WKN Windcurrent

Environmental Impact Assessment for the proposed Banna Ba Pifhu Wind Energy Project near Humansdorp, Eastern Cape: Final Environmental Impact Assessment Report

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Report details

Title:	**Environmental Impact Assessment for the proposed Banna Ba Pifhu Wind Energy Project near Humansdorp, Eastern Cape: Final Environmental Impact Assessment Report**
Purpose of this report:	This Final Environmental Impact Assessment Report (FEIA) forms part of a series of reports and information sources that are being provided during the Environmental Impact Assessment (EIA) process for the proposed Banna Ba Pifhu Wind Energy Project. In accordance with the EIA Regulations, the purpose of the FEIA is to: • Present the proposed project, including project alternatives and the need for the project; • Describe the affected environment, including the planning context, at a sufficient level of detail to facilitate informed decision making; • Provide an overview of the EIA process being followed, including public consultation; • Assess the predicted positive and negative impacts of the project on the environment; • Provide recommendations to avoid or mitigate negative impacts and to enhance the positive benefits of the project; and to • Provide a draft Environmental Management Programme (EMPR) for the design, construction and operational phases of the project. The Final EIA Report and EMPR are being made available to all stakeholders for review. All comments on the Final EIA Report and EMPR are to be submitted to Public Process Consultants and the national Department of Environmental Affairs (DEA) directly. DEA will then review the Final EIA Report and EMPR and will issue an Environmental Decision.
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Summary

PROJECT OVERVIEW

WKN Windcurrent SA (Pty) Ltd (referred to as "WKN Windcurrent") is proposing the construction of a wind energy project on the Broadlands and Saragossa Farms in the Kouga Municipal Area, approximately 3.5 km south of the town of Humansdorp (*Figure S1*). The proposed project is referred to as the Banna Ba Pifhu Wind Energy Project. At the start of the EIA process, this project was planned with a maximum generation capacity of 50 MW and a maximum of 28 wind turbines. The Final Scoping Report (October 2011) and Draft EIA Report (April 2012) refer to the 50 MW Banna Ba Pifhu wind energy project. At that stage of the EIA process, it was proposed to connect the wind farm either to the existing 66 kV Melkhout / St. Francis overhead powerline, which passes through the site, or to build a new 132 kV overhead powerline which would connect the wind farm to the Melkhout substation, located approximately 7 km north of the site. Since the release of the Draft EIA Report, Eskom has conveyed to WKN Windcurrent that the existing 66 kV Melkhout / St. Francis overhead powerline can only receive an additional connection of up to approximately 30 MW from this project. WKN Windcurrent has thus decided to **decrease the total capacity from 50 MW to 30.6 MW** (approx. 9 to 17 turbines) in order to utilize the on-site grid connection.

Both the 50 MW and 30.6 MW alternative layouts are assessed in the Final EIA report, with 50 MW being alternative 1 with a maximum of 28 turbines, and **30.6 MW being the preferred alternative** with a minimum of 9 and a maximum of 17 turbines (the actual number will be dependent on the capacity of the turbines selected in the range between 1.8 and 3.2 MW).

The Banna Ba Pifhu Wind Energy Project will be located on the following farms:

- Remainder of Farm 688;
- Portions 2 and 15 of Farm 689 and
- Portion 1 of Farm 868.

NEED FOR THE PROJECT

The aim of this project is to generate electricity that will be fed into the national or the provincial grid by erecting a wind farm of 30.6 MW. In mid-2011, the South African government indicated a change in pricing strategy for renewable energy. Instead of applying a predetermined renewable-energy feed-in tariff (Refit), as previously indicated, the government would conduct a selection process that would involve both price and non-price elements. This requires bidders to propose their price per MWh for the energy output to be generated, along with full or partial inflation indexation. The price indication would be for the first 20 years of operation, or for the duration of the power purchase agreement (PPA). On 3 August 2011, the Department of Energy (DoE) released the qualification and proposal documentation for South Africa's first renewable energy independent power producer (IPP) tender process, and announced that it has allocated

a total of 3 725 MW capacity across various renewables technologies, with 1 850 MW set aside for onshore wind. This allocation to wind energy is an increase on the 1 025 MW set out for the first procurement round in the Integrated Resource Plan (IRP) 2010-2030 (Source: Engineering News, 4 & 5 August 2011).

At a national scale, renewable energy (in particular, wind energy) has the potential to play an important role in meeting South Africa's energy demand through diversifying the sources of power generation whilst reducing the country's carbon footprint from power generation. Currently, approximately 93% of South Africa's power generation is derived from coal. The proposed Banna Ba Pifhu Wind Energy Project of 30.6 MW could offset over 61 200 tonnes of CO_2 per year, or 1 224 000 tonnes of CO_2 over the lifetime (20 years) of the project. [1,2.]

The Eastern Cape Province is reliant on electricity imports from other provinces yet houses significant industrial and rural development potential. Power from the national grid is largely generated from coal power stations, and transmitted considerable distances to the Eastern Cape (e.g. from Mpumalanga). This leads to significant transmission losses and local grid instabilities. Electricity supply to the Eastern Cape Province is further constrained by transmission infrastructure. Eskom currently supplies approximately 1 400 MW of electricity to the Eastern Cape Province.

At a provincial level, the project aims to assist the Eastern Cape in achieving improved energy stability and security. The local wind climate in the Humansdorp region creates the potential for a wind energy project to generate electricity, thereby contributing towards the provision of sustainable renewable energy.

PROJECT DESCRIPTION

Wind turbines

- Nine to seventeen turbines will be erected (the actual number will be dependent on the capacity of the turbines selected in the range between 1.8 and 3.2 MW). The turbines will have an expected hub height from 80 m to 105 m and a blade diameter from 90 m to 117 m.
- Turbines will be supported on foundations dimensioned to the geotechnical properties, for example reinforced concrete spread foundations of approximately 20 m by 20 m at a maximum depth of 3 m.
- Electrical transformers will be placed beside each turbine or in the nacelle of each turbine.
- Hard standing areas will be established adjacent to each turbine for use by cranes during construction and retained for maintenance use throughout the life span of the project.
- Gravel roads, approximately 5 m wide, will be necessary to provide access to each turbine site, with the intent being to upgrade existing roads as far as possible.

Electrical connections

1. The wind turbines will be typically connected to each other and to the substation using medium voltage cables which will, in most cases, be buried approximately 1 m below ground, except where a technical assessment of the proposed design suggests that above ground lines are appropriate. The final internal underground cabling design will not traverse any sensitive areas as identified by the environmental specialists. The impact through trenches for the underground cabling can thus be minimised by decreasing the total lengths needed.

[1] http://www.iea.org/co2highlights/

[2] http://www.sunearthtools.com/dp/tools/CO2-emissions-calculator.php?lang=de#txtCO2_3

2. A new substation will be built on site to connect to the distribution or transmission system (maximum size of 100 m by 100 m). It is proposed to connect the wind farm substation to the existing 66 kV Melkhout / St. Francis overhead powerline, which passes through the site.
3. The connection from the new substation to the Eskom grid line would be via underground cabling or a stretch of over head line supported on an intermediate pole(s), depending on the location of the substation relative to the 66 kV line.

Other infrastructure

1. Operations and maintenance building: An existing vacant building on the farm will be utilised as a storage/ maintenance and control/operations facility for the wind energy project. New buildings will not be erected.
2. Fencing as required.

Temporary activities during construction

1. A lay down area (alongside an access route) of maximum area 10 000 m^2 is necessary for the assembly of the turbine components– this hard standing area could be temporary or if the landowner prefers, left for long-term use.
2. The overall site compound for contractors would be approximately 5000 m^2.
3. Existing borrow pits will be used as far as possible for road upgrades. The size of these pits will be dependent on the terrain and need for granular fill material for use in construction.
4. At the end of construction these borrow pits will be backfilled as much as possible using surplus excavated material from the foundations.

A layout plan has been prepared for the preferred alternative comprising 30.6 MW, showing the locations of the turbines as well as supporting infrastructure such as roads relative to features such as riparian areas and the 1:100 year floodline (*Figure S2*). The current layout was reviewed by the specialists and was informed by the identification of buffer zones or no-go areas identified by the specialists (*Figure S2).*

Construction and operational phases

The construction will be undertaken in three distinct components: Civil construction; Electrical installation and wind turbine erection; and Commissioning. The construction and commissioning phases are expected to require a total period of 8 to 15 months. The operational life span of the wind turbines is expected to be 20 years. Turbine life can be extended beyond 20 years through regular maintenance and/or upgrades in technology.

REQUIREMENTS OF AN ENVIRONMENTAL IMPACT ASSESSMENT

Amended NEMA EIA Regulations (Notices GN R. 543, 544, 545, and 546) were published in the Government Gazette No. 33306 of 18 June 2010, and came into effect from 2 August 2010 (referred to as the ***2010 EIA Regulations***). This EIA application by WKN Windcurrent is undertaken under the 2010 EIA Regulations. In terms of these regulations, Scoping and Environmental Impact Assessment are required as the project includes *inter alia:*

GN.R545, 18 June 2010	*1*	1. The construction of facilities or infrastructure for the generation of electricity where the electricity output is 20 megawatts or more.

APPROACH TO THE EIA

An application to conduct the EIA process was re-submitted to the national Department of Environmental Affairs (DEA) in June 2011. The application was accepted and the project moved into the Scoping phase. The Final Scoping Report and Plan of Study for EIA

were submitted to DEA in November 2011, with the notice to proceed to the EIA phase issued by DEA on 22 February 2012. The Draft EIA Report was released for a 45-day public and authority review period which extended from the 25 April 2012 to 8 June 2012. The comment period was extended to accommodate public holidays, which fell over the review period. DEA acknowledged receipt of the Draft EIA Report in a letter dated 14 May 2012.

All comments received on the Draft EIA Report are included in the Final EIA Report, which is hereby submitted to DEA for review and decision-making. This Final EIA Report is available in the Jeffrey's Bay and Humansdorp Municipal Libraries; and on the project website at www.publicprocess.co.za. Hard copies and/or CDs containing the document will be sent to key stakeholders, including authorities. All I&APs on the project database have been notified of the release of the Final EIA Report and EMPR.

The Environmental Management Programme (EMPR) is available as PART B of this report. The EMP is based on the recommendations made by specialists for design, construction and operation of the project. The EMPR is intended as a "living" document and should continue to be updated regularly by WKN Windcurrent.

PROJECT ALTERNATIVES

The "no-go" alternative was included in the EIA as a benchmark against which to assess the impacts (positive and negative) of the proposed Banna Ba Pifhu Wind Energy Project. Apart from the "no-go" alternative, various other types of alternatives are considered in this EIA. These are described in Chapter 4 of this Final EIA Report, with the main alternatives being land use, technology, project scale and number of turbine alternatives.

Both the 50 MW and 30.6 MW alternative layouts are assessed in the Final EIA report, with 50 MW being alternative 1 with a maximum of 28 turbines, and **30.6 MW being the preferred alternative** with a minimum of 9 and a maximum of 17 turbines (the actual number will be dependent on the capacity of the turbines selected in the range between 1.8 and 3.2 MW).

IMPACT ASSESSMENT AND MITIGATION

The key issues identified during the scoping process were assessed during the EIA through specialist studies. The main findings of these studies are outlined below, together with proposed mitigation and recommendations.

IMPACTS ON TERRESTRIAL FAUNA AND FLORA

FLORA

Mucina & Rutherford classify vegetation units present within the wind farm sites as Humansdorp Shale Renosterveld (Endangered), Gamtoos Thicket (Least threatened) and Loerie Conglomerate Fynbos (Least threatened). Most of the wind farm infrastructure will occur in areas that are transformed cultivated pastures, thus minimising the overall impact to natural vegetation. Areas with an elevated vulnerability (moderate to high) include intact Humansdorp Shale Renosterveld, seeps, drainage lines and wetlands and thicket habitat on slopes. Sixteen terrestrial vegetation impacts that may occur during the construction and operational phases of the proposed project have been identified, which can be divided into three key types of impacts, namely:

- Loss of species of special concern (SSC) and SSC habitat;

- Loss of vegetation habitat; and
- Reduction or changes to ecological processes and functioning. This include temporary fragmentation of habitats, increased risk of alien invasion in drainage lines and disturbed areas, changes in natural fire regime and overall reduction of ecosystem functioning.

MITIGATION

- Protected flora or species of special concern must be removed from the development footprint to be safeguarded from destruction and relocated either to undeveloped areas or off-site in consultation with conservation authorities and relevant botanical specialists;
- Permission must be obtained from the provincial authorities to destroy or remove any protected plant species as per legislation;
- A long term alien plant management plan to control these invasive species must be implemented within the designated Open Space areas;
- Appropriate measures must be implemented where infrastructure crosses drainage lines or seeps and no turbine footprints or lay down areas will be sited within recommended wetland and riparian buffers;
- Kikuyu grass must not be utilised during re-grassing of verges, turbine footprints and other landscaped areas within the site, particularly adjacent to riparian habitat;
- An Environmental Control Officer (ECO)/Environmental Site officer (ESO) must be appointed to oversee the Environmental Management Plan and relocation of the Species of Special Concern before construction commences.
- A long-term alien plant management plan to control invasive plant species must be implemented within the designated Open Space areas, especially along access road verges.

Overall the impacts on terrestrial flora are estimated to be **negative** and of **medium** to **low** significance (after mitigation).

ASSESSMENT

The significance of impacts on wetland and riparian vegetation is **medium after mitigation.**
The overall impacts on terrestrial flora are estimated to be **negative** and of **medium** to **low significance (after mitigation).**

The Alternative 1 layout comprising 50 MW was also assessed. The preferred alternative 30.6 MW wind farm option will have a lower overall impact on vegetation compared to the alternative 1 layout of 50 MW.

FAUNA

Five key faunal impacts have been identified and assessed, namely:

- Habitat destruction may affect faunal diversity and composition;
- Road mortality from trucks and other service vehicles;
- Poaching(mammals);
- Fauna harmed by fences (mammals / reptiles); and
- Corridor disruptions as a result of habitat fragmentation.

The species that will be mostly affected during the construction phase of this project are those that can't vacate the affected area themselves, e.g. tortoises, burrowing reptiles and burrowing mammals. These species can suffer direct mortality during construction activities. Traffic on the access roads to and from the construction sites would most likely result in road kills, including possible amphibian migrations during rainy periods. As indicated, some species of special concern are found in the area and will be affected by

this development. All amphibians are of least concern and are well protected elsewhere. The reptiles of special concern are the FitzSimons long-tailed Seps and the Elandsberg Dwarf Chameleon. Although these species are well protected elsewhere (e.g. in the Lady Slipper Nature Reserve), their known distribution is limited. The likelihood of them being significantly affected by the proposed development is however low. The impact on the terrestrial fauna will largely be temporary and is expected to return to its normal state after construction, other than road mortalities, the risk of which are likely to persist.

MITIGATION

- Removal of animals from the affected areas before the start of site clearing and construction, and relocating these to safe areas would only be a valid mitigation option in the case of tortoises, so far as reasonable possible. All other reptile and small mammal species are extremely difficult to catch and it would be futile to attempt to relocate them. Before site clearing, affected areas should be thoroughly searched for tortoises. Tortoises found must be released in adjacent unaffected areas;
- Appropriate speed control measures must be implemented to keep vehicular traffic speeds within recommended limits;
- Road design must be such that it allows free movement of fauna;
- All staff active on site must be instructed and briefed regarding the strict faunal management requirements before construction commences; and
- Any fencing must be kept to minimum and recommended measures implemented to minimise risk of impacts to fauna.

ASSESSMENT

Overall the impacts on terrestrial fauna are estimated to be **negative** and of **medium** to **low significance (after mitigation).**

The Alternative 1 layout comprising 50 MW was also assessed. The preferred alternative 30.6 MW wind farm option will have a lower overall impact on fauna compared to the alternative 1 layout of 50 MW.

IMPACT ON BIRDS

The main potential impacts of the project on birds are:

- Mortality due to collision with the wind turbines;
- Displacement due to disturbance;
- Habitat loss due to the footprint of the wind farm; and
- Mortalities due to collision with associated power line infrastructure.

Although this is a relatively small wind farm site, it is not without intrinsic value for priority avifauna from a foraging, roosting and breeding perspective. The combination of pastures, wetlands and scrub is particularly well suited for Denham's Bustard, Blue Crane, White-bellied Korhaan, Black-winged Lapwing and Amur Falcon, as is the whole of the Jeffrey's Bay, Humansdorp and Oyster Bay agricultural districts. Displacement of some priority species is possible, particularly Denham's Bustard, but at this stage, with no wind farms having been constructed as yet in the area, it is not possible to test the validity of this statement. However, should this impact materialise, the cumulative effect of displacement of particularly Denham's Bustard (and possibly White-bellied Korhaan) might have regional or even national implications, depending on the number of wind farms that gets to be developed in the region, and the level of displacement. A proposal for an avifaunal habitat assessment

for the Kouga Municipal Area has been submitted to the applicant and two other wind energy developers by the bird specialist, Chris van Rooyen on behalf of the Kromme Trust. All three developers have agreed in principal to support the initiative. The objective of the assessment would be to delineate areas of sensitive habitat to assess the potential cumulative displacement impact of wind farm developments. As far as the risk of mortality due to collisions is concerned, with the data currently available, it would seem that soaring species, and particularly Amur Falcons, might potentially be most exposed to this impact and Blue Cranes to a lesser extent. Implementation of the proposed mitigation measures should reduce some of the envisaged impacts from medium to low, but while some impacts are low to start with, for others, very little practical mitigation is possible. It is proposed to connect the wind farm substation to the existing 66 kV Melkhout / St. Francis overhead power line, which passes through the site. Currently two alternative alignments have been identified, but the connection points still need to be confirmed by Eskom. Irrespective of where the alignment is planned, it will need to be mitigated because of the high density of power line collision sensitive species, particularly Blue Crane and Denham's Bustard, on the site.

Pre-construction bird monitoring was undertaken at the proposed turbine site by two experienced bird monitors under the guidance of the bird specialist, Chris van Rooyen. The monitoring commenced in March 2011 and continued until April 2012. The monitoring was done over four sampling periods, i.e. summer, winter/early spring, late spring and autumn. The specific objectives of the monitoring programme were to record the abundance and diversity of all birds, and flight patterns of priority species. The results from the pre-construction monitoring programme and the proposed mitigation measures based on the monitoring are included in the updated Bird specialist study (Chapter 6 of the Final EIA Report).

MITIGATION

- The dataset must be analysed in order to establish the statistical significance of potential trends that have been identified so far (e.g. the influence of wind direction and wind strength). This will assist in the formulation of the final recommendations;
- Access to the remainder of the site should be strictly controlled in order to minimise potential disturbance of sensitive priority species, particularly Denham's Bustard, both during the construction phase and the operational phase;
- Post-construction monitoring should be implemented to assess the impact of displacement, particularly on priority species. Initially, a 12 month period of post-construction monitoring should be implemented, using the same protocol as is currently implemented. Thereafter, the frequency for further monitoring will be informed by the results of the initial 12-month period;
- Should the results of the post-construction monitoring indicate significant displacement of priority species, appropriate off-set compensation should be negotiated with the developer to compensate for the loss of priority species habitat;
- The proposed 66kV power line should be marked with Bird Flight Diverters (BFDs) to lower the risk of avian collisions with the power line;
- Once the turbines have been constructed, post-construction monitoring as per the latest version of the Best practice guidelines for avian monitoring and impact mitigation at proposed wind energy development sites in southern Africa (Jenkins et al. 2011) should be implemented to assess actual collision rates. If actual collision rates indicate high mortality levels, mitigation measures such

as halting operation of specific turbines during high risk conditions, or reducing rotor speed, to reduce the risk of collision mortality should be considered.

ASSESSMENT

- As far as collision mortality is concerned, it is predicted that the project will have a **negative** impact of **Low significance (with mitigation).** This will have to be verified by post-construction monitoring.
- As far as displacement of birds is concerned, no firm conclusions can be drawn without actual post construction monitoring. Priority species likely to be affected include Amur Falcon, Korhaans, Blue Cranes and bustards. It is predicted that the project will have **a negative** impact of **High to Medium significance (with mitigation) during construction** and **Medium to Low significance (with mitigation) during operation**, depending on whether habituation takes place, or off-set compensation is implemented.
- As far as turbine layout alternatives are concerned, the preferred alternative (comprising 30.6 MW) is preferred from a potential bird impact perspective. The preferred alternative contains 30% fewer turbines compared to the alternative 1 layout of 50 MW, therefore the collision risk should be significantly less.

IMPACT ON BATS

Natural Scientific Services was commissioned by WKN Windcurrent to conduct a 12 month pre-construction bat monitoring survey at the Banna Ba Pifhu site. The bat study includes the findings of the first quarter of the twelve month preconstruction bat monitoring programme. NSS will generate a final bat monitoring report in May 2013. This chapter is therefore not the final bat monitoring report and NSS reserves the right to make changes to the findings, impact assessment and sensitivity mapping at the completion of the twelve months of monitoring. The final monitoring results and any updates in the findings and sensitivity mapping will be included in the project draft EMPR as part of the detailed design phase.

The following impacts are possible for the site:

- Bat roost disturbance and/or destruction due to construction activities;
- Fragmentation to and displacement from foraging habitat due to wind turbine construction and operation;
- Bat fatalities due to collision or barotrauma during foraging activity and during migration;
- Bat fatalities due to collision or barotrauma due to attraction of bats to towers for roosting or out of curiosity; and
- Bat fatalities due to electrocution from overhead power lines.

From the acoustic monitoring data collected thus far the following is evident:

- The Banna Ba Pifhu site is considered to have a relatively high bat activity index for the Southern Cape region. Compared to another site similarly located, the site is considered to be similar and slightly higher bat activity levels were recorded;
- *Miniopterus natalensis,* a Conservation Important species, has been confirmed to utilise the proposed site.
- 91% of all bat activity occurs between 17:30 and 19:30 in the evening; and
- The Banna Ba Pifhu site is so far considered to be of **Medium Risk** to bats where operational mitigation measures will be required to ensure that bats utilising the site are not significantly impacted on.

MITIGATION

- Further bat monitoring is required for the preconstruction bat monitoring to be in line

with Sowler and Stoffberg (2012) bat guidelines.
- Long-term post-construction monitoring must be conducted according to Sowler and Stoffberg's (2012) guidelines and should be conducted to monitor the effectiveness of the mitigation and residual bat impacts, in order to readjust mitigation measures;
- Identified roosting sites must be avoided during construction and recommended buffer zones must be adhered to;
- Should any new cave or tunnel roosts be discovered near to site, revised buffers must be placed on these systems;
- Keep all construction activities away from steep rocky slopes and distinct rock out crops;
- Avoid road and powerline crossings over rivers and gorges where possible; and
- Minimizing the extent of the footprint area to be disturbed by pre-construction and construction activities at the turbine localities.

ASSESSMENT

- The significance of the loss of conservation important bat species from the area due to construction activities is **negative and medium before and after mitigation**;
- The significance of the loss of conservation important bat species from the area due to the operation activities are **negative and High (before mitigation) and Medium (after mitigation)**;
- The significance of bat fatalities due to collision or barotraumas during foraging activity is **negative and High (before mitigation) and Low (after mitigation)**; and
- The significance of bat fatalities due to collision or barotrauma during migration is **negative and High (before mitigation) and Low (after mitigation).**

The 50 MW alternative 1 layout was assessed in the bat specialist study prepared by Stefanie Dippenaar and was included in the Draft EIA Report (CSIR 2012). Based on the existing limited information available at the time and the findings of the site visit, the potential impact of the wind turbines on bats at the proposed Banna Ba Pifhu was anticipated to be **negative and of medium significance with mitigation, and medium – high without mitigation**. Ms Dippenaar stated that the overall confidence levels were low as only one month of monitoring data has been incorporated into the study and proposed that further pre-construction monitoring be undertaken. Additional pre-construction monitoring was undertaken by NSS and informed the revised bat study that is included in the Final EIA report.

VISUAL IMPACT

Visual or aesthetic impacts will occur during the construction, operational and decommissioning phases of the proposed project. The main visual impacts of the proposed WKN Windcurrent wind energy project are:

- Visual impact on the landscape character;
- Visual impact on sensitive viewers during construction and operation activities; and
- Visual impact of lightning of turbines on the landscape.

There are a number of sensitive visual receptors in the surrounding landscape that will be highly affected by the development of a wind farm on the proposed site. These include residents of the St Francis Marina, some of who value scenic views of the mountains to their north, residents of Kromme River holiday homes and resorts, visitors to Eastcot Private Nature Reserve and residents of surrounding farms who may currently have sea or mountain views which will be intruded upon by the proposed wind farm.

The wind farm will be introduced into a landscape composed of agricultural and coastal resort elements. Stock farming (dairy and beef) is the main agricultural activity, and this landscape character type is expected to have a low sensitivity to changes brought by a wind farm since the farming will not be affected. Coastal resorts are likely to have a low sensitivity to the wind farm development since most of them are growing rapidly and their attraction to tourists and holiday makers is more related to well-established coastal activities. Oyster Bay is likely to be more sensitive to a wind farm development as it is less accessible than the other towns and has a sense of remoteness which may be compromised by the wind farm. The coastal dune system near Oyster Bay is sensitive for the same reasons.

MITIGATION

- Dust suppression is important as dust will raise the visibility of the development;
- New road construction should be minimised and existing roads should be used where possible;
- The contractor should maintain good housekeeping on site to avoid litter and minimise waste;
- Clearance of indigenous vegetation should be minimised and rehabilitation of cleared areas should start as soon as possible;
- Erosion risks should be assessed and minimised as erosion scarring can create areas of strong visual contrast with the surrounding vegetation, which can often be seen from long distances since they will be exposed against the hillslopes;
- Laydown areas and stockyards should be located in areas of low visibility (e.g. valleys between ridges) and existing vegetation should be used to screen them from views where possible;
- Night lighting of the construction sites should be minimised within requirements of safety and efficiency;
- Ensure that there are no wind turbines closer than 500 m to a residence. If there are appropriate mitigation measures must be implemented to reduce shadow flicker effect;
- Maintenance of the turbines is important. A spinning rotor is perceived as being useful. If a rotor is stationary when the wind is blowing it is seen as not fulfilling its purpose and a negative impression is created (Gipe 1995);
- Signs near wind turbines should be avoided unless they serve to inform the public about wind turbines and their function. Advertising billboards should be avoided;
- According to the Aviation Act, 1962, Thirteenth Amendment of the Civil Aviation Regulations, 1997: "Wind turbines shall be painted bright white to provide maximum daytime conspicuousness. The colours grey, blue and darker shades of white should be avoided altogether. If such colours have been used, the wind turbines shall be supplemented with daytime lighting, as required;"and
- Lighting should be designed to minimise light pollution without compromising safety. Investigate using motion sensitive lights for security lighting. Turbines are to be lit according to Civil Aviation regulations.

ASSESSMENT

The significance of the impact on the landscape character of the region is **High** since the impact duration is long, its extent regional and the intensity medium.
The significance of the visual impact on sensitive viewers during the construction phase of the wind farm is **High** due to the number of sensitive viewers who will be affected. Not all of the construction phase will necessarily have a negative visual impact since the construction of wind turbines is an incredible engineering feat and viewers are likely to find it fascinating to witness.

The overall significance of the visual impact on sensitive viewers during the operational phase of the wind farm is **High** due to the regional extent, long term and severe effect of the impact. The intensity of the impact is expected to be high for a number of highly sensitive viewers (residents) who will potentially be highly exposed to the wind farm, and since there are no structures of similar size in their existing views the visual intrusion will be high.
The significance of the impact of lighting of the turbines according to aviation regulations is expected to be **Moderate** for residents living in close proximity, but **Low** overall since it is unlikely to contribute to light pollution and there is an existing sky-glow produced by settlements and other developments in the region which will often be a backdrop to views of the lights.

The 50 MW (Alternative 1 Layout) was assessed in the visual specialist study that was included in the Draft EIA Report (CSIR 2012). The overall significance rating of visual impact has not changed for the new layout assessed in this report (Preferred Alternative Layout - 30.6 MW), but the new layout does take into consideration specific issues related to visual impact that I&APs raised after release of the draft report.

NOISE IMPACT

The noise impact during the construction period will be localised around the turbine sites, as well as noise from construction vehicles accessing the sites. There will be a short term increase in noise in the vicinity of the site during the construction phase as the ambient noise level will be exceeded. The impact during the construction phase will be difficult to mitigate.

Noise impacts were modelled for the operational phase, taking into consideration noise sensitive areas (NSAs) (i.e. receptors of noise impacts, such as offices or houses). The noise modelling (using WindPro Software) is precautionary, and does not take into account the masking effect that ambient wind noise will have on the turbine noise. Ambient noise increases as the wind speed increases. Under very stable atmospheric conditions (e.g. temperature inversion or a light wind), the turbines will in all likelihood not be operational as the cut-in speed is 4 m/s. As the wind speed increases above the cut-in speed, the ambient noise will also increase. If the atmospheric conditions are such that the wind is very light (<4 m/s) at ground level but exceeds the cut-in speed at hub height, it is feasible that little ambient noise masking will occur. The critical wind speeds are thus between 4-6 m/s when there is a possibility of little masking. Above 8 m/s the wind noise starts masking the turbine noise. The noise modelling indicates that provided that the mitigation measures presented in the noise specialist study are implemented effectively all the turbine positions met the required 500 m setback distance except for WTG 14 that is too close to NSA 10 (i.e. 413 m). . **This house will however be not be occupied once construction commences. The resident will be relocated (see letter from landowner in Appendix 9.4).**

MITIGATION

- All construction operations should only occur during daylight hours if possible;
- No construction piling should occur at night. Piling should only occur during the hottest part of the day to take advantage of unstable atmospheric conditions;
- Ensuring that construction staff is given “noise sensitivity” training;
- Use temporary noise screens around noisy, static equipment and activities such as generators, piling, cutting and drilling to reduce the noise levels at the residential buildings; and
- Ambient noise monitoring to be conducted at the 11 NSAs when operations

commence to verify the noise emissions meet the noise rating limit.

ASSESSMENT

The overall noise impact with recommended mitigation is expected to be **negative** and of **Low significance**.

Both alternative layouts were assessed with 30.6 MW being the Preferred Alternative with a maximum of 17 turbines and 50 MW being Alternative 1 with a maximum of 28 turbines. The actual assessment and modelling of the 50 MW wind farm was done in a separate noise study and is included in the Draft EIA Report (CSIR, 2012).

The overall impact ratings for the two alternatives will remain the same.

ECONOMIC IMPACTS

The main impacts identified during the construction and operational phases of the project include the following:

- Impacts on land owners within the site boundaries;
- Impact on surrounding land uses;
- Impacts on tourism; and
- Impacts on commercial activity associated with expenditure linked to the construction and operation of the development.

When considering the overall costs and benefits of the project it was found that the latter should be more prominent allowing for the achievement of a net benefit. Benefits would be particularly prominent for the project proponents, land owners on the site and in the achievement of national and regional energy policy goals. The project would also result in significant positive economic spin-offs primarily because of the large expenditure injection associated with it.

Positive cumulative impacts are also likely as the project should set a positive precedent for further investment in the area. By committing to investment in a large development, the proponent would be casting a strong 'vote of confidence' in the local economy. This has the potential to influence other investors (including locals) to also act with similar confidence thereby resulting in cumulative impacts on overall investment levels.

The key source of potential **negative cumulative impacts** is the project's risk to tourism when combined with other planned wind farm projects in the area. It is not clear how significant these risks would be particularly in the absence of a regional study focusing on this question. The lack of such a study in the area should be viewed as a significant information gap. In the absence of such a study, it is probably reasonable to tentatively rate cumulative risks as medium significance particularly when one considers the international literature on the subject and the findings of the visual specialist studies for the wind projects in the area. With respect to risks and negative impacts, these are difficult to assess accurately but should prove to be acceptable provided adequate mitigation is put in place much of which will revolve around optimal turbine locations.

MITIGATION

- Impacts on tourism are dependent on how the site is developed and managed to minimise negative biophysical impacts. The measures recommended in other specialist reports to these impacts (primarily the minimisation of visual, noise and ecological impacts) would thus also minimise tourism impacts;
- Adequate setbacks from buildings, structures and residences to be strictly enforced;
- Set targets for use of local labour and maximise opportunities for training;

- Use local sub-contractors where possible; and
- Explore ways to enhance local community benefits with a focus on broad-based BEE through mechanisms such as community shareholding schemes and trusts and preferential procurement in accordance with the relevant Department of Energy bidding guidelines for Independent Power Producers.

ASSESSMENT

The significance of the impact associated with project investment or expenditure during the construction phase would be **positive and Medium (without mitigation) and Medium (with mitigation)**.

The significance of the impact associated with project investment or expenditure during the construction phase would be **positive and Medium (without mitigation) and Medium (with mitigation)**.

The significance of the impact associated with project investment or expenditure during the operational phase would be **positive and Low to Medium (without mitigation) and Medium (with mitigation).**

The significance of the impact on tourism during the operational phase would be **negative and Medium (without mitigation) and medium (with mitigation)**.

The significance of the impact on the land owners during the operational phase would **be positive and Low to Medium (without mitigation) and Medium (with mitigation).**

Both alternative layouts were assessed in the Economics study. The overall impact ratings for the two alternatives would remain the same, but the following general observations can be made regarding nuances between the alternatives. The 50 MW alternative 1 would entail a larger overall investment and expenditure in the area when compared with the 30.6 MW alternative which would lead to higher positive impacts on associated economic activity, jobs and incomes.

IMPACT ON ARCHAEOLOGY

The proposed Banna Ba Pifhu Wind Energy Facility site is more than 5 km from the coast and falls outside the coastal sensitive zone. The proposed wind energy site has been ploughed in the past and is now covered by dense short grass which made it difficult to find archaeological materials. Apart from a few Early and Middle Stone Age stone tools exposed in a track, no significant sites/materials were found and it is highly unlikely that *in situ* archaeological material/sites will be exposed during development.

MITIGATION

- In the unlikely event that any concentrations of archaeological material are uncovered during further development of the site, it should be reported to the Albany Museum and/or the South African Heritage Resources Agency immediately so that systematic and professional investigation/excavations can be undertaken. Sufficient time should be allowed to remove/collect such material; and

- Construction managers/foremen should be informed before construction starts on the possible types of heritage sites and cultural material they may encounter and the procedures to follow when they find sites. It is suggested that a person be trained to be on site to report to the site manager if sites are found.

ASSESSMENT

Visually, the area investigated appears to be of **low archaeological sensitivity** and the

impact of construction will be **Low**. Together with the other proposed wind energy facilities proposed for the coastal foreland, this development will add to the general accumulative visual impact on the area, but will have little visual effect on the nearby coastal pre-colonial archaeological landscape.

Both alternative layouts were assessed (30.6 MW and 50 MW) and both assessment ratings are of **Low significance (after mitigation)**.

IMPACT ON PALAEONTOLOGY

The Banna Ba Pifhu Wind Energy Project study area is entirely underlain by Devonian marine rocks of the Lower Bokkeveld Group (Ceres Subgroup). These shallow marine sediments are *potentially* highly fossiliferous, but in practice on the southern coastal plain their fossil content has been largely or completely obliterated by high levels of deformation (*e.g.* cleavage development, especially within mudrocks) and by deep chemical weathering. Their effective palaeontological sensitivity is consequently very low and developments here are rated as of *low* significance in fossil heritage terms. No specialist palaeontological mitigation is regarded as necessary for this wind energy project.

MITIGATION

Should substantial fossil remains be exposed at any stage during development, these should be safeguarded - *in situ*, if feasible – and recorded by the responsible Environmental Control Officer (photos, GPS readings). SAHRA should be alerted as soon as possible so that appropriate mitigation measures may be considered.

ASSESSMENT

The operational and decommissioning phases of the Banna Ba Pifhu Wind Energy Project are unlikely to have any significant impacts on local fossil heritage. The overall impact on palaeontology (with mitigation) is therefore expected to be **negative** and of **Low significance (after mitigation)**.

Both alternative layouts were assessed (30.6 MW and 50 MW) and both assessment ratings are of **Low significance**.

IMPACT ON WETLANDS AND OTHER AQUATIC ECOSYSTEMS

This study has assessed a number of aquatic ecosystems, which were mostly characterised as wetlands or ephemeral drainage lines. The wetlands perform an important role in attenuating surface water flows, while providing a series of differing wetland habitats, which form part of a wetland network within the region.

The main potential impacts associated with the construction and operational phases are:

- Physical destruction of aquatic habitat;
- Loss of wetland habitat, ecosystem services and biodiversity services;
- Loss of species of special concern;
- Habitat fragmentation – loss of ecological corridors; and
- Sedimentation and erosion.

The crossing and any new structures being placed within 500 m of the wetland areas or 32 m from any water course, although posing a low risk to the aquatic environment, would require approximately 8 Section 21 c & I water use license applications. This process will however be taken forward with the Department of Water Affairs (DWA) and the layout and technical details will be assessed with regard the potential impacts by this department. Should DWA then feel that the applications pose a great risk to the aquatic environment, and then they may request that the layout be altered.

MITIGATION

- Stormwater should be managed using suitable structures such as swales, gabions and rock rip-wrap so that any run-off from the development site is attenuated prior to discharge. Silt and sedimentation should be kept to a minimum, through the use of the above mentioned structures by also ensuring that all structures don't create any form of erosion;
- Vegetation clearing should occur in parallel with the construction progress to minimise erosion and/or run-off. Large tracts of bare soil will either cause dust pollution or quickly erode and then cause sedimentation in the lower portions of the catchment;
- Only indigenous plant species must be used in the re-vegetation process. The species list mentioned in this and terrestrial vegetation study should be used as a guide;
- All construction materials including fuels and oil should be stored in demarcated areas that are contained within berms / bunds to avoid spread of any contamination into wetland or rivers. Washing and cleaning of equipment should also be done in berms or bunds, in order to trap any cement and prevent excessive soil erosion. These sites must be re-vegetated after construction has been completed. Mechanical plant and bowsers must not be refuelled or serviced within or directly adjacent to any river channel. It is therefore suggested that all construction camps, lay down areas, batching plants or areas and any stores should be more than 50m from any demarcated wetland or riverine area;
- It is also advised that an Environmental Control Officer (ECO), with a good understanding of the local flora be appointed during the construction phase. The ECO should be able to make clear recommendations with regards to the re-vegetation of the newly completed / disturbed areas, using selected species detailed in this and the terrestrial vegetation report. All alien plant re-growth must be monitored and should it occur these plants should be eradicated. Where any works (e.g. storm water control measures) near a wetland or river is required specific attention should be paid to the immediate re-vegetation of cleared areas to prevent future erosion of sedimentation issues; and
- All relevant buffers mentioned in this report should be included into future designs and later engineering diagrams.

ASSESSMENT

It seems based on the site visit and information contained in the specialist ecological report (Chapter 5) that the impacts assessed for the aquatic systems after mitigation, would be negative and of **Low significance (after mitigation)**. This is dependent on the proposed recommendations, contained in that report and in this study being upheld. This project would thus present a **low risk to the aquatic environment**.

Both alternative layouts were assessed in the Wetland and Aquatic Impact Assessment (30.6 MW and 50 MW). Due to the nature of the impacts and the current state of the water courses in the study area both of the proposed alternatives would have similar potential impacts on the aquatic environment. However due to the consolidated nature of the preferred alternative (30.6 MW), the potential impacts would present a lower risk, as well as reduce the number of Water Use License Applications required.

IMPACT ON AGRICULTURAL SOIL POTENTIAL

An overview investigation of soil conditions and agricultural capability at the site of the wind energy project proposed by WKN Windcurrent at the Farm Broadlands, near Humansdorp was done. The aim of this study was to investigate the potential impacts of the proposed development on the site's agricultural production and resource base. This included an investigation of soils and other agricultural resources across the site.

The soil investigation was based predominantly on an investigation of existing cuttings on the site, in combination with assessing topography, geology and surface conditions, and shallow auger holes were also used. This soil investigation methodology was considered completely adequate to gain a sufficiently accurate assessment of the agricultural soil capability across the site.

The soils are all residual soils that have formed from the weathering of underlying Bokkeveld mudrocks, and the underlying C horizon of all soils comprises partially weathered mudrocks. The soil catena (sequence of different soil types along a topographical transect) on this site, running north to south, is from well-drained Glenrosa (on the north facing slopes) to Swartland (on the well drained flat crest) to Sepane with some drainage limitations and then to Estcourt and Kroonstad on the poorly drained landscape positions to the south.

In terms of soil limitations to agricultural production, the soils are primarily limited by their shallow effective depth. Soils to the south, particularly in low lying spots, are limited by poor drainage as well. Due to these limitations, the majority of the soils are categorised as **medium agricultural suitability**. Those in particularly poorly drained positions are classified as **low agricultural suitability**.

Impacts on agricultural resources and productivity were identified as:

- Loss of agricultural land;
- Disturbance of run-off and resultant potential impact on erosion;
- Disturbance of existing contour banks;
- Soil profile disturbance and resultant decrease in soil agricultural capability;
- Prevention of crop spraying by aircraft over land occupied by turbines;
- Disturbance of cultivation practices due to the division of existing camps by turbines and access roads;
- Placement of spoil material generated from excavations;
- Yield reduction; and
- Prevention of possible future agricultural activities on land occupied by turbines.

After mitigation, the loss of agricultural land was determined as only 8.38 hectares for the preferred 30.6MW alternative, which represents a mere 0.7 % of the land surface of the farm.

MITIGATION

- Water run-off from all constructed and altered surfaces including roads, where slopes pose an erosion hazard, will be managed with an appropriate system to divert or channel any collected run-off water into existing natural or constructed waterways;
- An effective run-off management plan is a specific requirement of the Environmental Management Plan. As part of this, erosion will be monitored and corrective action will be implemented to the run-off plan in the event of any erosion problems;
- The layout of turbines and hard standings for cranes has been done on positions of minimum slope (see site plan in Agricultural specialist study, Chapter 14);
- No new roads are proposed on slopes where erosion is a potential hazard (For all

excavations and other direct disturbance of the soil surface (e.g. for roads, buildings) that are to be returned to agricultural use, the upper 20cm of the top soil will be stripped, stockpiled, and then re-spread over the surface of the backfilled excavation or disturbed surface, during rehabilitation;

- The wind farm utilises existing roads wherever possible and so the length of required new roads, and disturbance to agricultural soil as a result, is minimised (see site plan);
- If crop spraying by aircraft is ever required, the wind farm undertakes to lock all necessary turbines (with 1 day's notice) with the blades parked in parallel to facilitate easy access for aeroplanes between them. Crop spraying by aeroplane is usually done when there is little or no wind;
- The distance between turbines facilitates easy access for aeroplanes between them;
- Most turbines and new access roads are positioned on non cultivated, grazing land, where mechanised vehicular traffic is not required for cultivation; and
- WKN Windcurrent is committed to enabling the landowner to use the property for sustainable agriculture and as such will not limit usage of the area. In the event that an activity would interfere with the free flowing of the wind to the turbine, the landowner and WKN Windcurrent would need to come to an agreement as to the exact location of such activities.

ASSESSMENT

All the identified impacts on agricultural resources and productivity were considered to be **negative** and of **Low significance after mitigation**. The proposed wind energy project therefore poses a low level of disturbance to current or likely future agricultural productivity.

Both alternatives were assessed in the agricultural soil potential study. The preferred alternative of 30. 6 MW has a lower footprint and therefore a lower loss of agricultural land and a lower agricultural impact compared to the 50 MW alternative 1.

OVERALL EVALUATION OF IMPACTS BY ENVIRONMENTAL ASSESSMENT PRACTITIONER

No negative impacts have been identified that, in the opinion of the Environmental Assessment Practitioner, should be considered “fatal flaws” from an environmental perspective, and thereby necessitate substantial re-design or termination of the project.

The EIA process included a synthesized mapping of “no go” areas using environmental constraints provided by the specialist team (*Figure S.2*). This mapping guided the layout of turbines and internal access roads. In this way, the environmental and social constraints of the site informed the scale and configuration of the proposed project. Through the course of the EIA process, the project layout went through several iterations after consultation with the specialists on the project team. This indicates how the EIA process has actively and effectively informed the project planning. The specialist studies have been revised to incorporate and assess the preferred alternative layout comprising 30.6 MW (Chapters 5 to 14). The specialist reports assessed both the **preferred alternative of 30.6 MW** and the alternative 1 comprising 50 MW. The assessment ratings were not affected negatively. The assessment ratings either remained the same or have a less negative impact for the 30.6 MW option due to the reduction in the scale of the project.

Residual impacts are those that are expected to remain once appropriate mitigation has been implemented. The main residual negative impacts of the Banna Ba Pifhu Wind

Energy Project are the predicted impact on birds, bats and the visual impact.

- The impact on birds arises from the possible displacement of priority bird species during the construction and operational phases of the project. The impacts are predicted to be High to Medium (after mitigation) during the construction phase and Medium to Low (after mitigation) during the operational phase depending on whether habituation takes place or off-set compensation is implemented. The impact on birds arising from the collision of priority species with turbines is predicted to be Low (after mitigation with Low to Medium levels of confidence).
- The loss of conservation important bat species from the area due the construction and operational activities is anticipated to be negative and of Medium significance with mitigation.
- The visual impacts of the turbines on the landscape character are predicted to be negative and of High significance.

If the Banna Ba Pifhu wind farm is established, the actual physical footprint of the wind turbines is limited to approximately 8.38 hectares, which represents a mere 0.7% of the land surface of the farm, and grazing and other agricultural activities can continue in parallel with the operation of the turbines. The project will have no significant impact in terms of loss of agricultural productivity.

In conclusion, given South Africa's need for additional electricity generation and efforts to decrease the country's proportional dependency on coal-based power, renewable energy has been identified as a national priority, with wind energy identified as one of the most readily available, technically viable and commercially cost-effective sources of renewable energy. Taking into consideration the findings of the EIA process for the proposed Banna Ba Pifhu wind energy project near Humansdorp, it is the opinion of the Environmental Assessment Practitioner that the project benefits outweigh the costs, and that the project will make a positive contribution to steering South Africa on a pathway towards sustainable development. Provided that the specified mitigation measures are applied effectively, it is proposed that the project receives Environmental Authorization in terms of the EIA Regulations promulgated under the National Environmental Management Act (NEMA).

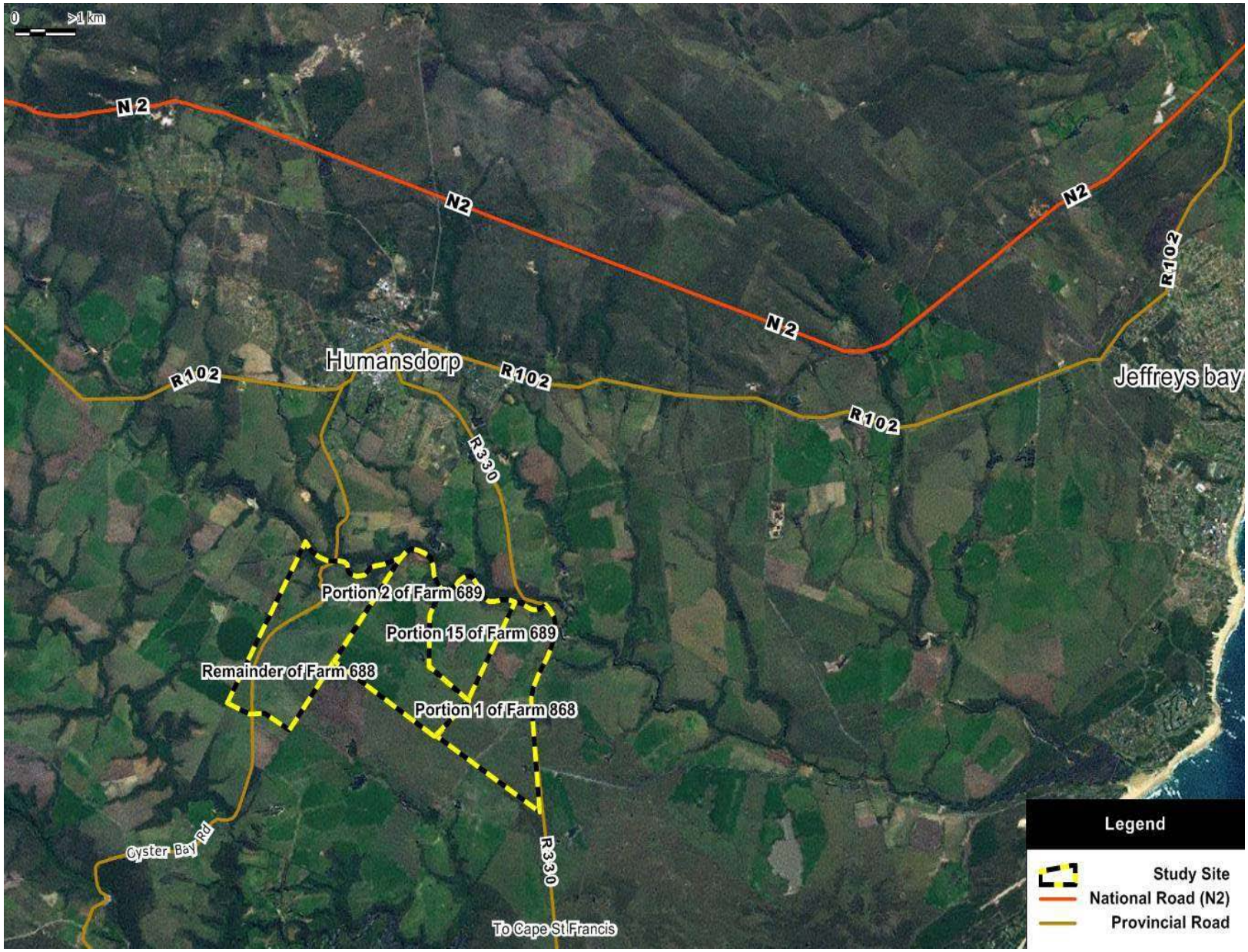

***Figure S.1**: Locality map of the proposed Banna Ba Pifhu Wind Energy Project near Humansdorp in the Eastern Cape (satellite image)*

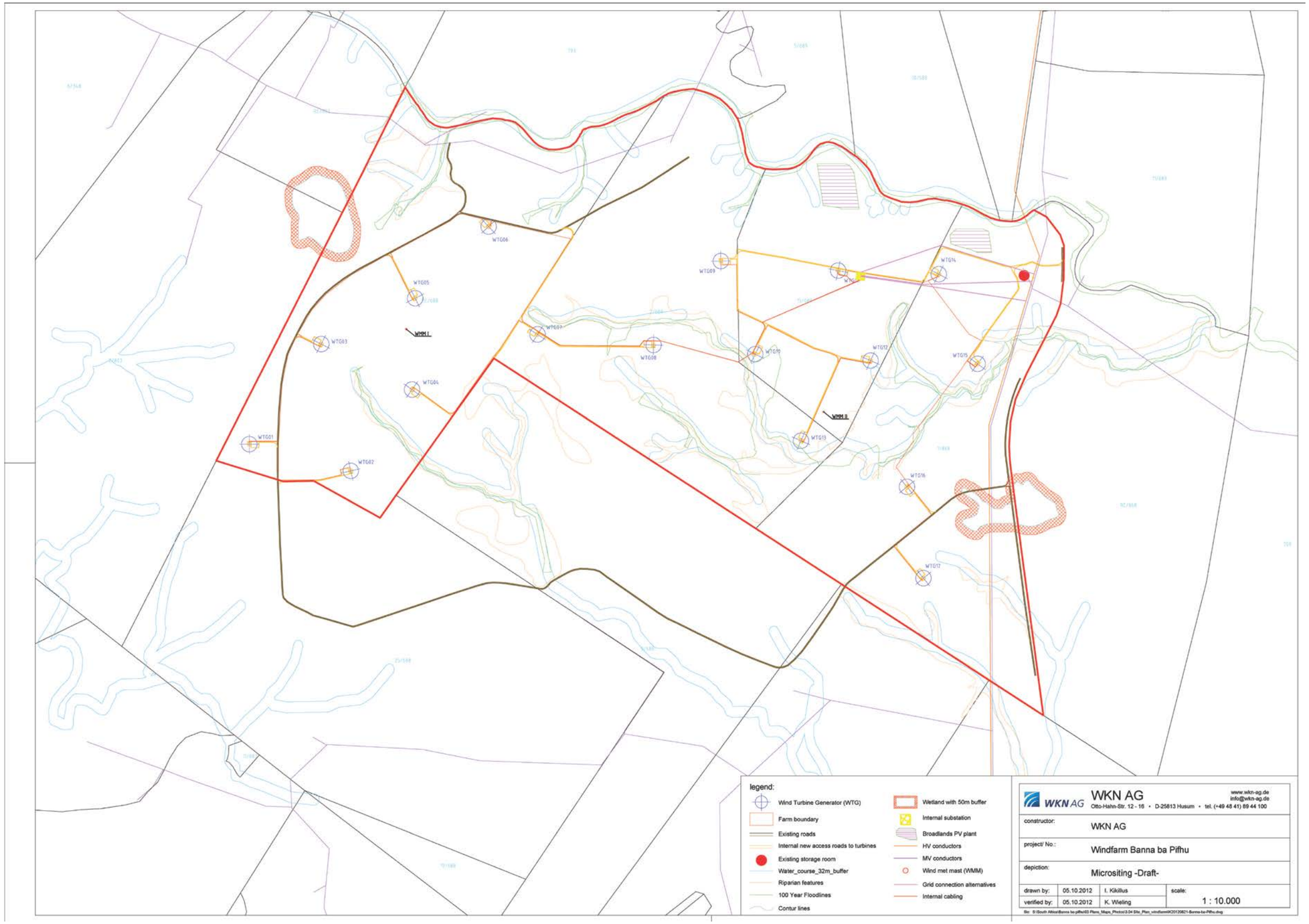

***Figure S.2**: Conceptual layout map for the proposed Banna Ba Pifhu project.*

COMMITMENT STATEMENT BY WKN WINDCURRENT SA (PTY) LTD

WKN Windcurrent

WKN Windcurrent SA (Pty) Ltd
PO Box 762
Wilderness 6560
South Africa

2 November 2012

Commitment Statement: Final EIA Report – Banna ba Pifhu Wind Farm, DEA reference number: 12/12/20/2289

WKN-Windcurrent SA (Pty) Ltd (WKN-Windcurrent) is a South African company specialising in the development of renewable energy projects. Banna ba Pifhu Windfarm (Pty) Ltd is a South African company formed with the express purpose of owning and operating the Banna ba Pifhu Wind Farm (the project).

The CSIR has been appointed by WKN-Windcurrent SA (Pty) Ltd, acting on behalf of Banna ba Pifhu Windfarm (Pty) Ltd, to undertake the Environmental Impact Assessment for the construction of the (proposed) 30 MW wind energy facility south of Humansdorp in the Eastern Cape.

WKN-Windcurrent undertakes to comply with all statutory and legislative requirements of South African law, specifically with regard to environmental aspects relating to the development of the Banna ba Pifhu Wind Farm.

Throughout the EIA process, WKN-Windcurrent has worked closely with stakeholders and the CSIR. The company is fully commited to implement the recommendations of the specialists as presented by the CSIR in the Final Environmental Report.

The company supports the recommendations for pre- and post construction monitoring for both birds and bats, and undertakes to ensure completion of these studies, to be carried out by specialists in those fields.

In addition, WKN-Windcurrent recognises that the project has socio-economic benefits for the local area, and as such, commits to doing all that is possible to ensure that local business and local labour are involved in the construction and operation of the Banna ba Pifhu Wind farm.

The company, in expectation of all requirements being concluded within the necessary timeframe, undertakes to continue communications regarding the status of the project with all stakeholders, including national, regional and local authorities, as well as interested and affected parties, and the local community.

Yours sincerely

Alan Wolfromm
(Director)

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WHAT IS NEW IN THE FINAL EIA REPORT?

This section provides an overview of the changes made to the Banna Ba Pifhu Final EIA Report (November 2012) since the publishing of the Draft EIA Report (April 2012).

1. **The scale of the Banna Ba Pifhu wind energy project has been reduced from 50 MW to 30.6 MW.** At the start of the EIA process it was initially planned that the wind energy project will be capped at 50 MW and that it will connect either to the existing 66 kV Melkhout / St. Francis overhead powerline, which passes through the site, or to a new 132 kV overhead powerline that would be constructed to connect the wind farm to the Melkhout substation, located approximately 7 km north of the site. Since the release of the Draft EIA Report, Eskom has conveyed to WKN Windcurrent that the existing 66 kV Melkhout / St. Francis overhead powerline can only receive an additional connection of up to approximately 30 MW from this project. WKN Windcurrent has thus decided to decrease the total capacity from 50 MW to 30.6 MW in order to utilize the on-site grid connection.

2. Both the 50 MW and 30.6 MW alternative layouts are assessed in the Final EIA report, with 50 MW being alternative 1 with a maximum of 28 turbines, and **30.6 MW being the preferred alternative** with a minimum of 9 and a maximum of 17 turbines (the actual number will be dependent on the capacity of the turbines selected in the range between 1.8 and 3.2 MW). The project description (Chapter 2) has been updated to include the new preferred alternative comprising 30.6 MW.

3. An **updated layout plan** has been prepared for the preferred alternative comprising 30. 6 MW. It shows the location of the proposed 17 turbines as well as supporting infrastructure (such as roads) relative to features such as riparian areas (refer to Figure S.2 in the Summary and Figure 2.4 in Chapter 2 of the Final EIA Report).

4. The Chapter on the **Approach to the EIA** (Chapter 4) has been updated to include the additional preferred alternative of 30.6 MW and to indicate the Public Publication Process followed since the release of the Draft EIA Report.

5. The **specialist studies** have been revised to incorporate and **assess the preferred alternative layout comprising 30.6 MW** (Chapters 5 to 14). The specialist reports assessed both the preferred alternative of 30.6 MW and the alternative 1 comprising 50 MW. The assessment ratings were not affected negatively. The assessment ratings either remained the same or have a less negative impact for the 30.6 MW option due to the reduction in the scale of the project.

6. **A twelve month pre-construction bird monitoring programme** was undertaken at the proposed wind farm site by two experienced bird monitors under the guidance of the bird specialist, Chris van Rooyen. The monitoring commenced in March 2011 and continued until April 2012. The monitoring was done over four sampling periods, i.e. summer, winter/early spring, late spring and autumn. The specific objectives of the monitoring programme were to record the abundance and diversity of all birds, and flight patterns of priority species. The results from the pre-construction monitoring programme and the proposed mitigation measures based on the monitoring are included in the updated Bird specialist study (Chapter 6 of the Final EIA Report) and informed the turbine layout for the 30.6 MW preferred option.

7. The **updated bat specialist report** included in the Final EIA Report was prepared by Natural Scientific Services (NSS). An initial bat assessment was conducted by Stephanie Dippenaar in late 2011 and this study was included in the Draft EIA Report. The report prepared by Stephanie Dippenaar was part of the desktop review for the bat specialist report prepared by NSS. Natural Scientific Services has been commissioned by WKN Windcurrent to conduct a **twelve month bat monitoring programme** which is being completed to satisfy the requirements of the South African Good Practice Guidelines for Surveying Bats in Wind Farm Developments (Sowler & Stoffberg, 2012). The bat monitoring at the Banna Ba Pifhu site commenced in mid April 2012 and is scheduled to run until mid April 2013. The bat monitoring was conducted over two seasons, autumn and winter. The data collected during the first quarter of the 12 month monitoring period are included in the Final EIA report and therefore incorporate on-site data measured compared with preliminary data collected at the start of the project. Chapter 7 on bats serves as a Preliminary Bat Impact Report with a final detailed monitoring report to be submitted mid-May 2013 and incorporated into the EMPr as part of the detailed project planning.

8. A **shadow flicker study** was undertaken by WKN Windcurrent and the data from the study are included in the visual report (Chapter 8). The data were analysed by the visual specialist on the project team, Mr Henry Holland of Mapthis. He identified the potential impacts of shadow flicker and proposed mitigation measures to reduce the potential impacts.

9. The **EIA Summary** and the **Conclusions** chapter (Chapter 15) have been updated to reflect the latest changes since the release of the Draft EIA Report as discussed above.

10. **Communications** to Interested and Affected Parties following the release of the Draft EIA Report are included (Appendix D).

11. **Correspondence** from Interested and Affected Parties following the release of the Draft EIA Report is included in Appendix E

12. The **Issues and Responses Trail** has been updated to include the comments received after the release of the Draft EIA Report and the comments thereto (Appendix F).

13. Details regarding the **second public meeting in Humansdorp on 8 May 2012** following the release of the Draft EIA Report are included. It includes the minutes of the public meeting (Appendix I) and attendance register (Appendix J).

14. The **EMPR** has been updated (Section B of the Final EIA Report) following the revision of the specialists reports.

15. **WKN Windcurrent SA (Pty) Ltd has signed a letter of commitment** to indicate that they will implement the mitigation measures and recommendations proposed in the specialist studies and the Environmental Management Programme (EMPr) of the Final Environmental Impact Assessment Report. They also commit to adhere to the conditions imposed by the national Department of Environmental Affairs (DEA), should this project receive Environmental Authorisation (see “Proponent’s Commitment Statement” inserted at the front of the report).

Glossary

BA	Basic Assessment
BID	Background Information Document
CARA	Conservation of Agricultural Resources Act
CO_2	Carbon Dioxide
CSIR	Council for Scientific and Industrial Research
CSP	Concentrated Solar Power
DEA	National Department of Environmental Affairs
DEDEA	Department of Economic Development & Environmental Affairs
DEIA	Draft Environmental Impact Assessment
DoE	Department of Energy
DSR	Draft Scoping Report
DWA	Department of Water Affairs
FSR	Final Scoping Report
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMPr	Environmental Management Programme
EWT	Endangered Wildlife Trust
HGM	Hydrogeomorphic Approach
I&AP	Interested and Affected Party
IDP	Integrated Development Plan
IEP	Integrated Energy Plan
IPP	Independent Power Producer
IRP	Integrated Resource Plan for electricity
IUCN	International Union for Conservation of Nature (Global conservation status)
kWh	Kilowatt Hours
LTMS	Long Term Mitigation Strategy
MW	Megawatts
NEMA	National Environmental Management Act (Act 107 of 1998)
NEMBA	National Environmental Management Act (Act 10 of 2004)
NERSA	National Energy Regulator of South Africa
NHRA	National Heritage Resources Act (Act 25 of 1999)
NSBA	National Spatial Biodiversity Assessment
NWA	National Water Act (Act 36of 1998)
NWCS	National Wetland Classification System
PES	Present Ecological State
PPA	Power Purchase Agreement
PPC	Public Process Consultants
PSEIA	Plan of Study for EIA
PV	Photovoltaic

REFIT	Renewable Energy Feed-in Tariff
REPA	Renewable Energy Purchasing Agency
SAHRA	South African Heritage Resources Agency
SDF	Spatial Development Framework
SSC	Species of Special Concern
ToR	Terms of Reference
WTG	Wind Turbine Generator
WUL	Water Use License
WULA	Water Use License Application

Glosssary of terms

Acoustic monitoring	The recording of the echolocation calls of bats
Aestivation	a state of animal dormancy, characterized by inactivity and a lowered metabolic rate, that is entered in response to high temperatures and arid conditions.
Aerobic	having molecular oxygen (O2) present.
Anaerobic	not having molecular oxygen (O2) present.
Ambient noise	Totally encompassing sound in a given situation at a given time, and usually composed of sound from many sources, both near and far. Note: Ambient noise includes the noise from the noise source under investigation.
Annoyance	General negative reaction of the community or person to a condition creating displeasure or interference with specific activities
Annual	Completing the cycle from seed to death in one year or season
Anthropogenic	of human creation
Arboreal	Living in trees
A-weighted sound pressure level (L_{pA} and $L_{Aeq,T}$)	A-weighted sound level L_{pA} which is the sound pressure level at specific frequencies and is given using the following equation: $L_{pA} = 10\text{Log}\left(\frac{P_A}{P_O}\right)_2$ Where: *PA* = is the root-mean-square sound pressure, using the frequency weighting network A *PO* = is the reference sound pressure (*PO* = 20 µPa). A-weighted sound pressure level is expressed in decibels dBA **Note:** For clarity in this study L_{pA} shall equal $L_{Aeq,T}$

Barotrauma	Tissue damage to the lungs caused by rapid or excessive changes in pressure
Bat detector	Electronic device that converts the ultrasonic echolocation calls of bats into an audible or readable signal
Bat detecting recorder	A recorder that records ultrasonic echolocation calls that can be played back afterwards and/or displayed through a sonogram.
Biennial	Completing the cycle from seed to death in two years or seasons
Bottomland:	the lowlands along streams and rivers, on alluvial (river deposited) soil.
Boundary	Landscape patches have a boundary between them which can be defined or fuzzy (Sanderson and Harris 2000). The zone composed of the edges of adjacent ecosystems is the boundary.
Chroma	the relative purity of the spectral colour, which decreases with increasing greyness.
Composition	refers to the number of patch types (see below) represented on a landscape, and their relative abundance
Connectivity	relates to how intact patches of indigenous vegetation are (i.e. it is the opposite of fragmentation). "Functional" connectivity refers to the ability of connective corridors to sustain ecosystem processes common to linked patches. The measure of how connected or spatially continuous a corridor, network, or matrix is. For example, a forested landscape (the matrix) with fewer gaps in forest cover (open patches) will have higher connectivity.
Corridors	have important functions as strips of a particular type of landscape differing from adjacent land on both sides. habitat, ecosystems or undeveloped areas that physically connect habitat patches. Smaller, intervening patches of surviving habitat can also serve as "stepping stones" that link fragmented ecosystems by ensuring that certain ecological processes are maintained within and between groups of habitat fragments. o An array of subtle yet complex interactions between plants and animals sustains the natural environment. Many ecological processes that could not be directly mapped as a GIS layer may still be conserved by maintaining closely-connected patches of natural vegetation. Areas where patches of remaining natural vegetation are considered relatively connected (within approximately 500 m or less of each other), and which support identified ecological processes, should be considered when identifying suitable "ecological corridors" for conserving biological diversity. o Key considerations when identifying ecological corridors that can contribute to the conservation of biodiversity: ▪ support connections between remaining natural habitat ▪ support connections between critically endangered or endangered vegetation and large, intact areas of natural vegetation ▪ include a diverse array of natural habitats, including wetlands ▪ include significant ecological processes that contribute to the regional persistence of biodiversity o Due consideration of certain of these processes (such as the maintenance of natural fire regimes) should also be incorporated into good land use management practices for the remaining natural vegetation and immediate surrounding areas.
Critically Endangered	critically endangered terrestrial ecosystems have lost so much of their original natural habitat (more than 80 % lost) that ecosystem functioning has to a large extent broken down and a significant proportion of species associated with the ecosystem have been lost or are likely to be lost.
Cumulative impact	Cumulative impact are defined as the impact on the environment, which results from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (CEQ, 1997).

Cumulative viewshed	A viewshed which indicates in some way how much of a development is visible from a particular viewpoint. In a raster based cumulative viewshed each pixel value will indicate how many points within the development area are visible. A power line development could, for example, use pylons as points to generate a cumulative viewshed for the development. Each pixel value in the viewshed will be a count (accumulation) of the number of pylons that will potentially be visible from that pixel.
dBA	The decibel is the unit used to measure sound pressure levels. The human ear does not perceive all sound pressures equally at all frequencies. The "A" weighted scale adjusts the measurement to approximate a human ear response.
Delineation (of a wetland)	to determine the boundary of a wetland based on soil, vegetation, and/or hydrological indicators (see definition of a wetland).
Digital Elevation Model (DEM)	A digital or computer representation of the topography of an area.
Disturbance	an event that significantly alters the pattern of variation in the structure or function of a system, while fragmentation is the breaking up of a habitat, ecosystem, or land-use type into smaller parcels. Disturbance is generally considered a natural process.
ECO/ESO	Environmental Site/Control Officer – person responsible for the Day-to-Day Environmental Management on-site during construction.
Ecocline	a type of landscape boundary, with a gradual and continuous change in environmental conditions of an ecosystem or community. Ecoclines help explain the distribution and diversity of organisms within a landscape because certain organisms survive better under certain conditions, which change along the ecocline. They contain heterogeneous communities which are considered more environmentally stable than those of ecotones
Echolocation	The ability of bats and some other animals to orient themselves and locate obstacles and their pray using echoes from sound emitted, typically from the mount or nostrils.
Ecological processes	ecosystems work because they are kept "alive" by ecological processes such as pollination, nutrient cycling, disturbance (e.g. fire), migration of species or soil maintenance. o In all areas where spatial components of ecological processes occur, loss or degradation of natural habitat should be avoided, to ensure that the ecological processes concerned continue to function. o Ecological processes typically only function well where natural vegetation remains, and in particular where the remaining vegetation is well-connected with other nearby patches of natural vegetation. Loss and fragmentation of natural habitat severely threatens the integrity of ecological processes. Where basic processes are intact, ecosystems are likely to recover more easily from disturbances or inappropriate actions if the actions themselves are not permanent. Conversely, the more interference there has been with basic processes, the greater the severity (and longevity) of effects. Natural processes are complex and interdependent, and it is not possible to predict all the consequences of loss of biodiversity or ecosystem integrity. When a region's natural or historic level of diversity and integrity is maintained, higher levels of system productivity are supported in the long run and the overall effects of disturbances may be dampened. o Other examples of processes include plant-herbivore processes, diversification of plant lineages along soil type transitions and lowland to upland gradients, natural fire regimes, predator-prey relationships, migration and exchange between inland and coastal biota (often along river corridors), faunal seasonal migration and hydrologic regimes.
Ecosystem	All of the organisms of a particular habitat, such as a lake or forest, together with the physical environment in which they live
Ecosystem status	ecosystem status of terrestrial ecosystems is based on the degree of habitat loss that has occurred in each ecosystem, relative to two thresholds: one for maintaining healthy ecosystem functioning, and one for conserving the majority of species associated with the ecosystem. As natural habitat is lost in an ecosystem, its functioning is increasingly compromised, leading eventually to the collapse of the ecosystem and to loss of species associated with that ecosystem. See Critically Endangered, Endangered, Vulnerable, Least Threatened.

Ecotone	the transitional zone between two communities. Ecotones can arise naturally, such as a lakeshore, or can be human-created, such as a cleared agricultural field from a forest. The ecotonal community retains characteristics of each bordering community and often contains species not found in the adjacent communities. Classic examples of ecotones include fencerows; forest to marshlands transitions; forest to grassland transitions; or land-water interfaces such as riparian zones in forests. Characteristics of ecotones include vegetational sharpness, physiognomic change, and occurrence of a spatial community mosaic, many exotic species, ecotonal species, spatial mass effect, and species richness higher or lower than either side of the ecotone.
Edge	the portion of an ecosystem near its perimeter, where influences of the adjacent patches can cause an environmental difference between the interior of the patch and its edge. This edge effect includes a distinctive species composition or abundance in the outer part of the landscape patch. For example, when a landscape is a mosaic of perceptibly different types, such as a forest adjacent to a grassland, the edge is the location where the two types adjoin. In a continuous landscape, such as a forest giving way to open woodland, the exact edge location is fuzzy and is sometimes determined by a local gradient exceeding a threshold, such as the point where the tree cover falls below thirty-five percent.
Emergent trees	Trees that grow above the top of the canopy
Endangered	endangered terrestrial ecosystems have lost significant amounts (more than 60 % lost) of their original natural habitat, so their functioning is compromised.
Endemic	a plant or animal species, or a vegetation type, which is naturally restricted to a particular defined region. It is often confused with indigenous, which means 'native, occurring naturally in a defined area'.
Endorheic	closed drainage e.g. a pan.
Equivalent continuous day/night rating level ($L_{R,dn}$)	Equivalent continuous A-weighted sound pressure level ($L_{Aeq,T}$) during a reference time interval of 24 h, plus specified adjustments for tonal character, impulsiveness of the sound and the time of day; and derived from the following equation: $L_{R,dn} = 10Log\left[\left(\frac{d}{24}\right)10^{\frac{L_{Req,d}}{10}} + \left(\frac{24-d}{24}\right)10^{\frac{L_{Req,n}+k_n}{10}}\right]_{dB}$ Where: $L_{R,dn}$ is the equivalent continuous day/night rating level; d is the number of daytime hours; $L_{Req,d}$ is the rating level for daytime; $L_{Req,n}$ is the rating level for night-time; K_n is the adjustment of 10 dB added to the night-time rating level.
Exotic	Non-indigenous; introduced from elsewhere, may also be a weed or invasive species.
Floodplain	Wetland inundated when a river overtops its banks during flood events resulting in the wetland soils being saturated for extended periods of time.
Fragmentation	causes land transformation, an important current process in landscapes as more and more development occurs.
Frequency	The “pitch” of a sound (high or low), determined by the number of wavelengths per second, measured in Hertz (1 Hz=1cycle per second).
Function	refers to how each element in the landscape interacts based on its life cycle events.
Gley:	soil material that has developed under anaerobic conditions as a result of prolonged saturation with water. Grey and sometimes blue or green colours predominate but mottles (yellow, red, brown and black) may be present and indicate localised areas of better aeration.

Groundwater	subsurface water in the zone in which permeable rocks, and often the overlying soil, are saturated under pressure equal to or greater than atmospheric.
Groundwater table	the upper limit of the groundwater
Habitat	the home of a plant or animal species. Generally those features of an area inhabited by animal or plant which are essential to its survival.
Heterogeneity	A landscape with structure and pattern implies that it has spatial heterogeneity or the uneven, non-random distribution of objects across the landscape.
High-energy impulsive sound	Sound from one of the following categories of sound sources: quarry and mining explosions, sonic booms, demolition and industrial processes that use high explosives, explosive industrial circuit breakers, military ordnance (e.g. armour, artillery, mortar fire, bombs, explosive ignition of rockets and missiles), or any other explosive source where the equivalent mass of TNT exceeds 25 g, or a sound with comparable characteristics and degree of intrusiveness
Highly impulsive sound	sound from one of the following categories of sound sources: small arms fire, metal hammering, wood hammering, drop-hammer pile driver, drop forging, pneumatic hammering, pavement breaking, or metal impacts of rail yard shunting operations, or sound with comparable characteristics and degree of intrusiveness
Hydric soil	soil that in its undrained condition is saturated or flooded long enough during the growing season to develop anaerobic conditions favouring the growth and regeneration of hydrophytic vegetation (vegetation adapted to living in anaerobic soils).
Hydrophyte:	any plant that grows in water or on a substratum that is at least periodically deficient in oxygen as a result of soil saturation or flooding; plants typically found in wet habitats.
Hydrology	the study of water, particularly the factors affecting its movement on land.
Indigenous	Native; naturally occurring.
Infilling or Fill	dumping of soil or solid waste onto the wetland surface. Infilling generally has a very high and permanent impact on wetland functioning and is similar to drainage in that the upper soil layers are rendered less wet, usually so much so that the area no longer functions as a wetland.
Infra sound	Sound which predominantly contains sound energy at frequencies below 10 Hz
Insectivorous	Feeding from insects
Invasive	a non-indigenous plant or animal species that adversely affect the habitats it invades economically, environmentally or ecologically.
Isopleth	Lines of equal intensity
Lacustrine	Lacustrine systems (e.g. lakes & dams) are wetlands that are situated in a topographic depression or a dammed river channel, have a total area greater than 8 ha and surface area coverage by mosses, lichens, trees, shrubs or persistent emergents of less than 30%.
Landscape baseline	A description of the existing elements, features, characteristics, character, quality and extent of the landscape (GLVIA, 2002).
Landscape character	The distinct and recognisable pattern of elements that occurs consistently in a particular type of landscape, and how this is perceived by people. It reflects particular combinations of geology, landform, soils, vegetation, land use and human settlement. It creates the particular sense of place of different areas of the landscape (GLVIA, 2002).
Landscape character sensitivity	This provides an indication of the ability of a landscape to absorb change from the proposed development without changing character. A pristine landscape prized for its natural beauty, or a landscape of high cultural value will have high sensitivity to changes brought about by new developments.

Landscape impacts	Change in the elements, characteristics, character and qualities of the landscape as the result of development (GLVIA, 2002). These effects can be positive or negative, and result from removal of existing landscape elements, addition of new elements, or the alteration of existing elements.
Least threatened terrestrial ecosystems	These ecosystems have lost only a small proportion (more than 80 % remains) of their original natural habitat, and are largely intact (although they may be degraded to varying degrees, for example by invasive alien species, overgrazing, or overharvesting from the wild).
Low frequency noise	Sound which predominantly contains sound energy at frequencies below 100 Hz
m/s	Metres per second
Marsh	a wetland dominated by emergent herbaceous vegetation (usually taller than 1 m), such as the common reed (*Phragmites australis*) which may be seasonally wet but are usually permanently or semi-permanently wet.
Matrix	the “background ecological system” of a landscape with a high degree of connectivity.
Memorability	The quality of being worth remembering; "continuous change results in lack of memorability"; "true memorability of phrase"
Mottles	soils with variegated colour patters are described as being mottled, with the "background colour" referred to as the matrix and the spots or blotches of colour referred to as mottles.
MW	Mega Watt of electricity (1000 kilowatts)
Nature-based tourism	Tourism that involves travelling to relatively undisturbed natural areas with the specific objective of studying, admiring and enjoying the scenery, fauna and flora, either directly or in conjunction with activities such as trekking, canoeing, mountain biking, hunting and fishing (Turpie et al. 2005)
Network	an interconnected system of corridors while mosaic describes the pattern of patches, corridors and matrix that form a landscape in its entirety.
NSA	Noise Sensitive Area
Off-sets	compensation for biodiversity loss resulting from authorized changes in land use. Can include assigning stewardship or protected area status to remaining conservation-worthy land or making a financial bequest for purposes of biodiversity conservation.
Patch	a term fundamental to landscape ecology, is defined as a relatively homogeneous area that differs from its surroundings. Patches are the basic unit of the landscape that change and fluctuate, a process called patch dynamics. Patches have a definite shape and spatial configuration, and can be described compositionally by internal variables such as number of trees, number of tree species, height of trees, or other similar measurements.
Pattern	is the term for the contents and internal order of a heterogeneous area of land.
Principal representative viewpoints	Principal representative viewpoints are identified during the visual baseline desk study and field survey. They should be representative of the visual amenity of the area and include walking public footpaths and visiting areas of open public access. A comprehensive photographic record of these points supports the visual impact assessment (GLVIA, 2002)
Receptor	An element or assemblage of elements that will be directly or indirectly affected by the proposed development.
Reference time interval	Representative duration of time periods that are regarded as typical for sound exposure of the community within a period of 24 h: – Daytime: 06:00 to 22:00 – Night-time: 22:00 to 06:00
Refuge	a location of an isolated or relict population of a once widespread animal or plant species
Residual noise	Totally encompassing sound in a given situation at a given time, and usually composed of sound from many sources, both near and far, excluding the noise under investigation

Rill	A very small stream of water
Riparian	the area of land adjacent to a stream or river that is influenced by stream-induced or related processes. Riparian areas which are saturated or flooded for prolonged periods would be considered wetlands and could be described as riparian wetlands. However, some riparian areas are not wetlands (e.g. an area where alluvium is periodically deposited by a stream during floods but which is well drained).
River corridors	River corridors perform a number of ecological functions such as modulating streamflow, storing water, removing harmful materials from water, and providing habitat for aquatic and terrestrial plants and animals. These corridors also have vegetation and soil characteristics distinctly different from surrounding uplands and support higher levels of species diversity, species densities, and rates of biological productivity than most other landscape elements. Rivers provide for migration and exchange between inland and coastal biotas.
Sense of place	That distinctive quality that makes a particular place memorable to the visitor, which can be interpreted in terms of the visual character of the landscape. The unique quality or character of a place, whether natural, rural or urban. Relates to uniqueness, distinctiveness or strong identity (Oberholzer 2005).
Shrub	A woody plant that produces no trunk but branches from the base.
Sonogram	A time-varying spectral representation (forming an image) that shows how the spectral density of a signal varies with time – thus a graphic display of bat calls plotting time over frequency.
Specific noise	Component of the ambient noise which can be specifically identified by acoustical means and which may be associated with a specific source **Note:** Complaints about noise usually arise as a result of one or more specific noises.
STEP	Sub-Tropical Ecosystem Planning.
Structure	is determined by the composition, the configuration, and the proportion of different patches across the landscape.
Transformation	in ecology, transformation refers to adverse changes to biodiversity, typically habitats or ecosystems, through processes such as cultivation, forestry, drainage of wetlands, urban development or invasion by alien plants or animals. Transformation results in habitat fragmentation - the breaking up of a continuous habitat, ecosystem, or land-use type into smaller fragments.
Tributary/Drainage line	A small stream or river flowing into a larger one.
Under-story	the area of a forest which grows in the shade of the canopy. Plants in the understory consist of a mixture of seedlings and saplings of canopy trees together with understory shrubs and herbs. Young canopy trees often persist as suppressed juveniles for decades while they wait for an opening in the forest overstory, which will enable their growth into the canopy. On the other hand, understory shrubs are able to complete their life cycle in the shade of the forest canopy.
Viewer sensitivity	The assessment of the receptivity of viewer groups to the visible landscape elements and visual character and their perception of visual quality and value. The sensitivity of viewer groups depends on their activity and awareness within the affected landscape, their preferences, preconceptions and their opinions.
Viewshed	A viewshed is an area of land, water, and other environmental elements that is visible from a fixed vantage point. In digital imaging, a viewshed is a binary raster indicating the visibility of a viewpoint for an area of interest. A pixel with a value of unity indicates that the viewpoint is visible from that pixel, while a value of zero indicates that the viewpoint is not visible from the pixel.
Visibility of Project	The geographic area from which the project will be visible, or view catchment area. (The actual zone of visual influence of the project may be smaller because of screening by existing trees and buildings). This also relates to the number of receptors affected (Oberholzer 2005)

Visual absorption capacity (VAC)	Visual Absorption Capacity signifies the ability of the landscape to accept additional human intervention without serious loss of character and visual quality or value. VAC is founded on the characteristics of the physical environment such as vegetative screening, diversity of colours and patterns and topographic variability. It also relates to the type of project in terms of its vertical and horizontal scale, colours and patterns. A high VAC rating implies a high ability to absorb visual impacts while a low VAC implies a low ability to absorb or conceal visual impacts.
Visual amenity	The value of a particular area or view in terms of what is seen. (GLVIA, 2002)
Visual baseline	A description of the extent and nature of existing views of the site from representative viewpoints, and the nature and characteristics of the visual amenity of the potentially sensitive visual receptors (GLVIA, 2002)
Visual envelope	The approximate extent within which the development can be seen. The extent is often limited to a distance from the development within which views of the development are expected to be of concern.
Visual exposure	Visual exposure refers to the relative visibility of a project or feature in the landscape (Oberholzer, 2005). Exposure and visual impact tend to diminish exponentially with distance.
Visual impact	Changes to the visual character of available views resulting from the development that include: obstruction of existing views; removal of screening elements thereby exposing viewers to unsightly views; the introduction of new elements into the viewshed experienced by visual receptors and intrusion of foreign elements into the viewshed of landscape features thereby detracting from the visual amenity of the area.
Visual impact assessment	A specialist study to determine the visual effects of a proposed development on the surrounding environment. The primary goal of this specialist study is to identify potential risk sources resulting from the project that may impact on the visual environment of the study area, and to assess their significance. These impacts include landscape impacts and visual impacts.
Visual intrusion	Visual intrusion indicates the level of compatibility or congruence of the project with the particular qualities of the area – its 'sense of place'. This is related to the idea of context and maintaining the integrity of the landscape (Oberholzer 2005).
Visual quality	An assessment of the aesthetic excellence of the visual resources of an area. This should not be confused with the value of these resources where an area of low visual quality may still be accorded a high value. Typical indicators used to assess visual quality are vividness, intactness and unity. For more descriptive assessments of visual quality attributes such as variety, coherence, uniqueness, harmony, and pattern can be referred to.
Visual receptors	Visual receptors include viewer groups such as the local community, residents, workers, the broader public and visitors to the area, as well as public or community areas from which the development is visible.
Visual resource	Visual resource is an encompassing term relating to the visible landscape and its recognisable elements which, through their coexistence, result in a particular landscape and visual character
Vulnerable	vulnerable terrestrial ecosystems have lost some (more than 60 % remains) of their original natural habitat, and their functioning will be compromised if they continue to lose natural habitat.
Weed	an indigenous or non-indigenous plant that grows and reproduces aggressively, usually a ruderal pioneer of disturbed areas. Weeds may be unwanted because they are unsightly, or they limit the growth of other plants by blocking light or using up nutrients from the soil. They also can harbour and spread plant pathogens.

Wetlands	a collective term used to describe lands that are sometimes or always covered by shallow water or have saturated soils, and where plants adapted for life in wet conditions usually grow. o Collectively, wetlands and their associated vegetation are highly diverse and productive ecosystems. Despite their invaluable social and environmental roles, wetlands have been identified as being among southern Africa's most threatened and neglected habitats. o Wetlands perform a number of valuable ecosystem functions, relating to: ▪ Water quality (biofiltration, sediment trapping, protecting shorelines and controlling erosion, aquifer recharge), ▪ Water quantity (reducing peak floods and storing flood waters, supporting stream base flow, groundwater discharge/recharge), and ▪ Habitat for insects, amphibians, birds, fish and mammals for all or portions of their life cycles.
Wetland catchment	the area up-slope of the wetland from which water flows into the wetland and including the wetland itself.
Wetland delineation	the determination and marking of the boundary of a wetland on a map
Zone of Theoretical Visibility (ZVT)	The area over which a development can theoretically be seen (also known as a Zone of Visual Influence, visual envelope and viewshed). (Horner, MacLennan and Envision 2006)
Zone of visual influence (ZVI)	The extent of the area from which the most elevated structures of the proposed development could be seen and may be considered to be of interest (see visual envelope or viewshed).