TERRA WIND ENERGY -GOLDEN VALLEY WIND ENERGY FACILITY, BLUE CRANE ROUTE LOCAL MUNICIPALITY,COOKHOUSE - EASTERN CAPE PROVINCE

DEA ref: 12/12/20/1717

MOTIVATION FOR AMENDMENT OF ENVIRONMENTAL AUTHORISATION

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1. INTRODUCTION

Terra Wind Energy Golden Valley (Pty) Ltd received an environmental authorisation for the construction of the **Terra Wind Energy Facility Golden Valley, Blue Crane Route Local Municipality, Cookhouse - Eastern Cape Province** (DEA ref: 12/12/20/1717) in April 2011, with an amendment in February 2012.

In terms of the environmental authorisation, the project description referred to the installation of up to 214 wind turbines mounted on 80 – 100m masts and nacelle with a 100m rotor diameter. Following subsequent developments in technology and in finalising the site development plan, Terra Wind Energy Golden Valley (Pty) Ltd is now proposing to increase the rotor diameter to 130m. This will enable the developer to install a newer technology on the site which is better suited to the conditions on the site (and will increase the efficiency of the facility). This change does not lead to a change in extent of the facility footprint, and it is still based on the layout as presented in the Final EIA report. The significance of the impacts as assessed in the EIA remains the same - this is supported by the reports and statements from the relevant specialists involved in the EIA (refer to Appendix A to Appendix D).

The project description as described in the authorisation is now requested to be amended as follows:

From:
To the installation of up to 214 wind turbines with a nominal power output of 2.5 MW (mounted on 80 – 100m masts and nacelle; 100m diameter rotor-consisting of 3x50m blades)

To:
The installation of up to 214 wind turbines with a nominal power output of 3 MW (mounted on 80 – 100m masts and nacelle; 130m diameter rotor - consisting of 3 blades)

In terms of Condition 1.5 of the Environmental Authorisation, it is possible for an applicant to apply, in writing, to the competent authority for a change or deviation from the project description to be approved. In this regard, **Terra Wind Energy Golden Valley (Pty) Ltd** has requested DEA to amend the project description as above. Savannah Environmental has prepared this motivation in support of this request/application on behalf of **Terra Wind Energy Golden Valley (Pty) Ltd**, and provides detail pertaining to the significance and impacts of the proposed change to the project description in order for interested and affected parties to be informed of the potential change in the project description, and for the competent authority to be able to reach a decision in this regard.

In order to verify the potential for a change in the impacts on visual exposure, avifauna, bats and noise the amendment has been presented to the relevant specialists engaged as part of the EIA as well as specialists involved with the bird and bat monitoring on site for consideration and comment. The comments and reports from the specialist consultants are attached within Appendix A to Appendix D.

2. MOTIVATION FOR AMENDMENT

Project history: The proposed wind energy project that was authorised by DEA in April 2011 (DEA ref: 12/12/20/1717).

Amendment request: The project description as described in the authorisation is requested to be amended to “Up to 214 Wind turbines with a nominal power output of 3 MW (mounted on 80 – 100 m masts and nacelle; 130m diameter rotor-consisting of 3 blades)”. This amendment relates solely to an increase in the rotor diameter. The potential impacts associated with the increase in turbine dimensions are discussed below, and compared to the extent of each impact as identified through the Environmental Impact Assessment.

Location:
The site is located on the eleven farms, as follows:

1. Olive Wood Estate
   - Portion 2 of the consolidated Farm Olive Woods No. 169, Bedford, in the Nxuba Municipality, Division of Bedford, Eastern Cape Province
2. Olive Fonteyn
   - The Farm Olive Fonteyn No. 166, situated as below
   - Remainder of the Farm Mullerskraal No. 159, Bedford, in the Nxuba Municipality, Division of Bedford, Eastern Cape Province
   - The Farm Klein Rietfontein No. 167, situated as above

3. Quaggas Kuyl
   - The Farm Quaggas Kuyl No. 155, Bedford, in the Nxuba Municipality, Division of Bedford, Eastern Cape Province
   - The Farm Jagersfontein No. 154, situated as above
   - Portion 10 of the Farm Gezhiret No. 161, situated as above
   - Portion 17 of the Farm Smoor Drift No. 162, as situated as above
   - The Farm Great Riet Fonteyn No. 160, situated as above

4. Lushof
   - Portion 24 of the Farm Oude Smoor Drift No. 164, Bedford, in the Blue Crane Route Municipality,
   - Portion 37 of the Farm Oude Smoor Drift No. 164, as situate above.
   - Portion 47 of the Farm Oude Smoor Drift No. 164, as situate above.
   - Portion 14 of the Farm Smoor Drift No. 162, Bedford, in the Blue Crane Route Municipality, Division of Bedford, Eastern Cape Province

5. Kroonkop
   - Portion 3 of the Farm Oude Smoor Drift No. 164, Bedford, in the Blue Crane Route Municipality, Division of Bedford, Eastern Cape Province
   - Portion 7 of the Farm Oude Smoor Drift No. 164, Bedford, in the Blue Crane Route Municipality, Division of Bedford, Eastern Cape Province
   - Portion 16 of the Farm Oude Smoor Drift No. 164, Bedford, in the Blue Crane Route Municipality, Division of Bedford, Eastern Cape Province
   - Portion 1 of the Farm Mullerskraal No. 159, in the Blue Crane Route Municipality, Division of Bedford, Eastern Cape Province

6. Ondersmoordrift
   - Portion 40 of the Farm Oude Smoor Drift No. 164
   - Portion 42 of the Farm Oude Smoor Drift No. 164

7. Matjiesfontein
   - Portion 1 of the Farm Creguskraal No. 181, in the Blue Crane Route Municipality, Division of Bedford, Eastern Cape Province
   - The Farm No. 283 Matjiesfontein, in the Blue Crane Route Municipality, Division of Bedford, Eastern Cape Province

8. Leuwe Drift
   - Remainder extent of the Farm 153, Leuwe Drift, Bedford, in the Blue Crane Route Municipality, Division of Bedford, Eastern Cape Province
   - Portion 1 of the Farm Bavians Krantz No. 151, situated as above

9. Gedagtenis
    - Portion 14 of the Farm 164, Bedford, in the Blue Crane Route Municipality, Division of Bedford, Eastern Cape Province
    - Portion 34 of the Farm 164, Bedford, in the Blue Crane Route Municipality, Division of Bedford, Eastern Cape Province
    - Portion 35 of the Farm 164, Bedford, in the Blue Crane Route Municipality, Division of Bedford, Eastern Cape Province
    - Portion 36 of the Farm 164, Bedford, in the Blue Crane Route Municipality, Division of Bedford, Eastern Cape Province
    - Portion 38 of the Farm 164, Bedford, in the Blue Crane Route Municipality, Division of Bedford, Eastern Cape Province

10. Varkens Kuyl
    - Portion 1 of the Farm Varkens Kuyl No. 158, Bedford, in the Nxuba Municipality, Division of Bedford, Eastern Cape Province

11. Wagenaarsdrift
    - The Farm No. 172, Bedford, in the Blue Crane Route Municipality, Division of Bedford, Eastern Cape Province
    - Portion 2 of the Farm No. 172, Bedford, in the Blue Crane Route Municipality, Division of Bedford, Eastern Cape Province
    - Portion 2 of the Farm No. 173, Bedford, in the Blue Crane Route Municipality, Division of Bedford, Eastern Cape Province
    - The Farm No. 284, Bedford, in the Blue Crane Route Municipality, Division of Bedford, Eastern Cape Province

The site is located approximately 5 km from Cookhouse in the Blue Crane Route Local Municipality. The site covers an area of approximately 29 400 hectares (ha).

<u>Environmental sensitivity:</u> From the specialist investigations undertaken within the EIA process for the proposed wind energy facility development site, no absolute environmental 'no go' areas were identified. However, the following environmental sensitivities and potential impacts were identified:

- Areas of ecological sensitivity
- Areas of heritage sensitivity
- Areas of avifauna sensitivity
- Areas of visual impact
- Areas sensitive to noise

Understanding the nature and extent of the proposed amendment to the turbine rotor diameter, the potential for the change in the significance of the impact as assessed in the EIA for the following is required to be evaluated:

» Impacts to avifauna
» Impacts to bats
» Visual impacts
» Impacts to noise receptors

The potential for change in the significance of impacts is discussed in detail below.

» ***Impacts on avifauna***: Findings from the avifauna specialist indicate that from an avifauna impact point of view, the most significant aspect of the proposed change is the change of the rotor swept area (rotor zone). Based on the proposed change, the rotor swept area will now have a lower limit of approximately 35m and upper limit of 165m above ground level (compared to a previous 50m to 150m above ground).

Indications from pre-construction bird monitoring data on site are that the Red Listed bird species recorded flying most frequently on site was the Blue Crane. (other species flying frequently enough to be at risk are non Red Listed species). This species was recorded flying 26 times, all of which were below the previous rotor zone of 50m above ground. Taking the new rotor zone of 35m above ground, only two (8%) flight records would have been within the rotor zone and hence at risk. Although estimating collision risk is not as simple as that, at least there is no indication based on data that the increased swept area would increase risk substantially.

It was, therefore, concluded by the avifaunal specialist that based on his understanding of bird movement on site to date, the recorded bird flight data on site, and the existing international literature, it is not evident that turbines with an increased rotor diameter will have any different effect on birds to the previous turbine considered. The significance of the impact assessed in the EIA therefore remains unchanged (refer to a letter of motivation drafted by the specialist, included in Appendix A).

» ***Impacts on bats:*** An increase in the rotor diameter leads to an increase in turbine tip height. Even though the studies of Howe *et al.* (2002) and Barclay *et al.* (2007) show bat mortalities to increase with turbine height, these were for migrating bats and the same does not necessarily apply to South African foraging bats. So far no signs of migrations have been found for this site. Passive bat detection systems are mounted on 5 meteorological masts on site, each with 2 microphones (one at 40m and the other at 80m height above ground level). This allows for a measurement of how altitude is related to foraging bat activity.

According to data gathered and analysed up to date during the long-term pre-construction bat monitoring programme, an increase in turbine tip height will not increase the mortality risk to foraging bat fauna. The risk may possibly remain unchanged, but the proposed amendment is not anticipated to increase the risk of mortality to resident foraging bats on site (refer to a letter of motivation drafted by the specialist, included in Appendix B).

» ***Visual Impacts associated with the Wind Energy Facility***: The most significant impact associated with the proposed wind energy facility and associated infrastructure is the visual impact on the surrounding area imposed by the components of the facility. The nature and extent of visual impact is related to the nature and extent of the infrastructure planned for the site.

  A comparative viewshed analysis was undertaken in order to be able to draw a comparison between the potential visibility of the facility as per the authorised installation of up to 214 wind turbines with a maximum tip height of 150m and the now proposed 214 wind turbines with a tip height of 165 m – an increase in rotor diameter to 130m. In order to determine whether the revised layout will alter the outcome of the visual impact assessment simple viewsheds were calculated for the two turbine tip heights.

  From the comparative viewshed analysis undertaken, it can be concluded that the difference in turbine tip height increases the viewshed area by 4100 ha and the number of buildings that will potentially be affected by 45. Map 1 in the attached specialist report (refer to Appendix C) provides a visual comparison of the two viewsheds. From this it is clear that the increase in viewshed area occurs mostly beyond 5 km from the nearest wind turbines where visual exposure to the wind farm would be of medium to low significance. Of the 45 buildings potentially affected by the increased turbine tip height, only one is closer than 6 km from the nearest turbine. It is a farmstead surrounded by tall trees and is unlikely to have clear views of turbines. The significance of the visual impact on sensitive visual receptors in the immediate vicinity of the wind energy facility was rated as high in the original VIA report, and an increase of 15 m in turbine tip height will not change this rating. The significance of the impact assessed in the EIA therefore remains unchanged.

» ***Impacts to noise receptors:*** Thirteen (13) Noise Sensitive Developments (NSDs) were identified that would be affected by the proposed Terra Wind Energy Golden Valley (Pty) Ltd; NSA1 Leuwedrift Farm House, NSA2 Ou Smoor Drift Farm House, NSA3 Matjesfontein Farm House, NSA4 Jagersfontein Farm House, NSA5 Olive Woods Farm House, NSA6 Rietfontein Farm House, NSA7 School, NSA8 Thorn Park Farm House, NSA9 Barn and Farm Workers Houses, NSA10 Farm House.NSA11 Farm Houses on Longhope Road, NSA12 Varkenskuil Farm House and NSA13 Abandoned Building.

With the proposed change in turbine, turbine rotor diameter/dimensions, the noise emissions from the turbines could possibly change, and were therefore recalculated for the construction and operation phases.

The modelling was conducted at the different wind speeds that the turbine operates up until maximum power is produced. For this area, the maximum allowable limit is 45 dB(A) over a 24 hour period. The predicted noise level should be 45dB(A) to meet the guideline limit.

The noise modelled is as if there is no background noise, but in reality the turbine noise will be one component of the overall ambient noise. Based on the findings of the noise impact remodelling, the Nordex 117/2400 turbine has the same impacts as the turbines modelled in the original noise impact study conducted in March 2010. There are no new or additional noise impacts. The noise impact that is predicted at Rietfontein, Jagersfontein and Matjiesfontein noise sensitive receptors did not meet the rating limit requirements in SANS 10103:2008 (Version 6 - The measurement and rating of environmental noise with respect to annoyance and to speech communication). The findings of the modelling are therefore consistent with the original modelling results. The impact as stated in the original Noise Assessment report is the same (low impact after mitigation measures implemented). It is recommended that a noise impact remodelling be conducted when the micro-siting of turbines is finalised.

It is concluded that an increase in the rotor diameter of the turbines for the Terra Wind Energy Golden Valley (Pty) Ltd will not change the impact significance ratings for impacts as assessed in the EIA. The significance of the impact assessed in the EIA therefore remains unchanged. In addition, there are no new impacts identified as a result of the proposed amendment (refer to Appendix D).

3. CONCLUSION

It is concluded that an increase in the rotor diameter of the turbines for the Terra Wind Energy Golden Valley (Pty) Ltd will not change the impact significance ratings for impacts as assessed in the EIA. In addition, there are no new impacts identified as a result of the proposed amendment.

Terra Wind Energy Golden Valley (Pty) Ltd is therefore formally requesting that the wording within the authorisation in terms of the project description be amended to accommodate this change in technology (and increase the rotor diameter to 130m). This request is made in terms of condition 1.5 of the Environmental Authorisation.

4. LIST OF APPENDICES

The following Appendices are attached in support of the motivation for amendment:

Appendix A: Avifauna – statement from WildSkies Ecological Services (Pty) Ltd
Appendix B: Bats - statement from Animalia (Zoology & Ecology Consultation)
Appendix C: Visual - statement from MapThis
Appendix D: Noise – assessment from SafeTech

APPENDIX A:
AVIFAUNA - STATEMENT FROM WILDSKIES ECOLOGICAL SERVICES (PTY) LTD

Golden Valley Wind Energy Facility – Cookhouse, Eastern Cape

Substantive amendment – avifaunal input

WildSkies Ecological Services (Pty) Ltd – Jon Smallie (SACNASP 400020/06)

9 November 2012

Background

The developers of the Golden Valley Wind Energy Facility have decided to change the wind turbine model to be used on the project, in line with recent technology developments.

The previous turbine dimension was of 100 metre hub height and 100m rotor diameter. The new proposed turbine will consist of a hub height of 100m and a rotor diameter of 130m. This means that the rotor swept area will now extend from approximately 35 to 165m above ground level (compared to a previous 50m to 150m above ground).

Literature

As the wind energy industry has grown and technology has advanced, rotor diameters, generator ratings and tower heights have all increased. The literature is divided on the effect this has on birds, certain authors having stated that turbine size may be proportional to collision risk, taller turbines causing more collisions (de Lucas *et al*, 2009) whilst others argue that large turbines cause the same number of collisions as smaller turbines (Howell, 1995; Erickson *et al*, 1999; Barclay *et al*, 2007). It appears that when mortalities are expressed as a function of power output then facilities with larger turbines kill fewer birds per MW, probably due to the fact that with larger turbines fewer are needed to achieve the same power output (Erickson *et al*, 1999).

Findings

Implications for avifauna of this change in turbine are as follows:

- A larger rotor diameter will result in an overall larger rotor swept area, and hence a larger risk area for collision of birds.
- The higher towers will intrude higher vertically into the airspace.
- The taller turbines will result in the lower limit of the rotor swept area being approximately 35m metres above the ground, and the upper limit 165m. This is a significant change from the previous model (50 - 150m).

  Indications from pre-construction bird monitoring data on site are that the Red Listed bird species recorded flying most frequently on site was the Blue Crane. [other species flying frequently enough to be at risk are non Red Listed species]. This species was recorded flying 26 times, all of which were below the previous rotor zone of 50m above ground. Taking the new rotor zone of 35m above ground, only two (8%) flight records would have been within the rotor zone and hence at risk. Although estimating collision risk is not as simple as that, at least there is no indication based on data that the taller turbine would *increase* risk substantially.

In conclusion, based on our understanding of bird movement on site to date, the recorded bird flight data on site, and the existing international literature, it does not seem that the larger turbines will have any different effect on birds to the previous turbine.

It is therefore recommended that the amendment be allowed to proceed.

Note: This is a rapid assessment using crude indices and should not in any way be interpreted as a final collision risk assessment, it is merely for comparative purposes.

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Howell, J.A. 1995. Avian mortality at rotor sweep areas equivalents Altamont Pass and Montezuma Hills, California. Prepared for Kenetech Wind Power, San Francisco, California.

Kingsley, A & Whittam, B. 2005. Wind turbines and birds – A background review for environmental assessment. Unpublished report for Environment Canada/Canadina Wildlife Service.

APPENDIX B:

BATS - ANIMALIA (Zoology & Ecology Consultation)

Short EIA amendment report on a proposed increase in turbine size

- For the proposed Golden Valley Wind Energy Facility near Cookhouse, Eastern Cape.

Werner Marais

November 2012

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Terms of Reference

The Golden Valley project was awarded environmental authorization by the Department of Environmental Affairs. An amendment to the EIA is underway where the following is proposed:

1. Turbine size from 2.5 to 3MW

2. Rotor diameter from 100m to 130m

1. INTRODUCTION

Although most bats are highly capable of advanced navigation through the use of echolocation and excellent sight, they are still at risk of physical impact with the blades of wind turbines. The corpses of bats have been found in close proximity to wind turbines and, in a case study conducted by Johnson *et al*. (2003) were found to be directly related to collisions.

The incident of bat fatalities for migrating species has been found to be directly related to turbine height, increasing exponentially with altitude, as this disrupts the migratory flight paths (Howe *et al*. 2002, Barclay *et al*. 2007). Although the number of fatalities of migrating species increased with turbine height, this correlation was not found for increased turbine blade sweep (Howe *et al*. 2002, Barclay *et al*. 2007). In the United States of America this was thought to be due to the hypothesis that migrating bats may navigate without the use of echolocation, instead using vision as its main sense for long distance orientation (Johnson *et al*. 2003, Barclay *et al*. 2007).

Despite the high incidence of deaths caused by direct impact with the blades, most bat mortalities have been found to be caused by barotrauma (Baerwald *et al*. 2008). This is a condition where low air pressure found around the moving blades of wind turbines, causes the lungs of a bat to collapse, resulting in internal haemorrhaging which is fatal (Kunz *et al*. 2007). Baerwald *et al*. (2008) found that 90% of bat fatalities around wind turbines involved internal haemorrhaging consistent with barotrauma. A study conducted by Arnett (2005) recorded a total of 398 and 262 bat fatalities in two surveys at the Mountaineer Wind Energy Centre in Tucker County, West Virginia and at the Meyersdale Wind Energy Centre in Somerset County, Pennsylvania, respectively. These surveys took place during a 6 week study period from 31 July 2004 to 13 September 2004, presumably during migrations. In some studies, such as that taken in Kewaunee County (Howe *et al.* 2002) bat mortalities were found to be three times higher than bird mortalities in the area.

Apart from the habitats where bats are mostly encountered, in conditions where valleys are foggy warmer air is drawn to the top of mountain slopes through thermal inversion, which may result in increased concentrations of insects and subsequently bats at hilltops close to the slope edge (Kunz *et al*. 2007). Some studies (Horn *et al*. 2008) suggest that bats may be attracted to the large turbine structure as roosting spaces or that swarms of insects may get trapped in low pressure air pockets around the turbine, thus attracting bats to the area. The presence of certain types of lights on wind turbines have also been identified as possible causes for increased bat fatalities. This is due to increased foraging activity of bats at lighted turbines, as a result of higher insect densities, opposed to non-lit turbines (Johnson *et al*. 2003). Clearings around wind turbines may also improve conditions for insects in densely forested areas, thereby attracting bats to the area and the swishing sound of the turbine blades could confuse bats (Kunz *et al*. 2007). Electromagnetic fields generated by the turbine may also affect bats which are sensitive to magnetic fields (Kunz *et al*. 2007). It could also be hypothesized, that under natural circumstances, the echolocation capabilities of bats are designed to locate smaller insect prey or avoid stationary objects, and may not be primarily focused on the detection of unnatural objects moving sideways across the flight path.

Whatever the reason for bat fatalities around wind turbines, it is clear that this can be an ecological problem of grave importance if wind turbines are placed in areas of bat importance. During a study by Arnett *et al*. (2009), 10 turbines monitored over a period of 3 months showed 124 bat fatalities in South-central Pennsylvania (America), which can cumulatively have a catastrophic long term effect on bat populations if this rate of fatality continues. Most bat species only reproduce once a year, bearing one young per female, therefore their numbers are slow to recover from mass mortalities. It is very difficult to assess the true number of bat deaths as a result of the presence of wind turbines, due to the fact that many of the carcasses may be removed through predation, where the rate of removal differs as a function of habitat type (Howe *et al*. 2002, Johnson *et al*. 2003). The implementation of curtailment processes, where the turbine cut-in speed is raised to a higher wind speed has proved an effective mitigation during bat migrations. This relies on the principle that the prey of bats will not be found in areas of strong winds and more energy is required for the bats to fly under these conditions. It is thought, that by the implementation of such a measure, that bats in the area are not likely to experience as great an impact as when the turbine blades move slowly in low wind speeds. Other mitigation measures are currently being researched and experimented with globally.

2. CONCLUSION

The proposed increase in turbine size will invariably lead to an increase in turbine height as well. Even though the studies of Howe *et al*. (2002) and Barclay *et al*. (2007) showed bat mortalities to increase with turbine height, these were for migrating bats and the same does not necessarily apply to South African foraging bats. So far no migrations have been found on the site. Passive bat detection systems are mounted on 5 meteorological masts on site, each with 2 microphones one at 40m and the other at 80m high. This allows for a measurement of how altitude is related to foraging bat activity.

Figure 1 indicates levels of bat activity at the 2 different heights, measured in average bat triggers / bat passes for the period of late January to early May 2012. **Figure 2** indicates levels of bat activity at the 2 different heights, measured in average bat triggers / bat passes for the period of early May to end July 2012. In both figures it can be seen that the majority of bat activity at 80m is less than at 40m in most cases. No migrations have been detected on site so far, therefore the graphs under discussion were analysed from foraging bats. Should a migration be detected, the proposed turbines will need to be mitigated during the time period of the migration.

According to data gathered and analysed up to date during the long term preconstruction bat monitoring, an increase in turbine size and height will not increase the mortality risk to foraging bat fauna. The risk may possibly remain unchanged, but the proposed amendment is not anticipated to increase the risk of mortality to resident foraging bats on site.

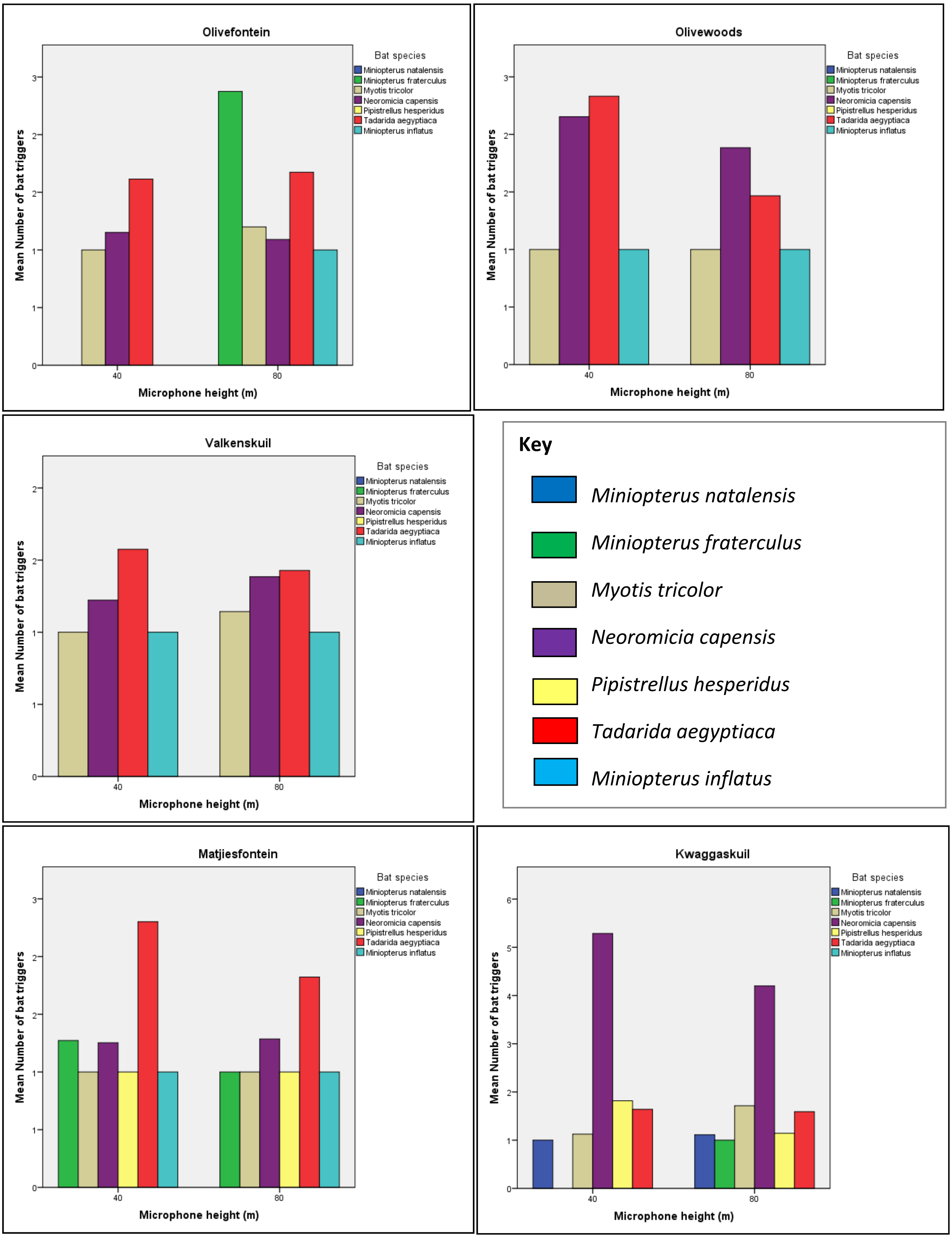

Figure 1: Bat activity variation at height for January - May 2012, for each passive system.

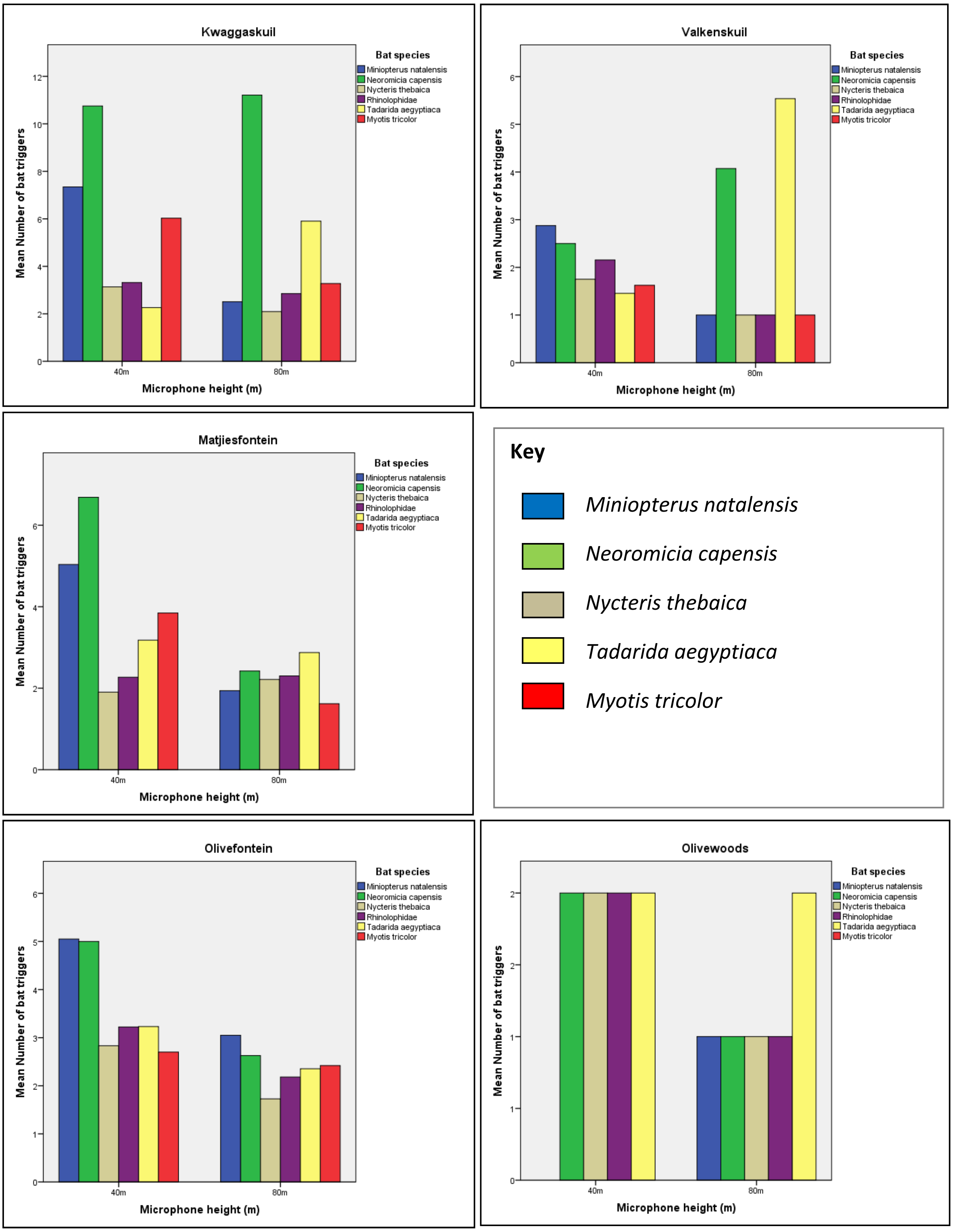

Figure 2: Bat activity variation at height for May - July 2012, for each passive system.

3. REFERENCES

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APPENDIX C:

VISUAL - STATEMENT FROM MAPTHIS

Golden Valley Wind Energy Facility – Visual Impact Assessment

Revised Wind Energy Facility Layout – 6 November 2012

Introduction

Changes were made to the wind energy facility layout since the visual impact assessment for the EIA was conducted in May 2011. In terms of potential visual impact the most important were changes in turbine size (from 2.5 MW to 3 MW) and height (150 m to 165 m). In order to determine whether the revised layout will alter the outcome of the visual impact assessment simple viewsheds were calculated for the two turbine heights

Results and Discussion

The table below shows viewshed areas for 150 m and 165 m turbines, as well as number of buildings[1] that will potentially provide views of wind turbines (the screening effect of buildings and vegetation is not taken into account, and neither is the effect of distance[2] from wind turbines included in calculations):

Turbine Height	Viewshed Area	Number of Buildings
150 m (Original VIA Report)	1603 km^2	3250
165 m (Most recent)	1644 km^2	3295

The difference in turbine height increases the viewshed area by 41 km^2 and the number of buildings that will potentially be affected by 45[3] Map 1 provides a visual comparison of the two viewsheds. From this it is clear that the increase in viewshed area occurs mostly beyond 5 km from the nearest wind turbines where visual exposure to the wind farm will tend to be medium to low. Of the 45 buildings potentially affected by the increased turbine height only one is closer than 6 km from the nearest turbine. It is a farm stead surrounded by tall trees and is unlikely to have clear views of turbines (Figure 0-1). The significance of the visual impact on sensitive visual receptors was rated as high in the original VIA report and an increase of 15 m in turbine height will not change this rating.

[1] Mudau, Nale. 2010. "SPOT Building Count Supports Informed Decisions." PositionIT, October.
[2] Visual exposure to wind turbines will drop off exponentially with increased distance from the wind turbines.
[3] Not all of these are residences – farm buildings, warehouses and other buildings are included.

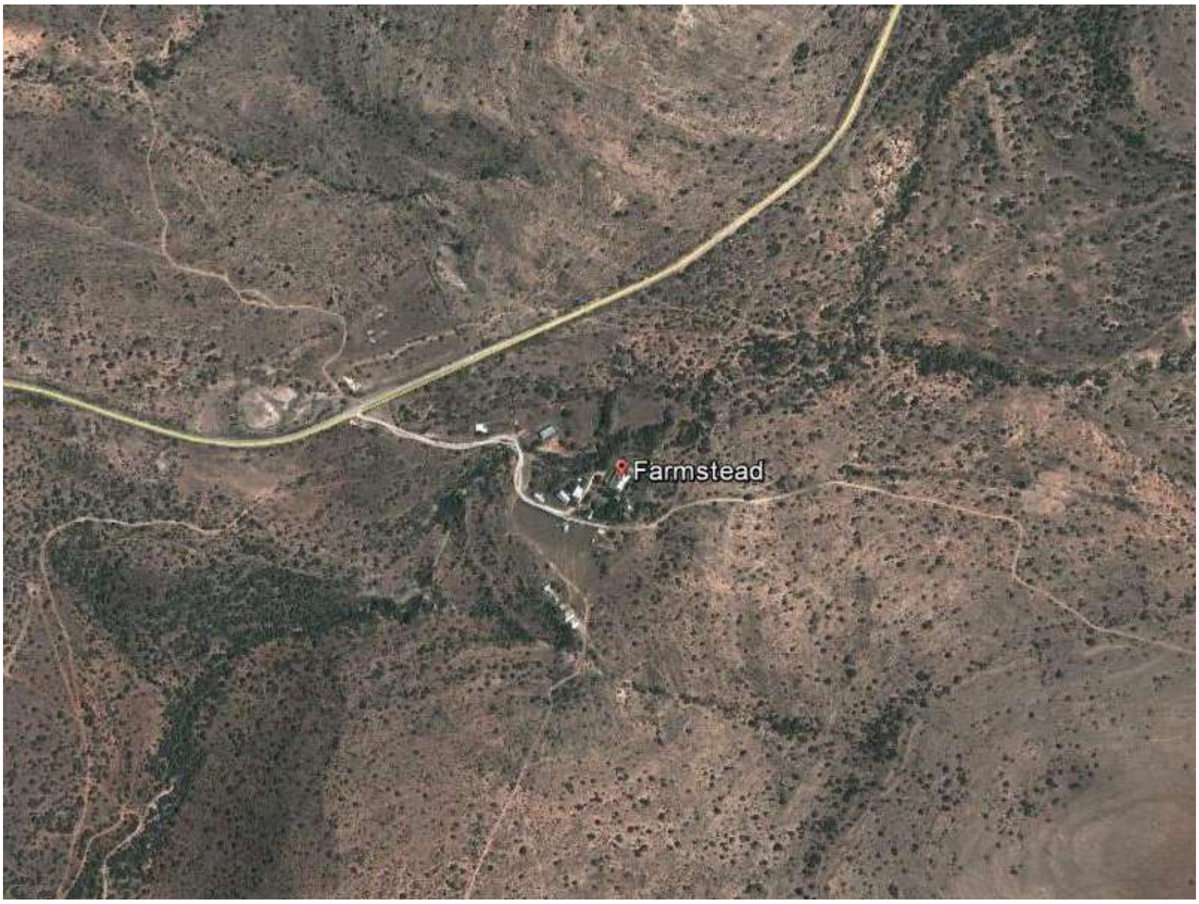
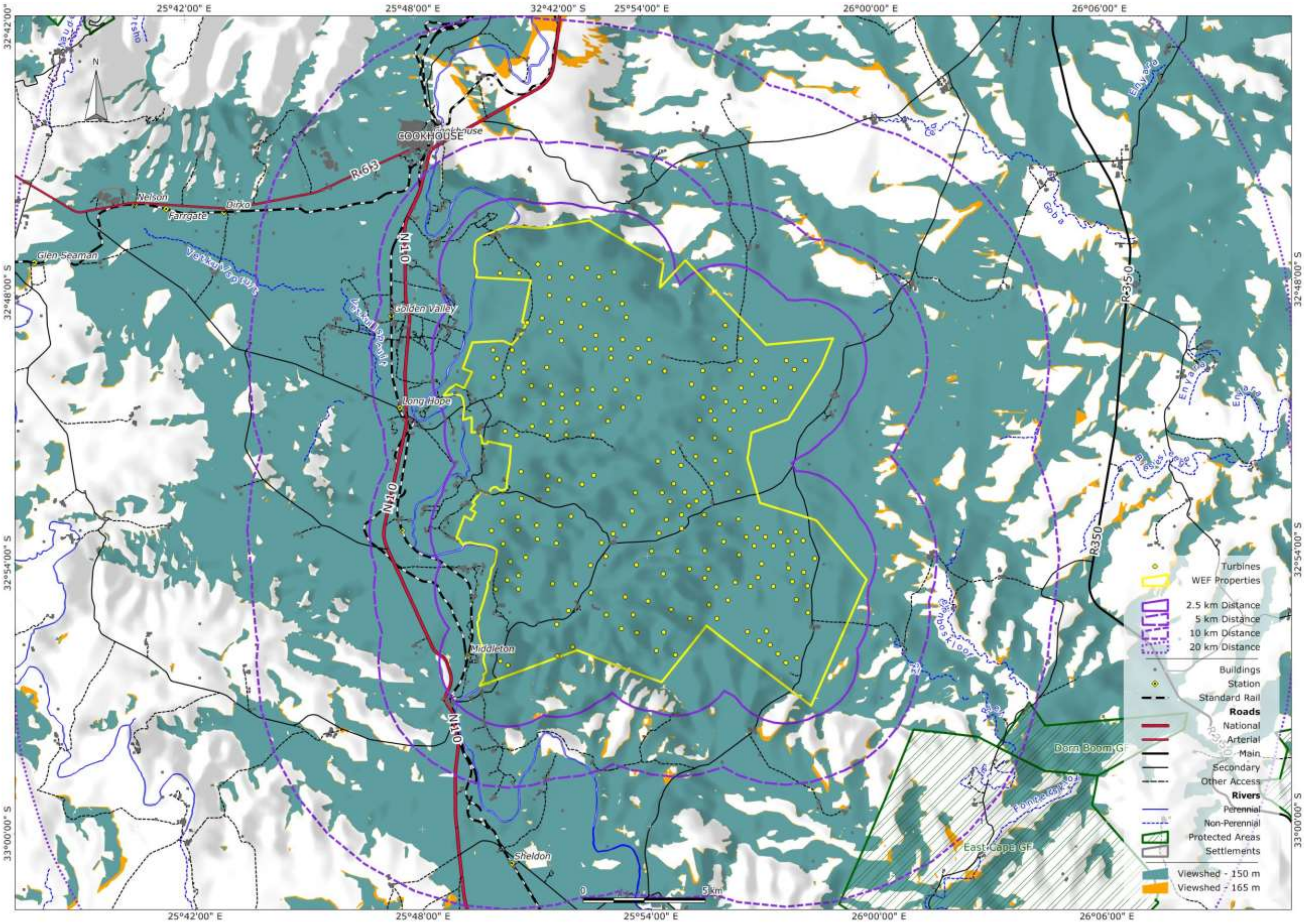


Figure 0-1 Farmstead potentially affected by change in turbine height. The building is surrounded by tall trees and clear views of wind turbines will be limited. (Source: Google Earth)



Map 1 Comparison of viewsheds for 150 m and 165 m wind turbines. The viewshed for the most recent layout(orange) is slightly larger than that of the layout used for the visual impact assessment (15 May 2011 – green).

APPENDIX D:
NOISE – ASSESSMENT FROM SAFETECH

13th February 2013

Ms. K. Jodas
Savannah Environmental (Pty) Ltd
PO Box 148
Sunninghill
2157

Dear Ms Jodas

ADDENDUM - NOISE IMPACT RE-MODELLING OF THE COOKHOUSE WIND ENERGY PROJECT

As instructed Safetech were requested to re-model the noise impacts from the operation of wind turbines for the Cookhouse Wind Energy Project. The request was made to determine if there is any further / different impacts relating an alternative wind turbine generator.

The following information is applicable to this report:

1. This report is an Addendum to the main noise report submitted on the 1st March 2010 (Safetech Report Number 26/1738). The methodologies, legal requirements and standards that are applicable to this report are contained in the main report.
2. All the relevant data pertaining to the original project is still applicable, except for the new turbine choice which is described below.
3. This report only relates to the selection of an alternative wind turbine.
4. The noise impact was modelled with WindPro Version 2.8.
5. The new turbine choice is a Nordex N117/2400 and has the characteristics contained in Table 1 and 2. The information was supplied by Nordex (Report Number F008_238_A02_EN dated 7th January 2011).

Table 1 – Nordex 117/2400

Type	3 blades, up-wind
Power control	Pitch, variable speed
Rated power	2400 kW (grid side)
Rotor diameter	117 m
Cut-in wind speed	3 m/s
Rated wind speed	11.5 m/s
Cut-out wind speed	22.0 m/s
Frequency converter	Located in nacelle
Transformer	Transformer located in nacelle
Hub heights	120m

The noise characteristics that were used in the modelling are as follows:

Table 2 – Nordex 117/2400

Hub Height	Noise Level (dB) 10 m above ground
LwA @ 3 m/s	97.2
LwA @ 4 m/s	100.8
LwA @ 5 m/s	104.1
LwA @ 6 m/s	104.6
LwA @ 7 m/s	105.0
LwA @ 8 m/	105.0
LwA @ 9 m/s	105.0
LwA @ 10 m/s	105.0
LwA @ 11 m/s	105.0
LwA @ 12 m/s	105.0

LwA = Sound Power Level

6. The turbine positions are shown in Table 3.

Table 3 – Turbine Positions

POINTS	EAST	SOUTH	POINTS	EAST	SOUTH	POINTS	EAST	SOUTH	POINTS	EAST	SOUTH
Turbine 1	25°50.5'	-32°47.4'	Turbine 56	25°57.4'	-32°50.1'	Turbine 111	25°51.4'	-32°52.5'	Turbine 166	25°55.6'	-32°54.3'
Turbine 2	25°51.2'	-32°47.5'	Turbine 57	25°51.0'	-32°50.2'	Turbine 112	25°53.7'	-32°52.6'	Turbine 167	25°57.7'	-32°54.3'
Turbine 3	25°51.8'	-32°47.5'	Turbine 58	25°51.5'	-32°50.2'	Turbine 113	25°54.4'	-32°52.6'	Turbine 168	25°50.6'	-32°54.4'
Turbine 4	25°52.5'	32°47.6'	Turbine 59	25°55.2'	-32°50.2'	Turbine 114	25°55.0'	-32°52.6'	Turbine 169	25°54.4'	-32°54.4'
Turbine 5	25°50.2'	-32°47.7'	Turbine 60	25°52.2'	-32°50.3'	Turbine 115	25°55.5'	-32°52.6'	Turbine 170	25°58.1'	-32°54.4'
Turbine 6	25°50.7'	-32°47.7'	Turbine 61	25°52.6'	-32°50.3'	Turbine 116	25°56.4'	-32°52.6'	Turbine 171	25°50.3'	-32°54.5'
Turbine 7	25°53.2'	-32°47.7'	Turbine 62	25°53.2'	-32°50.3'	Turbine 117	25°50.7'	-32°52.7'	Turbine 172	25°55.5'	-32°54.5'
Turbine 8	25°51.5'	-32°47.8'	Turbine 63	25°55.8'	-32°50.3'	Turbine 118	25°50.2'	-32°52.8'	Turbine 173	25°56.9'	-32°54.5'
Turbine 9	25°52.1'	-32°47.8'	Turbine 64	25°56.5'	-32°50.3'	Turbine 119	25°54.6'	-32°52.8'	Turbine 174	25°51.5'	-32°54.6'
Turbine 10	25°52.8'	-32°47.8'	Turbine 65	25°57.1'	-32°50.3'	Turbine 120	25°55.3'	-32°52.8'	Turbine 175	25°52.1'	-32°54.6'
Turbine 11	25°51.5'	-32°48.2'	Turbine 66	25°57.8'	-32°50.3'	Turbine 121	25°55.1'	-32°52.9'	Turbine 176	25°56.3'	-32°54.6'
Turbine 12	25°52.0'	-32°48.3'	Turbine 67	25°50.2'	-32°50.4'	Turbine 122	25°53.6'	-32°53.0'	Turbine 177	25°57.8'	-32°54.6'
Turbine 13	25°52.8'	-32°48.3'	Turbine 68	25°51.8'	-32°50.4'	Turbine 123	25°50.6'	-32°53.1'	Turbine 178	25°50.0'	-32°54.7'
Turbine 14	25°52.4'	-32°48.4'	Turbine 69	25°50.8'	-32°50.5'	Turbine 124	25°52.0'	-32°53.1'	Turbine 179	25°50.6'	-32°54.7'
Turbine 15	25°53.4'	-32°48.4'	Turbine 70	25°53.8'	-32°50.5'	Turbine 125	25°54.9'	-32°53.1'	Turbine 180	25°55.8'	-32°54.7'
Turbine 16	25°53.0'	-32°48.5'	Turbine 71	25°55.5'	-32°50.5'	Turbine 126	25°55.5'	-32°53.1'	Turbine 181	25°56.7'	-32°54.7'
Turbine 17	25°51.3'	-32°48.7'	Turbine 72	25°51.3'	-32°50.6'	Turbine 127	25°50.2'	-32°53.2'	Turbine 182	25°57.3'	-32°54.7'
Turbine 18	25°53.5'	-32°48.7'	Turbine 73	25°52.2'	-32°50.6'	Turbine 128	25°54.5'	-32°53.2'	Turbine 183	25°58.2'	-32°54.7'
Turbine 19	25°50.9'	-32°48.8'	Turbine 74	25°56.1'	-32°50.6'	Turbine 129	25°56.4'	-32°53.2'	Turbine 184	25°52.5'	-32°54.8'
Turbine 20	25°51.8'	-32°48.8'	Turbine 75	25°56.6'	-32°50.6'	Turbine 130	25°51.1'	-32°53.3'	Turbine 185	25°53.4'	-32°54.9'
Turbine 21	25°52.3'	-32°48.9'	Turbine 76	25°57.4'	-32°50.6'	Turbine 131	25°51.7'	-32°53.3'	Turbine 186	25°54.0'	-32°55.0'
Turbine 22	25°56.1'	-32°48.9'	Turbine 77	25°51.8'	-32°50.7'	Turbine 132	25°53.4'	-32°53.3'	Turbine 187	25°56.1'	-32°55.0'
Turbine 23	25°51.5'	-32°49.0'	Turbine 78	25°52.8'	-32°50.7'	Turbine 133	25°55.9'	-32°53.3'	Turbine 188	25°57.9'	-32°55.0'
Turbine 24	25°52.7'	-32°49.1'	Turbine 79	25°53.4'	-32°50.7'	Turbine 134	25°49.9'	-32°53.4'	Turbine 189	25°55.6'	-32°55.1'
Turbine 25	25°51.8'	-32°49.2'	Turbine 80	25°55.7'	-32°50.8'	Turbine 135	25°50.6'	-32°53.4'	Turbine 190	25°51.9'	-32°55.2'
Turbine 26	25°53.4'	-32°49.2'	Turbine 81	25°56.3'	-32°50.8'	Turbine 136	25°54.9'	-32°53.4'	Turbine 191	25°54.6'	-32°55.2'
Turbine 27	25°54.1'	-32°49.2'	Turbine 82	25°57.0'	-32°50.8'	Turbine 137	25°56.9'	-32°53.4'	Turbine 192	25°52.9'	-32°55.3'
Turbine 28	25°55.8'	-32°49.2'	Turbine 83	25°51.5'	-32°51.0'	Turbine 138	25°53.1'	-32°53.5'	Turbine 193	25°53.6'	-32°55.3'
Turbine 29	25°56.5'	-32°49.2'	Turbine 84	25°51.9'	-32°51.0'	Turbine 139	25°54.3'	-32°53.5'	Turbine 194	25°58.2'	-32°55.3'
Turbine 30	25°50.0'	-32°49.4'	Turbine 85	25°53.0'	-32°51.0'	Turbine 140	25°57.5'	-32°53.5'	Turbine 195	25°55.1'	-32°55.4'
Turbine 31	25°52.4'	-32°49.4'	Turbine 86	25°55.4'	-32°51.0'	Turbine 141	25°57.9'	-32°53.5'	Turbine 196	25°55.8'	-32°55.4'
Turbine 32	25°53.1'	-32°49.4'	Turbine 87	25°55.8'	-32°51.0'	Turbine 142	25°51.1'	-32°53.6'	Turbine 197	25°51.6'	-32°55.5'
Turbine 33	25°53.8'	-32°49.4'	Turbine 88	25°51.0'	-32°51.1'	Turbine 143	25°56.6'	-32°53.6'	Turbine 198	25°53.3'	-32°55.6'
Turbine 34	25°50.5'	-32°49.4'	Turbine 89	25°50.3'	-32°51.2'	Turbine 144	25°57.1'	-32°53.6'	Turbine 199	25°53.7'	-32°55.7'
Turbine 35	25°52.7'	-32°49.4'	Turbine 90	25°56.2'	-32°51.2'	Turbine 145	25°50.2'	-32°53.7'	Turbine 200	25°54.4'	-32°55.7'
Turbine 36	25°56.1'	-32°49.4'	Turbine 91	25°50.6'	-32°51.3'	Turbine 146	25°51.6'	-32°53.7'	Turbine 201	25°56.6'	-32°55.7'
Turbine 37	25°50.1'	-32°49.6'	Turbine 92	25°51.4'	-32°51.3'	Turbine 147	25°52.8'	-32°53.7'	Turbine 202	25°57.1'	-32°55.7'
Turbine 38	25°53.1'	-32°49.6'	Turbine 93	25°51.9'	-32°51.3'	Turbine 148	25°56.0'	-32°53.7'	Turbine 203	25°56.9'	-32°55.9'
Turbine 39	25°53.6'	-32°49.6'	Turbine 94	25°52.6'	-32°51.3'	Turbine 149	25°57.7'	-32°53.7'	Turbine 204	25°52.0'	-32°56.0'
Turbine 40	25°50.8'	-32°49.7'	Turbine 95	25°55.2'	-32°51.4'	Turbine 150	25°58.1'	-32°53.7'	Turbine 205	25°57.2'	-32°56.0'

POINTS	EAST	SOUTH	POINTS	EAST	SOUTH	POINTS	EAST	SOUTH	POINTS	EAST	SOUTH
Turbine 41	25°54.1'	-32°49.7'	Turbine 96	25°55.8'	-32°51.4'	Turbine 151	25°56.8'	-32°53.8'	Turbine 206	25°50.4'	-32°56.1'
Turbine 42	25°56.5'	-32°49.7'	Turbine 97	25°54.7'	-32°51.7'	Turbine 152	25°57.3'	-32°53.8'	Turbine 207	25°54.2'	-32°56.1'
Turbine 43	25°56.9'	-32°49.7'	Turbine 98	25°56.2'	-32°51.7'	Turbine 153	25°54.1'	-32°53.9'	Turbine 208	25°51.6'	-32°56.2'
Turbine 44	25°57.7'	-32°49.7'	Turbine 99	25°55.3'	-32°51.8'	Turbine 154	25°54.8'	-32°53.9'	Turbine 209	25°54.7'	-32°56.2'
Turbine 45	25°58.2'	-32°49.7'	Turbine 100	25°54.3'	-32°51.9'	Turbine 155	25°55.5'	-32°53.9'	Turbine 210	25°57.4'	-32°56.2'
Turbine 46	25°50.4'	-32°49.8'	Turbine 101	25°55.8'	-32°51.9'	Turbine 156	25°50.8'	-32°54.0'	Turbine 211	25°50.1'	-32°56.3'
Turbine 47	25°51.4'	-32°49.8'	Turbine 102	25°54.9'	-32°52.0'	Turbine 157	25°52.9'	-32°54.0'	Turbine 212	25°57.9'	-32°56.3'
Turbine 48	25°50.8'	-32°49.9'	Turbine 103	25°50.7'	-32°52.1'	Turbine 158	25°56.4'	-32°54.0'	Turbine 213	25°50.3'	-32°56.4'
Turbine 49	25°54.5'	-32°49.9'	Turbine 104	25°51.4'	-32°52.2'	Turbine 159	25°57.8'	-32°54.0'	Turbine 214	25°57.6'	-32°56.4'
Turbine 50	25°55.5'	-32°49.9'	Turbine 105	25°52.6'	-32°52.2'	Turbine 160	25°50.4'	-32°54.1'			
Turbine 51	25°56.2'	-32°49.9'	Turbine 106	25°56.1'	-32°52.2'	Turbine 161	25°58.4'	-32°54.1'			
Turbine 52	25°57.9'	-32°49.9'	Turbine 107	25°51.7'	-32°52.3'	Turbine 162	25°52.5'	-32°54.2'			
Turbine 53	25°50.0'	-32°50.0'	Turbine 108	25°52.3'	-32°52.4'	Turbine 163	25°53.7'	-32°54.2'			
Turbine 54	25°56.8'	-32°50.0'	Turbine 109	25°54.7'	-32°52.4'	Turbine 164	25°57.0'	-32°54.2'			
Turbine 55	25°53.5'	-32°50.1'	Turbine 110	25°55.7'	-32°52.4'	Turbine 165	25°55.1'	-32°54.3'			

7. The location of the identified Noise Sensitive Areas (NSA's) are shown in Table 4.

Table 4 – NSA Locations

Label	Location Description	Position
NSA 1	Leuwedrift Farm House	32°46.8733'S 25°50.0829'E
NSA 2	Ou Smoor Drift Farm House	32°52.7229'S 25°51.0873'E
NSA 3	Matjesfontein Farm House	32°55.0333'S 25°52.0978'E
NSA 4	Jagersfontein Farm House	32°48.9713'S 25°50.7686'E
NSA 5	Olive Woods Farm House	32°55.600'S 25°58.4941'E
NSA 6	Rietfontein Farm House	32°53.6918'S 25°53.0703'E
NSA 7	School	32°56.995'S 25°49.580'E
NSA 8	Thorn Park Farm House	32°51.1086'S 25°49.6574'E
NSA 9	Barn and Farm Workers Houses	32°50.5531'S 25°49.3851'E
NSA 10	Farm House	32°51.923'S 25°49.6973'E
NSA 11	Farm Houses on Longhope Road	32°52.4840'S 25°49.5793'E
NSA 12	Varkenskuil Farm House	32°50.8699'S 25°58.8663'E
NSA 13	Abandoned Building	32°51.6258'S 25°53.1636'E

8. The results of the noise modelling

The modelling was conducted at the different wind speeds that the turbine operates up until maximum power is produced. The maximum allowable limit is 45 dB(A) over a 24 hour period. The predicted noise level should be less than 45dB(A) to meet the guideline limit. The modelling results are contained in Table 5.

Table 5 – Modelling Results for each identified NSA

Noise Sensitive Area	Wind Speed m/s	Maximum Allowable as per SANS 1013:2008 Noise [dB(A)]	Predicted Noise (dB(A) from the Nordex 117/2400 WTG
Leuwedrift	4	45	30.4
	5	45	33.7
	6	45	34.2
	7	45	34.6
	8	45	34.6
	9	45	34.6
	10	45	34.6
	11	45	34.6
	12	45	34.6
Ou Smoor Drift	4	45	40.5
	5	45	43.8
	6	45	44.3
	7	45	44.7
	8	45	44.7
	9	45	44.7
	10	45	44.7
	11	45	44.7
	12	45	44.7
Matjiesfontein	4	45	41.4
	5	45	44.7
	6	45	45.2
	7	45	45.6
	8	45	45.6
	9	45	45.6
	10	45	45.6
	11	45	45.6
	12	45	45.6

Noise Sensitive Area	Wind Speed m/s	Maximum Allowable as per SANS 1013:2008 Noise [dB(A)]	Predicted Noise (dB(A) from the Nordex 117/2400 WTG
Jagerfontein	4	45	43.8
	5	45	47.1
	6	45	47.6
	7	45	48.0
	8	45	48.0
	9	45	48.0
	10	45	48.0
	11	45	48.0
	12	45	48.0
Olive Woods	4	45	35.9
	5	45	39.2
	6	45	39.7
	7	45	40.1
	8	45	40.1
	9	45	40.1
	10	45	40.1
	11	45	40.1
	12	45	40.1
Rietfontein	4	45	45.7
	5	45	49.0
	6	45	49.5
	7	45	49.9
	8	45	49.9
	9	45	49.9
	10	45	49.9
	11	45	49.9
	12	45	49.9
School	4	45	27.2
	5	45	30.5
	6	45	31.0
	7	45	31.4
	8	45	31.4
	9	45	31.4
	10	45	31.4
	11	45	31.4
	12	45	31.4
Thorn Park	4	45	33.0
	5	45	36.3

Noise Sensitive Area	Wind Speed m/s	Maximum Allowable as per SANS 1013:2008 Noise [dB(A)]	Predicted Noise (dB(A) from the Nordex 117/2400 WTG
	6	45	36.8
	7	45	37.2
	8	45	37.2
	9	45	37.2
	10	45	37.2
	11	45	37.2
	12	45	37.2
Barn & Farm workers houses	4	45	31.9
	5	45	35.2
	6	45	35.7
	7	45	36.1
	8	45	36.1
	9	45	36.1
	10	45	36.1
	11	45	36.1
	12	45	36.1
Farm Houses	4	45	30.6
	5	45	33.9
	6	45	34.4
	7	45	34.8
	8	45	34.8
	9	45	34.8
	10	45	34.8
	11	45	34.8
	12	45	34.8
Farm Houses	4	45	32.5
	5	45	35.8
	6	45	36.3
	7	45	36.7
	8	45	36.7
	9	45	36.7
	10	45	36.7
	11	45	36.7
	12	45	36.7

Noise Sensitive Area	Wind Speed m/s	Maximum Allowable as per SANS 1013:2008 Noise [dB(A)]	Predicted Noise (dB(A) from the Nordex 117/2400 WTG
Varkenskuil farm house	4	45	27.9
	5	45	31.2
	6	45	31.7
	7	45	32.1
	8	45	32.1
	9	45	32.1
	10	45	32.1
	11	45	32.1
	12	45	32.1
Abandoned buildings	4	45	34.6
	5	45	37.9
	6	45	38.4
	7	45	38.8
	8	45	38.8
	9	45	38.8
	10	45	38.8
	11	45	38.8
	12	45	38.8

The noise modelling indicates that the Nordex 117/2400 turbine has the same impacts as the turbines modelled in the original noise impact study conducted in March 2010. There are no new or additional noise impacts.

The noise impact that is predicted at Rietfontein, Jagersfontein and Matjiesfontein noise sensitive receptors did not meet the rating limit requirements in SANS 10103:2008 (Version 6 - The measurement and rating of environmental noise with respect to annoyance and to speech communication). The modelling is thus consistent with the original modelling. The impact as stated in the original report is thus the same (low impact after mitigation measures implemented) It is recommended that a noise impact remodelling be conducted when the micro-siting of turbines is finalised.

If any further information is required please feel free to contact me.

Thanking you

B. Williams