetation is not unnecessarily cleared or removed during the construction period.
    - ➢ Reduce the construction period through careful logistical planning and productive implementation of resources.

- Plan the placement of lay-down areas and any potential temporary construction camps along the corridor in order to minimise vegetation clearing.
- Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.
- Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed regularly at licensed waste facilities.
- Reduce and control construction dust through the use of approved dust suppression techniques as and when required (i.e., whenever dust becomes apparent).
- Restrict construction activities to daylight hours in order to negate or reduce the visual impacts associated with lighting.
- Ensure that all infrastructure and the site and general surrounds are maintained and kept neat.
- Rehabilitate all disturbed areas, construction areas, roads, slopes etc. immediately after the completion of construction works. If necessary, an ecologist should be consulted to assist or give input into rehabilitation specifications.
- Monitor all rehabilitated areas for at least a year for rehabilitation failure and implement remedial action as required. If necessary, an ecologist should be consulted to assist or give input into rehabilitation specifications.

- Mitigation of other lighting impacts includes the pro-active design, planning and specification lighting for the facility. The correct specification and placement of lighting and light fixtures will go far to contain rather than spread the light. Additional measures include the following:

  - Shielding the sources of light by physical barriers (walls, vegetation, or the structure itself);
  - Limiting mounting heights of lighting fixtures, or alternatively using foot-lights or bollard level lights;
  - Making use of minimum lumen or wattage in fixtures;
  - Making use of down-lighters, or shielded fixtures;
  - Making use of Low-Pressure Sodium lighting or other types of low impact lighting.
  - Making use of motion detectors on security lighting. This will allow the site to remain in relative darkness, until lighting is required for security or maintenance purposes.

- During Operations, monitor the general appearance of the facility as a whole as well as all rehabilitated areas. Implement remedial action where required.
- The maintenance of the turbines and ancillary structures and infrastructure will ensure that the facility does not degrade, thus aggravating visual impact.

- Secondary impacts anticipated as a result of the proposed infrastructure (i.e., impacts on landscape character and sense of place) are not possible to mitigate.

- Where sensitive visual receptors are likely to affected, it is recommended that the developer enter into negotiations regarding the potential screening of visual impacts at the receptor site. This may entail the planting of vegetation, trees or even the construction of screens. Ultimately, visual screening is most effective when placed at the receptor itself.

- After decommissioning, all infrastructure should be removed and all disturbed areas appropriately rehabilitated. Monitor rehabilitated areas post-decommissioning and implement remedial actions and consult an ecologist regarding rehabilitation specifications if necessary.

The possible mitigation of both primary and secondary visual impacts as listed above should be implemented and maintained on an on-going basis.

9. SUMMARY OF VISUAL IMPACTS ASSESSED

In light of the results and findings of the Visual Impact Assessment undertaken for the amended Waaihoek WEF proposed, it is acknowledged that the receiving environment will be significantly visually transformed for the entire operational lifespan of the infrastructure.

The following is a summary of the impacts assessed:

- The visual impact on sensitive receptors within 5km (residents of homesteads and users of the Emlwane Game Park), in close proximity to the proposed facility is expected to be of high significance.
- The visual impact on sensitive visual receptors (i.e., users of the arterial R34 and residents of homesteads and the town of Utrecht) within the region (i.e., beyond the 5km offset) is expected to be of moderate significance.
- The potential visual impact of construction on sensitive visual receptors in close proximity to the proposed infrastructure is likely to be of moderate significance and may be mitigated to low.
- The anticipated visual impact of lighting at night on sensitive visual receptors within the study area is likely to be of high significance.
- The potential visual impact on conservation areas () within the region is likely to be of high significance.
- The anticipated visual impact on the visual character and sense of place of the study area is expected to be of high significance.
- The potential visual impact on tourist access routes and tourist destinations within the region is likely to be of moderate significance.

10. CONCLUSION AND RECOMMENDATIONS

The proposed increase in the dimensions of the wind turbine structures is not expected to significantly alter the influence of the WEF on *areas of higher viewer incidence* (observers traveling along the arterial, main or secondary roads within the region) or *potential sensitive visual receptors* (residents of homesteads in close proximity to the WEF). However, based on the inclusion of new sensitive visual receptors and the subsequent impact assessment, the author is of the opinion that the wind turbine structures will have an overall significance rating of high and not moderate as stated in the original VIA report compiled in 2014.

While the proposed increase in dimensions is not expected to significantly influence the anticipated visual impact, as stated in the original VIA report (i.e., the visual impact is expected to occur regardless of the amendment). The visual impact is expected to be very high within a 5km radius of the wind turbine structures, high within 5-10 km radius and moderate from 10 km and beyond.

In spite of the fact that no individual receptors would benefit from the reduction in the number of wind turbines from 47 to 43, it is still considered to be a positive from a visual impact perspective. It will reduce the overall frequency of visual exposure of wind turbine structures within the region.

According to the Provincial Government of the Western Cape, Department of Environmental Affairs and Development Planning (DEA&DP) Guideline for Involving Visual and Aesthetic Specialists in the EIA Process (Oberholzer, 2005), the criteria that determine whether or not a visual impact constitutes a potential fatal flaw are categorised as follows:

1. Non-compliance with Acts, Ordinances, By-laws and adopted policies relating to visual pollution, scenic routes, special areas or proclaimed heritage sites.
2. Non-compliance with conditions of existing Records of Decision.
3. Impacts that may be evaluated to be of high significance and that are considered by stakeholders and decision-makers to be unacceptable.

In spite of the high residual ratings (as assessed in Section 8 Visual Impact Assessment), these visual impacts are not considered to be fatal flaws for a development of this nature. To the knowledge of the author the proposed development is compliant with all Acts, Ordinances, By-laws and adopted policies relating to visual pollution, scenic routes, special areas or proclaimed heritage sites, as well as, conditions of existing Records of Decisions. In addition, no reported objections from stakeholders within the region have been communicated by the EAP to the author of this report.

It is, therefore, suggested that the proposed amendment to the turbine dimensions and layout be supported, subject to the conditions and recommendations as stipulated in the current Environmental Authorisation, and according to the Environmental Management Programme and suggested mitigation measures, as provided in this and the original Visual Impact Assessment report.

11. REFERENCES

Council for Scientific and Industrial Research (CSIR), 2015. *The Strategic Environmental Assessment for wind and solar photovoltaic energy in South Africa.*

DEADP, Provincial Government of the Western Cape, 2011. Guideline on Generic Terms of Reference for EAPS and Project Schedules.

Oberholzer, B. (2005). Guideline for involving visual and aesthetic specialists in EIA processes: Edition 1.

DEA, 2021. *South African Renewable Energy EIA Application (REEA) Database.*

EOH Coastal & Environmental Services, 2014. Proposed Waaihoek Wind Energy Facility, Utrecht, Kwazulu-Natal, South Africa - *Visual Impact Assessment Report.*