Environmental Impact Assessment of the proposed amendment to the Environmental Authorisation for the Mainstream Renewable Power South Africa Wind Energy Project near Victoria West in the Northern Cape

DEA Ref Number: 12/12/20/1788 and 12/12/20/1788/AM1

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1. INTRODUCTION

Mainstream Renewable Power South Africa (hereinafter referred to as Mainstream) is proposing to construct a renewable energy facility in the Ubuntu Local Municipality and the Pixley KaSeme District Municipality, 25 km of Victoria West and 10 km from the Hutchinson Settlement, Northern Cape Province. As per the prevailing environmental legislation in force at that time (i.e. the Environmental Impact Assessment (EIA) Regulations of 2006 promulgated under the National Environment Management Act (NEMA) (Act No. 107 of 1998)), an Environmental Impact Assessment (EIA) was undertaken during 2010 to 2011 for the proposed renewable energy facility (ERM, 2011), which included a wind energy facility (WEF) and a solar energy facility, and received Environmental Authorisation (EA) from the National Department of Environmental Affairs (DEA) on 10 November 2011 (DEA Reference number: 12/12/20/1788, NEAS Reference number: DEAT/EIA/12225/2011). Subsequently, a non-substantive amendment process was followed and an amended EA was issued on 10 October 2014 (DEA Reference number: 12/12/20/1788/AM1). The non-substantive amendment entailed changing the EA holder's details and extending the validity period of the EA for two years.

Mainstream now wishes to apply for a substantive amendment to the EA issued to ensure that what is proposed on site is aligned with the EA and the conditions contained therein. The Council for Scientific and Industrial Research (CSIR) has been appointed by Mainstream to manage the required amendment process. The declaration of the Environmental Assessment Practitioner (EAP) who compiled the Amendment Report is included in Appendix A of this report.

2. LEGISLATIVE REQUIREMENTS

3.1 Transitional arrangements

As stated above, the EA received was issued in 2011 and the assessment process commenced under the EIA Regulations of 2006. As per Regulation 52 Section 2 of the EIA Regulations 2014, the EA issued in terms of the 2006 Regulations is regarded as EA issued in the 2014 EIA Regulations. Therefore, to amend the EA, the provisions set out in the EIA Regulations 2014 must be followed.

3.2 Amendment process requirements

In terms of Section 31 and 32 of the 2014 EIA Regulations, Mainstream wishes to apply for substantive amendments[1] to the EA issued. Section 31 (Part 2) of the Regulations states that:

"An environmental authorisation may be amended by following the process prescribed in this Part if the amendment will result in a change to the scope of a valid environmental authorisation where such change will result in an increased level or nature of impact where such level or nature of impact was not-

(a) assessed and included in the initial application for environmental authorisation; or
(b) taken into consideration in the initial environmental authorisation;

[1] *Where a change in scope occurs and where such change will result in an increased level or nature of impact*

and the change does not, on its own, constitute a listed or specified activity".

In term of subsection (a) above, the initial EIA assessed a much larger development, whilst the EA approved a smaller project footprint (this is discussed in more detail in Section 3 below). The proposed amendments (outlined in Section 3 below) were not taken into consideration in the initial EA issued (as per subsection (b) above) and would therefore require that a "substantive" amendment process be followed. Based on the previous EIA undertaken and the subsequent EA issued, the proposed changes do not constitute listed activities on their own since the construction of the wind farm was, inter-alia, approved in the EA through Item 1(a) of Government Notice Regulation (GNR) 387, which states "*the construction of facilities or infrastructure, including associated structures and infrastructure, for the generation of electricity where (i) the electricity output is 20 MW or more*". The purpose of the report is to identify and assess the potential additional impacts that may be associated with the proposed substantive amendment.

As per Section 32 of the EIA Regulations which outlines the process and consideration of application for amendment, the following is required:

> *The holder must-*
>
> *(a) within 90 days of receipt by the competent authority of the application made in terms of regulation 31, submit to the competent authority a report, reflecting-*
>
> *(i) an assessment of all impacts related to the proposed change;*
>
> *(ii) advantages and disadvantages associated with the proposed change;*
>
> *(iii) measures to ensure avoidance, management and mitigation of impacts associated with such proposed change; and*
>
> *(iv) any changes to the EMPR;*
>
> *which report-*
>
> *(i) had been subjected to a public participation process, which had been agreed to by the competent authority, and which was appropriate to bring the proposed change to the attention of potential and registered interested and affected parties, including organs of state, which have jurisdiction in respect of any aspect of the relevant activity, and the competent authority, and (ii) reflects the incorporation of comments received, including any comments of the competent authority.*

This report will be distributed to Interested and Affected Parties (I&APs) for a 30-day commenting period (as per Section 32 of the EIA Regulations) where after it will be submitted to the DEA for decision-making (Section 32 (a) of the EIA Regulations).

3. APPROVED RENEWABLE ENERGY FACILITY AND PROPOSED AMENDMENT

Mainstream received EA from the DEA to construct a renewable energy facility in the Ubuntu Local Municipality and the Pixley KaSeme District Municipality, Northern Cape Province. The proposed facility is located 25 km east-south-east of the town Victoria West and 10 km south-east of the Hutchinson Settlement, Northern Cape (Figure 1). The farm portions that were assessed as part of the EIA are:

- Portions 1 and 2 of Bultfontein Farm 217;
- Portion 1 of Kleinfontein Farm 265;
- Remainder of Kleinfontein Farm 93;
- Remainder of Bulthoudersfontein Farm 218; and
- Remainder of Wynandsfontein Farm 91.

The key components of the proposed renewable energy facility include the following:

- Wind turbine generators (WEF);
- Photovoltaic (PV) arrays;
- Internal and external electrical connections;
- Substation and associated transmission line;
- Access roads; and
- Additional infrastructure (includes a lay down area, a temporary sit compound area for contractors and a borrow pit).

Although the EIA undertaken assessed the whole renewable energy facility, as outlined in the bulleted points above, this report will only focus on the WEF component due to the fact that Mainstream is only proposing to amend the layout and generation capacity of the WEF described within the EIA and approved within the EA. In addition, the approved turbine locations occur on Portions 1 and 2 of Bultfontein Farm 217 (Figure 1) and the amended locations are also proposed on these farm portions, therefore, this assessment will only consider these farm portions.

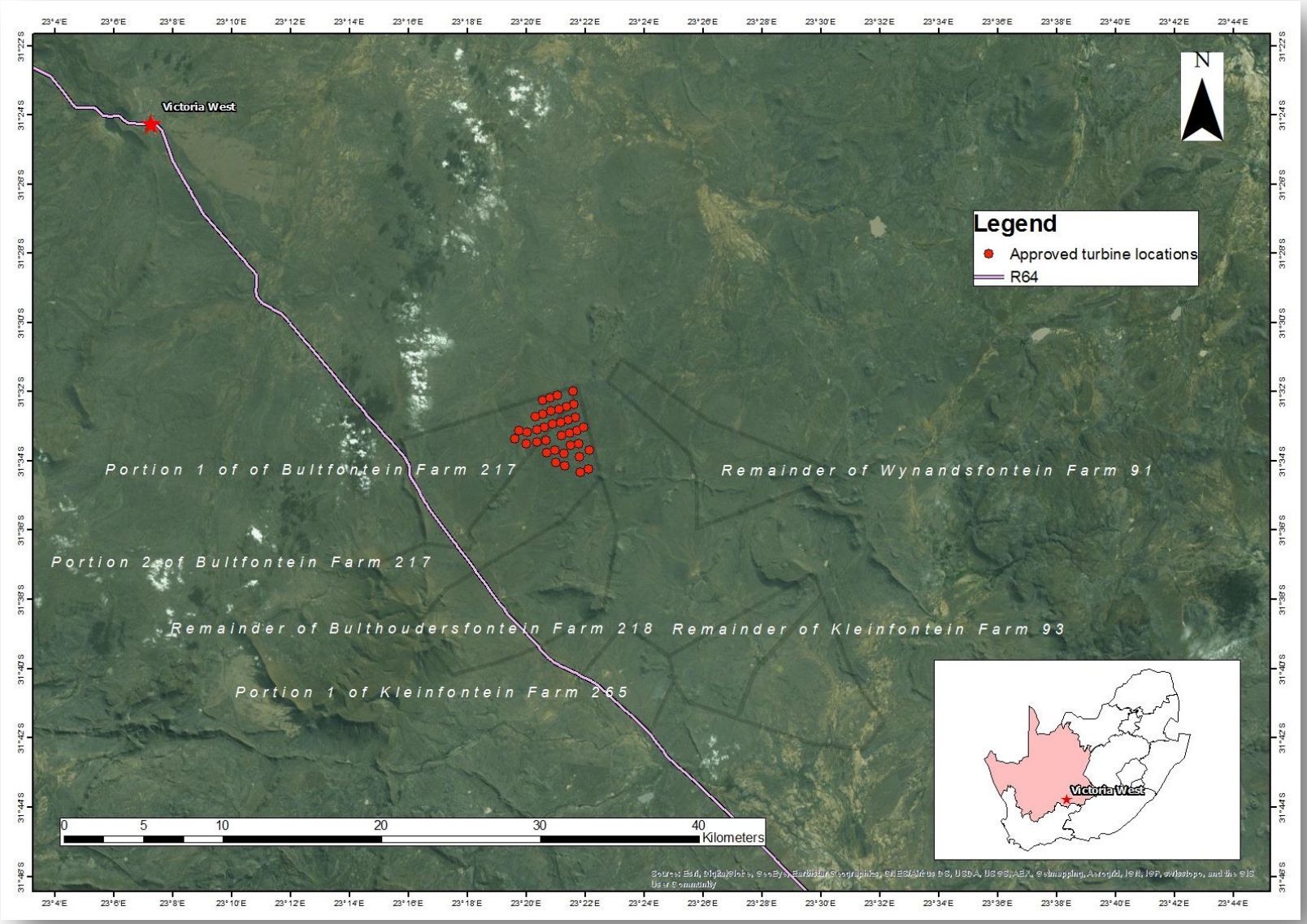

Figure 1. Location of the approved Wind Energy Facility near Victoria West in the Northern Cape

The EIA mostly considered a 'worst case scenario' whereby it was proposed that between 534 and 703 wind turbines would be constructed on site (ERM, 2011) (Figure 2). Based on the site specific constraints determined during the EIA process and the wind data available, the EIA concluded that the preferred Site Layout Alternative for the proposed development is Alternative 2 (shown in Figure 3 below), this layout was subsequently approved within the EA (Condition 1 of the EA).

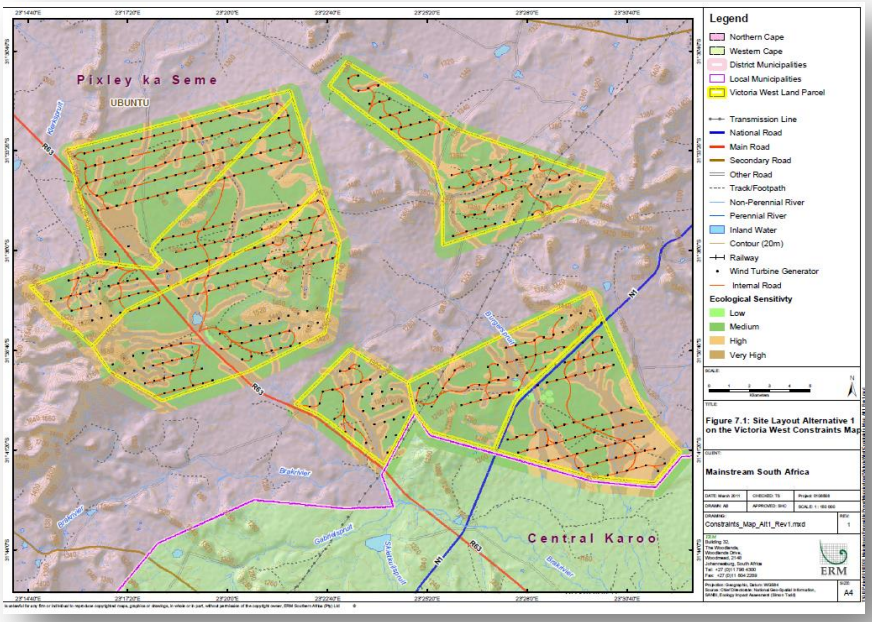

Figure 2. Site Layout Alternative 1 assessed within the original EIA (ERM, 2011)

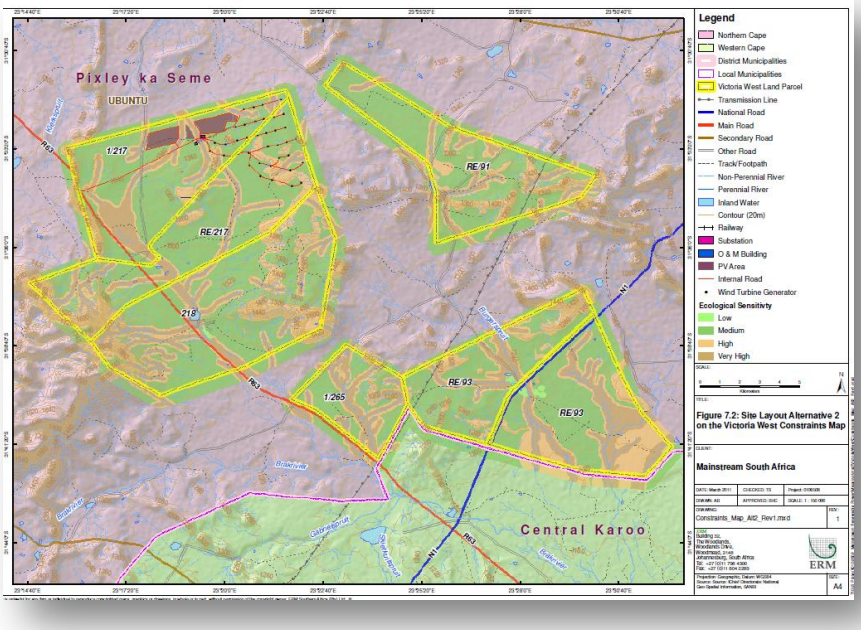

Figure 3. Site Layout Alternative 2 (deemed the preferred alternative) assessed within the original EIA (ERM, 2011)

Preferred Site Layout Alternative 2 authorised Mainstream to construct 37 turbines with a hub height from 100 m to 120 m and a rotor diameter (measured from blade tip to blade tip) range of between 80 m and 100 m (as detailed within the EIA report) (ERM, 2011). The generation capacity of the WEF is 95 megawatt (MW), based on the amount of turbines approved and the generation capacity of each turbine.

The main amendment proposed is to increase the WEF's generation capacity from 95 MW to 140 MW which, in turn, necessitates the following:

- Develop 70 wind turbines on site instead of 37 wind turbines approved as part of Site Layout Alternative 2; and
- Amend the approved layout to ensure the optimal placement of each individual turbine.

The approved locations of the turbines and the proposed amended and additional locations are shown in Figure 4 below (the coordinates of the amended locations are included in Appendix B of this report).

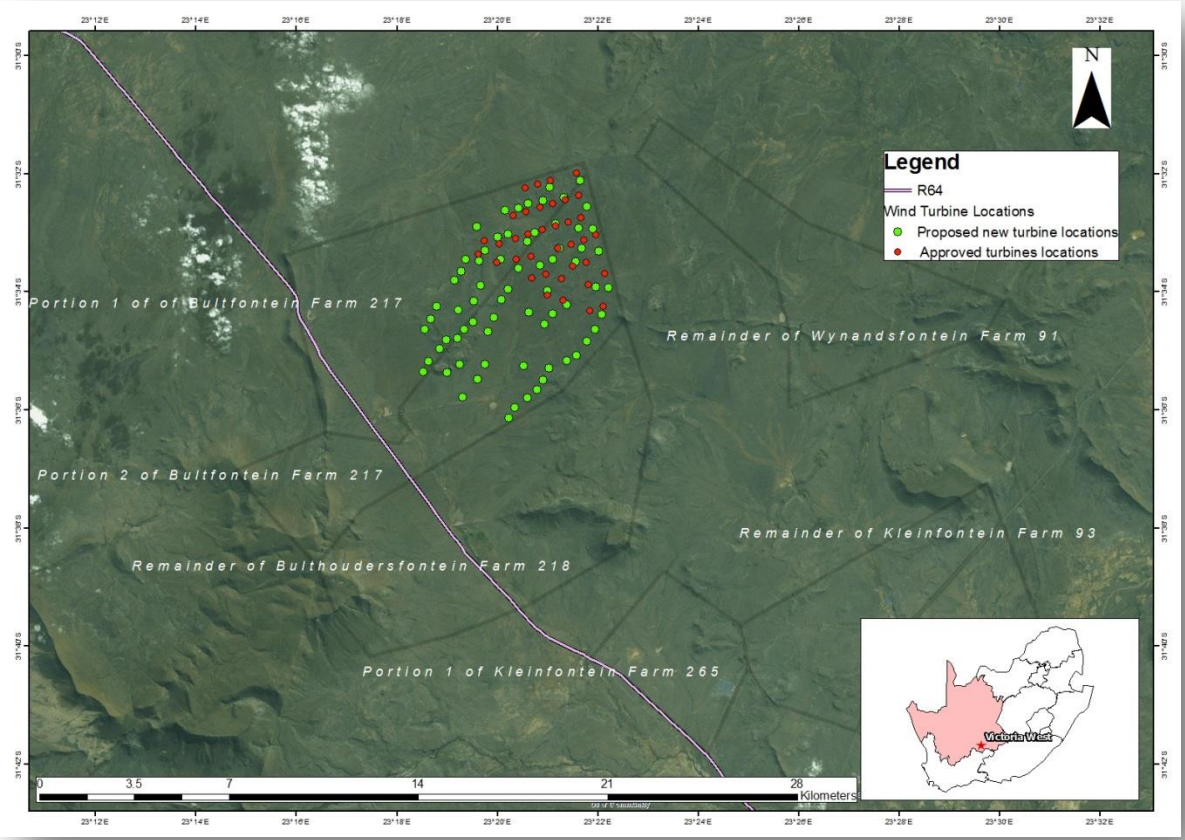

Figure 4. Proposed new and additional wind turbine locations (red) and previously authorised wind turbine locations (green).

4. IMPACT ASSESSMENT OF PROPOSED AMENDMENT

4.1 Summary of impact assessment previously undertaken

Various specialist studies were undertaken to assess the impacts associated with the proposed Mainstream renewable energy facility. Residual impacts show the significance of impacts following the implementation of the mitigation measures (this includes minimising the development footprint and selecting the Site Layout Alternative 2 (Figure 3) as the preferred layout for the project). The findings of the impact assessment undertaken as part of the previous EIA are summarised in tables below (Table 1 and Table 2) (ERM, 2011).

Table 1. Summary of pre-mitigation and residual impacts of the bio-physical and socio-economic environment during construction (ERM, 2011)

	Section	Impact	Pre-mitigation Significance	Residual Impact Significance
Flora and Fauna	7.1	Loss of natural vegetation	HIGH (-VE)	LOW (-VE)
	7.2	Impact on fauna	HIGH (-VE)	LOW (-VE)
Birds	8.2	Habitat loss – Destruction, disturbance and displacement	HIGH-MEDIUM (-VE)	MEDIUM (-VE)
Bats	9.1	Habitat loss	LOW (-VE)	LOW (-VE)
Soils, Surface and Groundwater	10.1	Loss of topsoil, compaction and erosion	MEDIUM (-VE)	LOW (-VE)
	10.2	Impact on surface and groundwater	LOW (-VE)	LOW (-VE)
Noise Impact	11.1	Construction noise	MEDIUM (-VE)	LOW - MEDIUM (-VE)
Cultural Heritage	13.1	Disturbance or damage to cultural heritage resources	HIGH-MEDIUM (-VE)	MEDIUM-LOW (-VE)
Socio-economic	14.1	Benefits to the local economy	MEDIUM (+VE)	MEDIUM (+VE)
	14.2	Increased social ills	LOW (-VE)	LOW (-VE)
	14.3	Disruption to agricultural activities	MEDIUM (-VE)	LOW (-VE)
	14.4	Loss of agricultural land	LOW (-VE)	LOW (-VE)
	14.6	Property prices and desirability of property	MEDIUM (-VE)	LOW (-VE)
Other Impacts	15.1	Dust and emissions	LOW (-VE)	LOW (-VE)
	15.2	Traffic	MEDIUM (-VE)	LOW (-VE)
	15.3	Waste and effluent	LOW (-VE)	LOW (-VE)
	15.4	Health and safety	LOW (-VE)	NEGLIGIBLE

Table 2. Summary of residual bio-physical and social residual impacts during the operational phase of the project (ERM, 2011)

	Section	Impact	Pre-mitigation Significance	Residual Impact Significance
	10.2	Impact on surface and groundwater	LOW (-VE)	LOW (-VE)
Noise Impact	11.2	Wind turbine noise during operation at boundary	MEDIUM-HIGH (-VE)	MEDIUM-LOW (-VE)
		Wind turbine noise during operation at sensitive receptors	MEDIUM (-VE)	LOW (-VE)
Visual Impact	12.1	Visual impact on fixed positions and temporary receptors	MEDIUM (-VE)	MEDIUM (-VE)
Cultural Heritage	13.2	Cultural heritage visual or sense of place	LOW-MEDIUM (-VE)	LOW (-VE)
Socio-economic	14.1	Benefits to the local economy	MEDIUM (+VE)	MEDIUM (+VE)
	14.2	Increased social ills	NEGLIGIBLE	NEGLIGIBLE
	14.3	Disruption to agricultural activities	LOW (-VE)	NEGLIGIBLE
	14.4	Loss of agricultural land	LOW (-VE)	LOW (-VE)
	14.5	Tourism activities (Positive)	LOW (+VE)	MEDIUM (+VE)
		Tourism activities (Negative)	LOW (-VE)	NEGLIGIBLE
	14.6	Property prices and desirability of property	LOW (-VE)	LOW (-VE)
Other Impact	15.1	Dust and emissions	LOW (-VE)	LOW (-VE)
	15.2	Traffic	LOW (-VE)	NEGLIGIBLE
	15.3	Waste and effluent	LOW (-VE)	NEGLIGIBLE
	15.4	Health and safety	LOW (-VE)	NEGLIGIBLE
	15.5	Shadow flicker	MEDIUM (-VE)	NEGLIGIBLE
	15.6	Electromagnetic interference	LOW (-VE)	NEGLIGIBLE
Flora and Fauna	7.1	Loss of natural vegetation	LOW (-VE)	LOW (-VE)
	7.2	Impact on fauna	MEDIUM (-VE)	LOW (-VE)
Birds	8.1	Collisions of birds with turbines	HIGH (-VE)	MEDIUM (-VE)
	8.2	Habitat loss – Destruction, disturbance and displacement	HIGH (-VE)	MEDIUM-HIGH (-VE)
Bats	9.1	Habitat loss – Destruction, disturbance and displacement	LOW (-VE)	LOW (-VE)
	9.2	Collision with turbines	HIGH (-VE)	MEDIUM (-VE)
	9.3	Barotrauma	HIGH (-VE)	MEDIUM (-VE)
Soils, surface and groundwater	10.1	Loss of topsoil, compaction and erosion	LOW (-VE)	LOW (-VE)

4.2 Specialist input of proposed amendments

Specialists have been appointed to provide comment on the proposed amendment. The appointed specialists are detailed in Table 3 below. The specialists were requested to confirm whether the original assessment ratings and management actions contained in the EIA dated June 2011 remain unchanged, or whether these are positively or negatively impacted upon. The amended turbine locations, adherence to the management measures of the original EIA, and the comments received from the various specialists are discussed below. Please refer to Appendix C of this report for specialist letters confirming their findings.

Table 3. Appointed specialists

Specialist	Consultancy	Field of study
Henry Holland	Private Consultant	Visual Impacts
Prof Brian van Wilgen	Private Consultant	Terrestrial Ecology
Wouter Fourie	PGS Heritage	Archaeology, Palaeontology and Cultural Landscape
Stephen van Staden	Scientific Aquatic Services	Freshwater Aquatic Ecosystems
Johann Lanz	Private Consultant	Soils and Agricultural Potential
Adrian Jongens	Jongens Keet Associates	Noise Impacts
Kate McEwan	Inkululeko Wildlife Services	Bats
Andrew Jenkins	Avisense	Avifaunal

4.2.1 Visual Impact

The visual impact assessment (VIA) assessed the Preferred Site Layout Alternative 2. The increase in the number of wind turbines may lead to the turbines being visible from more viewpoints. A summary of visual impacts identified as part of the EIA process are shown in the tables below (Table 4 and Table 5). The residual impacts following mitigation were considered to have a medium negative impact significance.

Table 4. Pre- and Post-Mitigation Significance: Visual Impact on fixed points (ERM, 2011)

Phase	Significance (Pre-mitigation)	Residual Impact Significance
Operation	MEDIUM (-VE)	MEDIUM (-VE)

Table 5. Pre- and Post-Mitigation Significance: Visual Impact on temporary receptors (ERM, 2011)

Phase	Significance (Pre-mitigation)	Residual Impact Significance
Operation	MEDIUM (-VE)	MEDIU M (-VE)

The main recommendations made within the EIA regarding visual impacts are the application of a 500 m buffer around farmsteads, district roads and external farm boundaries. The 500 m buffer around farmsteads has been adhered to and is reflected in Figure 5 below (Oberholzer & Lawson, 2011). Even though a 500 m has not been implemented around the farm boundary on the northern and eastern portions of the site, the closest neighbouring farm stead is 5 km away. In addition, it is Mainstream's internal policy to maintain a buffer of 800m and it is therefore considered that the amended wind turbine locations therefore do not go against the recommendation.

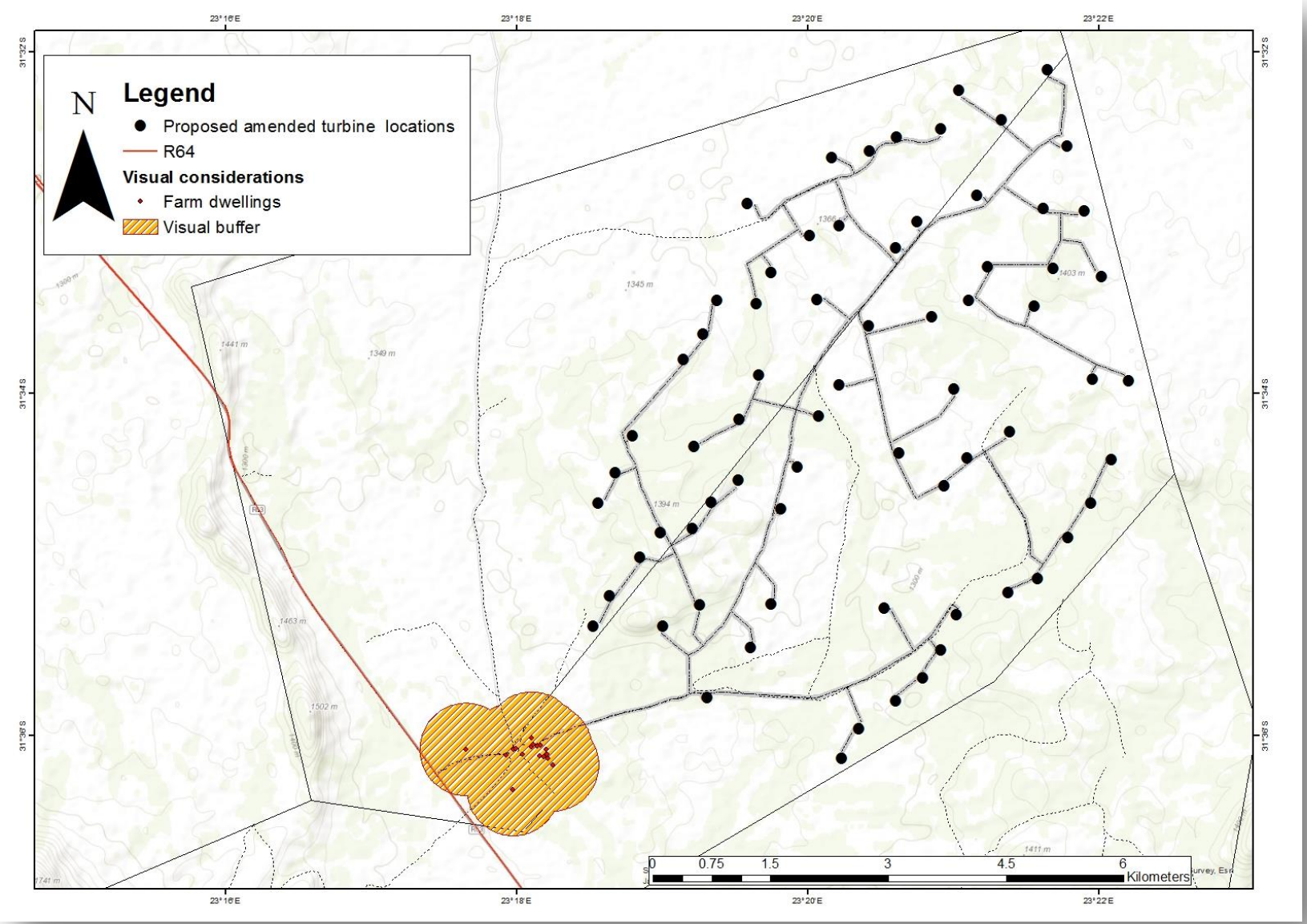

Figure 5. SPOT buildings (most likely farm dwellings) and 500 m visual buffer around the buildings.

Feedback from visual specialist

Visibility Analysis

The table below shows viewshed areas for the two layouts, as well as number of buildings that will potentially have views of wind turbines (the screening effect of buildings and vegetation is not taken into account) (Table 6). An area within 20 km of the wind turbines were used to calculate the viewsheds.

Table 6. Viewshed analysis

WEF Layout	Viewshed Area (within 20 km distance from turbines)	Visual Exposure (Number of Buildings Affected)			
		High	Medium	Low	Total
Authorised Layout with 37 Turbines	800 km^2	0	19	118	137
Amended Layout with 70 Turbines	980 km^2	16	4	143	163

Key viewpoints identified in the original report (Oberholzer and Lawson 2011) are either outside both viewsheds or are in low visual exposure areas. Their visual exposure ratings are very similar (Table 7).

Table 7. Key viewpoints and visual exposure

Viewpoint	Site	Visual Exposure to the Authorised Layout	Visual Exposure to the Amended Layout
V1	R63 Victoria West outskirts	Low	Low
V2	R63 Hutchinson rail bridge	Not Visible	Not Visible
V3	Mon Desir on district road near landing strip	Low	Low
V4	Vlakfontein turnoff on district road	Low	Low
V5	Roggefontein gate on district road	Not Visible	Not Visible
V6	N1 / district road intersection (Rondawel)	Not Visible	Not Visible
V7	N1 cutting near Blouberg	Not Visible	Not Visible
V8	N1 / R63 intersection (Skietkuil Resort)	Not Visible	Not Visible
V9	Loskop farmstead near R63	Low	Low
V10	R63 road cutting at power lines	Low	Not Visible
V11	R63 Uitvlugfontein	Not Visible	Low
V12	Hermanskraal on farm road	Not Visible	Not Visible
V13	Skanskraal gate on farm road	Not Visible	Not Visible
V14	Modderfontein farmstead	Low	Low
V16	Karoo Gastehuis on district road / N1 intersection	Not Visible	Not Visible

Discussion

The viewshed for the amended turbine layout (Figure 6) is larger than for the authorised layout, which is to be expected since there are almost twice as many turbines and the new layout extends further to the south. However, the 16 buildings in high visual exposure areas for the amended layout are all at a farmstead (Bultfontein) located on the same property as the wind turbines (see Figure 7 and Figure 8). Potential impact on views from the key viewpoints identified in the VIA report for the authorised layout will remain much the same for the amended layout. The Victoria West Nature Reserve is still located outside the viewshed as is the Horseshoe mountain. Hutchinson, the small settlement north-west of the proposed wind farm site, is located outside both layout viewsheds, while some parts of Victoria West are inside both viewsheds. A slightly longer section of the R64 will be within the amended layout viewshed than in that of the authorised layout viewshed and visual exposure will be high for a 10 km section of the R64 (approximately 6 minutes at 100 km/h) for the amended layout (Figure 8). Visual exposure for the R63 to the authorised layout (Figure 7) was at most moderate since it is further away from the nearest turbine location in that layout. Views from the N1 will be very limited for either layout and visual exposure will be low. There are no buildings within 500 m (distance used as a setback in the original report) of a wind turbine location in the amended layout. As noted above, Mainstream implements a standard buffer of 800 m.

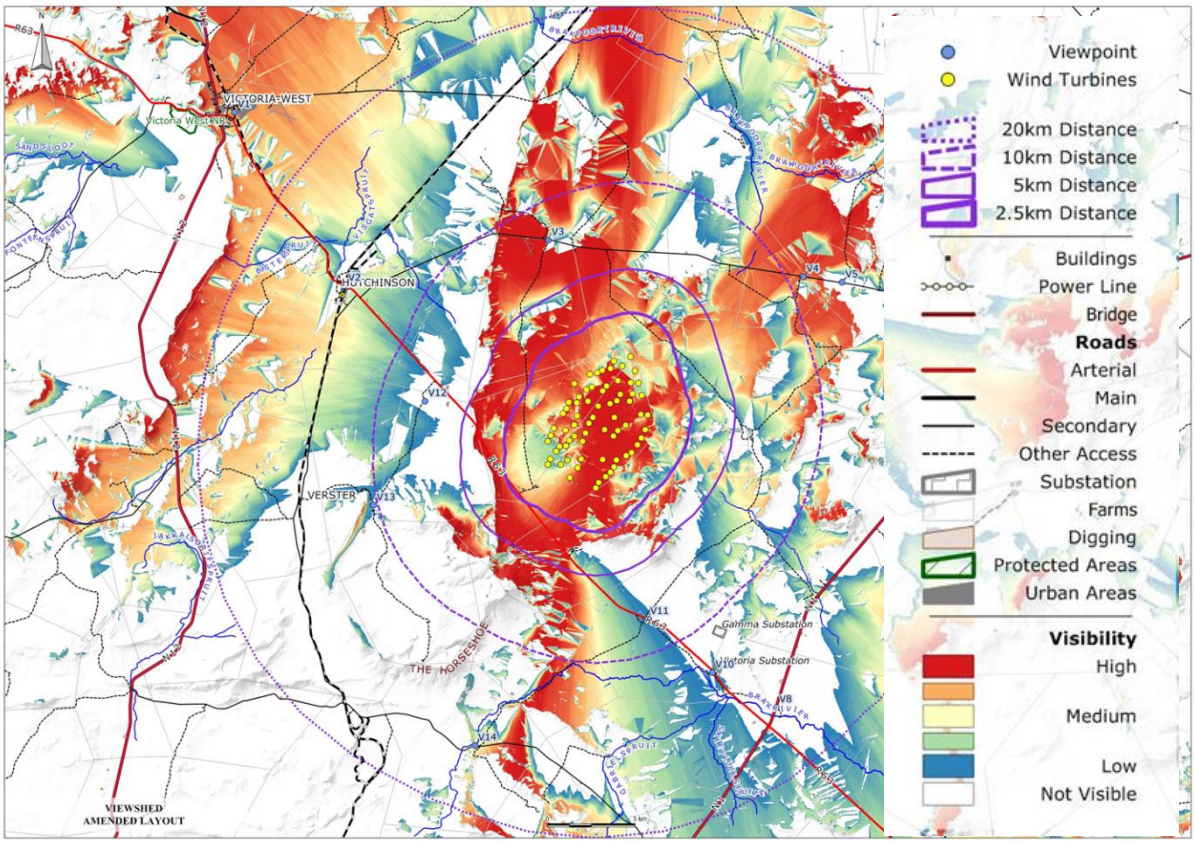

Figure 6. Cumulative viewshed for the Amended Layout of 70 wind turbines.

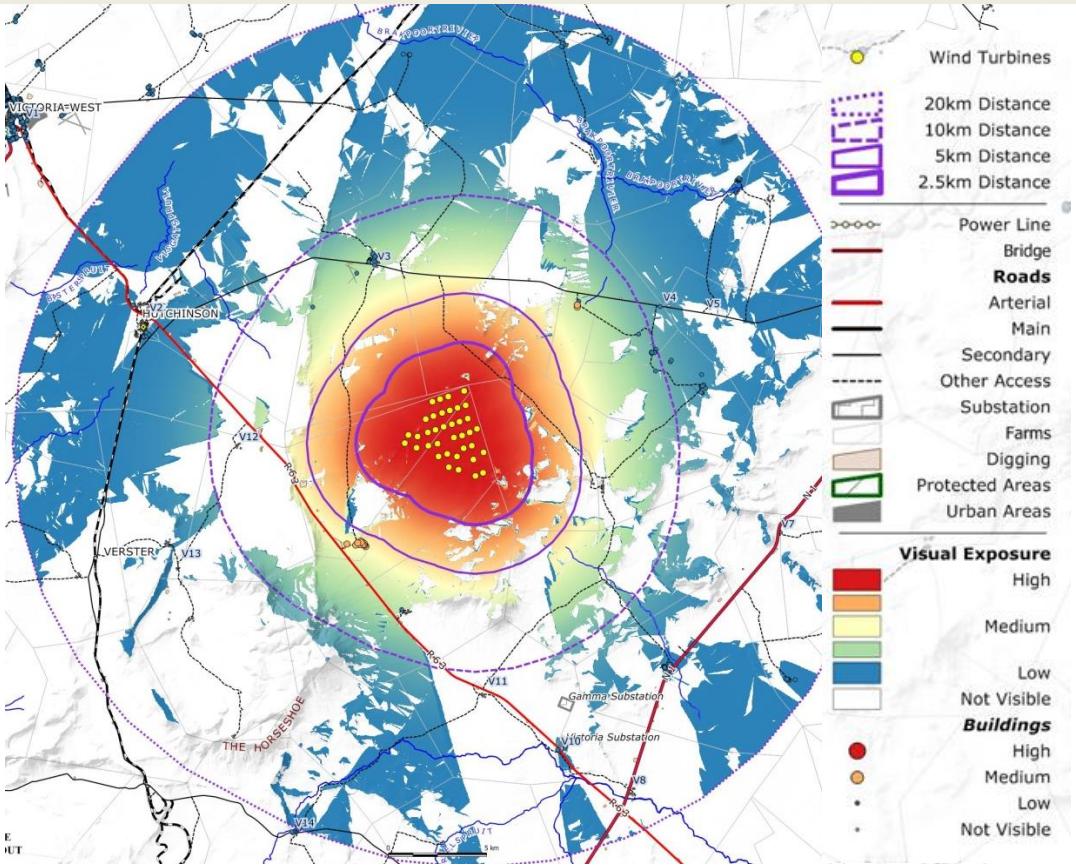

Figure 7. Visual exposure to wind turbines in the Authorised Layout for sensitive visual receptors in the region

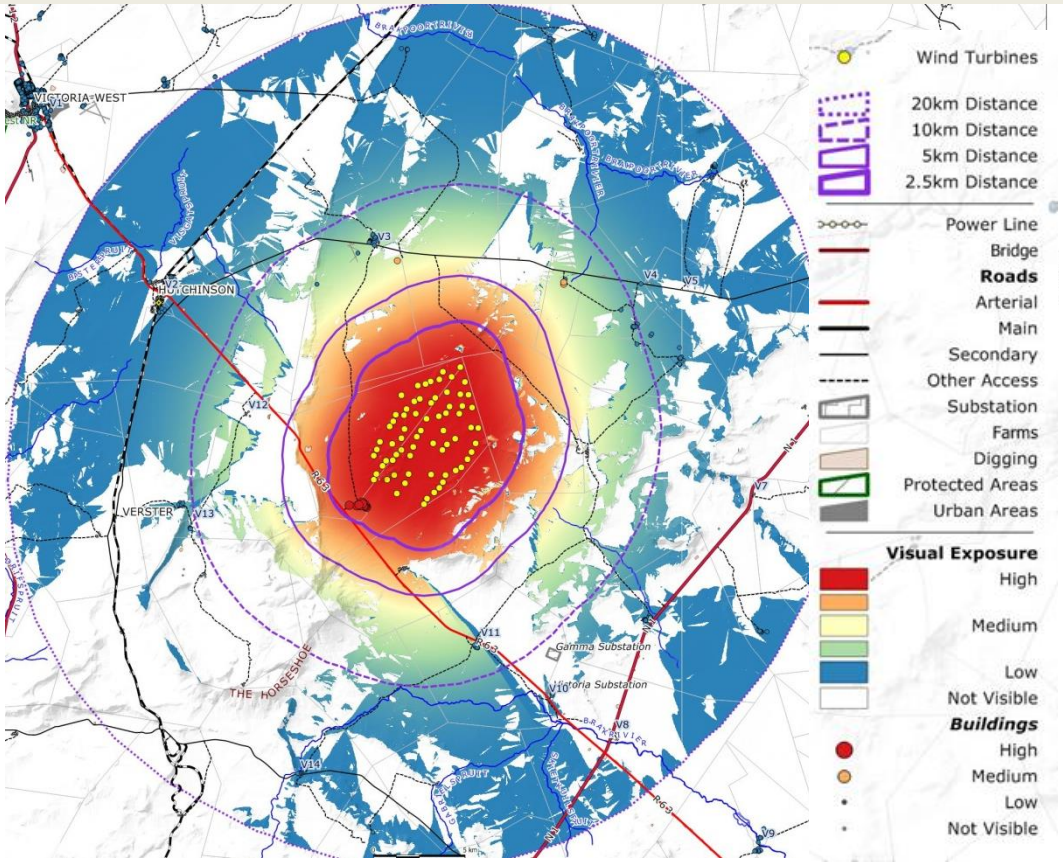

Figure 8. Visual exposure to wind turbines in the Amended Layout for sensitive visual receptors in the region.

Conclusions

The ratings for visual assessment criteria as set out in the original VIA report remain the same since the viewpoints identified in that report has the same potential visual exposure (Visibility rating in the original report) to the amended layout. The Bultfontein farmstead will experience high visual exposure to turbines in the new layout but it is located on the same property as where the original wind turbines would have been located (which indicate that one can assume that the owners/occupants are aware of the situation). Medium-high ratings for Visibility and Landscape Integrity will remain the same and the overall impact rating (Impact Intensity) of medium for the authorised layout will be therefore remain the same for the amended layout. The overall significance of the potential visual impact remains medium.

The conclusion then is that the changes in the wind farm layout as indicated in the amendment report will not alter the significance of the potential visual impact as assessed in the original VIA Report.

4.2.2 Impact on Terrestrial Ecology

The Vegetation of South Africa the natural vegetation found on the Victoria West site is Eastern Upper Karoo (NKu4), found on the open plains and Upper Karoo Hardeveld (NKu2), found on the rocky slopes and crests of the hills. The conservation status of these vegetation types is Least Threatened; however very little of the above mentioned vegetation types fall within protected areas (Simon Todd Consulting, 2010). The development is predominantly confined to the less sensitive Bultfontein, which consists primarily of Eastern Upper Karoo Vegetation (Simon Todd Consulting, 2010).

Of the above mentioned impacts, major impacts are likely to be related to the road network, as this accounts for the majority of the land required for the development. In addition, the continuous linear nature, parallel direction and high density of roads will pose a compound barrier to the dispersal and movement of many species. Although the construction of the wind turbines will probably create a greater severity of disturbance due to the large foundation each turbine requires, this impact is localised and the turbines are well dispersed relative to the size of the development footprint, thereby allowing biota to move freely among the turbines. However, since the roads must allow access to each wind turbine, there is little that can practically be done to reduce the extent of the roads' impact (Simon Todd Consulting, 2010).

The ecological impact assessment's findings for the construction and operational phases on loss of natural vegetation and fauna are summarised below (Table 8 and Table 9).

Table 8. Pre- and Post-Mitigation Significance: Loss of natural vegetation (ERM, 2011)

Phase	Significance (Pre-mitigation)	Residual Impact Significance
Construction	HIGH (-VE)	LOW (-VE)
Operation	MEDIUM (-VE)	LOW (-VE)

Table 9. Pre- and Post-Mitigation Significance: Impacts on Fauna (ERM, 2011)

Phase	Significance (Pre-mitigation)	Residual Impact Significance
Construction	HIGH (-VE)	LOW (-VE)
Operation	LOW (-VE)	LOW (-VE)

The key mitigation measures proposed as part of the assessment pertaining to the proposed amendment are summarised below (Simon Todd Consulting, 2010):

- Development within the drainage lines should be avoided. No turbines should be placed within these areas and only the minimum number of roads required should traverse the drainage lines (even if this means service vehicles using the site will need to travel further);
- No turbines should be placed within areas mapped as Very High Sensitivity and as few roads as possible should traverse it; and
- During construction in areas classified as high sensitivity areas, an ecologist should be consulted to ensure micro-siting of turbines minimises damage to or loss of sensitive habitat.

Figure 9 below shows the ecological sensitivity map that was duplicated using the information contained in the original ecological impact assessment (Simon Todd Consulting, 2010). A 100 m buffer has been placed around major drainage lines and the area within the buffer is deemed to have a Very High Sensitivity. The High Sensitivity areas are based within a buffer area of 150 m around the major drainage lines as well as other terrestrial features such as “koppies”. Several other minor drainage lines are present in the area and were deemed to have a Medium Sensitivity. In most cases, where proposed internal access roads will traverse Very High Sensitivity areas, these roads will coincide with the routing of existing farm roads on site (Figure 9).

Within the EA, Condition 57 stated that “all turbines and PV arrays must be located at least 100 m from the edge of any highly sensitive areas”. Based on the above mitigation measures and sensitivity map below (Figure 9) the proposed amendments do not go against any recommendation made by the specialist or conditions contained within the EA.

Feedback from ecologist

The original assessment provided predicted impacts for the development of between 534 and 703 wind turbines. However, an authorisation for only 37 wind turbines was issued. There is now an application to increase this to 70 wind turbines. As this is still only 10% of the number of turbines originally proposed, and for which potential impacts were assessed, the proposed “additional” wind turbines will not change the impact assessments. These impacts include a long-term loss of natural vegetation at the sites where the turbines are erected, and along access roads, and disturbance of fauna during the construction phase, which will be reduced to a small impact during the operational phase.

The proposed mitigation measures should remain the same. These include that development within the drainage lines should be avoided; that no turbines should be placed within areas mapped as Very High Sensitivity and as few roads as possible should traverse it; and that an ecologist should be consulted to ensure micro-siting of turbines minimises damage to or loss of sensitive habitat (as specified in more detail in the above-mentioned report).

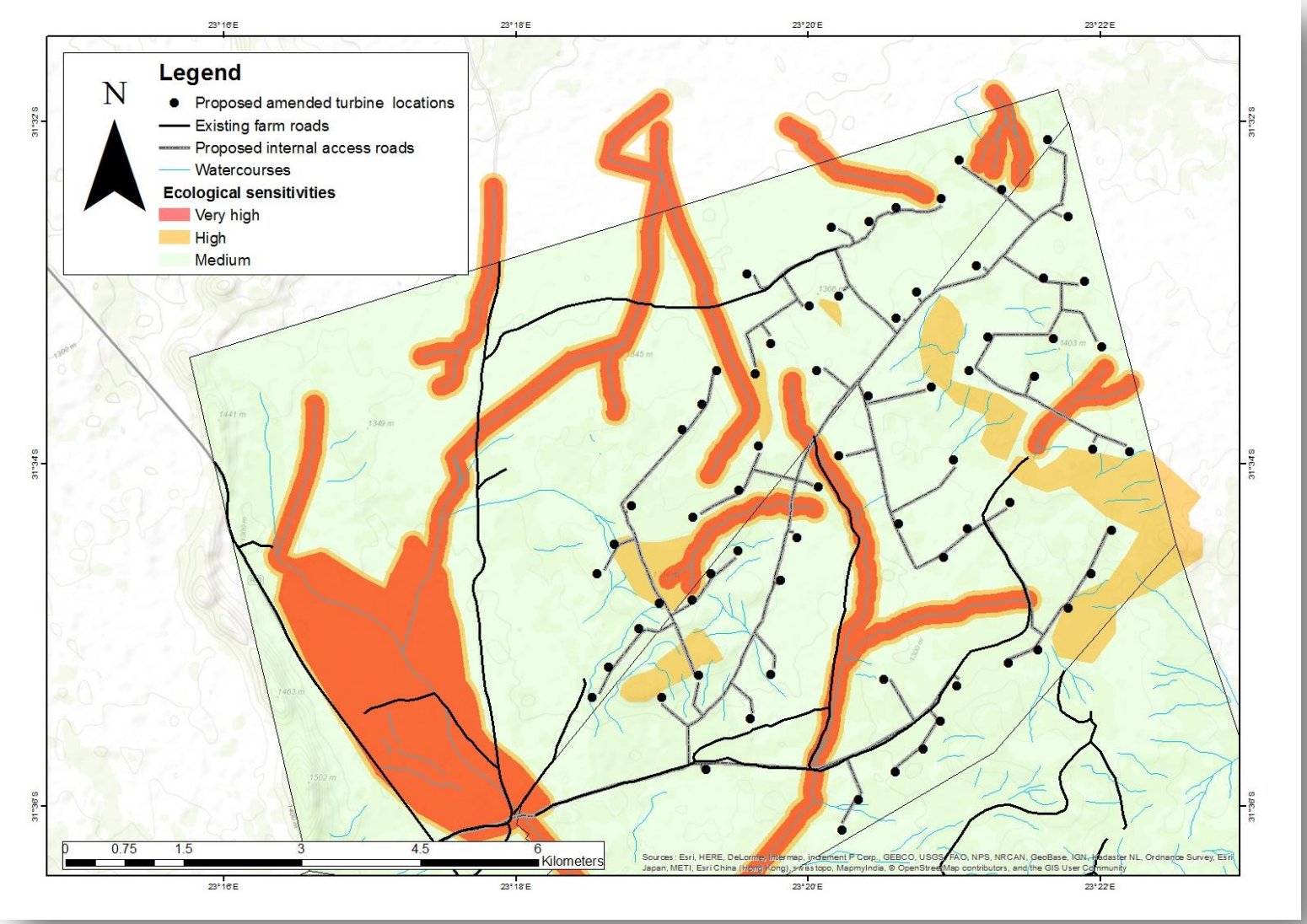

Figure 9. Proposed amended locations of the wind turbines and internal access roads in relation to ecological sensitive areas identified on site.

4.2.3 Impact on the Heritage Environment

The Heritage Impact Assessment (HIA) assessed the turbine locations of the Site Layout Alternative 2. The assessment found that no buildings of historical significance and official scenic routes were present in the vicinity of the site. The built environment will not be impacted on since there are no structures on the REF site itself or in the vicinity of the facility (this is also shown in Figure 5). No graves were recorded during the survey but according to the owner of the property, there are two graves close to a possible access route (ACO Associates, 2011). Proposed access roads were noted to have a significant impact on archaeology. Therefore, final road layouts must be assessed during the Environmental Management Programme (EMPr) and issues resolved by changes to alignments of the roads or sampling of archaeological material (ACO Associates, 2011). The table below shows the impact significant on heritage interests pre and post mitigation (Table 10).

Table 10. Pre- and Post-Mitigation Significance: Damage or destruction to cultural heritage interests (ERM, 2011)

Phase	Significance (Pre-mitigation)	Residual Impact Significance
Construction	HIGH- MEDIUM (-VE)	LOW - MEDIUM (-VE)
Operation	N/A	N/A

The mitigation of impacts on cultural heritage interests can be achieved at the design phase by avoiding sensitive areas and by undertaking the following (ACO Associates, 2011):

- Mitigation of palaeontological heritage can be achieved by ensuring that surfaces, trenches and deep rock excavations are checked by a palaeontologist;
- Avoid disturbance or damage to buildings and structures older than 60 years by maintaining 500 m buffers around the on-site dwellings;
- Avoid inland water bodies (100 m buffer) and rivers (200 m buffer); and
- The hill in the south eastern corner of the REF must be avoided as there are several discrete archaeological sites distributed across the hill that may be of high scientific value.

Figure 10 below shows the heritage features that were identified as part of the previous HIA. The figure shows that no turbine locations are proposed at the heritage features identified but it should be noted that during the heritage assessment only the Site Layout Alternative 2 wind turbine positions were assessed. Therefore, the presence of additional heritage features close to or at the proposed amended wind turbine locations is unknown.

From a paleontological point of view, it was recommended within the study that the following be undertaken (Almond, 2011):

1. Before any major construction (i.e. substantial bedrock excavation) commences a thorough field scoping survey of representative natural and already existing artificial rock exposures (e.g. dams, road cuttings) within the study region as a whole should be undertaken by a qualified palaeontologist to identify specific areas or horizons of high palaeontological sensitivity on the ground.

2. On the basis of the initial field scoping, a realistic, collaborative mitigation programme and protocol should be drawn up by the palaeontologist in conjunction with the developer and SAHRA so that any important fossil heritage on site may be conserved cost-effectively. This mitigation would normally involve the recording and judicious collection of fossil material within the development area as well as the recording of relevant geological data, before or during the construction phase of the development. The palaeontologist involved in mitigation work will be required to obtain a palaeontological collection permit from SAHRA and to arrange a suitable repository for any fossils collected (e.g. Iziko: South African Museum, Cape Town).

Note that for those sites or areas of inferred high palaeontological sensitivity, repositioning of infrastructure should not be necessary except in exceptional cases, but selective monitoring of substantial excavations during development by a specialist palaeontologist might be required.

Feedback from heritage specialist

The nature of heritage resources has shown that it would require a cost prohibitively detailed survey to identify every heritage resources, be it palaeontological, archaeological or historical inside the study area. The methodology utilized in the 2011 study is still considered the best practical option, through a selective field survey focusing on the identification of obvious heritage resources and the identification of landforms that is associated with certain heritage features. A mitigation and monitoring program is then proposed for implementation during the pre-construction and construction phase.

The evaluation of the original 2011, confirmed the methodology utilised during field work. It was decided to do an additional field assessment linked to the assessment of the electrical infrastructure Basic Assessment for the WEF project (undertaken as part of a separate process). A site visit was conducted on the 29th of February 2016, with the aim of confirming the findings of the 2011 study related to the increase of lithic scatters associated with hills and ridges. Approximately 30 km was covered by foot and vehicle and focused on the central plato of the study area where new turbine positions were planned. Due to the terrain only a few turbine positions could be accessed during the day on site. The field work did however confirm that a general background scatter of lithics occur over the study area. Some higher densities of lithics were identified in areas that were thought to be void of such finds. The increase in the amount of turbines will increase the probability of heritage features occurring in the foot print areas of the turbines. This will however not elevate the impact significance and with the implementation of the recommendations as proposed in the 2011 study will keep the residual impact to the same levels as previously assessed.

It is recommended that the mitigation measures as proposed in the original study still be implemented and that the following overarching recommendation must be implemented:

“The presence of additional heritage features close to or at the proposed amended wind turbine locations is unknown. It is therefore recommended that prior to the determination of the final layout and construction an archaeologist must undertake a site visit to each proposed wind turbine location. Any specific mitigation measures identified following the pre- construction walk down must be included in the updated EMPr.”

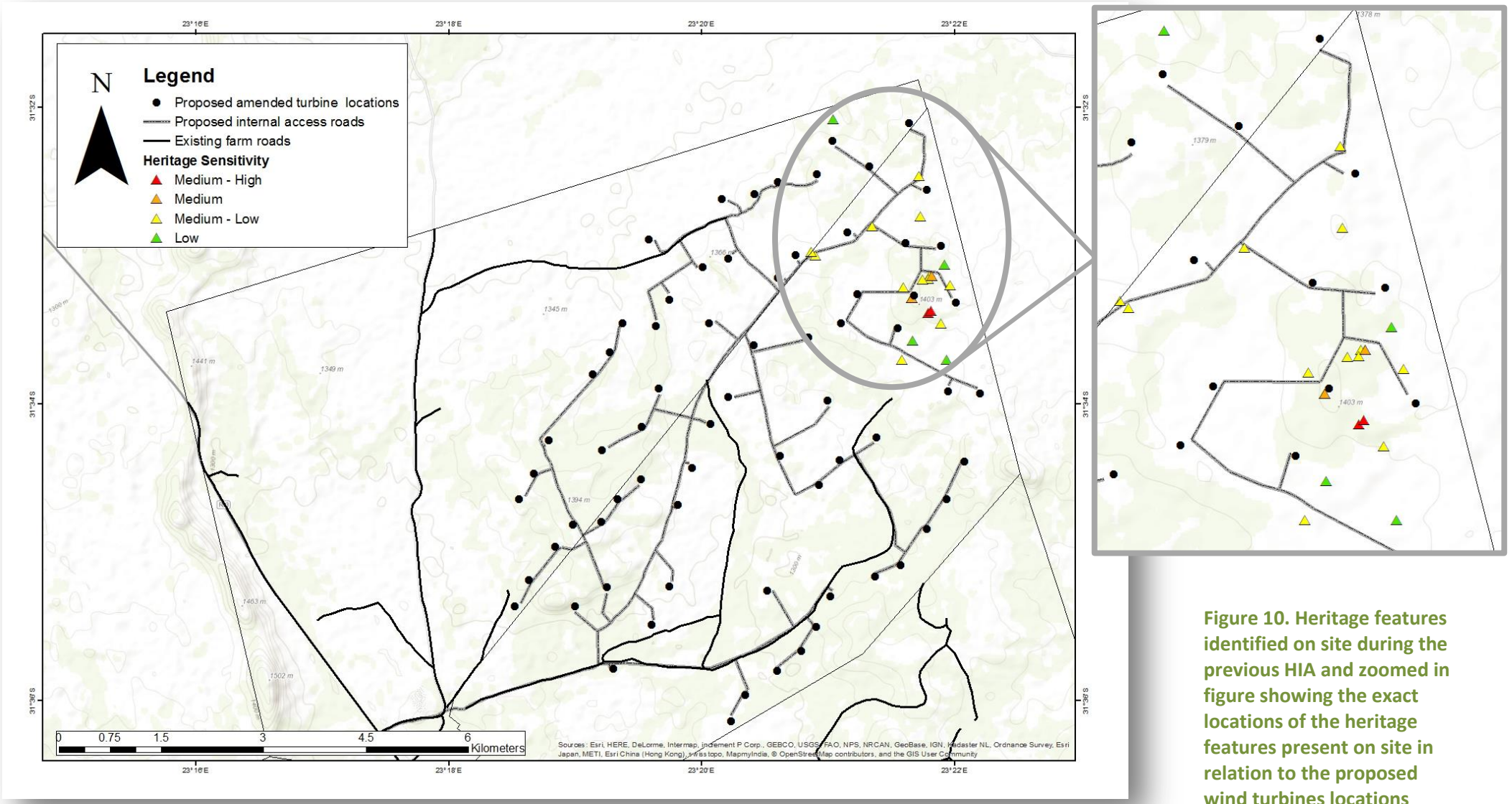

Figure 10. Heritage features identified on site during the previous HIA and zoomed in figure showing the exact locations of the heritage features present on site in relation to the proposed wind turbines locations

4.2.4 Impact on Freshwater Ecology

A study focussing specifically on the freshwater ecology was not undertaken as part of the initial EIA but a description of the aquatic features president on site was included within EIA and an impact assessment undertaken and mitigation measures proposed to manage any potential impacts to these features.

The only conspicuous drainage line on Bultfontein is the Brakrivier which runs parallel to the R63 (this river is shown as one of the NFEPA rivers in Figure 11, on the western portion of the farm). This river is classified as Category C: Moderately Modified. The aquifer beneath the site is classified as a fractured and major aquifer with moderate vulnerability and high susceptibility (ERM, 2011). Areas cleared in preparation for the establishment of the REF are prone to erosion by wind or rain and may increase the intensity and volume of surface water runoff as a result of a decrease in water infiltration, which in turn may impact the non-perennial drainage channels (ERM, 2011).

The surface water features present on site are shown in Figure 11. All major drainage lines have been allocated a buffer of 100 m, which have been identified to have a very high sensitivity as part of the terrestrial ecological study (discussed in Section 3.2 above), and have been excluded from the proposed amended turbine locations. The table below (Table 11) shows the impact significant on surface and ground water pre and post mitigation. The main mitigation measures to manage erosion impacts to drainage lines and manage contamination of surface or groundwater are (ERM, 2011):

- Proper drainage controls such as culverts, cut-off trenches must be used to ensure proper management of surface water runoff to prevent erosion;
- Cleared or disturbed areas will be rehabilitated as soon as possible to prevent erosion; and
- Fuel, oil and used oil storage areas will have appropriate secondary containment (i.e. bunds).

Table 11. Pre- and Post-Mitigation Significance: Impacts on surface and groundwater (ERM, 2011)

Phase	Significance (Pre-mitigation)	Residual Impact Significance
Construction	LOW (-VE)	LOW (-VE)
Operation	LOW (-VE)	LOW (-VE)

Feedback from the freshwater ecologist

The following points highlight the key findings of the site assessment and subsequent review:

1. One primary river was identified, namely the Brak River, located south of the R63 provincial road. However, an unnamed tributary of the Brak River flows from the north-west of the Bultfontein farms, traversing the Bultfontein farm portions on which the proposed turbines will be located, across the R63, and enters the Brak River at a point approximately 5,7km north-west of the junction of the R63 and N1 highway;

2. Although the EIA Amendment report makes reference to this river being mapped, the map referred to is included in the Impact on Terrestrial Ecology section of the report, which may lead to

confusion of the reader in the findings and discussion of the freshwater ecological aspects. Furthermore, the referenced map does not clearly indicate the Brak River or its unnamed tributary, thus making it difficult for the reader to ascertain where these riverine resources are located in relation to the proposed development. It is therefore recommended that an additional map, clearly indicating the locality of the Brak River, its unnamed tributary and associated ephemeral drainage lines, in relation to the proposed turbines be included in the discussion on freshwater ecology; *(CSIR note, this figure has been included as Figure 11 below)*.

3. The map of the riverine resources included in the section on Terrestrial Ecology as discussed above, appears to have been developed utilising available topographic maps of the area, and does not depict the extent of the riparian zones associated with the watercourses on the study area. It is recommended therefore that, as a minimum, a desktop delineation and classification of these resources using available aerial photographs and/or digital satellite imagery be undertaken, and that a map be provided of these delineated watercourses and associated riparian zones depicting the proposed locality of the turbines in relation to the features, in order to aid the relevant authorities in considering the potential impacts of the proposed turbines on the watercourses;

4. No national or regional desktop information as it pertains to the freshwater ecology of the area is provided, as available on the National Freshwater Ecosystem Areas (NFEPA) Database. This information is considered important to ensure that the project takes into consideration national and regional ecological conservation targets and to assist in the impact significance determination; *(CSIR note, these features have been included as Figure 11 below)*.

5. Whilst a full assessment of the Present Ecological State, ecological functioning and characterisation according to Ollis et. al (2013) of the unnamed tributary of the Brak River (hereafter referred to as the "riverine resource") had not been completed at the time that this specialist input was prepared, it was apparent during the site visit that the riverine resource has undergone several modifications primarily as a result of historical and current agricultural activities. Such modifications include streambank incision and erosion, vegetation loss resulting from trampling and grazing by domestic livestock and wildlife, altered flow patterns due to installation of weirs and farm dams within the river, road crossings, and sedimentation as a result of erosion both within the riparian habitat and surrounding terrestrial areas. Nevertheless, the riverine resource is not considered to be severely degraded, and is still considered to provide important faunal habitat and migratory connectivity, despite its seasonal nature. Furthermore, it is considered to be important in contributing to the ecological functioning of the Brak River;

6. A desktop analysis of the proposed turbine localities in relation to the riverine resource, in conjunction with observations made in the field, indicates that no turbines are to be placed directly within the riverine resource or any smaller, ephemeral drainage lines associated with this riverine resource. As a consequence, the 100m buffer assigned to the riverine resource (as discussed in the EIA Amendment report) is deemed sufficient to provide adequate protection to the riverine resource from impacts which may arise as a result of the construction and operations of the turbines, particularly if careful mitigation of potential impacts is implemented;

7. Since due consideration has been given to the location of the proposed turbines as discussed in point 6 above, it is the opinion of the specialist that whilst the provision of additional baseline information pertaining to the freshwater ecology of the study area, including an assessment of the

Present Ecological State, ecological functioning and characterisation of the watercourses, may be included for completeness, it is not deemed essential in order to allow for cogent decision making to take place by the EAP, proponent and the relevant regulatory authorities who must approve the EIA. The information may however be necessary in fulfilment of Regulation GN1199 as it pertains to the National Water Act.

As discussed in the draft EIA Amendment report, erosion (wind and water) as a result of clearing of vegetation in preparation for construction activities is of concern, and such cleared areas may also result in increased volume and intensity of stormwater runoff which may in turn result in altered flow volumes within the riverine resource as well as increase sediment entering the watercourse.

Mitigation measures to be included:

- Due to the naturally erodible nature of the soils in the vicinity of the proposed turbines, it is considered essential that in order to minimise potential impacts, particularly during the construction phase, erosion control measures such as berms, energy dissipating structures, silt curtains and strategic placement of geotextiles such as Geojute or hessian be utilised in areas where soils are to be exposed. Such measures will aid in reducing sediment inputs to the riverine resource as well as protecting soils in the vicinity of the turbines which will ultimately aid in the effective rehabilitation of the disturbed areas.
- Vegetation clearing in preparation for construction should also be kept to a minimum to aid in erosion prevention and no vegetation within the riparian zone itself should be cleared. In addition, access for construction vehicles must be restricted to designated access roads and prevented from entering the riparian habitat, and the riparian habitat must be designated as a “no-go” area for all personnel associated with the project.

Based on the findings of this review, it is the opinion of the independent reviewer that although it is desirable that additional baseline information pertaining to the freshwater ecology of the study area is presented, along with relevant maps as recommended in Points 2-4 to provide further clarity, the locality of these watercourses in relation to the proposed turbines, and the potential impacts of the related activities, have been carefully considered during the planning phase. Therefore, the proposed mitigation measures contained in the EIA Amendment report (and in particular the commitment to ensuring that all turbines are placed outside of a 100m buffer around the watercourses), in conjunction with those recommended above, are deemed sufficient to minimise perceived impacts of the construction and operations of the proposed turbines.

Taking the above into consideration, it is the opinion of the independent reviewer that adequate information is contained within the EIA amendment report to allow for informed decision-making by the relevant authorities.

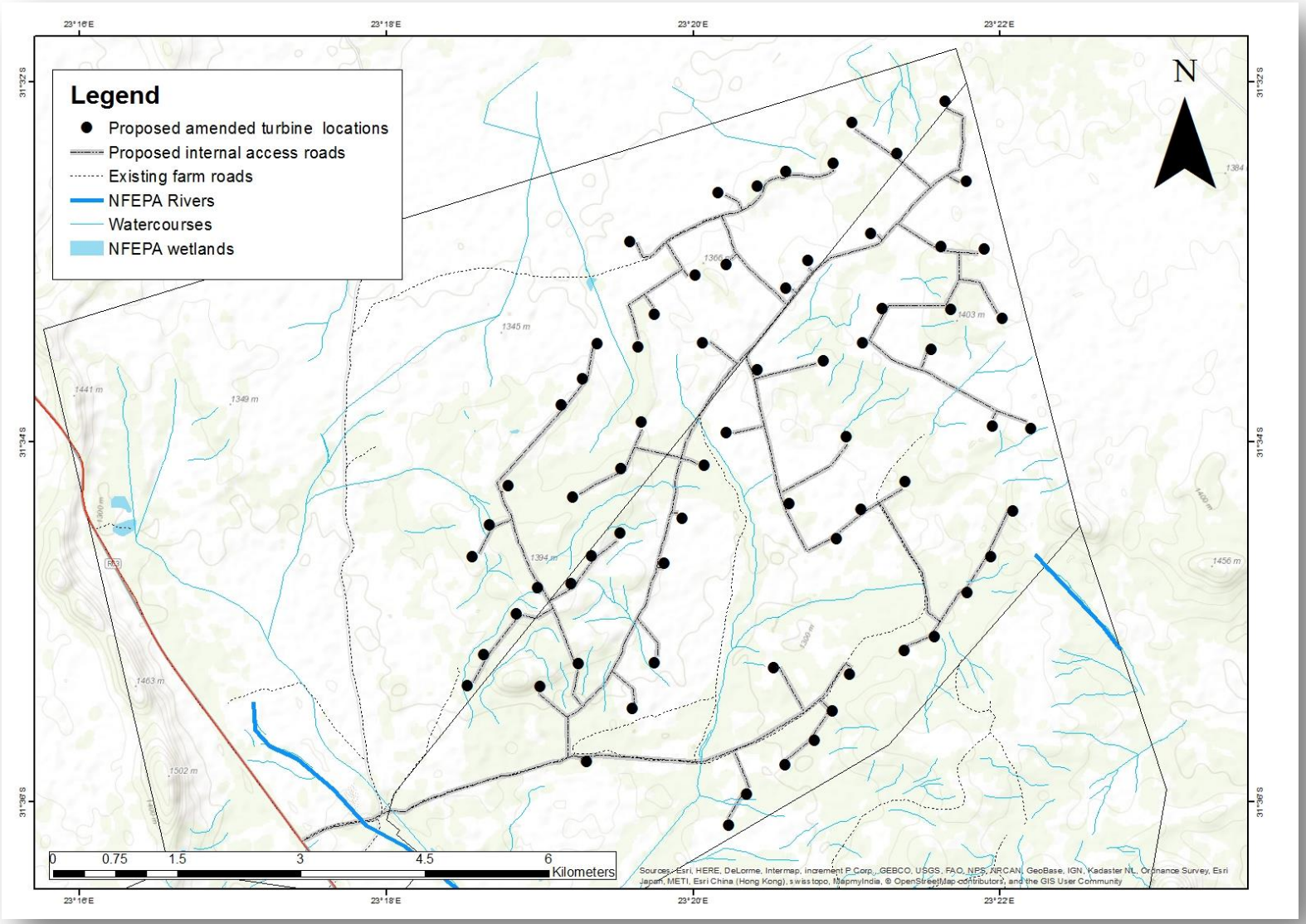

Figure 11. Freshwater features present within the project site

4.2.5 Impact on Agriculture

A study focussing specifically on soils and agricultural was not undertaken as part of the initial EIA but a soils and agricultural study assessment was undertaken by Johann Lanz for this project and a summary of this is included below and the full report is attached in Appendix C of this report.

The proposed development is located on land zoned and used for agriculture. South Africa has very limited arable land and it is therefore critical to ensure that development does not lead to an inappropriate loss of potentially arable land. The assessment has found that the footprint of disturbance of the development will only impact agricultural land which is unsuitable for cultivation.

The key findings of this study are:

There are two important factors that cause the significance of all agricultural impacts of the proposed development to be low. The first is that the actual footprint of disturbance of the wind farm (including all infrastructure and roads) is very small in relation to the available land (<1% of the surface area of the farm), and all agricultural activities would be able to continue unaffected on all parts of the farm other than the actual development footprint. The second is the fact that the proposed site is on land of very limited agricultural potential that is only suitable for low intensity grazing. All areas that had to be excluded, based on agriculture restrictions, have been avoided (shown in Figure 12 below).

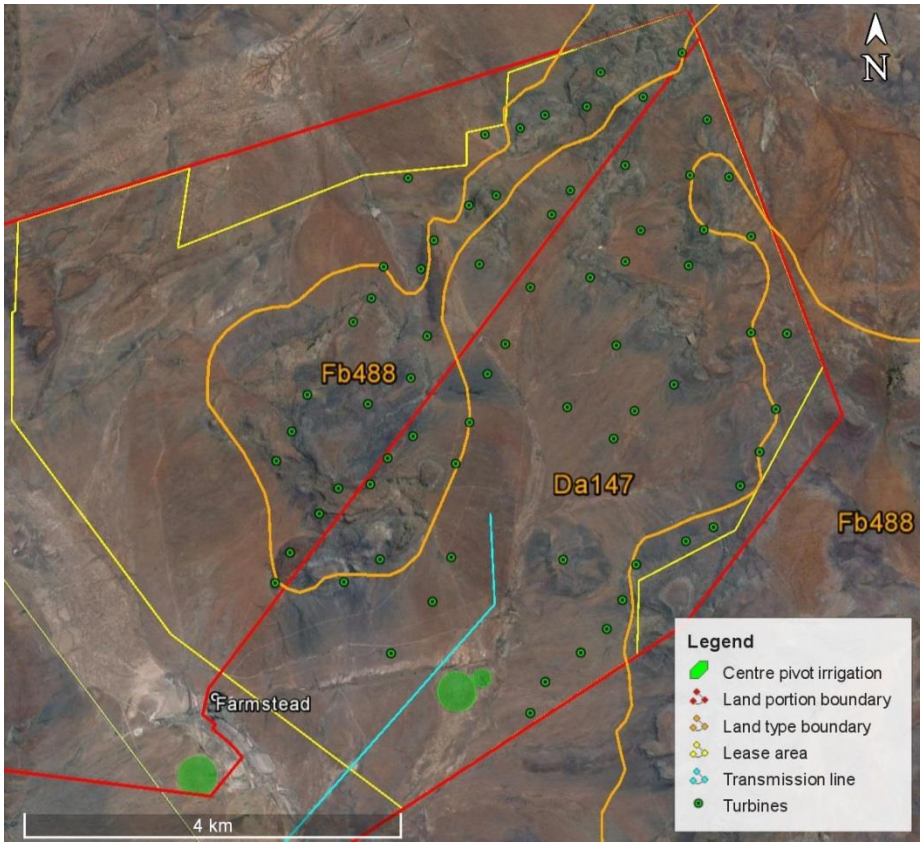

Figure 12. Detailed satellite image showing the centre pivot irrigation areas that must be avoided.

The soils of the site comprise shallow to moderately deep sandy loam soils on underlying clay, rock or hardpan carbonate on the plains (Swartland, Mispah, Valsrivier, Oakleaf, Glenrosa, Hutton soil forms). The ridges are dominated by rock outcrop and shallow soils on underlying rock (Mispah, Swartland, Hutton, Glenrosa soil forms). The entire Bultfontein Farm has a land capability classification, on the 8 category scale, of Class 7 - non-arable, low potential grazing land. The limitations to agriculture are climate, soil and terrain related, all of which make the wind farm site unsuited to any form of cultivation. The grazing capacity of the farm is low, at 31-40 hectares per large stock unit.

Four potential negative impacts of the development on agricultural resources and productivity were identified as:

1. Loss of agricultural land use caused by direct occupation of land by the energy facility footprint.
2. Soil Erosion caused by alteration of the surface characteristics.
3. Loss of topsoil in disturbed areas, causing a decline in soil fertility.
4. Degradation of veld vegetation beyond the direct footprint due to constructional disturbance, dust and vehicle trampling.

The areas of irrigated cultivation represent sensitive areas from an agricultural point of view, particularly the centre pivots, which cannot be crossed by power lines, and must therefore be avoided. Cultivated areas other than centre pivots can be crossed by power lines but any footprint of disturbance on the ground (eg pylons, substations) should be excluded from these areas. There are no required buffers.

Recommended mitigation measures are:

- Implement an effective system of storm water run-off control using bunds and ditches, where it is required - that is at points, for example on roads, where water accumulation might occur. The system must effectively collect and safely disseminate any run-off water from all hardened surfaces and it must prevent any potential down slope erosion. The integrity of the system must be inspected regularly and if any instances of erosion occur, it must immediately be amended to prevent these.
- Control vehicle access on roads only. Control dust generation during construction activities by implementing standard construction site dust control measures of damping down with water where dust generation occurs.

If an activity will mechanically disturb the soil below surface in any way, then any available topsoil should first be stripped from the entire surface to be disturbed and stockpiled for re-spreading during rehabilitation. Topsoil stockpiles must be conserved against losses through erosion by establishing vegetation cover on them. During rehabilitation, the stockpiled topsoil must be evenly spread over the entire disturbed surface. Any subsurface spoils from excavations must be disposed of where they will not bury the topsoil of agricultural land.The impact of the development on agriculture was assessed as being of low significance.

4.2.6 Noise Impact

The Noise Impact Assessment (NIA) was undertaken for Site Layout Alternative 1 i.e. the worst case scenario of the development (Figure 13). The potential noise impacts associated with the proposed REF include noise resulting from construction related activities and noise generated by wind turbine operation. The N1 carries continuous traffic throughout a 24-hour period with heavy duty vehicles accounting for approximately 30% of the total traffic flow. A daytime $L_{Req,d}$ 2of 52 dBA and night-time LReq,n of 47 dBA at the dwellings due to road traffic noise were calculated using procedures contained in SANS 10210 (Jongens Keet Associates, 2011).

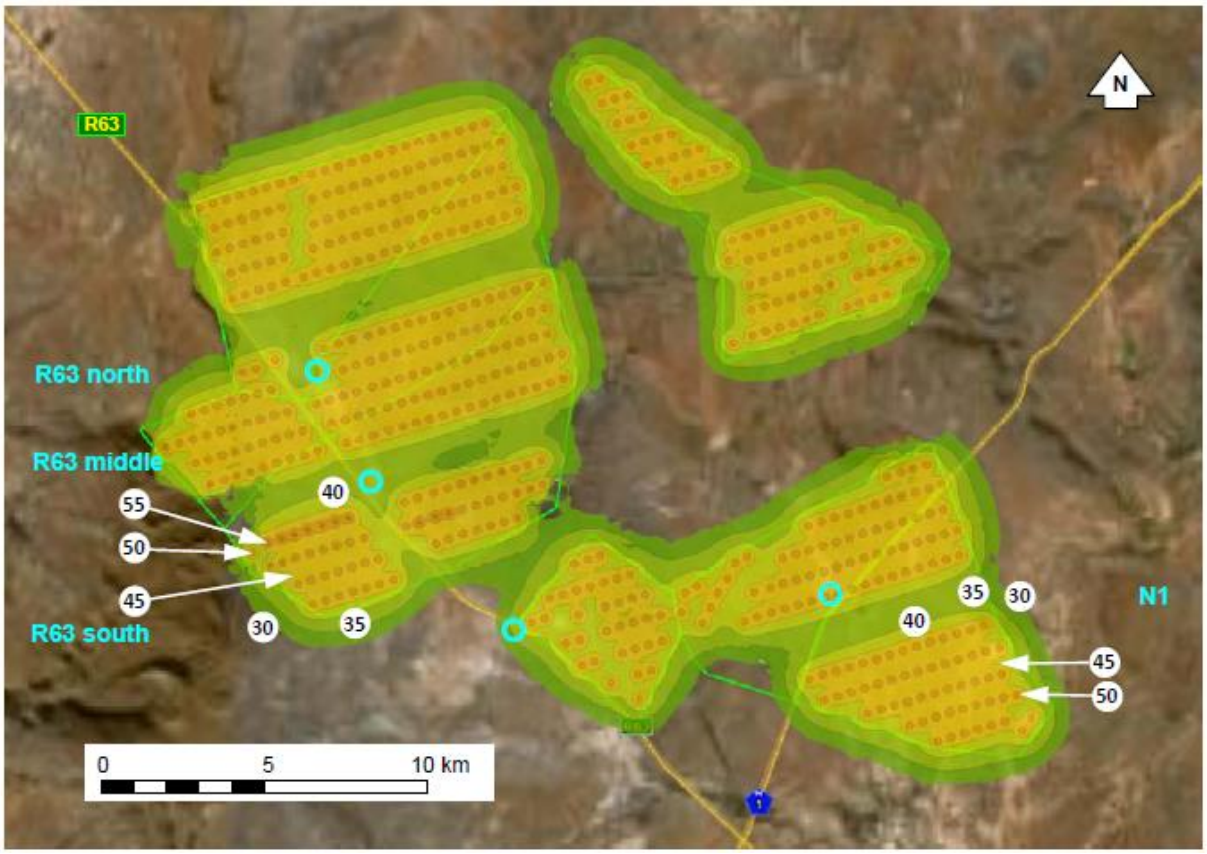

Figure 13. Site layout alternative 1 (i.e. the worst case scenario) assessed as part of the NIA in 2011. Wind turbine locations indicated in red; residences demarcated by blue circles; and calculated LAeq contours due to noise from wind turbines (Jongens Keet Associates, 2011)

Apart from locations near the N1, in rural settings such as the Victoria West site, there are few sources of noise to mask the noise emanating from the operation of the wind turbines. At high wind speeds this is not necessarily a problem but at lower wind speeds, background noise may not be sufficient to mask noise emanating from turbines (Jongens Keet Associates, 2011).

The land adjacent to the proposed wind farm site boundary is zoned for agricultural use (rural). In terms of SANS, a ”rural” district would apply with typical outdoor day time noise level or LReq,d of 45 dBA and a night time level ($L_{Req,n}$) of 35 dBA. The intensity of the noise impact on the boundary of the site is assessed using the lower of the two, i.e. the night-time $L_{Req,n}$ of 35 dBA. In accordance with SANS 10328, the predicted impact that noise emanating from a proposed development would have on surrounding land is assessed by determining whether the daytime rating level, $L_{Req,d}$, and/or the night-time rating level, $L_{Req,n}$, of the predicted ambient noise would exceed the typical rating level of noise on that land as indicated. If the rating level of the ambient noise under investigation exceeds

the typical rating level, it is probable that the noise is annoying or otherwise intrusive to a community exposed to the noise i.e. sensitive site (Jongens Keet Associates, 2011).

Land within 300 m of the northern site boundary would be exposed to $L_{Aeq,T}$ between 40 dBA and 45 dBA with an associated medium intensity of noise impact. This is due to an excess of between 5 dB and 10 dB from the $L_{Req,n}$ of 35 dBA applicable for the rural setting. The noise levels would exceed the $L_{Aeq,T}$ of 33 dBA measured during daytime by 7 dB or more and would thus constitute a disturbing noise in terms of the Noise Control Regulations (NCR). Noise mitigation would thus be required to reduce the excess to under 7dB or obtain exemption from this provision from the local municipality (Jongens Keet Associates, 2011).

The noise impact significance determined for Site Layout Alternative 1 and the residual impact significance (which includes reducing the number of turbines and removing all turbines that were in close proximity to farm dwellings) are shown in Table 12 below.

Table 12. Pre- and Post- Mitigation Significance: Noise impacts (ERM, 2011)

Phase	Significance (Pre-mitigation)	Residual Impact Significance
Construction	N/A	N/A
Operation (boundary impacts)	MEDIUM-HIGH (-VE)	MEDIUM-LOW (-VE)
Operation (sensitive sites)	MEDIUM (-VE)	LOW (-VE)

Feedback from the noise specialist

For 37 (the approved turbine layout), 70 (the proposed amended layout) and 525 (original assessed layout) turbines the predicted noise levels in all cases exceeded the permissible levels beyond the boundary with the same level of impact on affected land. However due to much longer boundaries the total land area affected was much greater for the 525 turbine study. The overall significance would therefore be reduced for both 37 and 70 turbine scenarios compared to the original study. Comparing results of the 37 and 70 turbines in the present amendment study, the level of impact is the same for marginally different affected land areas beyond the boundaries thus no difference in significance as contained in the table (Table 12).

The boundaries of the wind energy facility previously assessed are outlined in red. Noise sensitive receptors are denoted by blue ellipses. The predicted L_{Aeq} contours for the respective turbine layouts are displayed in Figure 14 and Figure 15 below. These comprise a main residence surrounded by other dwellings. The turbine locations are at the centre of the dark orange circles. The respective L_{Aeq} contour values have been denoted by numerals on a white background with a lowest value of 20 dBA. This is well below the measured residual L_{Aeq} of 33 dBA recorded during sunset in the study area. The probability of a noise impact on noise sensitive residential areas beyond the 20 dBA contour line was considered to be very low. Areas that would be exposed to levels less than 20 dBA therefore contain no colour shading.

The land areas beyond the WEF boundary where the predicted L_{Aeq} would exceed the residual level of 33 dBA by 7 dB i.e. 40 dBA is depicted by part of the 40 dBA contour highlighted in yellow (Figure 14 and Figure 15).

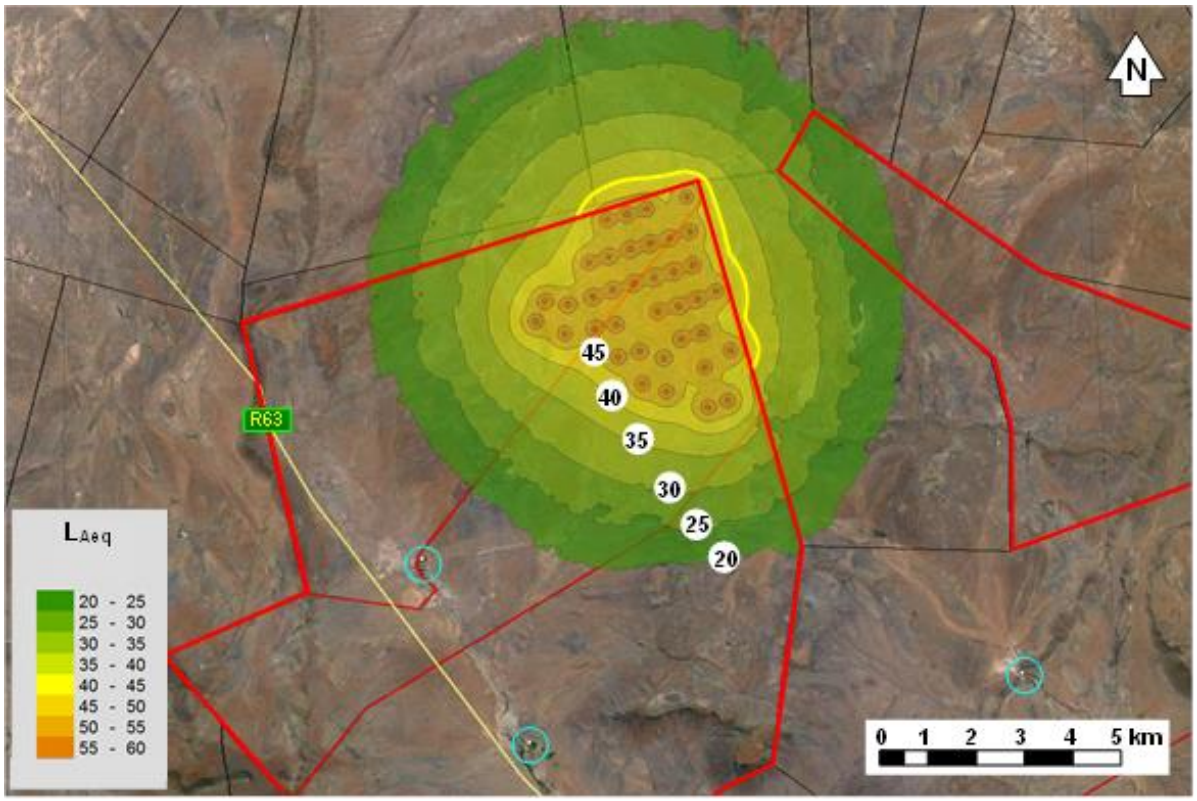

Figure 14. Predicted L_{Aeq} contours for the approved turbine layouts

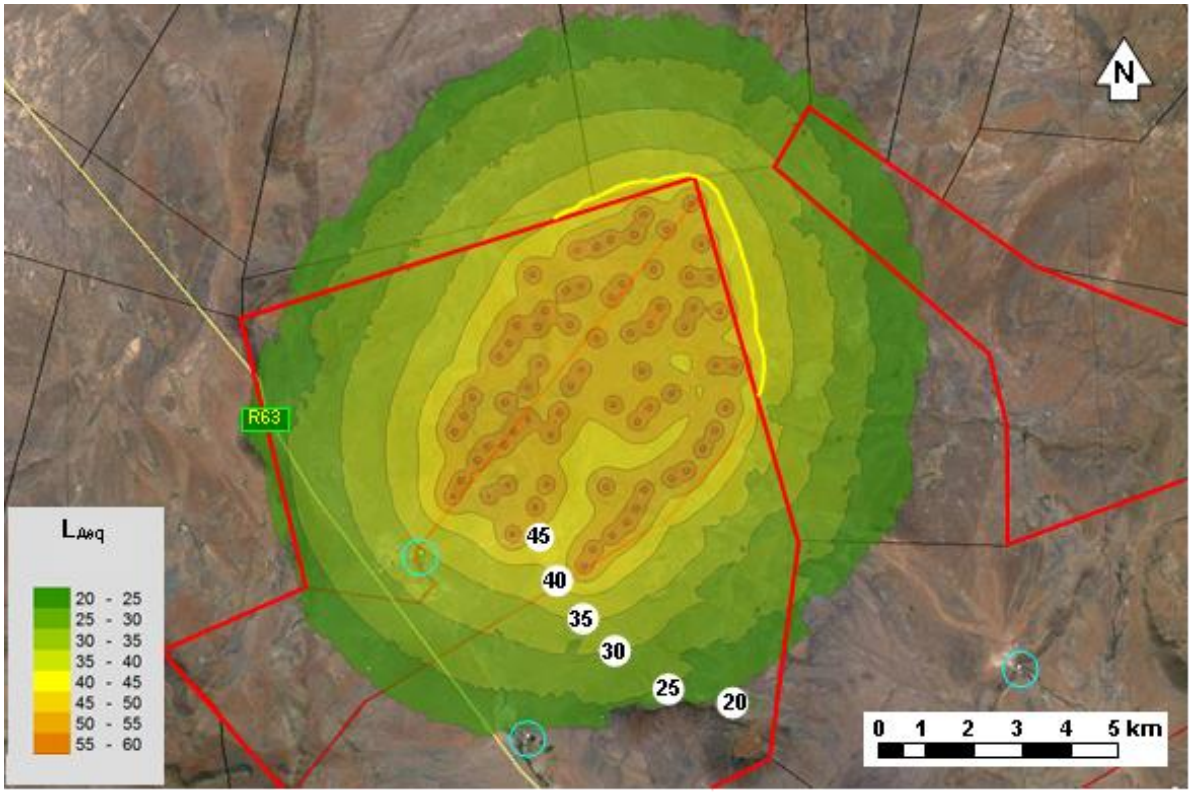

Figure 15. Predicted L_{Aeq} contours for the proposed amended layout

Assessment of the results

Approved layout

The results of the investigation predicted that the L_{Aeq} at all identified noise sensitive residential areas would be significantly lower that the day/night level of 45 dBA for a rural area and thus compliant with conditions 81, 87 and 88 of the EA.

The land beyond the northern and eastern boundaries and the 40 dBA contour (highlighted in yellow in Figure 14 and Figure 15) would exceed the measured ambient (residual) level of 33 dBA by 7 dB or more. In terms of the NCR the noise would be adjudicated as being a disturbing noise and noise mitigation procedures would need to be implemented in order to comply with condition 82 of the EA.

Proposed amended layout

The results of the investigation predicted that the L_{Aeq} at the nearest noise sensitive residents of Bultfontein farm would be 34 dBA for rotors with clean blade edge and 33 dBA for rotor blades with serrated edges. The values would be just lower than the night-time value for a rural area and thus compliant with conditions 81, 87 and 88 of the EA. The L_{Aeq} at the other identified noise sensitive residential areas would be significantly lower.

Comparison of the spectrum of the predicted wind turbine noise with that of the measured residual indicates that it is highly probable that noise from the turbines would be audible and might be considered to be intrusive at the closest residence.

The land beyond the northern and eastern boundaries and the 40 dBA contour (highlighted in yellow) would exceed the measured ambient (residual) level of 33 dBA by 7 dB or more. In terms of the NCR the noise would be adjudicated as being a disturbing noise and noise mitigation procedures would need to be implemented in order to comply with condition 82 of the EA.

Comparison of the results in Figure 14 and Figure 15 indicate a slight, but not significantly, larger land area between the boundaries and the 40 dBA contour line for the amended layout.

Conclusions

The results of the study indicated that the predicted L_{Aeq} would comply with the conditions 81, 87 and 88 of the EA. The identified noise sensitive residential area would be located approximately 1 400 m from the nearest wind energy turbine; well beyond the setback of 500 m stipulated in condition 87 of the EA. Due to the low residual noise levels, the results of the detailed analysis indicated a high probability that the noise would impact on the residents during certain meteorological conditions.

However, due to the low residual noise levels in the study area large areas beyond the WEF boundaries would not comply with the NCR and thereby not compliant with condition 82.

Mitigation measures

Reducing the noise emission levels at source by the amount required to comply with the NCR beyond the WEF boundaries would not be practically feasible.

From the L_{Aeq} contours displayed in Figure 15 compliance with the NCR and thus with condition 82 of the EA would require relocation of several of the turbines with a minimum distance of 800 m between turbines and WEF boundaries. Increased separation distances between noise sensitive

residence and nearest turbine locations would be required to reduce the probability noise impact on the residents. From previous experience and literature a minimum distance of 2 000 m should be considered.

Recommendations

It is anticipated that implementation of the mitigation measures outlined above would have a serious impact on the viability of the proposed WEF. An alternative option would be to apply for exemption as provided for in Regulation 7 of the NCR. Although not stipulated, the process of applying for exemption should afford an opportunity to all interested and affected parties to submit representations on the exemptions applied for.

4.2.7 Bat Impact

The bat study undertaken and included in the original EIA report was undertaken by Dr David Jacobs. The findings from the study before and after mitigation are shown in the tables below (Table 13 and Table 14).

Table 13. Pre- and Post- Mitigation Significance: Habitat loss - Destruction, Disturbance and Displacement (ERM, 2011)

Phase	Significance (Pre-mitigation)	Residual Impact Significance
Construction	MINOR (-VE)	MINOR (-VE)
Operation	MINOR (-VE)	MINOR (-VE)

Table 14. Pre- and Post- Mitigation Significance: Collision Risk (ERM, 2011)

Phase	Significance (Pre-mitigation)	Residual Impact Significance
Construction	N/A	N/A
Operation	HIGH (-VE)	MEDIUM (-VE)

Feedback from the bat specialist

As per condition 36 of the EA, a bat monitoring programme must be implemented to document the effect of the operation of the energy facility on avifauna and bats. This should commence prior to construction, and continue during operation of the energy facility. Mainstream appointed the bat division of NSS to undertake the monitoring. Fourteen months of bat preconstruction monitoring was completed by the bat division of Natural Scientific Services (NSS) (now Inkululeko Wildlife Services (IWS)) in 2012/ 2013 for the boundary area shown in Figure 16 below. A bat specialist report was completed for this period, dated 2013.

In a letter, dated 10 February 2016 and included in Appendix C of this report, it is stated that as long as turbines are built within the original study boundary area covered by NSS (Figure 16) and all mitigation measures and no-go areas as per the sensitivity map (Figure 17) are adhered to, IWS does not envisage a change in terms of the impact assessment from a turbine siting perspective from the original recommendations due to the increase in the number of turbines.

As shown in Figure 17 below, the proposed new turbine locations occur outside the highly sensitive areas identified. Where some turbines occur in too close proximity to the highly sensitive areas, as shown in Figure 17, these turbines will be moved further from the areas during micro-siting.

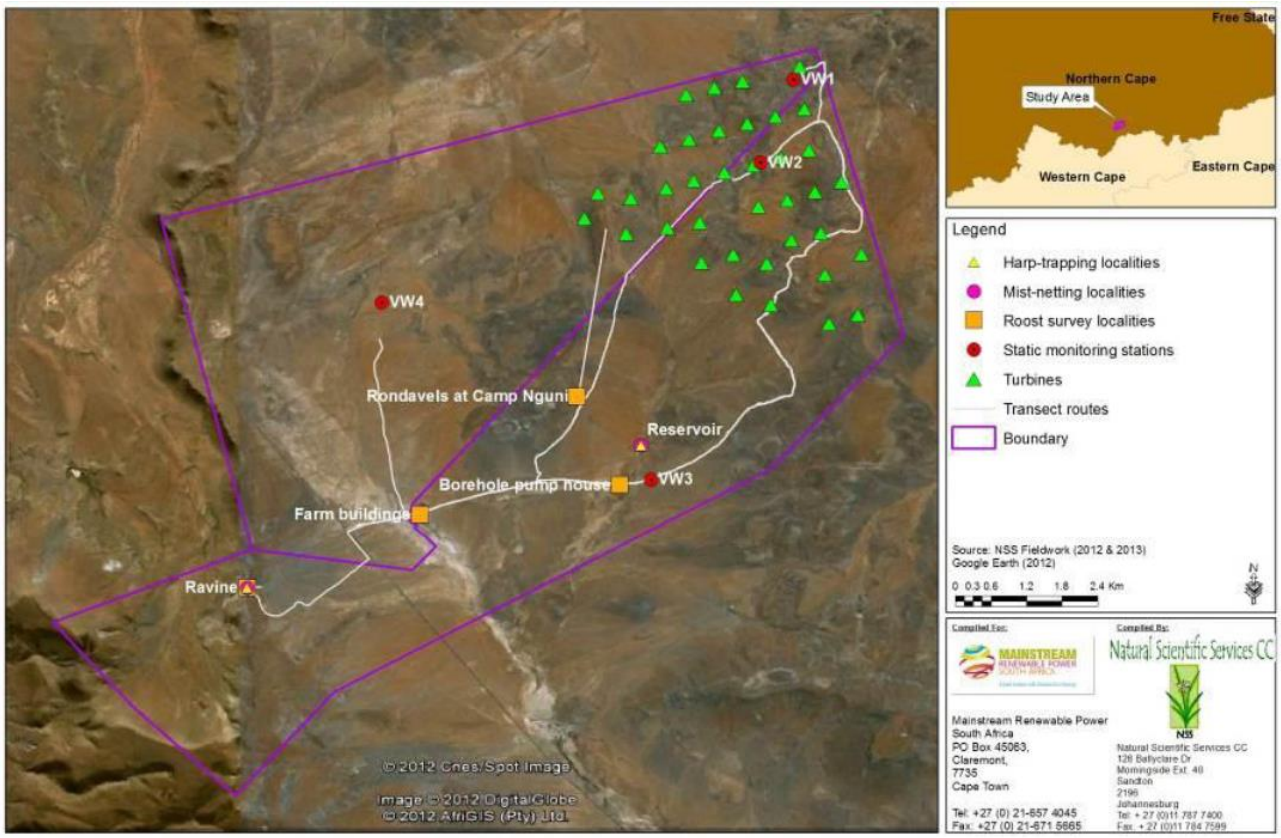

Figure 16. Bat Monitoring Study Boundary and Detector Locations

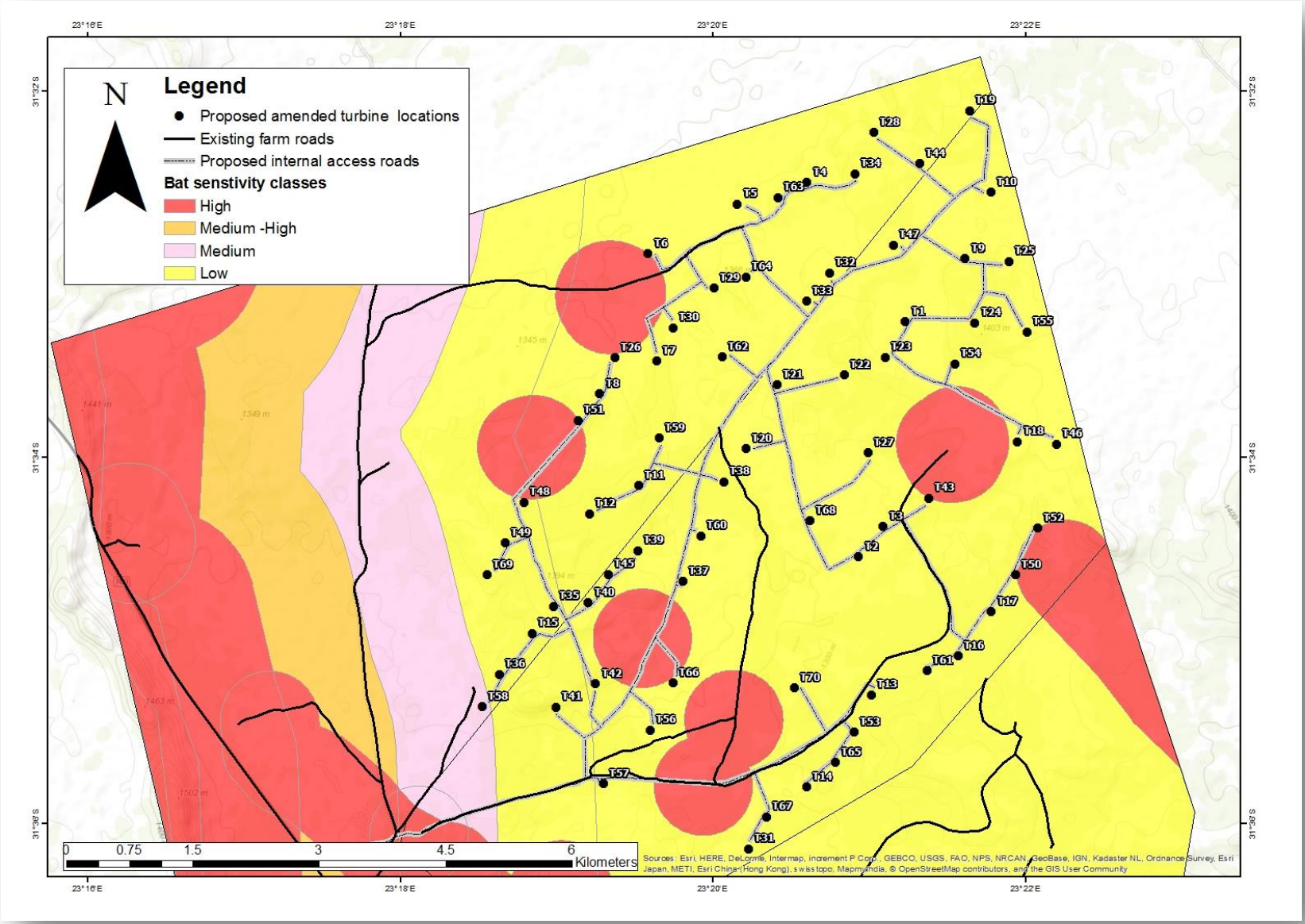

Figure 17. Bat sensitivity areas as identified within the NSS report, dated 2013.

4.2.8 Avifaunal Impact

The avifaunal impact assessment's findings for the construction and operational phases are summarised below (Table 15 and Table 16).

Table 15. Pre- and Post- Mitigation Significance- Collision of birds with wind turbines (ERM, 2011)

Phase	Significance (Pre-mitigation)	Residual Impact Significance
Construction	N/A	N/A
Operation	HIGH (-VE)	MEDIUM (-VE)

Table 16. Habitat Loss – Destruction, Disturbance and Displacement (ERM, 2011)

Phase	Significance (Pre-mitigation)	Residual Impact Significance
Construction	HIGH-MEDIUM (-VE)	MEDIUM (-VE)
Operation	HIGH(-VE)	MEDIUM-HIGH (-VE)

Feedback from the avifaunal specialist

Dr Andrew Jenkins from Avisense has undertaken all the pre-construction bird monitoring for the Victoria West WEF (this project) and has been requested to provide feedback on the proposed amendments to the wind turbine locations and specifications. Dr Jenkins states in the letter, dated 20 November 2015 and included in Appendix C of this report, that even though the changes do mean that there is an increase in the development footprint that was approved and a 150 % increase in the rotor swept area of the wind farm, it should be noted that the current authorisation for this development was based on a far bigger wind farm proposal (in excess of 700 turbines spread across a far bigger area). Therefore, the impacts are still likely to be substantially less than those already approved. A comparison of the project layout at the time of the pre-construction bird study, the new proposed layout, and the actual coverage achieved by the pre-construction bird study (Figure 18), shows that much of the newly proposed footprint was included in the bird survey and monitoring work done to service the original approved WEF.

Overall, while Mainstream is proposing to increase the avian risk profile of the development considerably from the previously proposed layout and turbine specifications, the requirements of the existing EA for the project have still been met by the bird impact studies done to date, and there is no need adjust these requirements or otherwise change the conditions of the EA.

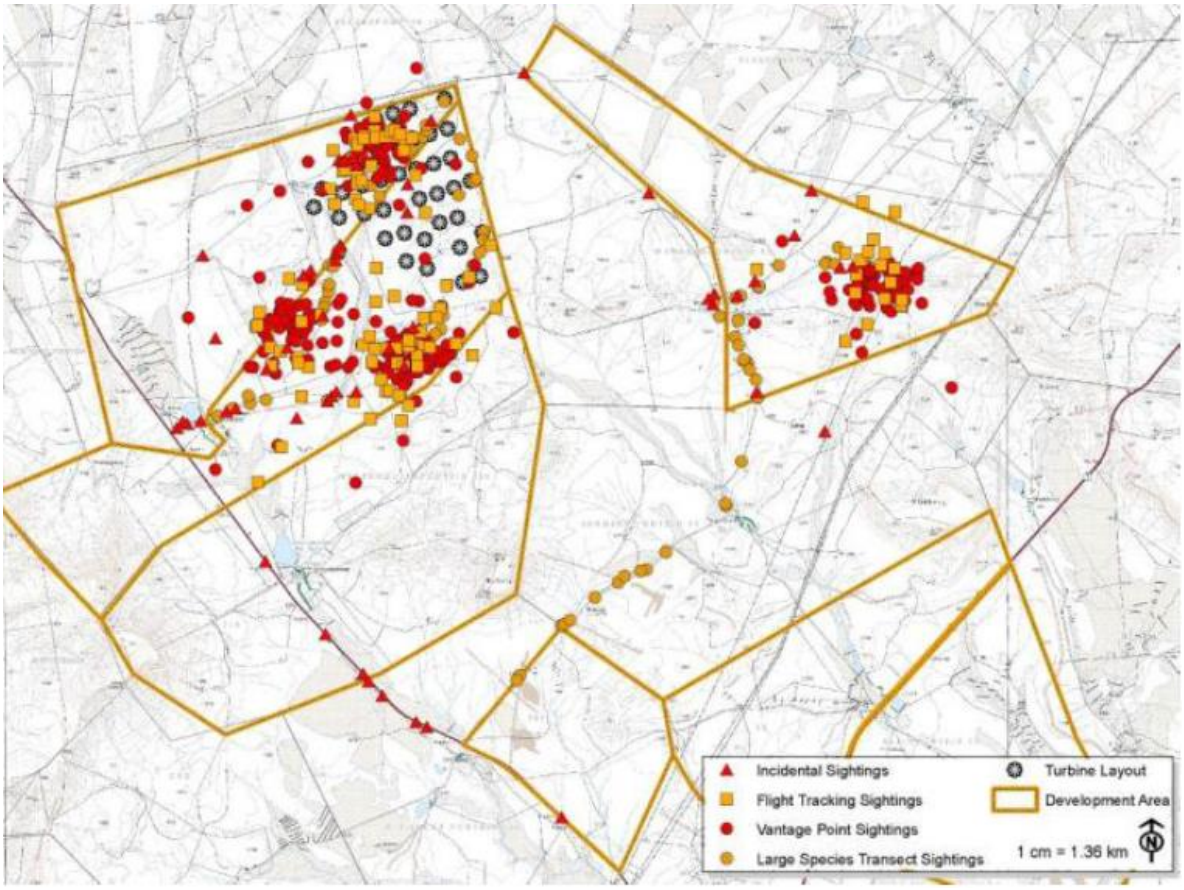

Figure 18. The coverage of the general area achieved by the pre-construction bird study, with bird sightings (red and orange icons) and the layout assessed (white circles).

5. Conclusion

5.1 Environmental sensitivity map

Based on the sensitivities identified during the previous EIA undertaken and discussed in Section 4 of this report, an integrated environmental sensitivity map has been produced for the Portions 1 and the 2 of Bultfontein Farm 217. The map shows the highly sensitive areas where no development may take place (Figure 19). The proposed wind turbine locations and new internal access roads have been overlain with the sensitivity map to determine whether any turbine placement or routing of the road goes against any recommendations made within the EIA, EA and specialist input received on the proposed amendment. Some of the internal roads do traverse areas that have been identified as having a high sensitivity but are proposed to occur within existing roads present on site and additional mitigation measures have been provided by the freshwater specialist to manage these crossings therefore, no new impact is expected.

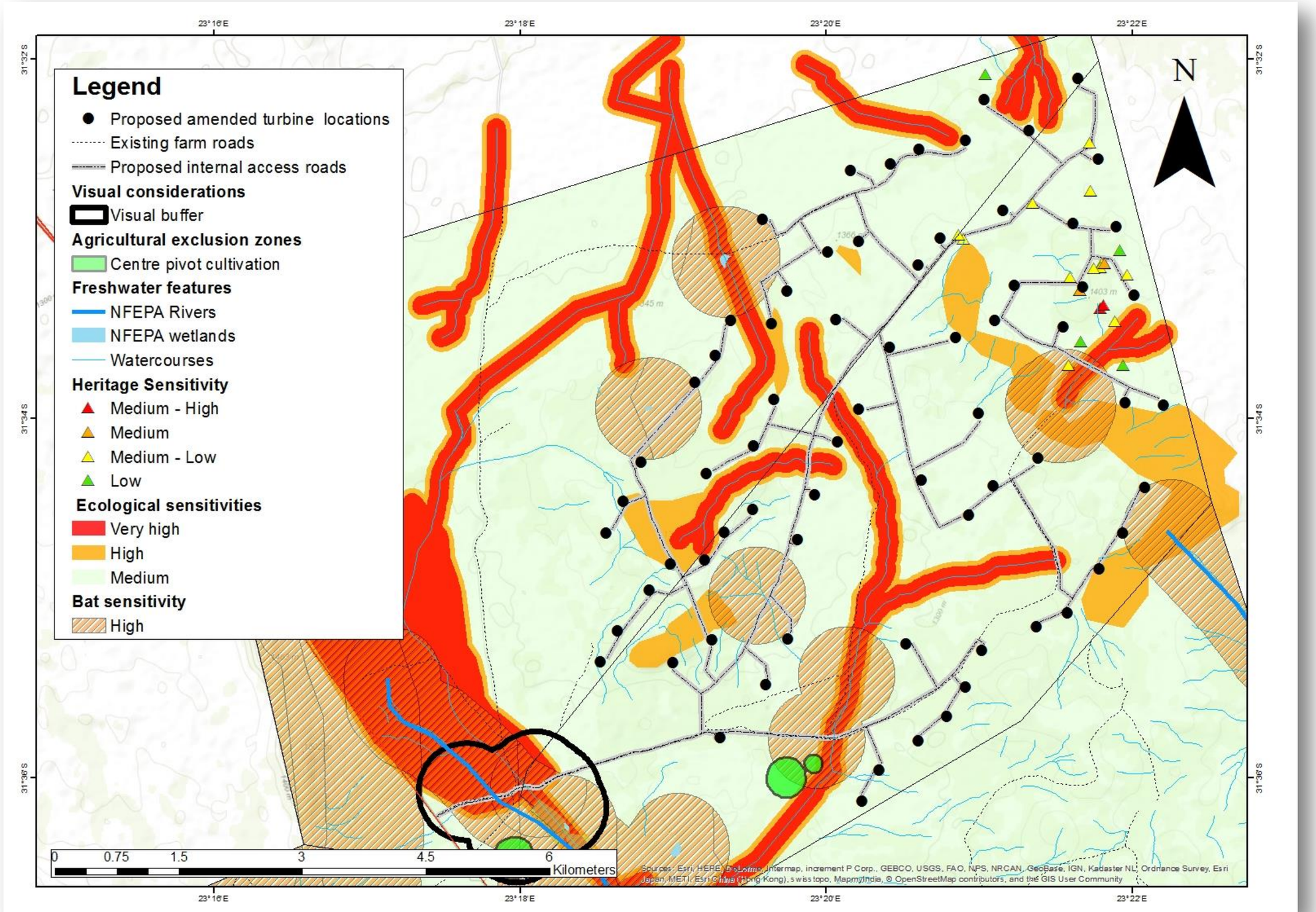

Figure 19. Environmental sensitivity map overlain with the proposed amended wind turbine locations and proposed internal access roads

5.2 Additional recommendations to include in authorisation

Should the DEA decide to authorise the proposed amendment, the following conditions should be included within the EA. These conditions have been provided by the appointed specialists, following the review of the proposed amendment.

5.2.1 Heritage

The presence of additional heritage features close to or at the proposed amended wind turbine locations is unknown. It is therefore recommended that prior to the determination of the final layout and construction an archaeologist must undertake a site visit to each proposed wind turbine location. Any specific mitigation measures identified following the pre- construction walk down must be included in the updated EMPr.

5.2.2 Freshwater

Due to the naturally erodible nature of the soils in the vicinity of the proposed turbines, it is considered essential that in order to minimise potential impacts, particularly during the construction phase that the following be implemented:

- Erosion control measures such as berms, energy dissipating structures, silt curtains and strategic placement of geotextiles such as Geojute or hessian be utilised in areas where soils are to be exposed. Such measures will aid in reducing sediment inputs to the riverine resource as well as protecting soils in the vicinity of the turbines which will ultimately aid in the effective rehabilitation of the disturbed areas.
- Vegetation clearing in preparation for construction should also be kept to a minimum to aid in erosion prevention and no vegetation within the riparian zone itself should be cleared.
- Access for construction vehicles must be restricted to designated access roads and prevented from entering the riparian habitat, and the riparian habitat must be designated as a “no-go” area for all personnel associated with the project.

5.2.3 Soils and agriculture

Mitigation measures to included:

- If an activity will mechanically disturb the soil below surface in any way, then any available topsoil should first be stripped from the entire surface to be disturbed and stockpiled for re-spreading during rehabilitation.
- Topsoil stockpiles must be conserved against losses through erosion by establishing vegetation cover on them.
- During rehabilitation, the stockpiled topsoil must be evenly spread over the entire disturbed surface.
- Any subsurface spoils from excavations must be disposed of where they will not bury the topsoil of agricultural land.

5.2.4 Noise

From the L_{Aeq} contours displayed in Figure 15 compliance with the NCR and thus with condition 82 of the EA would require that certain mitigation measures be implemented:

- Relocation of several of the turbines with a minimum distance of 800 m between turbines and WEF boundaries.
- Increased separation distances between noise sensitive residence and nearest turbine locations would be required to reduce the probability noise impact on the residents.
- If the above mitigation measures are not feasible, exemption as provided for in Regulation 7 of the NCR must be applied for. Although not stipulated, the process of applying for exemption should afford an opportunity to all interested and affected parties to submit representations on the exemptions applied for.

5.3 Concluding statement by EAP

Disadvantages and advantages of the proposed amendment

Based on the assessment undertaken and the conclusions by the specialists, no disadvantages (i.e additional impacts or change in increased negative impact significance) have been identified that have not been considered and assessed within the original project that received EA. In terms of advantages, the main advantage associated with the proposed amendment is the capacity of the facility to generate 140 MW instead of 95 MW of electricity from wind energy. Should this project therefore receive Preferred Bidder status during the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) this will lead to more electricity produced by the WEF and therefore more electricity input into the national grid. In terms of costing, the amendment will also make the project financially more favourable.

Statement by the EAP

All specialist studies undertaken determined that the amendment in turbine locations would not require a change in the significance of the impacts identified during the previous EIA. Therefore, the anticipated overall negative and positives impacts assessed and subsequently approved within the original EA would still be considered to be valid. Nevertheless, additional mitigation measures have been included within the section above to ensure that any potential additional impacts are suitably addressed and managed.

The most notable finding from the impact assessment of the proposed amendment to the WEF is the NIA findings indicating non-compliance to the NCR (see section 4.2.6). The NIA undertaken for both the previous EIA and the amendment indicates that the level of impact is the same for marginally different affected land areas beyond the boundaries thus no difference in significance. In terms of the noise impacts on the closest residence within the project's boundary, the results of the investigation predicted that the L_{Aeq} at the nearest noise sensitive residents of Bultfontein farm (farm under consideration with this assessment) would be 34 dBA for rotors with clean blade edge and 33 dBA for rotor blades with serrated edges. The values *would be just lower* than the night-time value for a rural area and thus compliant with conditions 81, 87 and 88 of the EA. The L_{Aeq} at the other identified noise sensitive residential areas would be significantly lower.

In terms of noise emanating outside the project's boundary, the NIA states that a comparison of the spectrum of the predicted wind turbine noise with that of the measured residual indicates that it is highly probable that noise from the turbines would be audible and might be considered to be

intrusive at the closest residence. As shown in yellow (Figure 14 and Figure 15) both the approved facility and the proposed amendment locations' predicted L_{Aeq} exceed the residual level of 33 dBA by 7 dB. Although it is noted that this is a non-compliance in terms of the NCR, the closest residence from the zone shown in yellow is located 5 km away and is therefore located well outside this area. This means that the disturbing noise will most likely only be experienced if there is someone present within the zone or under certain unpredictable meteorological conditions. It is therefore not foreseen that the exceedance of the residual level of 7 dBA would have a tangible impact on the closest receptors and that, based on the exceedance, exemption provided for in Regulation 7 of the NCR would not be obtained. Given the above, Mainstream will apply for exemption and should this not be approved, further refinements to the turbine locations will be undertaken.

With specific reference to the WEF that will be constructed on site as part of the authorised renewable energy facility, the proposed amendment should reflect that the following may be constructed on site:

- A WEF with a hub height from 100 m to 120 m and a rotor diameter (measured from blade tip to blade tip) range of between 80 m and 100 m (as detailed within the previous EIA report (ERM, 2011));
- A WEF with a generation capacity of 140 MW; and
- The construction of 70 wind turbines.

Following the assessment process undertaken by the CSIR and the appointed specialist team, it is not foreseen that by authorising the proposed amendment, that additional impacts would occur that that could have a detrimental impact on the receiving environment that have not been identified and assessed within the original EIA and the assessment of the proposed amendment. The original EA's conditions must still be adhered to by Mainstream during all phases of the project and the additional mitigation measures included within Section 5.2 of this report must be added to this authorisation. When Mainstream submits the final Environmental Management Programme to the DEA, these measures should also be included therein with the updated environmental sensitivity map provided within this report.

6. REFERENCES

ACO Associates, 2011, Heritage Impact Assessment: Proposed Victoria West Mini Renewable Energy Facility on the Farm Bultfontein 217, Northern Cape Province.

Almond, J.E., 2011, Palaeontological Impact Assessment: Pre-Scoping Desktop Study.

Bernard Oberholzer and Quinton Lawson, 2011, Proposed Renewable Energy Facilities in the Western and Northern Cape by Mainstream SA Victoria West Site in the Great Karoo Visual Impact Assessment.

Environmental Resource Management (ERM), 2011, Environmental Impact Report Proposed Renewable Energy Facility at Victoria West Site, Northern Cape.

Jongens Keet Associates, 2011, Environmental Noise Impact Study into the Proposed Establishment of Wind Farms at Victoria West in the Northern Cape.

Simon Todd Consulting, 2010, Environmental Impact Assessment: Terrestrial Ecology Specialist Study for the Proposed Establishment of a Renewable Energy Facility near Victoria West, Western and Northern Cape Provinces.

APPENDIX A – Declaration of EAP

I, Surina Laurie, declare that –

General declaration:

- I act as the independent environmental practitioner in this application
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting environmental impact assessments, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I will take into account, to the extent possible, the matters listed in regulation 8 of the Regulations when preparing the application and any report relating to the application;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- I will ensure that information containing all relevant facts in respect of the application is distributed or made available to interested and affected parties and the public and that participation by interested and affected parties is facilitated in such a manner that all interested and affected parties will be provided with a reasonable opportunity to participate and to provide comments on documents that are produced to support the application;
- I will ensure that the comments of all interested and affected parties are considered and recorded in reports that are submitted to the competent authority in respect of the application, provided that comments that are made by interested and affected parties in respect of a final report that will be submitted to the competent authority may be attached to the report without further amendment to the report;
- I will keep a register of all interested and affected parties that participated in a public participation process; and
- I will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not
- all the particulars furnished by me in this form are true and correct;
- will perform all other obligations as expected from an environmental assessment practitioner in terms of the Regulations; and
- I realise that a false declaration is an offence in terms of regulation 48 of the Regulations and is punishable in terms of section 24F of the Act.

Disclosure of Vested Interest (delete whichever is not applicable)

- I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remuneration for work performed in terms of the Regulations;
- ~~I have a vested interest in the proposed activity proceeding, such vested interest being:~~

Signature of the environmental assessment practitioner:
CSIR

Name of company
17 March 2016

Date:

APPENDIX B – Coordinates of the amended locations of the wind turbines

Turbine Name	X_DMS	Y_DMS	Turbine Name	X_DMS	Y_DMS
T1	23° 21' 13.90" E	31° 33' 15.60" S	T36	23° 18' 38.03" E	31° 35' 11.06" S
T2	23° 20' 55.92" E	31° 34' 32.54" S	T37	23° 19' 48.66" E	31° 34' 40.57" S
T3	23° 21' 5.59" E	31° 34' 22.61" S	T38	23° 20' 4.42" E	31° 34' 8.03" S
T4	23° 20' 36.25" E	31° 32' 30.04" S	T39	23° 19' 31.20" E	31° 34' 30.48" S
T5	23° 20' 9.55" E	31° 32' 37.12" S	T40	23° 19' 12.30" E	31° 34' 47.51" S
T6	23° 19' 35.04" E	31° 32' 53.38" S	T41	23° 18' 59.95" E	31° 35' 21.68" S
T7	23° 19' 38.45" E	31° 33' 28.47" S	T42	23° 19' 15.13" E	31° 35' 14.07" S
T8	23° 19' 16.54" E	31° 33' 39.14" S	T43	23° 21' 22.99" E	31° 34' 13.35" S
T9	23° 21' 36.96" E	31° 32' 54.92" S	T44	23° 21' 19.72" E	31° 32' 23.87" S
T10	23° 21' 46.86" E	31° 32' 33.24" S	T45	23° 19' 20.05" E	31° 34' 38.25" S
T11	23° 19' 31.63" E	31° 34' 9.15" S	T46	23° 22' 12.18" E	31° 33' 55.63" S
T12	23° 19' 12.89" E	31° 34' 18.49" S	T47	23° 21' 9.41" E	31° 32' 50.49" S
T13	23° 21' 1.11" E	31° 35' 17.63" S	T48	23° 18' 47.49" E	31° 34' 14.69" S
T14	23° 20' 36.02" E	31° 35' 47.84" S	T49	23° 18' 40.37" E	31° 34' 27.93" S
T15	23° 18' 50.68" E	31° 34' 57.54" S	T50	23° 21' 56.47" E	31° 34' 38.43" S
T16	23° 21' 34.46" E	31° 35' 4.99" S	T51	23° 19' 8.37" E	31° 33' 47.92" S
T17	23° 21' 47.12" E	31° 34' 50.45" S	T52	23° 22' 4.91" E	31° 34' 23.10" S
T18	23° 21' 57.20" E	31° 33' 54.88" S	T53	23° 20' 54.49" E	31° 35' 29.90" S
T19	23° 21' 38.67" E	31° 32' 6.46" S	T54	23° 21' 33.09" E	31° 33' 29.37" S
T20	23° 20' 12.78" E	31° 33' 57.11" S	T55	23° 22' 0.89" E	31° 33' 18.88" S
T21	23° 20' 24.96" E	31° 33' 36.17" S	T56	23° 19' 36.20" E	31° 35' 29.18" S
T22	23° 20' 50.77" E	31° 33' 32.97" S	T57	23° 19' 18.24" E	31° 35' 46.78" S
T23	23° 21' 6.27" E	31° 33' 27.22" S	T58	23° 18' 31.47" E	31° 35' 21.58" S
T24	23° 21' 40.83" E	31° 33' 16.03" S	T59	23° 19' 39.58" E	31° 33' 53.64" S
T25	23° 21' 53.85" E	31° 32' 55.90" S	T60	23° 19' 55.60" E	31° 34' 25.69" S
T26	23° 19' 22.47" E	31° 33' 27.32" S	T61	23° 21' 22.51" E	31° 35' 9.77" S
T27	23° 20' 59.90" E	31° 33' 58.45" S	T62	23° 20' 3.69" E	31° 33' 27.11" S
T28	23° 21' 2.04" E	31° 32' 13.59" S	T63	23° 20' 25.09" E	31° 32' 34.94" S
T29	23° 20' 0.66" E	31° 33' 4.51" S	T64	23° 20' 12.74" E	31° 33' 1.01" S
T30	23° 19' 44.73" E	31° 33' 17.64" S	T65	23° 20' 47.30" E	31° 35' 39.80" S
T31	23° 20' 13.89" E	31° 36' 8.11" S	T66	23° 19' 44.83" E	31° 35' 13.78" S
T32	23° 20' 44.84" E	31° 32' 59.67" S	T67	23° 20' 20.79" E	31° 35' 57.63" S
T33	23° 20' 36.10" E	31° 33' 8.86" S	T68	23° 20' 37.34" E	31° 34' 20.77" S
T34	23° 20' 54.78" E	31° 32' 27.11" S	T69	23° 18' 33.51" E	31° 34' 38.37" S
T35	23° 18' 58.95" E	31° 34' 48.73" S	T70	23° 20' 31.35" E	31° 35' 15.39" S

APPENDIX C – Comments received from appointed specialists on the proposed amendment

C.1 Visual specialist

Introduction

Preferred Site Layout Alternative 2 (referred to in this report as the Authorised Layout) authorised Mainstream to construct 37 turbines with a hub height from 100 m to 120 m and a rotor diameter (measured from blade tip to blade tip) range of between 80 m and 100 m. The generation capacity of the WEF is 95 megawatt (MW), based on the amount of turbines approved and the generation capacity of each turbine.

The main amendment proposed is to increase the WEF's generation capacity from 95 MW to 140 MW which, in turn, necessitates the following:

- Develop 70 wind turbines on site instead of 37 wind turbines approved as part of Site Layout Alternative 2; and
- Amend the approved layout to ensure the optimal placement of each individual turbine.

The newly proposed layout will be referred to as the Amended Layout in this report.

Visibility Analysis

The table below shows viewshed areas for the two layouts, as well as number of buildings that will potentially have views of wind turbines (the screening effect of buildings and vegetation is not taken into account). An area within 20 km of the wind turbines were used to calculate the viewsheds.

WEF Layout	Viewshed Area (within 20 km distance from turbines)	Visual Exposure (Number of Buildings Affected)			
		High	Medium	Low	Total
Authorised Layout with 37 Turbines	800 km²	0	19	118	137
Amended Layout with 70 Turbines	980 km²	16	4	143	163

Key viewpoints identified in the original report (Oberholzer and Lawson 2011) are either outside both viewsheds or are in low visual exposure areas. Their visual exposure ratings are very similar:

Viewpoint	Site	Visual Exposure to the Authorised Layout	Visual Exposure to the Amended Layout
V1	R63 Victoria West outskirts	Low	Low
V2	R63 Hutchinson rail bridge	Not Visible	Not Visible
V3	Mon Desir on district road near landing strip.	Low	Low
V4	Vlakfontein turnoff on district road.	Low	Low
V5	Roggefontein gate on district road.	Not Visible	Not Visible
V6	N1 / district road intersection (Rondawel)	Not Visible	Not Visible
V7	N1 cutting near Blouberg	Not Visible	Not Visible
V8	N1 / R63 intersection (Skietkuil Resort)	Not Visible	Not Visible

V9	Loskop farmstead near R63	Low	Low
V10	R63 road cutting at power lines	Low	Not Visible
V11	R63 Uitvlugfontein	Not Visible	Low
V12	Hermanskraal on farm road	Not Visible	Not Visible
V13	Skanskraal gate on farm road	Not Visible	Not Visible
V14	Modderfontein farmstead	Low	Low
V16	Karoo Gastehuis on district road / N1 intersection	Not Visible	Not Visible

Discussion

The viewshed for the Amended Layout (Map 0-1) is larger than for the Authorised Layout (Map 0-2), which is to be expected since there are almost twice as many turbines and the new layout extends further to the south. However the 16 buildings in high visual exposure areas for the Amended Layout are all at a farmstead (Bultfontein) located on the same property as the wind turbines. Potential impact on views from the key viewpoints identified in the VIA report for the Authorised Layout will remain much the same for the Amended Layout. The Victoria West Nature Reserve is still located outside the viewshed as is the Horseshoe mountain. Hutchinson, the small settlement north-west of the proposed wind farm site, is located outside both layout viewsheds, while some parts of Victoria West are inside both viewsheds. A slightly longer section of the R64 will be within the Amended Layout viewshed than in that of the Authorised Layout viewshed and visual exposure will be high for a 10 km section of the R64 (approximately 6 minutes at 100 km/h) for the Amended Layout (Map 4). Visual exposure for the R64 to the Authorised Layout (Map 0-3) was at most moderate since it is further away from the nearest turbine location in that layout. Views from the N1 will be very limited for either layout and visual exposure will be low. There are no buildings within 500 m (distance used as a setback in the original report) of a wind turbine location in the Amended Layout.

Conclusions

The ratings for visual assessment criteria as set out in the original VIA report remain the same since the viewpoints identified in that report has the same potential visual exposure (Visibility rating in the original report) to the Amended Layout. The Bultfontein farmstead will experience high visual exposure to turbines in the new layout but it is located on the same property as the wind turbines (which indicate that one can assume that the owners/occupants are aware of the situation). Medium-High ratings for Visibility and Landscape Integrity will remain the same and the overall impact rating (Impact Intensity) of **Medium** for the Authorised Layout will be therefore remain the same for the Amended Layout. The overall significance of the potential visual impact remains **Medium**. The conclusion then is that the changes in the wind farm layout as indicated in the Amendments Report will not alter the significance of the potential visual impact as assessed in the original VIA Report.

References

Oberholzer, Bernard, and Quinton Lawson. 2011. "Proposed Renewable Energy Facilities in the Western and Northern Cape by Mainstream SA, Victoria West Site in the Great Karoo, Visual Impact Assessment." Draft Visual Impact Assessment. Cape Town, South Africa: Environmental Resources Management.

C.2 Terrestrial ecology specialist

P.O. Box 6041
Uniedal 7612

2 March 2016

CSIR Consulting and Analytical Services
P.O. Box 320
Stellenbosch 7601
Attention: Surina Laurie

Dear Surina

Victoria West Basic Assessment: Confirmation of assessment and ratings

I hereby confirm receipt of the document entitled "Environmental Impact Assessment of the proposed amendments to the Environmental Authorisation for the Mainstream Renewable Power South Africa Wind Energy Project near Victoria West in the Northern Cape" (DEA Ref Number: 12/12/20/1788 and 12/12/20/1788/AM1).

This letter is in response to your request for specialists to confirm whether or not the original assessment ratings and management actions contained in the EIA dated June 2011 remain unchanged.

I have noted that the original assessment provided predicted impacts for the development of between 534 and 703 wind turbines. However, an authorization for only 37 wind turbines was issued. There is now an application to increase this to 70 wind turbines. As this is still only 10% of the number of turbines originally proposed, and for which potential impacts were assessed, the proposed "additional" wind turbines will not change the impact assessments. These impacts include a long-term loss of natural vegetation at the sites where the turbines are erected, and along access roads, and disturbance of fauna during the construction phase, which will be reduced to a small impact during the operational phase.

The proposed mitigation measures should remain the same. These include that development within the drainage lines should be avoided; that no turbines should be placed within areas mapped as Very High Sensitivity and as few roads as possible should traverse it; and that an ecologist should be consulted to ensure micro-siting of turbines minimises damage to or loss of sensitive habitat (as specified in more detail in the above-mentioned report).

Please let me know if you require any further information.

Yours sincerely

Prof. B.W. van Wilgen

C.3 Heritage specialist

5 March 2016

CSIR environmental Division
PO Box 320,
Stellenbosch,
7599

Attention: Ms. Surina Laurie

Environmental Impact Assessment of the proposed amendments to the Environmental Authorisation for the Mainstream Renewable Power South Africa Wind Energy Project near Victoria West in the Northern Cape – Specialist Heritage Opinion

PGS Heritage (Pty) Ltd has been appointed by the CSIR to review the proposed amendment to the existing approved Mainstream Renewable Power South Africa Wind Energy Project near Victoria West in the Northern Cape and provide input on the potential impact of the amended project scope.

1. Proposed scope of amendment

The main amendment proposed is to increase the WEF's generation capacity from 95 MW to 140 MW which, in turn, necessitates the following:

- Develop 70 wind turbines on site instead of 37 wind turbines approved as part of Site Layout Alternative 2; and
- Amend the approved layout to ensure the optimal placement of each individual turbine.

The approved locations of the turbines and the proposed amended and additional locations are shown in Figure 1 below.

2. Original study

The original study completed by ACO Associates in 2011, evaluated the original proposed layout against the findings of a selective field study that focused on a specific layout. This field study recorded 23 find spots of which one was seen as significant.

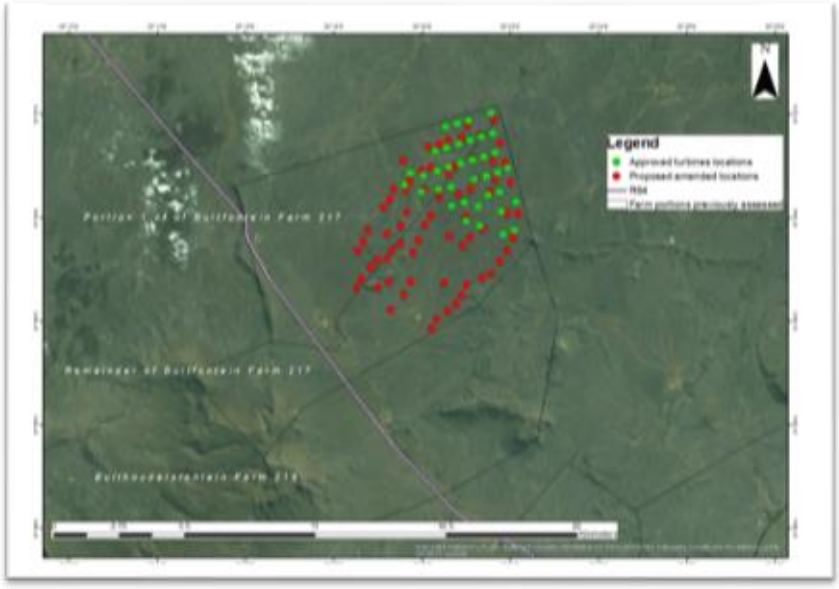

Figure 1. Proposed new and additional wind turbine locations (red) and previously authorised wind turbine locations (green). (Provided by CSIR, 2016)

The general observation made was that widely scattered lithics and, material used for the manufacture of lithics were found across the study area. The study further noted a discrete increase in the incidence of lithics scatters towards the south eastern hills and ridges of the study area.

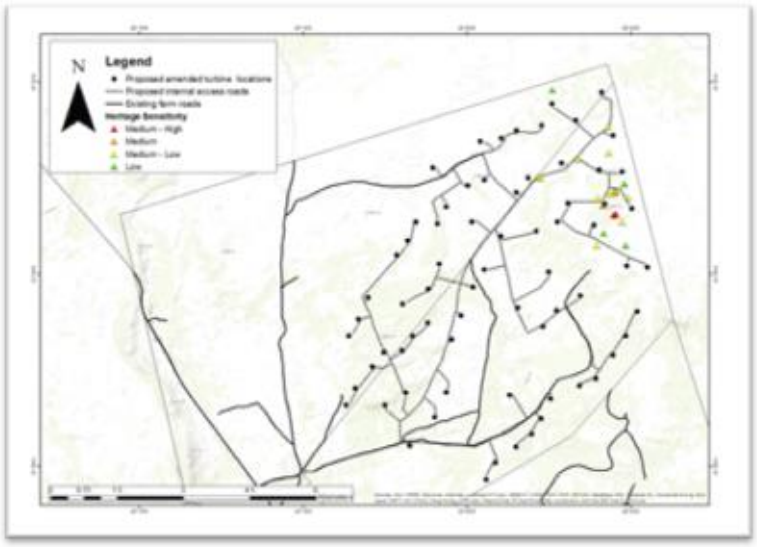

Figure 2. Sit distribution of known heritage features in relation t the new proposed turbine positions (Provided by CSIR, 2016)

3. Review

3.1. Methodology

The nature of heritage resources has shown that it would require a cost prohibitively detailed survey to identify every heritage resources, be it palaeontological, archaeological or historical inside the study area. The methodology utilized in the 2011 study is still considered the best practical option, through a selective field survey focusing on the identification of obvious heritage resources and the identification of landforms that is associated with certain heritage features (Table 1).

A mitigation and monitoring program is then proposed for implementation during the pre-construction and construction phase.

Table 1: Landform to heritage matrix

Land from Type	Heritage Type
Crest and foot hill	LSA and MSA scatters
Crest of small hills	Small LSA sites – scatters of stone artefacts, ostrich eggshell, pottery and beads
Pans	Dense LSA sites
Dunes	Dense LSA sites
Outcrops	Occupation sites dating to LSA
Farmsteads	Historical archaeological material

3.2. Site visit

The evaluation of the original 2011, confirmed the methodology utilized during field work. It was decided to do an additional field assessment linked to the assessment of the electrical infrastructure Basic Assessment for the WEF project.

A site visit was conducted on the 29th of February 2016, with the aim of confirming the findings of the 2011 study related to the increase of lithic scatters associated with hills and ridges. Approximately 30 km was covered by foot and vehicle and focused on the central plato of the study area where new turbine positions were planned. Due to the terrain only a few turbine positions could be accessed during the day on site.

The field work did however confirm that a general background scatter of lithics occur over the study area. Some higher densities of lithics were identified in areas that were thought to be void of such finds.

4. Findings and recommendation

The increase in the amount of turbines will increase the probability of heritage features occurring in the foot print areas of the turbines. This will however not elevate the impact significance and with the implementation of the recommendations as proposed in the 2011 study will keep the residual impact to the same levels as previously assessed.

It is recommended that the mitigation measures as proposed in the original study still be implemented. The over arching recommendation must still be implemented:

> *"The presence of additional heritage features close to or at the proposed amended wind turbine locations is unknown. It is therefore recommended that prior to the determination of the final layout and construction an archaeologist must undertake a site visit to each proposed wind turbine location. Any specific mitigation measures identified following the pre- construction walk down must be included in the updated EMPr."*

We trust that this review and input addresses the proposed amendment application for this project.

Any further queries can be submitted to Mr. Wouter Fourie on +27 12 332 5305 or email: wouter@pgsheritage.co.za

Sincerely,

Wouter Fourie
Director - Professional Archaeologist (ASAPA), Professional Heritage Practitioner (APHP)

C.4 Freshwater ecology specialist

Scientific Aquatic Services

Applying science to the real world

91 Geldenhuis Road, Malvern East Ext 1
Tel 011 616 7893
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Name: Stephen van Staden
Date: Monday, 07 March 2016
Ref: SAS 216030

Council for Scientific and Industrial Research (CSIR)
Environmental Management Services
PO Box 320,
Stellenbosch,
7599
Tel: (021) 888 2482
Email: SLaurie@csir.co.za

Attention: Ms. Surina Laurie

Dear Madam,

RE: SPECIALIST INPUT ON THE FRESHWATER ECOLOGY COMPONENT OF THE PROPOSED AMENDMENTS TO THE ENVIRONMENTAL AUTHORISATION FOR THE MAINSTREAM RENEWABLE POWER SOUTH AFRICA WIND ENERGY PROJECT NEAR VICTORIA WEST IN THE NORTHERN CAPE

Scientific Aquatic Services (SAS) was requested to undertake a review and provide specialist input on the freshwater ecology component for the above project. Following the single site visit which was conducted in February 2016 for the purposes of verifying key "points of interest" relating to the freshwater resources associated with the study area, a review of the information contained in the draft EIA Amendment report[1] was undertaken. The objective of the review was focused on the following aspects:

- To ensure that the work has adequately assessed the impacts of the proposed development; and
- To provide an independent opinion of the relevant section of the report, its findings and conclusion as it relates to the assessment of the impacts associated with the proposed project.

[1] *Environmental Impact Assessment of the proposed amendments to the Environmental Authorisation for the Mainstream Renewable Power South Africa Wind Energy Project near Victoria West in the Northern Cape.* Prepared by CSIR for Mainstream Renewable Power (Pty) Ltd. February 2016.

The following points highlight the key findings of the site assessment and subsequent review:

1. One primary river was identified, namely the Brak River, located south of the R63 provincial road. However, an unnamed tributary of the Brak River flows from the north-west of the Bultfontein farms, traversing the Bultfontein farm portions on which the proposed turbines will be located, across the R63, and enters the Brak River at a point approximately 5,7km north-west of the junction of the R63 and N1 highway;
2. Although the EIA Amendment report makes reference to this river being mapped, the map referred to is included in the Impact on Terrestrial Ecology section of the report, which may lead to confusion of the reader in the findings and discussion of the freshwater ecological aspects. Furthermore, the referenced map does not clearly indicate the Brak River or its unnamed tributary, thus making it difficult for the reader to ascertain where these riverine resources are located in relation to the proposed development. It is therefore recommended that an additional map, clearly indicating the locality of the Brak River, its unnamed tributary and associated ephemeral drainage lines, in relation to the proposed turbines be included in the discussion on freshwater ecology;
3. The map of the riverine resources included in the section on Terrestrial Ecology as discussed above, appears to have been developed utilising available topographic maps of the area, and does not depict the extent of the riparian zones associated with the watercourses on the study area. It is recommended therefore that, as a minimum, a desktop delineation and classification of these resources using available aerial photographs and/or digital satellite imagery be undertaken, and that a map be provided of these delineated watercourses and associated riparian zones depicting the proposed locality of the turbines in relation to the features, in order to aid the relevant authorities in considering the potential impacts of the proposed turbines on the watercourses;
4. No national or regional desktop information as it pertains to the freshwater ecology of the area is provided, as available on the National Freshwater Ecosystem Areas (NFEPA) Database. This information is considered important to ensure that the project takes into consideration national and regional ecological conservation targets and to assist in the impact significance determination;
5. Whilst a full assessment of the Present Ecological State, ecological functioning and characterisation according to Ollis *et. al* (2013) of the unnamed tributary of the Brak River (hereafter referred to as the "riverine resource") had not been completed at the time that this specialist input was prepared, it was apparent during the site visit that the riverine resource has undergone several modifications primarily as a result of historical and current agricultural activities. Such modifications include streambank incision and erosion, vegetation loss resulting from trampling and grazing by domestic livestock and wildlife, altered flow patterns due to installation of weirs and farm dams within the river, road crossings, and sedimentation as a result of erosion both within the riparian habitat and surrounding terrestrial areas. Nevertheless, the riverine resource is not considered to be severely degraded, and is still considered to provide important faunal habitat and migratory connectivity, despite its seasonal nature. Furthermore, it is considered to be important in contributing to the ecological functioning of the Brak River;
6. A desktop anaylsis of the proposed turbine localities in relation to the riverine resource, in conjunction with observations made in the field, indicates that no turbines are to be placed directly within the riverine resource or any smaller, ephemeral drainage lines associated with this riverine resource. As a consequence, the 100m buffer assigned to the riverine resource (as discussed in the EIA Amendment report) is deemed sufficient to provide adequate protection to the riverine resource from impacts which may arise as a result of the construction and operations of the turbines, particularly if careful mitigation of potential impacts is implemented;
7. Since due consideration has been given to the location of the proposed turbines as discussed in point 6 above, it is the opinion of the specialist that whilst the provision of additional baseline information pertaining to the freshwater ecology of the study area, including an assessment of the Present Ecological State, ecological functioning and characterisation of the watercourses, may be included for completeness, it is not deemed essential in order to allow for cogent decision making to take place by the EAP, proponent and the relevant regulatory authorities who must approve the EIA. The information may however be necessary in fulfilment of Regulation GN1199 as it pertains to the National Water Act.

As discussed in the draft EIA Amendment report, erosion (wind and water) as a result of clearing of vegetation in preparation for construction activities is of concern, and such cleared areas may also result in increased volume and intensity of stormwater runoff which may in turn result in altered flow volumes within the riverine resource as well as increase sediment entering the watercourse.

Due to the naturally erodible nature of the soils in the vicinity of the proposed turbines, it is considered essential that in order to minimise potential impacts, particularly during the construction phase, erosion control measures such as berms, energy dissipating structures, silt curtains and strategic placement of geotextiles such as Geojute or hessian be utilised in areas where soils are to be exposed. Such measures will aid in reducing sediment inputs to the riverine resource as well as protecting soils in the vicinity of the turbines which will ultimately aid in the effective rehabilitation of the disturbed areas. Vegetation clearing in preparation for construction should also be kept to a minimum to aid in erosion prevention and no vegetation within the riparian zone itself should be cleared. In addition, access for construction vehicles must be restricted to designated access roads and prevented from entering the riparian habitat, and the riparian habitat must be designated as a "no-go" area for all personnel associated with the project.

Based on the findings of this review, it is the opinion of the independent reviewer that although it is desirable that additional baseline information pertaining to the freshwater ecology of the study area is presented, along with relevant maps as recommended in Points 2-4 to provide further clarity, the locality of these watercourses in relation to the proposed turbines, and the potential impacts of the related activities, have been carefully considered during the planning phase. Therefore, the proposed mitigation measures contained in the EIA Amendment report (and in particular the commitment to ensuring that all turbines are placed outside of a 100m buffer around the watercourses), in conjunction with those recommended above, are deemed sufficient to minimise perceived impacts of the construction and operations of the proposed turbines.

Taking the above into consideration, it is the opinion of the independent reviewer that adequate information is contained within the EIA amendment report to allow for informed decision-making by the relevant authorities.

Please do not hesitate to contact me should you require clarity about this external review or have any other queries pertaining to the matter.

Yours Faithfully,

Digital Documentation Not Signed For Security Purposes

Stephen van Staden

C.5 Agricultural specialist

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AGRICULTURAL IMPACT STUDY FOR PROPOSED MAINSTREAM WIND ENERGY FACILITY ON THE FARM BULTFONTEIN NEAR VICTORIA WEST NORTHERN CAPE PROVINCE

Report by
Johann Lanz

March 2016

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Executive Summary

The proposed development is on land zoned for agriculture. South Africa has very limited arable land and it is therefore critical to ensure that development does not lead to an inappropriate loss of potentially arable land. This assessment has found that the proposed development is on land of very limited agricultural potential, that is only suitable for low intensity grazing. The wind farm development will not impact on any land that could be used for cultivation.

The key findings of this study are:

- There are two important factors that cause the significance of all agricultural impacts of the proposed development to be low. The first is that the actual footprint of disturbance of the wind farm (including all infrastructure and roads) is very small in relation to the available land (<1% of the surface area of the farm), and all agricultural activities would be able to continue unaffected on all parts of the farm other than the actual development footprint. The second is the fact that the proposed site is on land of very limited agricultural potential that is only suitable for low intensity grazing.
- The soils of the site comprise shallow to moderately deep sandy loam soils on underlying clay, rock or hardpan carbonate on the plains (Swartland, Mispah, Valsrivier, Oakleaf, Glenrosa, Hutton soil forms). The ridges are dominated by rock outcrop and shallow soils on underlying rock (Mispah, Swartland, Hutton, Glenrosa soil forms).
- The entire Bultfontein Farm has a land capability classification, on the 8 category scale, of Class 7 - non-arable, low potential grazing land.
- The limitations to agriculture are climate, soil and terrain related, all of which make the wind farm site unsuited to any form of cultivation.
- The grazing capacity of the farm is low, at 31-40 hectares per large stock unit.
- Four potential negative impacts of the development on agricultural resources and productivity were identified as:
    - Loss of agricultural land use caused by direct occupation of land by the energy facility footprint.
    - Soil Erosion caused by alteration of the surface characteristics.
    - Loss of topsoil in disturbed areas, causing a decline in soil fertility.
    - Degradation of veld vegetation beyond the direct footprint due to constructional disturbance, dust and vehicle trampling.
- The impact of the development on agriculture was assessed as being of low significance.

2 INTRODUCTION

Mainstream Renewable Power South Africa proposes to construct a Wind Energy Facility on the farm Bultfontein no 217, approximately 28 kilometres south east of the town of Victoria West in the Northern Cape (see Figure 1).

The facility will have 70 turbines with concrete foundations, hard standing areas at each turbine, internal access roads, cabling, an on-site substation, control buildings, a temporary lay down, and a 132kV power line connection to the Eskom transmission network. The farm Bultfontein is 7,880 hectares in extent, but the actual footprint of the energy facility that directly impacts agricultural land, will be less than 1% of the total farm area.

The objectives of this study are to identify and assess all potential impacts of the proposed development on agricultural resources, including soils, and agricultural production potential. Johann Lanz was appointed by Mainstream Renewable Power South Africa as an independent specialist to conduct this Agricultural Impact Study.

Figure 1. *Location map of the Bultfontein farm (red outline), south east of the town of Victoria West.*

3 TERMS OF REFERENCE

The terms of reference for the study fulfills the requirements for a soils and agricultural study as described in the National Department of Agriculture's document, *Regulations for the evaluation and review of applications pertaining to renewable energy on agricultural land,*

dated September 2011.

The study applies an appropriate level of detail for the agricultural suitability on site. A detailed soil survey, as per the requirement in the above document, is appropriate for arable land only. It is not appropriate for this site, where soil and climate constraints make cultivation completely non-viable. Conducting a soil survey at the required level of detail would be very time consuming but would also be a complete waste of that time as it would add no value to the impact assessment. The level of soil assessment that was conducted for this report (reconnaissance ground proofing of land type data) is considered more than adequate for a thorough assessment of all agricultural impacts.

The above requirements may be summarised as:

- Describe and map soil types (soil forms) and characteristics (soil depth, soil colour, limiting factors, and clay content of the top and sub soil layers).
- Describe the topography of the site.
- Describe the climate in terms of agricultural suitability.
- Summarise available water sources for agriculture.
- Describe historical and current land use, agricultural infrastructure, as well as possible alternative land use options.
- Describe the erosion, vegetation and degradation status of the land.
- Determine the agricultural potential across the site.
- Identify and assess all potential impacts of the proposed development on agriculture.
- Provide recommended mitigation measures and rehabilitation guidelines for all identified impacts.

4 METHODOLOGY OF STUDY

4.1 Methodology for assessing soils and agricultural potential

The pre-fieldwork assessment was based on existing soil and agricultural potential data for the site. The source of this data was the online Agricultural Geo-Referenced Information System (AGIS), produced by the Institute of Soil, Climate and Water (Agricultural Research Council, undated). Satellite imagery of the site available on Google Earth was also used for evaluation.

The AGIS data was supplemented by a field investigation. This was aimed at ground-proofing the AGIS data and achieving an understanding of specific soil and agricultural conditions, and the variation of these across the site. The field investigation involved a drive and walk over of the site using assessment of surface conditions and existing cuttings. The field assessment was done on 22 January 2016.

The owner of the farm, Mr MD Oberholzer was consulted on agricultural conditions and practices on the farm.

5 DESCRIPTION OF THE SOILS AND AGRICULTURAL CAPABILITY OF THE AFFECTED ENVIRONMENT

All the information on soils and agricultural potential in this report has been obtained from the online Agricultural Geo-Referenced Information System (AGIS), produced by the Institute of Soil, Climate and Water (Agricultural Research Council, undated).

5.1 Climate and water availability

Rainfall for the site is given as 300 mm per annum (The World Bank Climate Change Knowledge Portal, undated). The average monthly distribution of rainfall is shown in Figure 2. One of the most important climate parameter for agriculture in a South African context is moisture availability, which is the ratio of rainfall to evapotranspiration. Moisture availability is classified into 6 categories across the country (see Table 1). This site falls into the highest, class 6, which is labelled as a very severe limitation to agriculture.

There are wind pumps on the site, which are used for stock watering. There are also 48 hectares of irrigation under centre pivot on the farm. Irrigation water is pumped from boreholes in the vicinity of the centre pivots.

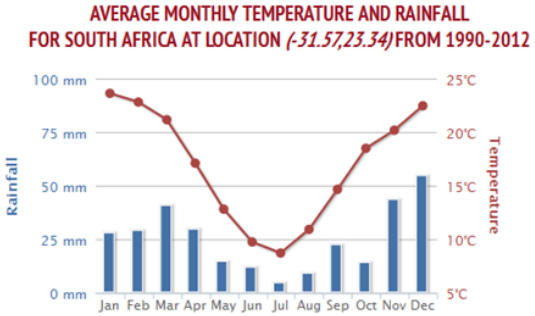

Figure 2. *Average monthly temperature and rainfall for the site (The World Bank Climate Change Knowledge Portal, undated).*

Table 1. The classification of moisture availability climate classes for summer rainfall areas across South Africa (Agricultural Research Council, Undated)

Climate class	Moisture availability (Rainfall/0.25 PET)	Description of agricultural limitation
C1	>34	None to slight
C2	27-34	Slight
C3	19-26	Moderate
C4	12-18	Moderate to severe
C5	6-12	Severe
C6	<6	Very severe

5.2 Terrain, topography and drainage

The proposed turbine development is located across two terrain units, level plains with some relief, intersected through the middle and on the southern boundary by a terrain unit of open high hills or ridges. Proposed turbine positions across the area range in altitude from 1,300 to 1,400 metres. Slopes are very variable across the site with very flat areas on the plains and slopes of up to 20% on the sides of the ridges.

Satellite image maps of the site are shown in Figure 3 and 4. Photographs of site conditions are shown in Figures 5 to 9.

The geology of the site is mudstone and shale of the Beaufort Group of the Karoo Supergroup. Dolerite intrusions are frequent, particularly on the ridges.

There are several non perennial drainage courses, typical of arid environments, across the site. These would only run for short periods after significant rainfall events.

5.3 Soils

The land type classification is a nationwide survey that groups areas of similar soil, terrain and climate conditions into different land types. There are two land types across the site, Fb488 which occupies the higher ridge terrain and Da147, which occupies the lower lying plains (see Figure 4). Da147 comprises shallow to moderately deep sandy loam soils on underlying clay, rock or hardpan carbonate. The soils of this land type fall into the Duplex, Lithic and Calcic soil groups according to the classification of Fey (2010). Fb488 is dominated by rock outcrop and shallow soils on underlying rock, which fall into the Lithic soil group according to the classification of Fey (2010). A summary detailing soil data for the land types is provided in Table A1.

The field investigation confirmed variable soil types and depths on the plains with underlying clay and rock, and on the ridges, the dominance of very shallow soils on underlying rock.

The land is classified as having low to moderate water erosion susceptibility (land type Fb488 is class 3 and land type Da147 is class 5). The land is classified as being moderately susceptible to wind erosion (class 3a).

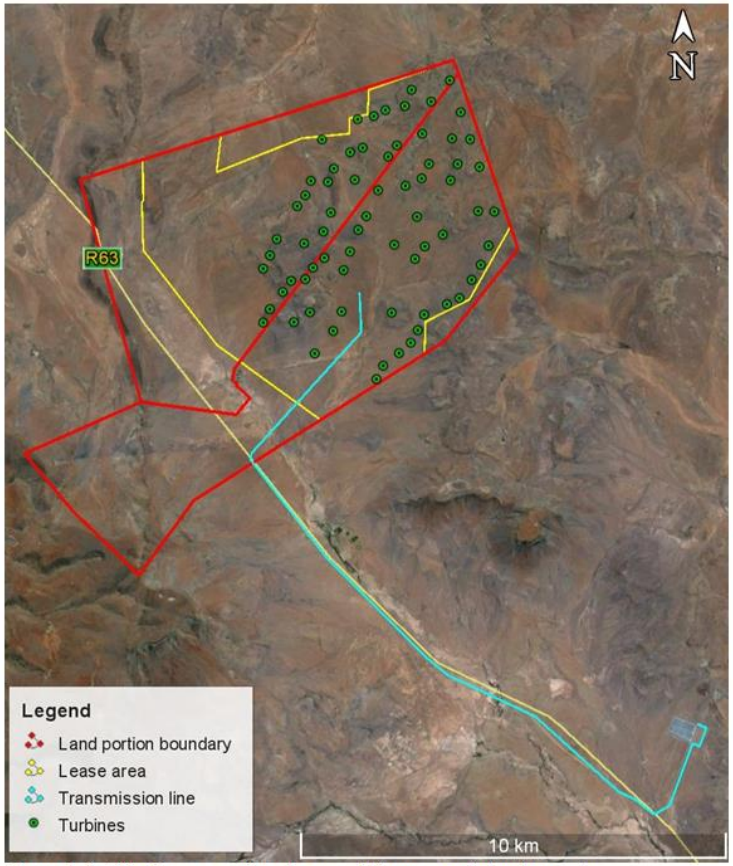

Figure 3. *Satellite image overview* site map of the proposed development.

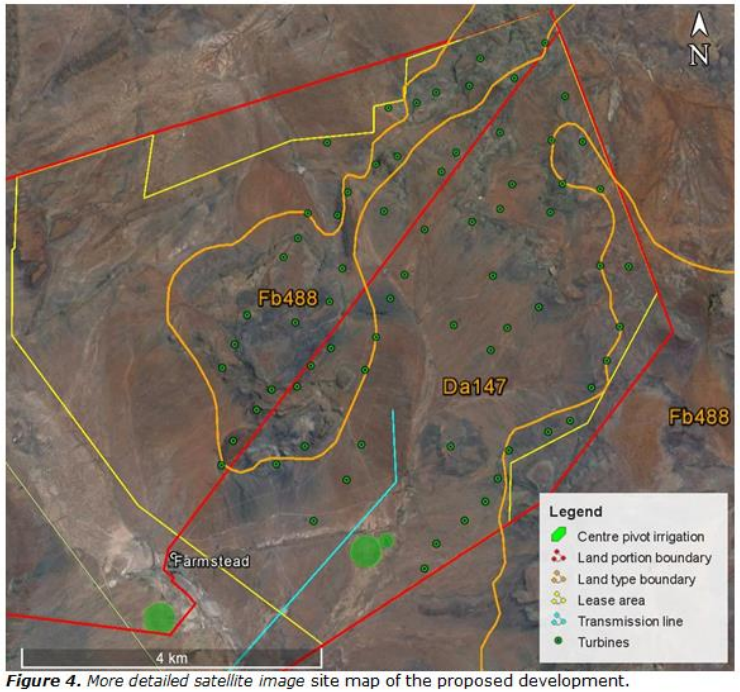

Figure 4. *More detailed satellite image* site map of the proposed development.

Figure 5. *View westwards across the site showing site conditions. The lower ridges in the background (in front of the mountains on the skyline) mark the western extent of the site.*

Figure 6. *Photo of typical surface outcrops of Beaufort sediments, this one within land type Da147.*

Figure 7. *Photo of typical, shallow Valsrivier soil on underlying clay.*

Figure 8. *Photo of deeper, sandy Oakleaf soil that occurs in places across the site.*

5.4 Agricultural capability

Land capability is the combination of soil suitability and climate factors. The entire Bultfontein Farm has a land capability classification, on the 8 category scale, of Class 7 - non-arable, low potential grazing land.

The limitations to agriculture are both climate and soil related. The moisture availability class 6 classification is a severe limitation to all agriculture. The grazing capacity of the farm is given on AGIS as very low at 31-40 hectares per large stock unit. Cultivation is not viable without irrigation. There is land, in addition to what has already been developed, available for irrigation on the farm, but water is limited. The available irrigation land is on lower lying, flatter parts of the farm in the vicinity of the existing centre pivots and not in the area of the wind farm development.

5.5 Land use and development on and surrounding the site

The farm is in an agricultural sheep farming region, and that is the major commercial agricultural activity on the farm and surrounding area. The centre pivot land is used for producing additional fodder.

There is a farmstead to the west of the proposed wind farm development. There is a tourist game lodge and a game area within the wind farm development. Agricultural infrastructure beyond that is confined to stock watering pints and fencing into grazing camps.

Road access to the site will be via the existing road network on the farm. Additional internal access roads will need to be constructed to individual turbines.

5.6 Status of the land

The biome classifications for the farm is Eastern Upper Karoo. The vegetation is grazed, but there is no evidence of significant erosion or other land degradation on the site.

5.7 Possible land use options for the site

The only viable agricultural land use for the proposed wind farm site is low intensity grazing. Although some parts of the farm are suitable for irrigated cultivation, the wind farm site is unsuited, predominantly because of the distance from and height above the water source. In much of the wind farm site the terrain and shallow soils are further limitations to any cultivation.

6 IDENTIFICATION AND ASSESSMENT OF IMPACTS ON AGRICULTURE

The components of the project that can impact on soils, agricultural resources and productivity are:

- Occupation of the site by the footprint of the facility
- Constructional activities that disturb the soil profile and vegetation, for example for levelling, excavations, etc.

There are two important factors that cause the significance of all agricultural impacts of the

proposed development to be low. The first is that the actual footprint of disturbance of the wind farm (including all roads and infrastructure) is very small in relation to the available land (<1% of the surface area of the farm), and all agricultural activities would be able to continue unaffected on all parts of the farm other than the actual development footprint. The second is the fact that the proposed site is on land of very low agricultural potential, that is only suitable for low intensity grazing. The wind farm development will not impact on any land that could be used for irrigated cultivation.

The following four potential impacts of the development on agricultural resources and productivity are identified, and discussed below:

1. Loss of agricultural land use due to direct occupation by all the development infrastructure, including roads, for the duration of the project (all phases). This will take affected portions of land out of agricultural production. The impact will be bigger during the construction phase, when construction activity will prevent areas from being used for grazing. During operation, the footprint of agricultural exclusion will be very small.

2. Erosion due to alteration of the land surface run-off characteristics. Alteration of run-off characteristics may be caused by construction related land surface disturbance, vegetation removal, and the establishment of hard standing areas and roads. Erosion will cause loss and deterioration of soil resources and may occur during all phases of the project. Erosion can be effectively controlled through erosion control measures.
   Mitigation measures: Implement an effective system of storm water run-off control using bunds and ditches, where it is required - that is at points, for example on roads, where water accumulation might occur. The system must effectively collect and safely disseminate any run-off water from all hardened surfaces and it must prevent any potential down slope erosion. The integrity of the system must be inspected regularly and if any instances of erosion occur, it must immediately be amended to prevent these.

3. Degradation of veld vegetation beyond the direct footprint due to constructional disturbance, dust and vehicle trampling.
   Mitigation measures: Control vehicle access on roads only. Control dust generation during construction activities by implementing standard construction site dust control measures of damping down with water where dust generation occurs.

4. Loss of topsoil due to poor topsoil management (burial, erosion, etc) during construction related soil profile disturbance (levelling, excavations, road surfacing etc.) and resultant decrease in that soil's capability for supporting vegetation.
   Mitigation measures: If an activity will mechanically disturb the soil below surface in any way, then any available topsoil should first be stripped from the entire surface to be disturbed and stockpiled for re-spreading during rehabilitation. Topsoil stockpiles must be conserved against losses through erosion by establishing vegetation cover on them. During rehabilitation, the stockpiled topsoil must be evenly spread over the entire disturbed surface. Any subsurface spoils from excavations must be disposed of where they will not bury the topsoil of agricultural land.

All impacts are considered to be of low significance.

7 CONCLUSION AND RECOMMENDATIONS

The development will not impact on any land that is suitable for cultivation. The agricultural impact of the development will be low.

8 REFERENCES

Agricultural Research Council. Undated. AGIS Agricultural Geo-Referenced Information System available at http://www.agis.agric.za/.

Fey, M. 2010. Soils of South Africa. Cambridge University Press, Cape Town.

The World Bank Climate Change Knowledge Portal available at http://sdwebx.worldbank.org/climateportal/

Johann Lanz
08 March 2016

APPENDIX 1: SOIL DATA

Table A1. Land type soil data for site.

Land type	Land capability class	Soil series (forms)	Depth (cm)	Clay % A horizon	Clay % B horizon	Depth limiting layer	% of land type
Da147	7	Swartland	20-50	10-15	25-40	vp	19
		Mispah	5-15	10-20		R, ca	15
		Valsrivier	50-120	10-15	25-40	vp	14
		Oakleaf	40-120	10-20	25-40		13
		Glenrosa	15-30	10-20	15-40	R, so	9
		Hutton	20-60	10-15	15-25	R, ca	7
		Rock outcrop	0			R	5
		Oakleaf	40-120	10-20	25-40		4
		Valsrivier	50-120	10-15	25-40	vp	4
		Hutton	20-60	5-15	15-20	R, ca	4
		Swartland	20-60	10-15	25-40	vp	3
Fb488	7	Rock outcrop	0			R	21
		Mispah	5-15	10-20		R	20
		Swartland	20-30	10-20	35-40	vp	15
		Hutton	10-30	10-20	15-20	R	15
		Mispah	5-15	10-20		ca	13
		Glenrosa	10-30	10-20	20-30	so	9
		Oakleaf	40-60	10-20	15-30	R	8

Land capability classes: 7 = non-arable, low potential grazing land.

Depth limiting layers: R = hard rock; so = partially weathered bedrock; ca = hardpan carbonate; vp = dense, structured clay layer.

C.6 Noise specialist

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NOISE IMPACT ASSESSMENT REPORT ON AN AMENDMENT TO THE PROPOSED ESTABLISHMENT OF A WIND FARM NEAR VICTORIA WEST IN THE NORTHERN CAPE

Prepared for
CSIR – Environmental Management Services

Prepared by
A.W.D. Jongens

JANUARY 2016

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Noise Impact Assessment Report on an Amendment to the Proposed Establishment of a Wind Energy Facility near Victoria West in the Northern Cape Province

1 INTRODUCTION

In 2011 Mainstream Renewable Power South Africa (Mainstream) received Environmental Authorisation (EA) from the Department of Environmental Affairs (authorisation register number 12/12/20/1788; NEAS reference number DEA/NEAS/12225/2011) for the development of a Wind Energy Facility near Victoria West in the Northern Cape Province. Mainstream wishes to apply for two amendments which will be undertaken during two separate processes. The first amendment is to increase the electrical capacity of 95 MW by 37 wind energy turbines in an approved layout located on the farm Bultfontein to 140 MW by 70 wind energy turbines and the second amendment is to increase the turbine hub heights to 150 m; and increase the rotor diameters to 150 m. This Noise Impact Assessment (NIA) assesses both the proposed amendments.

The Environmental Impact Assessment (EIA) for the initial application for EA contained the Noise Impact Assessment (NIA) undertaken by Jongens Keet Associates (JKA, February 2011). All acoustical factors and procedures pertaining to the present study are contained in the previous report that contains a glossary of terms used in the measurement and assessment of sound; a description of the affected environment; details of the legislative framework and regulatory guidelines; study approach; noise calculation procedures; and factors influencing noise at receptors understood at that time.

The present study compares the predicted equivalent continuous A-weighted sound pressure levels, L_{Aeq}, and associated noise impacts emanating from the approved 37 turbine layout with that emanating from the proposed amended 70 turbine layout with increased hub height and rotor diameter.

The approved and the proposed amended turbine layouts are displayed in Figure 1.

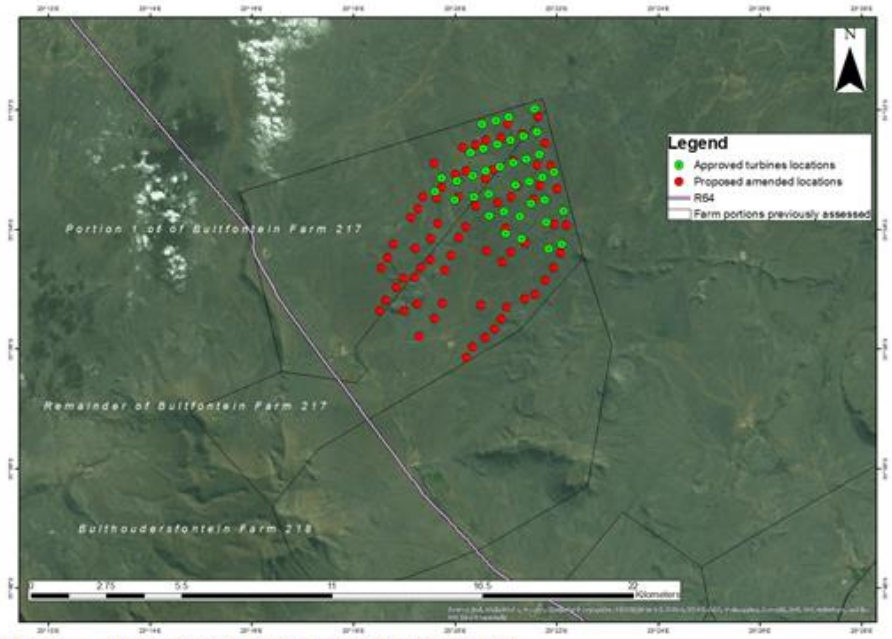

Figure 1 Approved and amended wind turbine layouts.

2 LEGISLATIVE FRAMEWORK

Under **Specific conditions - Noise** of the EA the following are listed:

81. *Noise from the turbines at the identified noise sensitive areas must be less than the 45dB(A) limit for rural areas presented in SANS10103.*
82. *The applicant must ensure that the National Noise Control Regulations and SANS10103:2008 are adhered to and reasonable measures to limit noise from the work site are implemented.*
87. *All wind turbines should be located at a setback distance of 500m from any homestead and a day/night noise criteria level at the nearest residents of 45dB(A) should be used to locate the turbines. The 500m setback distance can be relaxed if local factors, such as high ground between the noise source and the receiver, indicate that a noise disturbance will not occur.*
88. *Positions of turbines jeopardizing compliance with accepted noise levels should be revised during the micro-siting of the units in question and predicted noise levels re-modelled by the noise specialist, in order to ensure the predicted noise levels are less than 45dB(A).*

In accordance with the Noise Control Regulations (NCR) the ***measuring point*** *relating to a piece of land from which an alleged disturbing noise emanates, means a point outside the property projection plane where an alleged disturbing noise must be measured.* This encompasses the common law principle that the owner or occupier of land has the duty to exercise his or her rights of ownership or use in such a manner that they do not infringe on the rights of peace and enjoyment of property of adjoining owners whether it is occupied or not. It may not influence the value of the property.

3 ASSUMPTIONS AND LIMITATIONS

The NIA in this study was conducted in accordance with the Noise Control Regulations (NCR) and relevant South African National Standards (SANS). These are in line with existing international regulations and standards.

Over recent years it has internationally become increasingly evident that **these procedures are inadequate in assessing the response of humans, as well as animals, exposed to wind turbine noise**. Efforts are underway in some countries to introduce more appropriate assessment criteria in their standards and regulations relating to turbine noise.

The single-figure, equivalent continuous A-weighted sound pressure level, L_{Aeq}, averaged over a daytime or night-time period has for decades been successfully applied by noise regulations and relevant standards to assess and control environmental noise. Typically this includes industrial noise and road traffic noise. The success is due to the level of noise ("loudness") from the respective sources being constant (industry) or varying slowly (road traffic) over an hour or longer periods of time. The noise is predictable from one day to any other day and therefore relatively simple to measure, predict and assess.

By contrast wind turbine noise is not constant. It can vary over short time periods from being inaudible to "very loud". It is described by exposed communities as varying between "swishing", low-frequency "whooshing" and at times loud "thumping". The variation and erratic nature of the noise render it distinctly more noticeable and intrusive than other man made noise. This has been confirmed by measurements conducted by this author. Complaints have been received by affected communities residing up to 2 km from wind farms.

This occurrence is termed Amplitude Modulation which is the rapid variation, within parts of a second, of the level as well as the frequency content of turbine noise. The L_{Aeq} that averages the level over extended time periods of minutes or hours is an inadequate measure of humans' response to this phenomenon. Notwithstanding its importance, insufficient knowledge exists to predict amplitude modulation and is not considered further in this report.

The single L_{Aeq} value contains no information regarding the frequency content of noise. Much of the disturbance experienced by recipients of noise wind turbine noise is caused by low frequency content of the noise that is concealed by employing A-weighted sound levels. At separation distances beyond 100 m the low frequency content becomes increasingly dominant compared to high frequencies due to atmospheric absorption effects. This is illustrated in Figure 5.

In addition the erroneous perception is held by many that when the wind blows turbine noise will be masked by noise from rustling trees and vegetation. The impact of turbine noise occurs predominantly during the most noise sensitive period between sunset and sunrise when meteorological effects can cause significant wind speeds at the height of rotor blades (more than 100m above ground) whilst wind-still conditions prevail at ground level. Ambient (residual) sound levels are very low resulting in insignificant masking noise thereby rendering turbine noise more noticeable during night-time.

This study therefore includes a more detailed frequency analysis at the nearest noise sensitive receptor under section 5 that considered the predicted noise for the proposed amendment turbine layout. This was not necessary for the approved layout.

4 WIND TURBINE NOISE EMISSION DATA

4.1 APPROVED LAYOUT

The original NIA was based on 1/3rd octave frequency band noise emission data of a wind energy turbine of 2,3 MW electrical capacity; hub height of 80 m; rotor diameter of 100,6 m; and an overall, single-figure A-weighted Sound Power emission level of 106,9 dBA operating in a wind speed of 8 m/s referenced to 10 m height. The same data was used in the present study for the 37 turbine approved layout.

4.2 PROPOSED AMENDED LAYOUT

The proposed amendment relates to 70 wind energy turbines with a total electrical capacity of 140 MW; hub height up to 150 m; and rotor diameter up to 150 m.

At the time of writing Mainstream had not made a decision on which turbines would be installed. Under consideration was a 4,2 MW turbine with 141 m rotor diameter, hub height of between 129 and 159 m and maximum Sound Power Emission Level of 105.5 dBA. The rotor blades comprised what is termed "Trailing Edge Serrations" (TES) the purpose of which was to reduce noise emission levels accompanying reduced air turbulence at the trailing edge of the blades. The principle is based on the same effect produced by the feathers of birds in flight.

No 1/3rd octave frequency band noise emission data was available of the turbine being considered. This study therefore made use of detailed noise emission data available from another manufacturer of a 3,3 MW turbine with 126 m diameter rotor and 100m hub height with a similar overall A-weighted Sound Power Level. 1/3rd octave frequency band Sound Power emission levels for conventional "clean" rotor edges as well as serrated trailing edges were available.

In the absence of detailed noise emission data of the turbines under consideration by Mainstream, it was judged that use of the data from the other manufacturer in the sound propagation calculations would provide a best estimate of the predicted noise levels in the study area.

Figure 2 displays the 1/3rd octave frequency band Sound Power emission levels for serrated and clean rotor edges for a wind speed of 13 m/s at hub height. The overall A-weighted Sound Power emission Levels of 105,7 and 108,3 dBA, respectively, are recorded in the legend.

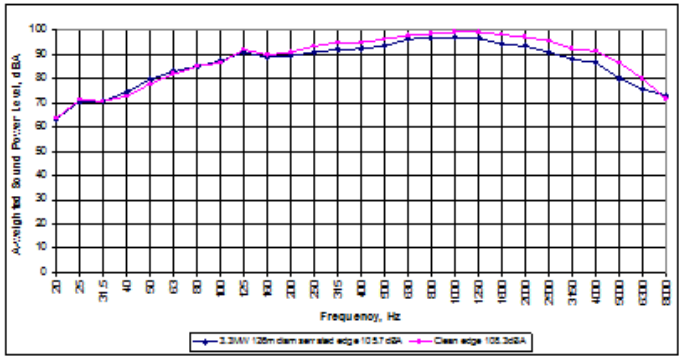

Figure 2 A-weighted Sound Power emission Levels for serrated & clean rotor blades

It is apparent from the graph that a serrated rotor edge reduces noise emission levels for frequencies above 200 Hz but has no influence on emission levels for frequencies below 200 Hz.

5 RESULTS OF WIND TURBINE NOISE CALCULATIONS

The predicted L_{Aeq} contours for the respective turbine layouts are displayed in the figures included in the following sub-sections. The turbine locations are at the centre of the dark orange circles. The respective L_{Aeq} contour values have been denoted by numerals on a white background with a lowest value of 20 dBA. This is well below the measured residual L_{Aeq} of 33 dBA recorded during sunset in the study area. The probability of a noise impact on noise sensitive residential areas beyond the 20 dBA contour line was considered to be very low. Areas that would be exposed to levels less than 20 dBA therefore contain no colour shading.

The boundaries of the wind energy facility previously assessed are outlined in red. Noise sensitive receptors are denoted by blue ellipses. These comprise a main residence surrounded by other dwellings.

The land areas beyond the WEF boundary where the predicted L_{Aeq} would exceed the residual level of 33 dBA by 7 dB i.e. 40 dBA is depicted by part of the 40 dBA contour highlighted in yellow.

Figure 5 in Section 5.2 displays the calculated 1/3rd octave frequency band L_{Aeq} sound levels (spectrum levels) at the Bultfontein main residence and the measured daytime residual L_{Aeq} spectrum during minimal wind speed. The overall L_{Aeq} values are recorded in the legend.

5.1 APPROVED LAYOUT

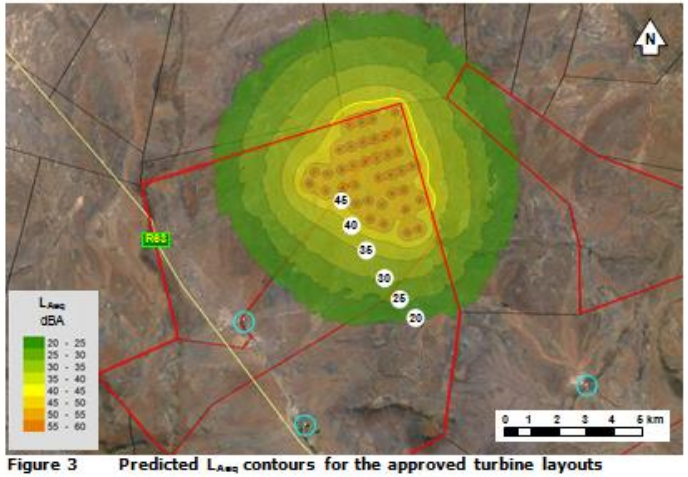

Figure 3 Predicted L_{Aeq} contours for the approved turbine layouts

5.2 PROPOSED AMENDED LAYOUT

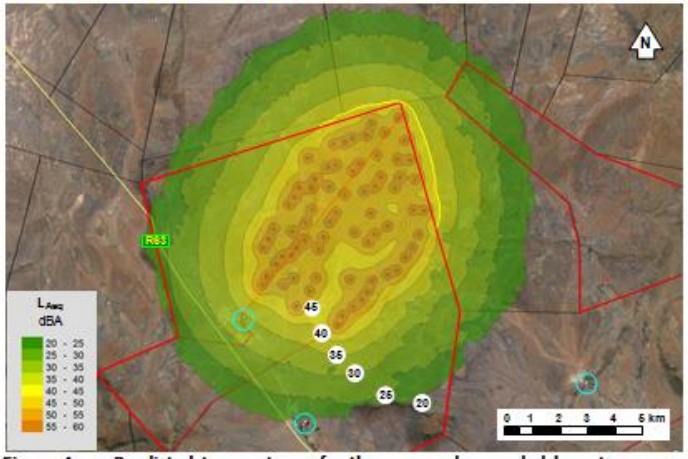

Figure 4 Predicted L_{Aeq} contours for the proposed amended layout

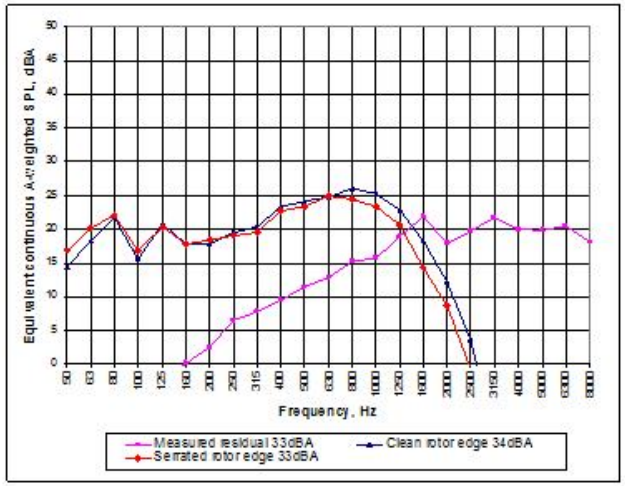

Figure 5 Calculated L_{Aeq} spectra for clean and serrated rotor edge at main residence, proposed amended layout

6 ASSESSMENT OF THE RESULTS

6.1 APPROVED LAYOUT

The results of the investigation predicted that the L_{Aeq} at all identified noise sensitive residential areas would be significantly lower that the day/night level of 45 dBA for a rural area and thus compliant with conditions 81, 87 and 88 of the EA (refer Section 2).

The land beyond the northern and eastern boundaries and the 40 dBA contour (highlighted in yellow) would exceed the measured ambient (residual) level of 33 dBA by 7 dB or more. In terms of the NCR the noise would be adjudicated as being a disturbing noise and noise mitigation procedures would need to be implemented in order to comply with Condition 82 of the Environmental Authorisation.

6.2 PROPOSED AMENDED LAYOUT

The results of the investigation predicted that the L_{Aeq} at the nearest noise sensitive residents of Bultfontein farm would be 34 dBA for rotors with clean blade edge and 33 dBA for rotor blades with serrated edges. The values would be just lower than the night-time value for a rural area and thus compliant with Conditions 81, 87 and 88 of the EA (refer Section 2). The L_{Aeq} at the other identified noise sensitive residential areas would be significantly lower.

Notwithstanding compliance with the conditions (outlined in Section 2 of this report, with reference to the content in Section 3, comparison of the spectrum of the predicted wind turbine noise with that of the measured residual noise in Figure 5 indicates that the latter noise would have little masking effect on wind turbine noise below 1 250 Hz. The levels at frequencies below 1 000 Hz exceed the residual levels by 10 dB or more. This indicates that it is highly probable that noise within this frequency range would be audible similar in character to that described in Section 3 and might be considered to be intrusive at the closest residence.

The land beyond the northern and eastern boundaries and the 40 dBA contour (highlighted in yellow) would exceed the measured ambient (residual) level of 33 dBA by 7 dB or more. In terms of the NCR the noise would be adjudicated as being a disturbing noise and noise mitigation procedures would need to be implemented in order to comply with Condition 82 of the Environmental Authorisation.

Comparison of the results in Figures 3 and 4 indicate a slight, but not significantly, larger land area between the boundaries and the 40 dBA contour line for the amended layout. Were the turbines to be the same as the previous, approved layout there the land area would not be significantly different.

7 CONCLUSIONS

The results of the study indicated that the predicted L_{Aeq} would comply with the conditions 81, 87 and 88 of the EA.

However, due to the low residual noise levels in the study area large areas beyond the WEF boundaries would not comply with the NCR and thereby not compliant with condition 82.

The identified noise sensitive residential area would be located approximately 1 400 m from the nearest wind energy turbine; well beyond the setback of 500 m stipulated in condition 87 of the EA. Yet, due to the low residual noise levels, the results of the detailed analysis indicated a high probability that the noise would impact on the residents during certain meteorological conditions.

8 MITIGATION MEASURES

Reducing the noise emission levels at source by the amount required to comply with the NCR beyond the WEF boundaries would not be practically feasible.

From the L_{Aeq} contours displayed in Figure 4 compliance with the NCR and thus with condition 82 of the Environmental Authorisation would require relocation of several of the turbines with a minimum distance of 800 m between turbines and WEF boundaries.

Increased separation distances between noise sensitive residence and nearest turbine locations would be required to reduce the probability noise impact on the residents.

From previous experience and literature a minimum distance of 2 000 m should be considered.

9 RECOMMENDATIONS

It is anticipated that implementation of the mitigation measures under Section 8 would have a serious impact on the viability of the proposed WEF.

An alternative would be to apply for exemption as provided for in Regulation 7 of the NCR. Although not stipulated, the process of applying for exemption should afford an opportunity to all interested and affected parties to submit representations on the exemptions applied for.

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C.7 Bat specialist

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Attention: Mercia Grimbeek
Mainstream Renewable Power South Africa
4th Floor, Mariendahl House, Newlands on Main
Corner Main Road and Campground, Claremont, Cape Town

Date: 10 February 2016

Dear Mercia

CHANGE IN CAPACITY OF VICTORIA WEST 1 WIND ENERGY FACILITY

Mainstream Renewable Power South Africa (Mainstream) intends on developing a 140MW wind energy project called the Victoria West 1 Wind Energy Facility (Vic West 1 WEF). Vic West 1 has received environmental authorisation, however, approval was for a 95MW facility, not 140MW. The recent increase in capacity is due to Mainstream adding more turbines. Fourteen months of bat preconstruction monitoring was completed by the bat division of Natural Scientific Services (NSS) (now Inkululeko Wildlife Services (IWS)) in 2012/ 2013 for the boundary area shown in **Figure 1** below. A bat specialist report was completed (NSS, 2013). As long as turbines are built within the original study boundary area covered by NSS (**Figure 1**) and all mitigation measures and no-go areas as per the sensitivity map (**Figure 2**) are adhered to that were recommended in NSS (2013), IWS does not envisage a change in terms of the impact assessment *from a turbine siting perspective* from the original recommendations due to the increase in the number of turbines.

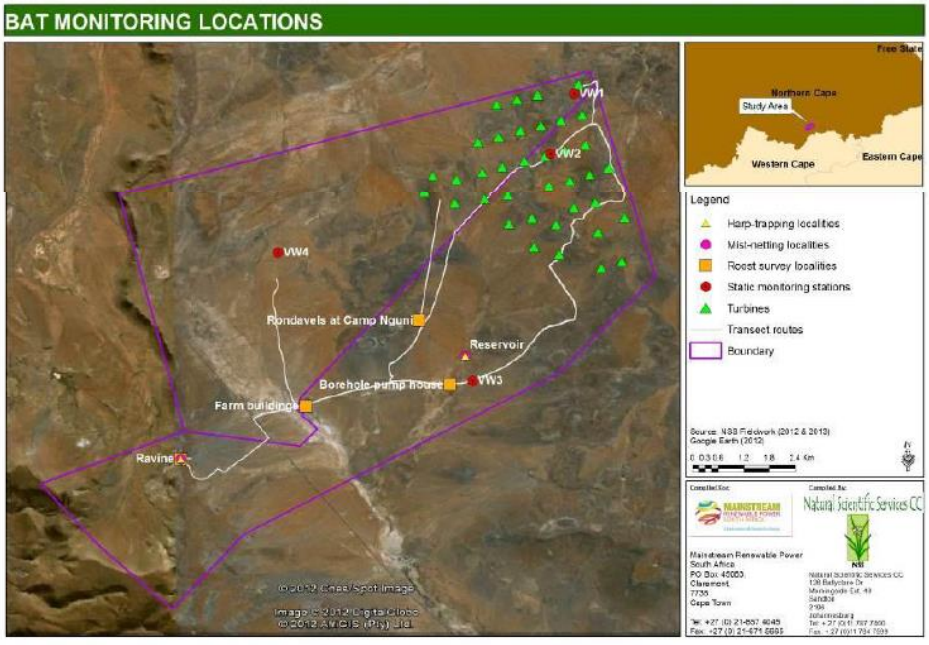

Figure 1 Bat Monitoring Study Boundary and Detector Locations (NSS, 2013)

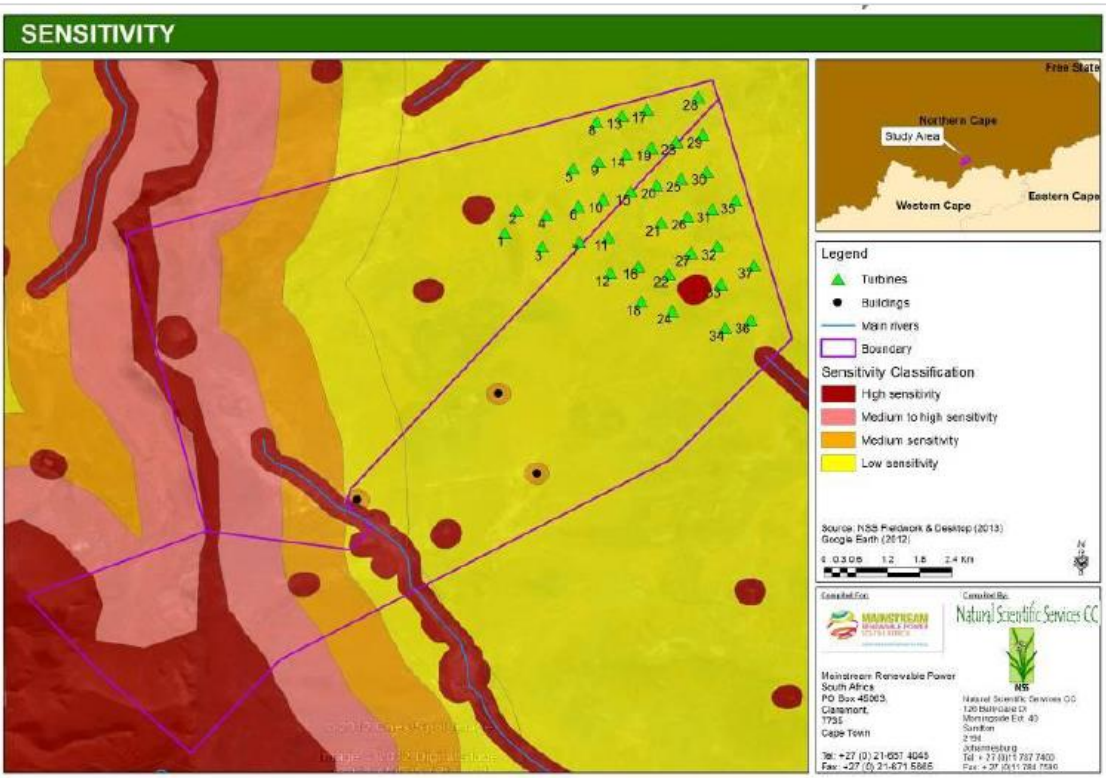

Figure 2 **Bat Sensitivity Map (NSS, 2013)**

Kind Regards

Kate MacEwan
for Inkululeko Wildlife Services

C.8 Avifaunal specialist

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20 November 2015

Enelge Gildenhuys
Project Development Executive
Mainstream Renewable Power South Africa

Dear Enelge

Comments on the implications of changes in the size and layout of the proposed Victoria West 1 Wind Farm, and in the specifications of the wind turbines installed, for the anticipated avian impacts of this development

This is to confirm that as the bird specialist contracted to work on the identification and mitigation of bird impacts resulting from the proposed Victoria West Wind Farm, I have been asked to comment on the implications for bird impacts of changes in the specifications, number and layout of the wind turbines making up the project.

The new proposal is for nearly double the number of turbines (60 *vs* 37) considered in the pre-construction study of the affected avifauna (Jenkins *et al.* 2013), completed as per the Environmental Authorisation. In terms of the latter comparison, the proposed changes also include variation in the siting of the original turbine placements, an increase in the hub height (150 m *vs* a maximum of 120 m) and rotor diameter (150 m *vs* a maximum of 120 m) of the turbines, and a resulting 150% increase in the rotor swept area of the wind farm (all other things being equal, a reasonable proxy for the net impact risk posed by the wind farm on the local birdlife). The new proposal also includes a doubling in the length of the attending power line - the impacts of which are covered in a new, separate study.

However, it should be noted that the current authorisation for this development was based on a far bigger wind farm proposal (in excess of 700 turbines spread across a far bigger area – Jenkins 2010), so the impacts are still likely to be substantially less than those already approved.

Hence, the key question in evaluating the implications of the latest changes in project parameters for the standing authorisation is whether or not the requirement of the EA to gather pre-construction data to inform the final layout of the wind farm is still met?

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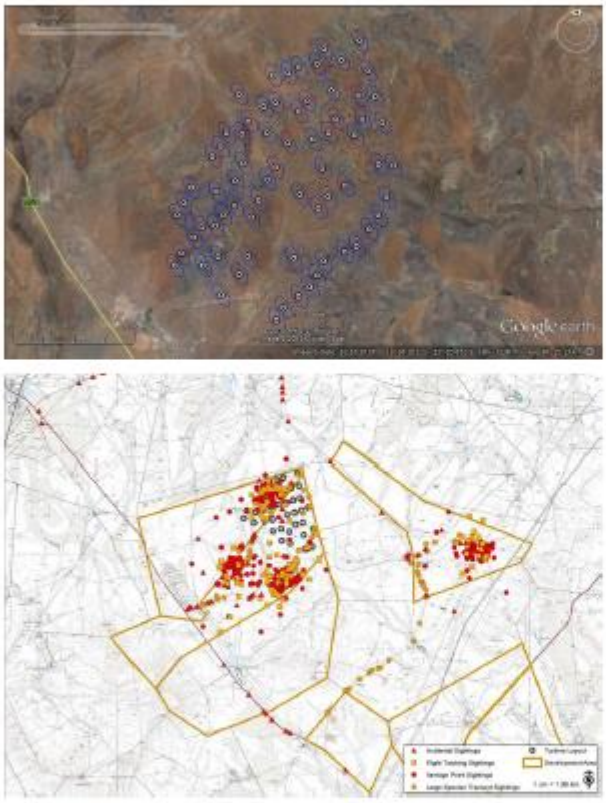

Figure 1. The project layout addressed by the pre-construction bird study (above; red circles), the new proposed layout (above; white circles/blue elispses), and the coverage of the general area achieved by the pre-construction bird study, with bird sightings (red and orange icons) and the layout assessed (white circles) (below).

A comparison of the project layout at the time of the pre-construction bird study, the new proposed layout, and the actual coverage achieved by the pre-construction bird study (Fig. 1), shows that much of the newly proposed footprint was actually included in the bird survey and monitoring work done to service the original project. Also note that little of concern (in terms of the regular presence or movement through the development area of important populations of impact susceptible birds) was recorded during the course of the pre-construction bird study for the site (Jenkins *et al.* 2013).

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Overall, while the client is proposing to increase the avian risk profile of the development considerably from the previously proposed layout and turbine specifications, the requirements of the existing Environmental Authorisation for the project have still been met by the bird impact studies done to date, and there is no need adjust these requirements or otherwise change the conditions of the EA.

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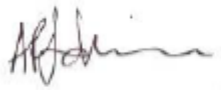
Yours sincerely



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