WKN Windcurrent

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

SUMMARY

Prepared by:
CSIR
Contact person:
Ms. Minnelise Levendal
PO Box 320, Stellenbosch, 7599

Tel: 021 – 888 2495/2661
Fax: 021 – 888 2693
Email: mlevendal@csir.co.za

Prepared for:
WKN Windcurrent SA (Pty) Ltd
Contact person:
Mr Alan Wolfromm
PO Box 762
Wilderness
6560
Tel: 044 877 0564

April 2012

Public Process Consultants
Environmental Impact Assessment and Public Participation Management

DEA Reference Number:
12/12/20/2289

CSIR Report No:
GWDS Stel General: 10728

CSIR
our future through science

Summary

Summary

PROJECT OVERVIEW

WKN Windcurrent SA (Pty) Ltd (referred to as "WKN Windcurrent") is proposing the construction of a 50 MW wind energy facility 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. WKN Windcurrent is a joint venture company between Windcurrent SA (Pty) Ltd and WKN AG (referred to as "WKN").

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.

The Banna Ba Pifhu Wind Energy Project will consist of 15 to 27 wind turbines pending the capacity of the turbine to be used, i.e. approximately 1.8 to 3.2 MW each.

A new substation will be built on site to connect to the transmission system. 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, therefore no additional power lines will need to be constructed. The turbines will be connected via underground cabling.

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 50 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 50 MW could offset over 100 000 tonnes of CO_2 per year, or 2 000 000 tonnes of CO_2 over the lifetime (20 years) of the project. [1,2.] Wind farms have a relatively short construction lead time and could therefore be quickly developed to meet South Africa's power need. Coal fired power stations used approximately 292 million cubic metres of water, or 1.5% of national water consumption, for electricity generation during 2005. The future availability and treatment costs of water therefore present a serious challenge for the economic sustainability of South Africa's current (coal-based) electricity supply.

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.

Against the background of international commitments to generation of "green energy" with low or zero CO_2 emissions, the intention of this project is to generate additional electricity that will be fed into the national grid by installing a wind farm with a capacity of 50 MW. The objective of the Banna Ba Pifhu project is to support the growing demand for electricity by means of renewable energy and to lower the emissions of carbon dioxide (CO_2) into the atmosphere. Electricity generated by wind energy, that replaces the use of fossil fuels, results in greenhouse gas emission reductions. Wind energy is a national imperative. A constrained national energy supply and South Africa's commitments to meeting its 2013 CO_2 reduction target and to the Kyoto Protocol require the rapid deployment of renewable energy, of which wind power has the greatest commercial potential.

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

Fifteen to twenty seven 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. The turbines will be supported on foundations dimensioned to the geotechnical properties, for example reinforced concrete spread foundations of approximately 20 m by 20 m and 3 m in depth. Electrical transformers will be placed beside 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 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. A wind monitoring mast with a height of 100 m has been erected on site.

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

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

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.
2. A new substation will be built on site to connect to the distribution or transmission system (maximum size of 70 m by 70 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. Should this option become unfeasible, a new 132 kV overhead powerline would connect the wind farm to the Melkhout substation, which is located approximately 7 km north of 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 PV plant. 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.

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 is now being released to stakeholders for a 40-day comment period. All comments received will be included in the Final EIA Report, which will be submitted to DEA for review and decision-making. This Draft 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 Draft EIA Report and EMP.

The Environmental Management Plan (EMP) 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.

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 Draft EIA Report, with the main alternatives being land use, technology, turbine scale and turbine layout alternatives.

WKN Windcurrent prepared three preliminary alternative layouts based on three alternative suppliers and turbine sizes (see alternative layouts in Figures 4.7-4.9 of Chapter 4 in the DEIA Report). These layouts were assessed by the specialists working on the project. WKN Windcurrent subsequently prepared a new preferred layout based on the recommendations from the specialists. 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 (see Figure S2).

IMPACT ASSESSMENT AND MITIGATION

The key issues identified during the scoping process, and assessed during the EIA, were investigated and specialist studies conducted. The overall impacts (after mitigation) are summarised below:

- Impacts on terrestrial fauna and flora: **Medium to Low** (negative);
- Impacts on birds: **Low to High** (negative); (low for collision mortality - this will have to be verified by post-construction monitoring). High to Medium during construction and Medium to Low during the operational phase for displacement of birds);

- Impacts on bats: **Medium** (negative), (confidence levels are Low as it is based on only one month of monitoring data). After the data from additional monitoring has been assessed, the confidence in predictions will be higher.
- Visual impacts: **High** (negative);
- Noise impacts: **Low** (negative);
- Economic impact: **Medium** (negative) for tourism during operational phase, **Medium** (positive) for project investment/ expenditure during construction phase;
- Impacts on archaeology: **Low** (negative);
- Impacts on palaeontology: **Low** (negative);
- Impact on wetlands and aquatic systems: **Low** (negative); and
- Impact on Agricultural soil potential: **Low** (negative).

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

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; and
- 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.

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

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. 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;
- A speed limit of 60 km/h needs to be implemented on the access roads to the site and a 40 km/h speed limit on the construction sites and for the cranes;
- Appropriate speed control measures must be implemented to keep vehicular traffic speeds to 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.

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 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. 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. 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.

WKN Windcurrent has commissioned a pre-construction bird monitoring programme on site which commenced in March 2011.

As far as collision risk is concerned, the following preliminary observations were made, based on the monitoring data gathered to date:

- The passage rates for priority species of 6.88 birds/hour (all heights) and 2.56 birds/hour (medium heights) indicate significant flight activity over the turbine area.
- Based solely on the amount of time spent at medium height over the turbine area, soaring species seem to be more at risk of collision than terrestrial species.
- Of the priority species recorded (both soaring and terrestrial species), Amur Falcons are most exposed to potential collision risk, based on the number of birds observed at the site at medium height over the turbine area.
- Of the terrestrial priority species recorded, Blue Cranes and Denham's Bustard are most exposed to potential collision risk, based on the number of birds observed at the site at medium height over the turbine area.
- Flight patterns of priority species at medium height recorded to date indicate areas where flight activity is more concentrated, although it is acknowledged that observations are inevitably biased towards the centre of the VP area. At this stage it seems that suitable foraging habitat might be an important factor in flight activity patterns.

From the results of the transect surveys the following preliminary trends emerge:

- The survey area supports high densities of Blue Crane, Amur Falcon and Black-winged Lapwing, which indicate the suitability of the study area across multiple habitat types for these species;
- Wetlands tend to support a high variety of birds; while agriculture supports the highest number of birds (but fewer species);

MITIGATION

- The monitoring should continue as planned during late autumn of 2012 in order to gather additional baseline data over four seasons;
- 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 developer to compensate for the loss of priority species habitat; and
- During construction activity should be restricted to the construction footprint itself. Access to the rest of the properties must be strictly controlled to prevent unnecessary disturbance of birds.

This report should be seen as work in progress since full results of the pre-construction monitoring programme will only become available later in 2012, when the autumn monitoring has been completed. The final results of the current baseline monitoring will then be available to feed into the final lay-out of the turbines.

IMPACT ON BATS

The main potential negative impacts of the proposed Banna Ba Pifhu Wind Energy Project on bats are:
- Loss of foraging habitat;
- Direct collisions with the rotating turbine blades; and
- Fatalities from barotrauma (i.e. effect of a change in air pressure caused by the rotation of the wind turbine blades on the internal organs of the bats, such as lungs).

The site visit conducted on 19 January 2011 and recordings of echolocation from 6 to 18 October 2011 as part of this specialist study, recorded five bat species present on site. No large caves or maternal colonies were identified in close vicinity of the proposed turbine sites. The majority of species calls were for *Tadarida aegyptiaca,* an open air forager, and *Neoromicia capensis,* for which the highest number of calls were recorded. Both these species have a South African Conservation Status of Least Concern. It is expected that open air foragers will be mostly negatively affected during operation of the turbines.

Bats change their flying patterns when they migrate. Consequently, those species which usually forage at a lower elevation might fly, or even forage, in the vicinity of the turbine blades when migrating. Thus the need to investigate the area for a 12 month period covering all four seasons and also do recordings at hub height, is important. The proponent has already commenced with monitoring.

The no-go scenario has the least negative impact from a bat perspective compared to the other options investigated. The literature suggests that bat fatalities may increase exponentially with tower height, suggesting that larger turbines are reaching the airspace of migrating bats. At present no recordings at tower height have been incorporated in the study. Furthermore, no studies concerning the impact of different sizes of wind turbines on South African bat species are available. The effect of smaller but more turbines to larger but less turbines will have to be estimated and evaluated. Furthermore, it would be preferable if alternative positions, as far as possible, close to open water bodies, such as option 28, could be avoided. Bats that fly to the proposed area to drink water is expected to be more at risk if turbines are situated close to open water bodies.

Due to limited data available it is not possible to make confident predictions on the negative cumulative effect of several wind farms in the Jeffrey's Bay/Humansdorp vicinity. It is nevertheless expected that the combined proposed wind developments in the area might have a cumulative negative impact on the bat population, at least through a loss of habitat.

MITIGATION

- A condition of this assessment is that the pre-construction monitoring be completed;
- It is further recommended that post-construction monitoring be undertaken

while the turbines are in operation, to determine the extent of bat fatalities and the species affected;
- If further monitoring data confirm low bat activity, the main mitigation proposed is to completely seal off roofs of new buildings within the study area, and those of existing buildings within the study area that do not have any bats roosting in them at present. If a high number of bats are recorded during the complete monitoring period, bat roost sites could be established (e.g. roost boxes) as a trade-off to offset potential mortalities during turbine operation; and
- If future monitoring data shows high activity, the client together with a bat specialist should investigate further mitigation measures. This could include an increase in the distance of buffer zones, depending on the foraging habitat of species that will be negatively impacted upon, and refining operational procedures of the turbines, such as an increase in turbine cut-in speed (curtailment).

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;
- Visual impact on viewers;
- Intrusion of large highly visible wind turbines on the existing views of sensitive visual receptors; and
- Visual impact of night lights of a wind farm on existing nightscape.

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 PNR 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 low visibility areas (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;
- 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;"
- 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;
- An information centre (provided that it is located in a low visibility area) and trails along the wind farm can enhance the project by educating the public about the need and benefits of wind power. 'Engaging school groups can also assist the wind farm proponent, as energy education is paramount in developing good public relations over the long term. Instilling the concept of sustainability, and creating awareness of the need for wind farm developments, is an important process that can engage the entire community' (Johnston 2001). This has also been borne out by a more recent study on the effect of wind farms on tourism in which respondents said they would visit wind farms as long as there was an information centre (Frantál and Kunc 2010); and
- The aviation standards have to be followed and no mitigation measures are applicable in terms of marking the turbines. Lighting of ancillary buildings and structures should be designed to minimise light pollution without compromising safety. Motion sensitive lighting can be used for security purposes.

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.
Noise impacts were modelled for the operational phase, taking into consideration noise sensitive areas (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, in general, noise from the turbines will be below the SANS10103 limits for rural areas at a

distance of approximately 500m from the turbines.

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; and
- Ambient noise monitoring to be conducted at the 11 NSAs when operations commence to verify the noise emissions meet the noise rating limit.

ECONOMIC IMPACTS

The main economic 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. Preliminary estimates indicate that a total of approximately R800 million would be spent on the entire construction phase and R20 million per year during operations. Roughly 187 jobs of 6 to 10 month duration would be associated with the construction phase. Approximately 82 of these jobs would be allocated to workers from the Kouga municipal area and a further 72 to workers from the rest of the Eastern Cape. With regard to direct employment during operations, it is expected that approximately 10 direct employment opportunities would be created by the project.

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.

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.

IMPACT ON ARCHAEOLOGY

The proposed Banna Ba Pifhu Wind Energy Facility site is more than 5 kilometres 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.

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.

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.

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;
- 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.
- All relevant buffers mentioned in the wetlands and aquatic report should be included into future designs and later engineering diagrams.

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.

A number of mitigation measures have been implemented to significantly mitigate the impacts of the wind farm development on agricultural resources and productivity. These are listed below. The most significant of these involve the layout of the wind farm, which has been done to minimise various agricultural impacts. After mitigation, the loss of agricultural land was determined as only 13.02 hectares, which represents a mere 1.1 % 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 report; Chapter 14, Figure 14.2);
- No new roads are proposed on slopes where erosion is a potential hazard (see site plan);
- 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 20 cm 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 in Agricultural specialist study, Chapter 14);
- 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; and
- Most turbines and new access roads are positioned on non-cultivated, grazing land, where mechanised vehicular traffic is not required for cultivation.

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 and cabling. 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.

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 and 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 Medium to Low (after mitigation).

- Based on existing available information and the findings of the site visit, the potential impact of the wind turbines on bats at the proposed Banna Ba Pifhu is anticipated to be of medium significance with mitigation. Although confidence levels for the October recordings are high, overall confidence levels are low as only one month of monitoring data has been incorporated into the study. After the data from additional monitoring have been assessed, the confidence in predictions will be higher.
- 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 13.02 hectares, which represents a mere 1.1% 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 Jeffrey's Bay, 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).

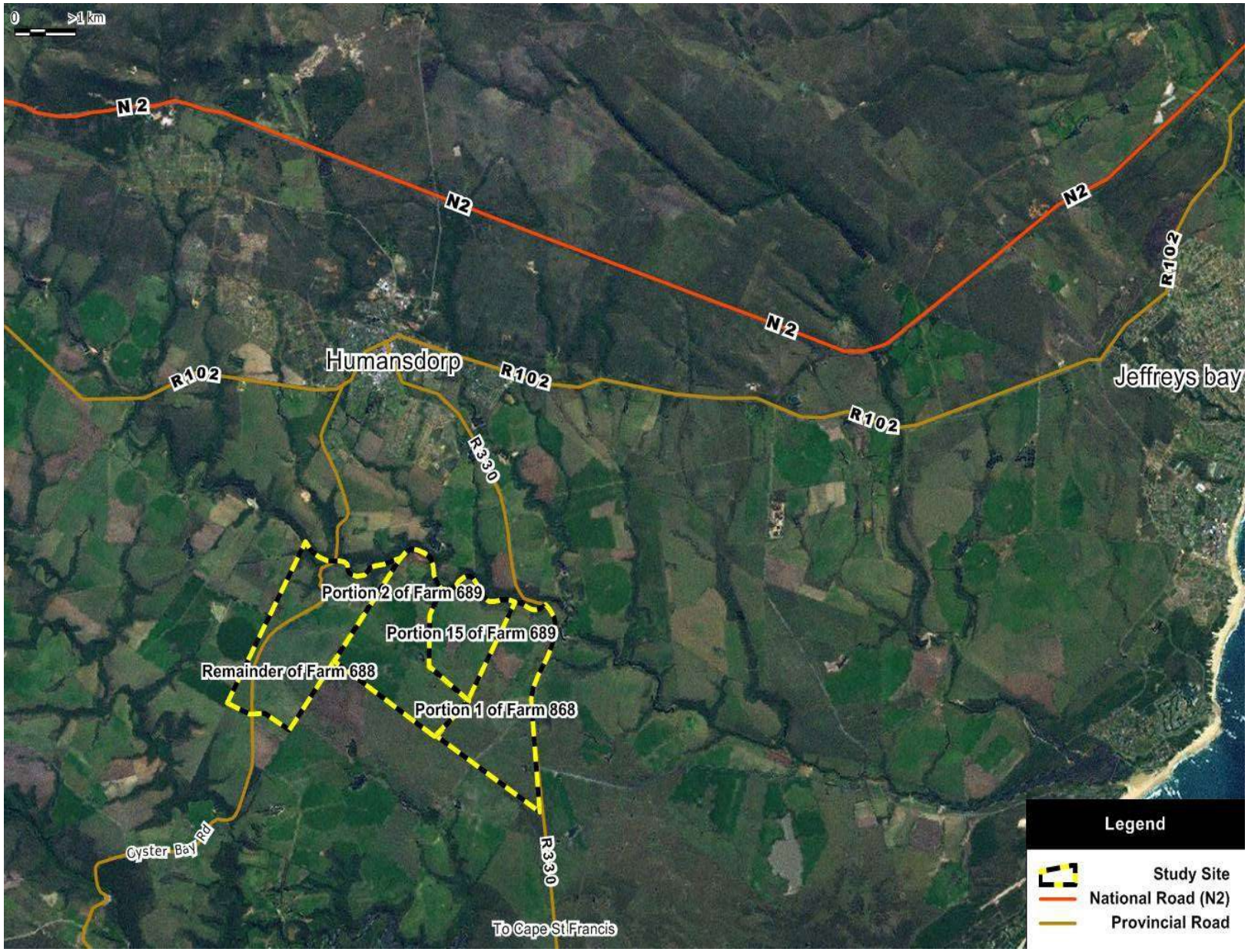

***Figure S.1**: Locality map of the proposed Banna Ba Pifhu Wind Energy Project near Humansdorp in the Eastern Cape (satellite image)*

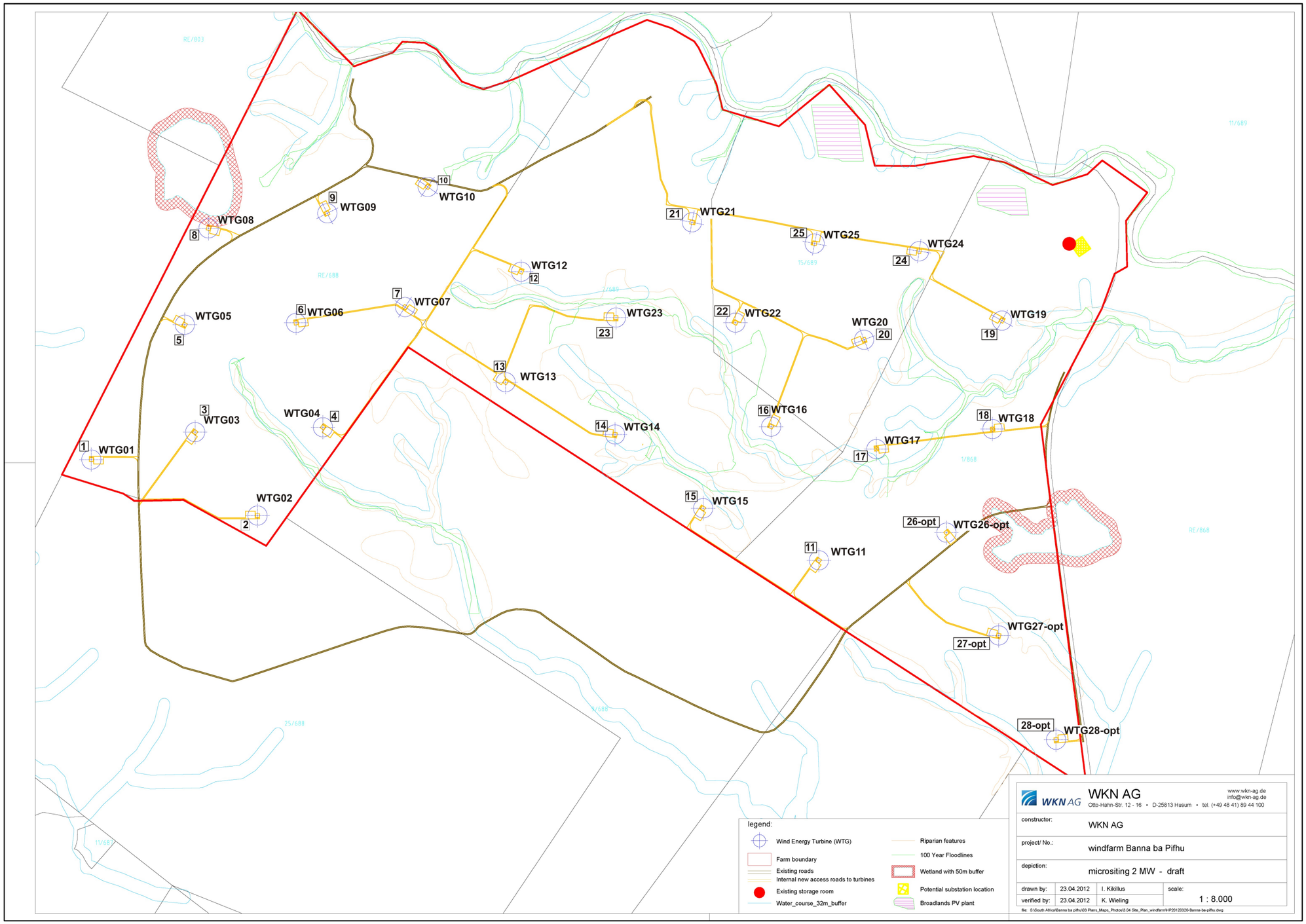

***Figure S.2**: Layout of the location of the turbines as well supporting infrastructure such as roads relative to features such as riparian areas and the 1:100 year floodline.*