STRATEGIC ENVIRONMENTAL ASSESSMENT FOR WIND AND SOLAR PHOTOVOLTAIC ENERGY IN SOUTH AFRICA

Appendix A

Specialist Reports

STRATEGIC ENVIRONMENTAL ASSESSMENT FOR WIND AND SOLAR PHOTOVOLTAIC ENERGY IN SOUTH AFRICA

Appendix A1

Agriculture Scoping Assessment Report

Specialist name:
Johann Lanz (Pr.Sci.Nat.)

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ABBREVIATIONS AND ACRONYMS

AGIS	Agricultural Geo-Referenced Information System
CARA	The Conservation of Agricultural Resources Act No. 43 of 1983
CSIR	Council for Scientific and Industrial Research
DAFF	Department of Agriculture, Forestry and Fisheries
DEA	Department of Environmental Affairs
DoE	Department of Energy
EA	Environmental Authorisation
EIA	Environmental Impact Assessment
IRP	Integrated Resource Plan
MinMec	Ministers and Members of Executive Council
MW	Mega Watts
RE	Renewable Energy
REDZ	Renewable Energy Development Zone
REI4P	Renewable Energy Independent Power Producer Procurement Programme
REIPPP	Renewable Energy Independent Power Producer Procurement Programme
SALA	Subdivision of Agricultural Land Act 70 of 1970
SEA	Strategic Environmental Assessment

1 BACKGROUND

As part of the roll-out of renewable energy in South Africa, the Department of Energy (DoE) has entered into a bidding process for the procurement of 3725 MW of renewable energy from independent power producers by 2016. This process is known as the Renewable Energy Independent Power Producer Procurement Programme (REI4P). In order to submit a bid, the proponent is required to have obtained an Environmental Authorisation (EA) in terms of the Environmental Impact Assessment (EIA) Regulations as well as several additional authorisations or consents.

By December 2012, the national Department of Environmental Affairs (DEA) had received approximately 500 applications for environmental authorisation for renewable energy projects (mostly for wind and solar photovoltaic projects), and had identified certain inefficiencies in the system. In order to address these inefficiencies the DEA, in discussion with DoE, has been mandated by the Ministers and Members of Executive Council (MinMec) to undertake a Strategic Environmental Assessment (SEA) to facilitate the efficient and effective roll-out of wind and solar PV energy.

The DEA subsequently appointed the Council for Scientific and Industrial Research (CSIR) to undertake the SEA which aims to identify geographical areas best suited for the roll-out of wind and solar PV energy projects, referred to as Renewable Energy Development Zones (REDZs). It is envisaged that wind and solar PV development will be incentivised and streamlined in the REDZs. The SEA process also provides a platform for coordination between the various authorities responsible for issuing authorisations, permits or consents and thereby will allow for a more streamlined environmental authorisation process.

Based on a number of positive and negative aspects including the resource potential, environmental, social, land-use and other factors, Phase I and II of the wind and solar PV SEA identified 8 focus areas (see Figure 1). Phase III of the SEA entails the refinement of these focus areas through broad stakeholder consultation as well as specialist assessments involving sensitivity mapping of the focus areas. This study assesses agricultural sensitivities in the eight focus areas and makes recommendations with regard to project level assessment and approval processes.

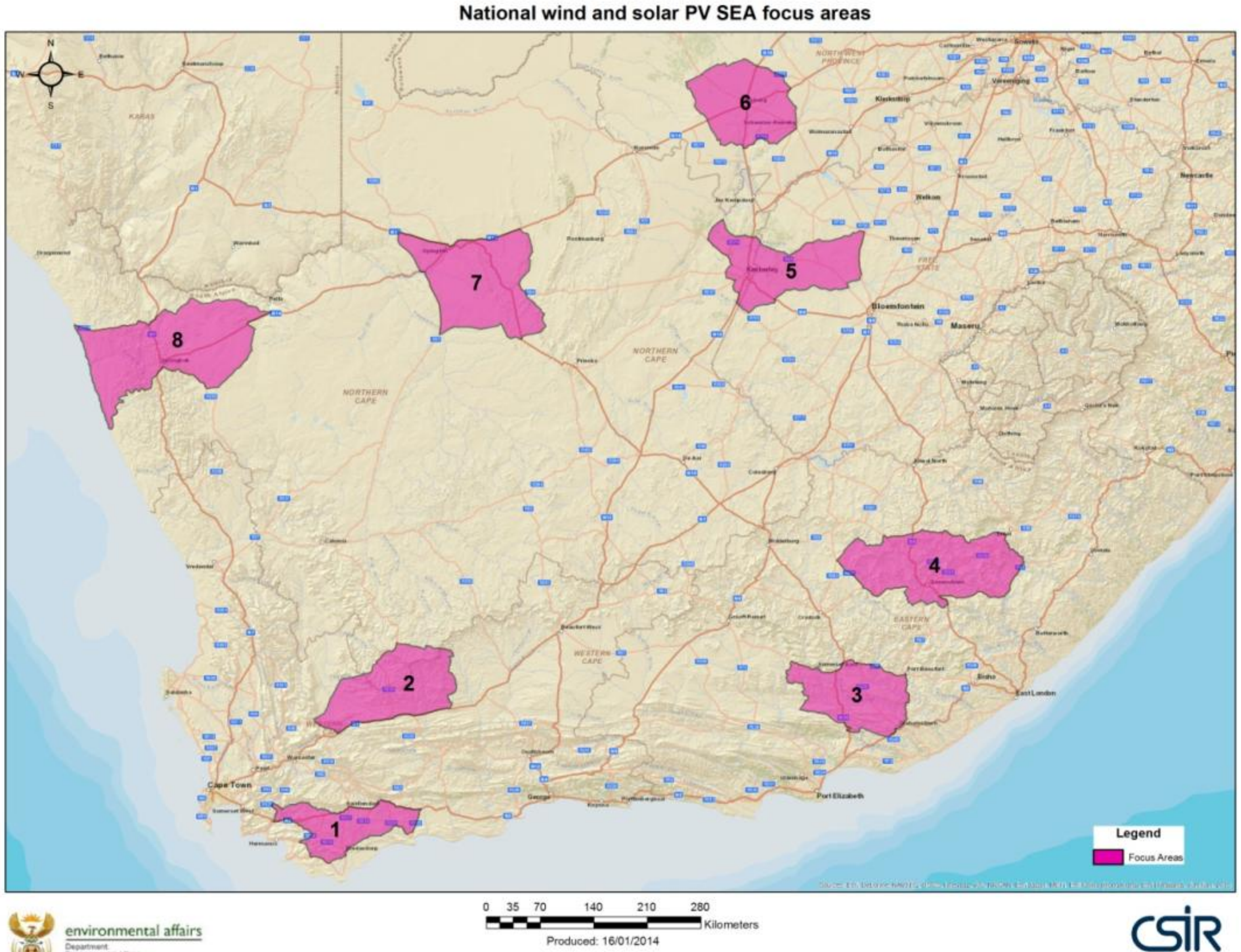


Figure 1: The eight focus areas identified in phase II of the SEA

2 APPROACH AND METHODOLOGY

2.1 Study methodology

The study is informed predominantly by the specialist's experience of conducting specialist agricultural assessments for renewable energy projects around the country. This has involved interaction with the Department of Agriculture, Fisheries and Forestry (DAFF), farmers and the renewable energy sector. The focus of this study is on the major impact of potential loss of agriculturally important land. It addresses background issues related to this impact that are considered to be important. The study is motivated by the need to find solutions that will facilitate renewable energy development and at the same time ensure preservation of critical agricultural land resources.

The analysis of the eight focus areas to determine agricultural sensitivity is done in terms of a desktop exercise using existing data on land capability that covers the whole country, compiled at a scale of 1:250 000. This is supplemented by additional supporting data and considerations to overcome certain short-comings of using this data set for the purposes of this study.

2.2 Data Sources

Data title	Source and date of publication	Data Description
Land capability	DAFF, 2002	Categorises all land nationally into 8 different classes of agricultural land capability. The classification is based on soil, terrain and climate parameters. Soil data originates from the land type survey that was conducted from the 1970's until 2002.
Field crop boundaries	DAFF, 2013	Delineates the boundaries of all cultivated land, based on satellite and aerial imagery.
Agricultural Geo-Referenced Information System (AGIS)	DAFF	An on-line information system containing a collection of spatial data on South African agriculture, including all data from the land types survey.

2.3 Assumptions and Limitations

The study is limited by the resolution of the data sets. Soil in particular is highly spatially variable. Climate which, in many of the focus areas, has a more important influence on land capability than soil is much less spatially variable. The resolution of the soil data has, however, been taken into account in terms of the way that the data has been used to inform the sensitivity analysis and the recommended protocols arising out of this.

Within the Overberg focus area, a finer scale assessment of potential wheat yield would be useful to grade the variation in agricultural potential in that area, at a finer level and with more accuracy than the use of land capability classes allows. This has not been done, with the result that the sensitivity analysis and resultant recommendations cannot take account of this variation in land potential.

Improved land capability data will shortly become available from DAFF and can then be used as the basis of the sensitivities and allowable development limits established in this report. That will to some extent alleviate the limitations imposed by data resolution.

2.4 Relevant Regulatory Instruments

National Instrument	Key objective
The Conservation of Agricultural Resources Act No. 43 of 1983.	Protection of natural agricultural resources including soils. The Act applies to all agricultural land (grazing and cultivated). It manages rehabilitation after disturbances to agricultural land. Any disturbance to soil conservation works such as contour banks requires permission in terms of this act.
Subdivision of Agricultural Land Act 70 of 1970.	Preservation of agriculturally viable farm portions. Consent use or change of land use (re-zoning) for developments on agricultural land need to be approved in terms of this act.
DAFF Guidelines for the evaluation and review of applications pertaining to renewable energy on agricultural land, dated September 2011.	Preservation of arable land through prohibition of the development of renewable energy facilities on cultivated and high potential agricultural land.

3 BACKGROUND CONSIDERATIONS OF IMPORTANCE TO THE AGRICULTURAL ASSESSMENT

The aim of this SEA is to facilitate and encourage the development of wind and solar PV renewable energy in the country in such a way that the negative impacts on natural and social resources are minimized and positive socio-economic impacts optimised. There are a number of background issues that are of importance in considering agricultural impacts. These are highlighted in this section.

3.1 Terminology for assessing the capability of agricultural land

The terminology used to describe different capability categories of agricultural land can lead to confusion, and so clarity on this is needed in this report. In the Land Capability Classification System, eight classes (labelled I – VIII) are identified. There are four classes of potentially arable land from very high potential through moderate to marginal (Classes I – IV), and four classes of non-arable land that is only suitable for grazing (Classes V – VII), or not suitable for agriculture at all (Class VIII). However, within the context of South Africa's very limited availability of arable land (see next section), DAFF considers any land that is capable of consistently and sustainably (including economic sustainability) producing agricultural crops to be high potential agricultural land. For example, most of the maize land in the Free State and North West provinces has a land capability classification of IV and is contributing significantly to the maize production yield of the country. It is therefore included in the category of high potential land. This category thus includes land capability classes I – III, productive class IV land, all irrigated land (irrespective of capability class) as well as land termed as unique agricultural land. Unique agricultural land is land that is important to agriculture and used for the production of specific, high value agricultural enterprises due to its special combinations of location, terrain, climate and soil. Unique agricultural land is not taken account of in the land capability data set.

The term “high potential agricultural land” will be used in this report to refer to all land within the above described DAFF classification of high potential land. It is therefore a much wider category than those land capability classes labelled as high potential within the 8 class capability system, or within other systems such as the rating out of 10 used by Western Cape soil scientists. The DAFF classification of high potential agricultural land includes all land except that which is only able to support very marginal, non-sustainable crop production or extensive grazing. Grazing land in South Africa is far less scarce than potentially arable land and there is less pressure on it from land uses other than agriculture.

In this report, where the terminology of potential is used in specific reference to the eight land capability classes, this will be made explicit to distinguish it from the term high potential agricultural land discussed above.

One of the difficulties with the delineation of high potential agricultural land in South Africa is that there is no clear, measurable way to classify unique agricultural land, and currently no adequate data set that delineates it with any usable degree of accuracy. In addition, the boundary between marginal and acceptable levels of production for inclusion into the category of high potential land is not clearly defined. An improved data set on land capability that will shortly be made available by DAFF will include unique agricultural land within its classification and will therefore make it possible to more accurately delineate all high potential agricultural land.

For the purposes of this SEA, it is important to recognise that within the category of "high potential agricultural land" there is land with a fairly wide range of agricultural capability. But given the scarcity of such land, all of it is preservation worthy from an agricultural production point of view.

3.2 The argument for preservation of high potential agricultural land

The major concern from an agricultural point of view with any development on agricultural land is the potential loss of high potential agricultural land. Such land in South Africa is a threatened, scarce and non-renewable resource that is essential to the well-being of society. As an indication of the availability of such land in South Africa, land capability classes I-III constitute only 12.6% of the land surface of the country.

The country's long term future potential for food production is entirely dependent on having sufficient arable land. But the reality is that we already have too little. The international norm for food security is 0.4 hectares of high potential arable land per capita. South Africa's ratio is declining and is currently estimated to be 0.25 ha per capita[1].

Not only do we have too little, but what we have is also under threat from a number of competing land uses, which are leading to a significant cumulative loss of arable land across the country. A 2012 spatial analysis of available agricultural land determined that 7.5% of land capability classes I – III is already being utilised for non-agricultural purposes.

Even though renewable energy, particularly wind energy, has a small footprint on agricultural land, the loss of even small amounts of high potential agricultural land must be seen in the context of both the overall scarcity of the resource as well as the cumulative losses due to other competing land uses.

An analysis of the statistics on arable land availability and loss in South Africa can, from an agricultural production point of view, have only one conclusion: that we cannot afford to lose any more potentially arable land, and that any development which will lead to losses, should wherever possible be sited off such land.

3.3 Is the argument for preservation of high potential agricultural land really justified by the concept of food security?

Appealing to the concept of food security as justification for prohibiting alternative land use on agricultural land carries weight but may not actually reflect the reality of the situation. The concept of food security is a complex one that is influenced by many factors, other than simply the quantity of food that a country produces. But the concept carries importance for society and is currently a fashionable concept and therefore effectively dispels argument against it. But using it to prohibit non-agricultural land use may not be accurate.

All agricultural land use does not necessarily contribute to food security. One example is wine farming. If it were really essential to retain all agricultural land for food security, then wine farming on agricultural land

[1] Collett, A. 2013. The impact of effective (geo-spatial) planning on the agricultural sector. Paper presented at the SA Surveying and Geomatics Indaba 2013 at Emperors Palace Ekurhuleni Gauteng, 23 July 2013.

that was suitable for production of other food crops should not be permitted. The same is true for cut flowers, tobacco wool etc.
Furthermore it can be argued that any export food crop does not actually contribute to the country's food security. It does not feed South Africans. What it does is earn income that contributes to the country's GDP. A large proportion of South Africa's agricultural land is used for production of export commodities including fruit, maize and sugar cane. Because of the income these products earn, the country can afford to import the basic foods such as wheat that do contribute directly to food security.

In a global economy choices of agricultural land use are made, not in terms of food security, but in terms of profit. The reason why any of the products discussed above are farmed is not because they contribute to South African food security, but because they are profitable.

This begs the question: Does a large proportion of South Africa's agricultural land use really contribute any more to food security than renewable energy generation does? Both use land to produce a product that has commodity value and earns income towards GDP. But they do not feed South Africans. Perhaps "farming" electricity is not so different from farming many other products in South Africa.

This view point on agricultural production and food security suggests that the optimal land use for any piece of land is the one that can sustainably generate the most income. And this would argue for renewable energy generation taking precedent over most agricultural land uses.

3.4 The clash between preservation of high potential agricultural land and renewable energy development

From an agricultural perspective it would be desirable if all renewable energy developments could be sited off high potential agricultural land. In the case of solar energy this is entirely feasible as the solar resource in the country is generally mutually exclusive spatially from high potential agricultural land: those parts of the country with the highest annual radiation are generally too arid for crop production. However in the case of wind energy, there is overlap between where the high wind energy resources and high potential agricultural land are located. The most significant area of overlap in term of areas considered as part of this study is within the Overberg focus area.

Within the SEA process there has been a motivation to develop a land use integration system whereby very small footprints of renewable energy development can be allowed on cultivated land, in order to utilize the available wind energy resource. The arguments can be summarised as follows:

- The Overberg focus area has some of the highest wind energy resource in the country as identified by the first phase of this SEA. Without some footprint on cultivated land, renewable energy development will not be possible within this area and the resource will therefore not be utilizable;
- Wind energy, because of its small, widely distributed footprint, offers an opportunity for land use integration that includes both wind energy generation and crop production;
- The actual footprint of disturbance of a wind farm and therefore the actual agricultural land lost as a result of its development is very small. The following calculations made for six proposed wind farms in the Western and Eastern Cape (ranging from 30 to 150 MW), for which data was available, provide some perspective on this. The total footprint of each wind farm is calculated as the total area that is directly occupied by all wind farm infrastructure during its operational phase. This includes turbine foundations, hard standing areas for cranes, new roads, substations and buildings – in other words all the land that is actually excluded from agricultural use by the wind farm. The percentage of the farm portions taken up by the wind farm footprints ranged between 0.17 and 0.81%. All footprints were therefore less than 1% of the total farm area. Further perspective on the small amounts of land impacted by renewable energy development may be provided by considering the total amount of land that will be required to fulfil the total renewable energy requirement provided for in terms of the 2010 – 2030 Integrated Resource Plan (IRP) of

16.8 GW of wind and solar by 2030. The calculated amounts of land are shown in Table 1. The calculation is based on the assumption that all wind and solar PV renewable energy development will take place only within the identified focus areas. The hectares of footprint per MW generated for solar is the industry accepted norm. For wind, the calculations from the same six projects as above gave a range from 0.15 to 0.19. ha/MW. In a US study[2] which evaluated 172 existing or proposed wind farm projects, the average, overall, direct, permanent impact area was found to be 0.3 ± 0.3 ha/MW. Given the local and US data above it is safe to assume a figure of 0.3 for Table 1. The surface area of all focus areas is the sum of focus areas dedicated to a particular energy type and where a focus area includes both energy types the assumption is made that half the area is available for the one type and half for the other. The calculation shows that only extremely small proportions of the total land area will, in the foreseeable future, be used for renewable energy. It also shows that the footprint is much smaller for wind energy than it is for solar PV;

Table 1: Land required to fulfil the total energy requirement of IRP.

	Total IRP energy requirement in MW	Hectares of footprint required per MW generated	Total hectares required for total IRP generation	Total surface area of all focus areas per energy type (ha)	Percentage of focus area used for RE footprint
Solar PV	8400	2.5	21,000	5,333,614	0.394
Wind	8400	0.3	2,520	2,699,391	0.093
Total	**16800**		**23,520**	**8,033,004**	**0.293**

- As discussed in section 2.1, the category of "high potential agricultural land" includes a fairly wide range of agricultural capability. Cultivated land in the Overberg is likely to fall within the lower part of this range. It therefore has lower sensitivity than many other areas of high potential land elsewhere in the country. Some of the wheat production within this area may well be fairly marginal;
- Wind energy can offer benefits to farmers in terms of additional land use income and improved road and storm water drainage infrastructure. Used as an investment into the farm, it can potentially increase overall production, despite the small loss of agricultural land use from the footprint;
- The total economic returns per unit area of land from renewable energy will far outweigh the returns from agriculture. A calculation of the amounts of rental income earned by farmers from renewable energy projects provides the following data. Wind farm rental is generally paid per turbine and is based on a percentage (typically 1 – 2%) of the value of power sold. The hectares of footprint per turbine was calculated for the same six wind farms as above using the same definition of footprint. This provided a range from 0.27 to 0.57. These figures are likely to be representative of most wind farms in South Africa. The rental amounts agreed with farmers are confidential. However, the different developers of the projects mentioned above, independently provided an approximate range of their agreed rentals. All of these were within R100,000 to R200,000 per turbine per year. Calculated as net farm income using a worst case scenario of 0.6 hectares per turbine it is an amount of between R166,667 and R333,333 per hectare per year. This is much greater than any equivalent per hectare net farm income that could be generated by agricultural production. For comparison the net farm income figures for the last six years supplied by Overberg Agri (Edms) Bpk for grain producers in focus area 1 are given in Table 2. The net farm income from agricultural production is up to 400 times less than the income from energy facility rental. Other focus areas are likely to have a lower net farm income than the Overberg focus area

[2] Denholm. P., Hand, M., Jackson, M. and S. Ong. 2009. Land-Use Requirements of Modern Wind Power Plants in the United States. Technical Report NREL/TP-6A2-45834. National Renewable Energy Laboratory, Golden, Colorado. Available electronically at http://www.osti.gov/bridge.

because it has the most intensive agricultural production. Solar farm rental is calculated similarly and paid per occupied hectares. Ranges provided by solar developers are between R2,000 and R12,000 per hectare per year. Much larger footprints are involved than for wind;

Table 2: Net farm income for grain producers in the Overberg focus area in ZAR per hectare per year.

Year	2013	2012	2011	2010	2009	2008
Income (R/ha)	2,157	2,581	2,335	882	812	1,135

- The regional economic benefits and job creation from renewable energy projects are likely to be positive. It is highly unlikely that a loss of production land of around 0.09% (see table 1) will lead to job losses anywhere in the agricultural value chain. In contrast it is more likely that increased farm income and demand for various services as a result of the presence of an energy facility will lead to job creation in an area. These aspects are covered in detail in the socio-economic specialist assessment for this SEA. However it is notable that for the Overberg focus area the study shows that agricultural production has declined by 1.6% and had 12 059 job losses from 2005 to 2011. The sector that is growing and creating jobs is the finance and business services sector. The Cape Agulhas Local Municipality (which makes up the largest part of this focus area) has identified their dependency on agriculture as a challenge. There is thus economic motivation for diversification and land use integration in this specific area.
- Many farmers are in support of renewable energy development on their farms but are free to refuse if they do not want it; and
- Internationally wind farms are integrated with arable agriculture.

The argument to not utilise any viable cultivated land for renewable energy development is based predominantly on the need to preserve all high potential agricultural land and is justified in section 2.2, but part of this justification in terms of food security is also questioned in section 2.3. Loss of land is the critical concern from an agricultural perspective. It must be noted that the potential benefit of increased overall production given above, does not mitigate this impact. Although integrated use can potentially increase agricultural production on a farm, it still leads to a loss of the scarce, non-renewable resource of high potential agricultural land. However, land itself, whatever the land use, is a non-renewable, irreplaceable resource. Land for energy generation is as equally irreplaceable and non-renewable as it is for agriculture. What may differ is the availability and scarcity of suitable land for these different land uses. Products of the particular land uses, electricity or agricultural production, are however both replaceable and can be imported from elsewhere.

In addition to the issue of loss of the agricultural land resource, the following counter commentary is applicable to some of the arguments given above.

- The benefits of additional land use income argument: There is no guarantee that additional income will be invested in improving farm productivity. It could also potentially lead to less productivity due to reduced reliance on farming income in favour of income from leasing land for renewable energy projects. However, preventing a farmer from engaging in a more profitable enterprise than farming is not justifiable or desirable. For example: it would not be justifiable to prevent a farmer from reducing his farming activity in favour of a more profitable town-based business. Equally so it is not justifiable to use the argument that an alternative income source may lead to decreased farming activity as an argument against renewable energy development on farms;
- The farmer support argument: The support of farmers and landowners is likely to be biased towards short to medium term profitability, rather than long term resource preservation. Farmers are basing their decision on their own farming enterprise and are not concerned with the cumulative impact of land loss regionally and nationally; and

- The international example argument: The South African context of extreme scarcity of arable land makes comparison to the international, particularly European example, problematic.

The arguments on both sides have value. South Africa has a need for agricultural production and it has a need for energy. The ultimate decision of whether any, and if so, how much, productive agricultural land can be utilised for renewable energy development involves weighing the need and value of preserving such land against the need and value of using it for renewable energy. This decision cannot be made exclusively from one perspective. It must involve a weighing of the above arguments and an integrated consideration of the costs and benefits to the country as a whole rather than to only one sector, whether that sector is energy or agriculture. From the perspective of preserving all potentially arable land for crop production, wind energy development should not take place in the Overberg focus area. From the perspective of renewable electricity supply to the country, or economic development wind energy development should take place in the Overberg focus area.

The balance of the arguments presented above suggests that it may be in the interests of the country as a whole to sacrifice small amounts of cultivated land so that wind energy generation in the Overberg focus area is possible. This would allow both energy generation and agriculture (with only a very small loss of production land) and would seem to be a more integrated decision than prohibiting renewable energy development. However it is also clear from the above that such sacrifice of arable land must be strictly controlled and limited to the absolute minimum that is necessary.

Ultimately the question of which land use – agriculture only or agriculture plus renewable energy - in a particular area is of more benefit to the country as a whole, is a question of political priorities influenced by individual values and perspectives rather than a choice that can be determined absolutely by science.

3.5 Context and history of agricultural concerns in relation to renewable energy development.

The environmental impact community largely comes out of, and is informed by, concerns with biodiversity conservation. Within this context, agriculture is seen as a threat rather than something to be preserved. Renewable energy is generally viewed positively within the sector. The issue of preservation of agricultural land therefore may well be undervalued in Environmental Impact Assessments (EIAs) in relation to issues of biodiversity conservation and renewable energy. It is also not an issue that is in the public or political limelight, and may well be overshadowed by more visible and politically more significant issues.

DAFF's concern is therefore that it does not enjoy a weighting that is in true relation to its importance when it comes to compromise between the competing concerns within this SEA, and generally within the renewable energy development sector.

A somewhat adversarial relationship has developed between DAFF and the EIA / renewable energy development sector in relation to renewable energy authorisation. This is partly a result of DAFF's concerns that the importance of agriculture issues is undervalued. It can be understood in terms of where the issue of preservation of agricultural land has fitted into the EIA process for renewable energy developments to date. When these EIA's started several years ago they tended to address all the traditional specialist areas of concern, and then present the remaining option to DAFF for approval, only after a significant investment had been made into a particular site by the developer. In rejecting those that lead to a loss of arable land DAFF was perceived as being an unreasonable stumbling block.

As the number of applications increased, DAFF produced their guidelines for renewable energy developments on agricultural land. These were perceived as unreasonable by the renewable energy sector, even though they were based on the existing specifications as set out in the Conservation of Agricultural Resources Act and the Subdivision of Agricultural Land Act. This perception of unreasonableness is likely due to a number of reasons including:

- Disagreement with the underlying philosophy informing DAFF's guidelines (and therefore CARA and SALA) which is that agricultural land use has priority over any alternative land use, irrespective of the potential societal benefits of such a land use in comparison to those of agriculture. DAFF was perceived as weighing the costs and benefits of alternative land use purely from an agricultural production perspective and not from what might be of benefit to the country as a whole;
- Their prohibitory tone;
- The fact that the significance of the loss of high potential land was not well communicated or understood within the renewable energy sector;
- DAFF's definition of what constituted high potential agricultural land was not clear or well understood;
- The experience that the criteria by which approval was given for different projects was not consistent, transparent and clear; and
- The experience that objections were raised by DAFF to applications where the threat to loss of high potential agricultural land did not seem justified.

In the light of the above, this SEA should fulfil a need to highlight and better communicate the importance of DAFF's concerns, and set the basis through which decisions can be made that fully respect the concerns of both sides.

3.6 How reversible is loss of agricultural land in relation to RE developments

Theoretically, agricultural land lost to the footprint of a renewable energy development can be rehabilitated and returned to agricultural production. The concern from DAFF is that once land has been withdrawn from agricultural use and developed, it is unlikely to ever be returned to agricultural use. This will lead to an effective permanent loss of agricultural land. It should also be noted, however, that even though lost agricultural land might be irreplaceable, agricultural produce is replaceable as it can be imported from elsewhere.

3.7 Conclusions from background considerations

The preservation of agricultural land is a critical issue in South Africa. From an agricultural production perspective, the country cannot afford to lose any more high potential agricultural land. Therefore, all non-agricultural development on agricultural land should be sited, wherever possible, on non-arable grazing land. However, there is overlap between the country's best wind energy resources and land that is considered part of the broad category of high potential agricultural land, predominantly in the Overberg region and also in the Eastern Cape. The current DAFF guidelines prohibit any footprint of renewable energy infrastructure within land that has been cultivated within the previous ten years. This prevents wind energy development in the Overberg focus area and parts of the Eastern Cape, including the former homelands. If the wind energy resource in these focus areas is to be used, there will need to be some compromise in the current authorisation system to one which allows some footprint on cultivated land and at the same time ensures preservation of critical agricultural land resources.

The ultimate decision of whether any, and if so, how much, cultivated land can be utilised for renewable energy development involves weighing the need and value of preserving such land against the need and value of using it for renewable energy. The balance of the arguments presented above suggests that it may be in the interests of the country as a whole to sacrifice small amounts of least valuable cultivated land so that wind energy generation in the Overberg and Eastern Cape focus areas is possible. Such a sacrifice must be strictly controlled and limited to the absolute minimum.

4 FOCUS AREAS DESCRIPTION

The agricultural characteristics of each focus area, are briefly discussed below in terms of:

- Moisture availability;
- Terrain;
- Soils;
- Land capability;
- Amount of cultivated land;
- Type of farming; and
- Grazing capacity.

This is based on data available in AGIS[3].

Moisture availability is one of the most important climate parameters for agriculture in a South African context. It is the ratio of rainfall to evapotranspiration, and it is classified into 6 categories across the country (see Table 3). A moisture availability classification of C5 or C6 is a severe limitation to agriculture and regardless of soil conditions will impose a land capability classification which is at best class V. This applies to much of the land included in the eight focus areas. Such land is non-arable (without irrigation) regardless of how good the soils might be. The implication for this study is that all such land, unless there is available irrigation, can be considered to be low sensitivity for renewable energy development, regardless of soil conditions.

Table 3: The classification of moisture availability classes in South Africa

Class	Moisture availability		Description of agricultural limitation
	Summer rainfall areas (Rainfall/0.25 PET)	Winter rainfall areas (Rainfall/0.40 PET)	
C1	>34	>34	None to slight
C2	27-34	25-34	Slight
C3	19-26	15-24	Moderate
C4	12-18	10-14	Moderate to severe
C5	6-12	6-9	Severe
C6	<6	<6	Very severe

Soil types are described according the generalized soil patterns of AGIS, shown in Table 4 and derived from the 1:250 000 land type data set.

Table 4: Generalised soil patterns.

Label	Description
AC	Red and yellow soils with low to medium base status.
AR1	Red, excessively drained sandy soils with high base status, mainly dunes.
AR2	Red and yellow, well drained sandy soils with high base status.

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

CM	Red soils with high base status
FL	Soils with negligible to weak profile development, usually occurring on deep alluvial deposits
LP1	Soils with minimal development, usually shallow, on hard or weathering rock, with or without intermittent diverse soils. Lime rare or absent in the landscape.
LP2	Soils with minimal development, usually shallow, on hard or weathering rock, with or without intermittent diverse soils. Lime generally present in part or most of the landscape
PL1	Soils with a marked clay accumulation, strongly structured and a reddish colour. Prismacutanic and/or pedocutanic diagnostic horizons dominant
PL2	Soils with a marked clay accumulation, strongly structured and a non-reddish colour. They may occur associated with one or more of vertic, melanic and plinthic soils.
PT2	Red, yellow and /or greyish soils with high base status.
SC	Strongly saline soils generally occurring in relatively deep deposits in low lying arid areas

The breakdown of surface area coverage of land capability classes and different categories of cultivated land are compared across all eight focus areas in Table 5.

Table 5: Surface area coverage (% of focus area) of land capability classes and different categories of cultivated land, per focus area.

Focus Area	Land Capability Class								Cultivation Class		
	I	II	III	IV	V	VI	VII	VIII	Cult 1*	Cult 2**	Cult T***
1	0	0	0	14.0	7.9	67.1	4.2	6.9	1.1	68.4	69.5
2	0	0	0	0	0.4	4.4	60.6	34.7	0.0	0.6	0.7
3	0	0	0	0	16.8	67.7	11.5	4.0	0.3	1.7	2.0
4	0	0	14.4	23.6	6.2	24.9	20.7	9.9	0.0	13.0	13.1
5	0	0	0	6.0	83.1	1.8	9.2	0	0	9.2	10.4
6	0	0	0	7.4	78.8	13.8	0	0	1.2	18.5	19.6
7	0	0	0	0	0	0	92.5	7.5	0.2	1.3	1.5
8	0	0	0	0	0	0	90.3	9.7	0.0	0.1	0.1

*Cult 1 refers to land in the following categories: pivot irrigation; horticulture / viticulture; and land under shadenets. The field crop boundaries data set does not include a specific category for any other irrigated land. It is presumed that all irrigated land is included in the above 3 categories.

**Cult 2 refers to all other cultivated land.

***Cult T is the total of these two.

4.1 Overberg focus area 1

Moisture availability in this focus area is predominantly class 4 but is higher in the western parts which include some class 3 and 2 areas. The terrain predominantly consists of rolling hills. Soils are almost entirely LP2. Land capability is predominantly class VI, with smaller amounts of class IV and V. Land capability is the result of the shallow soils and limited moisture availability. However, this land is considered unique agricultural land because of the climate and soils being suitable for wheat production. The area is an important contributor to the country's wheat harvest. 70% of the focus area is under cultivation in a rotation system of small grains rotated with pastures for sheep.

4.2 Komsberg focus area 2

In this focus area the moisture availability is a severe limitation. It is higher in the west and declines from class 5 to class 6 moving eastwards. The terrain includes mountainous land, high plateaus and lower lying irregular plains. The soils are dominated by LP2 with smaller areas of SC and FL in places. Less than 1 % of the focus area is cultivated. The moisture availability and soils in this focus area limit agricultural use to extensive grazing of sheep only. Grazing capacity is low and varies from 26 to as low as 80 hectares per animal unit.

4.3 Cookhouse focus area 3

Moisture availability is a severe limitation over the majority of this focus area and predominantly consists of class 5, with some class 6 in the west and smaller areas of higher moisture availability in the south east. The terrain is mostly open hills and rolling plains with some low mountainous areas. The area is almost entirely soil type LP2 with only 2% of the focus area being cultivated. The moisture availability and soils limit agricultural use in this focus area to grazing. The area supports grazing of sheep, cattle and game with a grazing capacity of between 8 and 21 hectares per animal unit.

4.4 Stormberg focus area 4

There is a steady decline in moisture availability moving westwards across the focus area from small patches of class 1 and 2 in the east through classes 3 to 5 in the west. The terrain is mountainous plateaus interspersed with plains with hillier terrain occuring in the east. Dominant soil types are LP2, PL1 in the west, and LP1 in the east. There are smaller areas of AC in the east and FL in the extreme west of the focus area. The focus area includes 14% class III land capability, confined to the eastern part while 13% of the focus area is cultivated, predominantly in the east. Agriculture is mainly subsistence farming in the former homeland areas in the east and grazing of sheep, cattle and game in the western parts. The grazing capacity is between 5 and 13 hectares per animal unit, but is lower in the extreme west of the focus area at 14 to 21 hectares per animal unit.

4.5 Kimberley focus area 5

Moisture availability is a severe limitation in this focus area. There is a decline in moisture availability westwards but the majority of the area is within class 5. The terrain consists of level plains with some relief. Soils are predominantly CM, followed by PL2. 83% of the focus area is land capability class V and 10% of it is under cultivation, predominantly dryland field crops in the east, including maize and sunflower production, and irrigation along the Vaal and other rivers. The rest of the focus area is predominantly used for cattle farming. Grazing capacity in the focus area is between 11 and 17 hectares per animal unit.

4.6 Vryburg focus area 6

There is a decline in moisture availability westwards but almost the entire focus area is within class 4 and moisture is therefore moderately to severely limited. The terrain is level to rolling plains with some relief. The soils are fairly equally divided between the following types in decreasing order: PT2, CM, AR2 and LP2. 79% of the focus area is land capability class V and 20% of it is under cultivation, predominantly dryland field crops and pasture in the north, east and west, including maize and sunflower production, and irrigation, predominantly in the west. The focus area is predominantly utilised for cattle farming. Grazing capacity ranges between 11 and 17 hectares per animal unit with some small parts in the south east of the focus area being as high as 8.

4.7 Upington focus area 7

In this focus area moisture availability is a very severe limitation with the entire area being class 6. The terrain is mostly level plains with some relief, with irregular plains with hills and ridges in places. Soils are predominantly LP2 with some CM, AR1 and AR2. The entire focus area is land capability class VII or higher and only 1.5% of it is under cultivation in irrigated lands along the floodplain of the Orange River. The rest of the focus area is predominantly utilised for sheep farming. Grazing capacity in this focus area is low at between 22 and 40 hectares per animal unit.

4.8 Springbok focus area 8

Moisture availability in this focus area is a very severe limitation with the entire area falling within class 6. The terrain varies moving westwards from high inland plains through mountainous land to level coastal plains. The soils of the mountains are predominantly LP2 while the plains are predominantly AR2 with lesser amounts of AR1. The entire focus area is land capability class VII or higher and only 0.1% of it is under cultivation. The focus area is predominantly utilised for sheep farming. Grazing capacity is low at mostly between 31 and 60 hectares per animal unit, with some higher areas on the coastal side of the mountains west of Springbok.

5 SENSITIVITY ASSESSMENT

5.1 Identification of sensitivity criteria

Sensitivity criteria are considered the same for both wind and solar in this study. This is because the agricultural impacts for wind and solar are essentially the same. It is only the footprint that differs, solar being a larger and more continuous footprint concentrated in one place, and wind being a discontinuous footprint of small areas distributed over a large area. This difference has been accounted for in the implementation recommendations, and it is therefore not considered necessary to distinguish between wind and solar in the sensitivity assessment.

Because the major potential agricultural impact is loss of high potential agricultural land, agricultural sensitivity is directly related to the agricultural potential of the site. The 2002 land capability data set is the best, most comprehensive data set currently available to delineate agricultural potential, but better data will shortly become available (see end of this section). The 2002 data set is based on analysis of a large set of land type data gathered across the country.

There are, however, short-comings in the land capability data set in terms of its accurate categorisation of the agricultural capability of all land across the country. These are:

- The data is low resolution with the result that smaller areas of higher land capability may well exist within areas demarcated as low land capability (and vice versa), particularly where the agricultural limitations are soil related rather than climate related. The consequence of this is that if areas are approved for development based on their low land capability, agriculturally viable areas of higher land capability may be lost to development within them;
- Land capability is based on dryland production potential with the consequence that it does not identify land that may be high potential agricultural land if water is available for irrigation; and
- Land capability does not take account of unique agricultural land, which is land that is important to agriculture and used for the production of specific, high value agricultural enterprises, due to its special combinations of location, terrain, climate and soil. The problem is that no clearly defined criteria exist for categorization of unique agricultural land and there are no suitable data sets that delineate it in South Africa.

Given these gaps in the land capability data, it alone cannot be used as a criterion to effectively assess and approve non-agricultural use of land. Additional data sets are, therefore, needed with which to determine agricultural sensitivity for the purposes of this study. The other data set that is deemed useful in this regard is field crop boundaries, which delineate, based on satellite and aerial imagery, all land that has been cultivated within the last several years.

This data set is deemed the most effective existing data set for demarcating viable arable land in South Africa that might occur outside of land capability classes I to III. The value of the field crop boundaries data is that all this land has been subject to an effective test of its arable viability. A farmer, whose livelihood depends on it, has invested in the cultivation of that land and in most cases that decision has been tested over time. This data has the advantage of being much higher resolution than the land capability data. It has a disadvantage in that it is likely to include marginal arable land which is not agriculturally valuable enough to be included within the broad category of high potential agricultural land, and therefore to be preservation worthy. However, following the precautionary principle, it is better to presume that all such land is preservation worthy and to test it through field investigations where necessary.

The criteria used for sensitivity mapping in this study are a combination of land capability categories and field crop boundary categories. The way in which these are combined to give 4-tier sensitivity categories is discussed in the following section. This is considered the best way, with currently available data, to delineate agricultural sensitivity. It should be noted that DAFF is currently engaged in a project of significantly improving the national land capability data set, which will to an extent overcome the short-comings identified above. The updated data set will improve the accuracy of mapping agricultural sensitivity. It is important to note that the availability of more accurate data has no impact on the principle of what is being proposed in this study. All that will be required to adapt what is proposed in this report to the new data is to fit the new capability classes into the criteria as they are set out in Table 6.

6 FOUR-TIER SENSITIVITY MAPPING

Sensitivity mapping is standardised across all eight focus areas. The sensitivity mapping criteria are fitted into the four sensitivity categories according to Table 6. The sensitivity categories are, in terms of the purpose of this SEA, to translate to protocols that govern development. They therefore need to be clearly defined and based on accepted, available data sets.

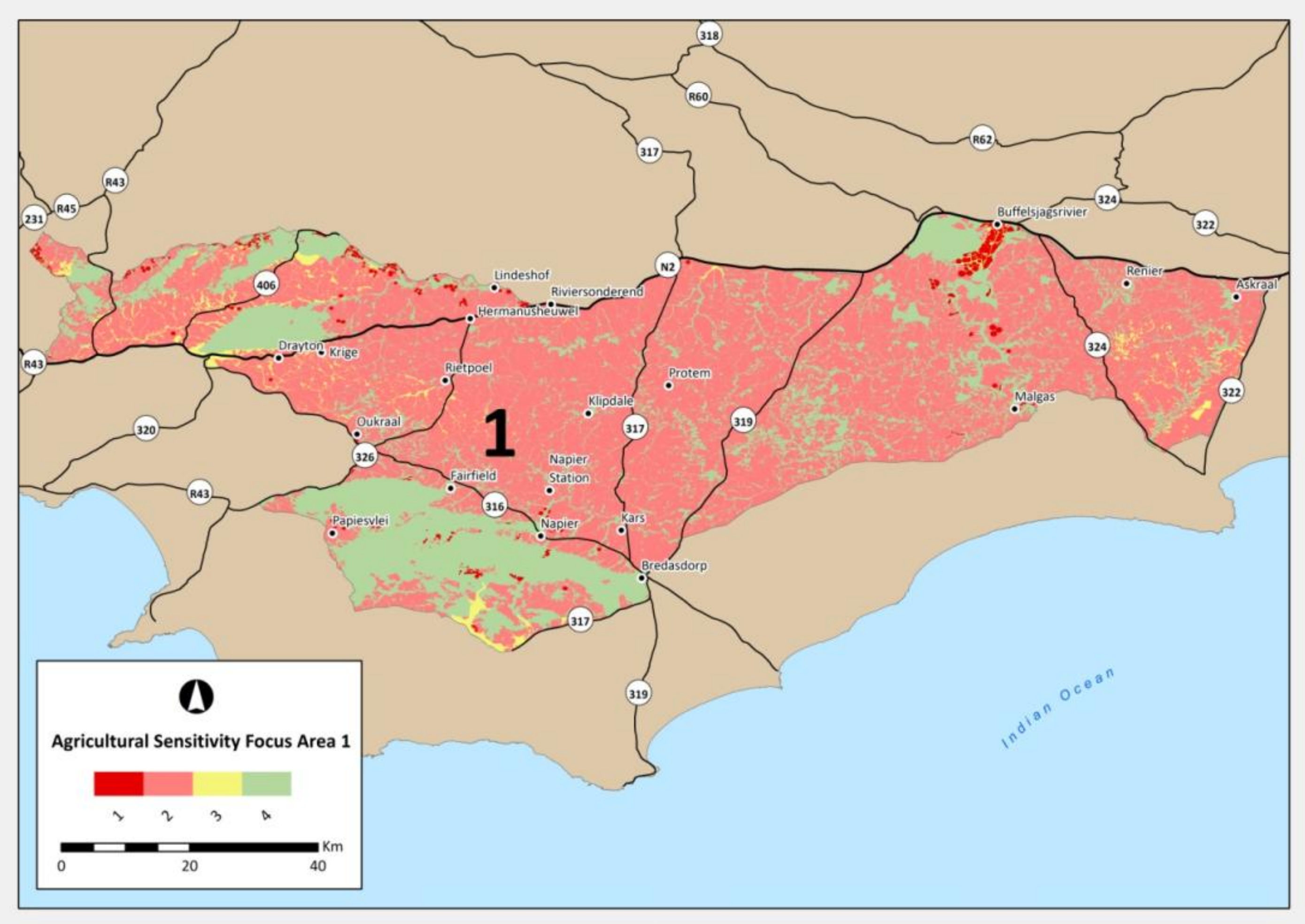
Table 6: Criteria for definition of the 4-tier sensitivity mapping.

Colour	Sensitivity	Criteria
	Very high	Land capability classes I, II and III as well as field crop boundaries for Pivot irrigation, horticulture/viticulture and shadenet*
	High	All other field crop boundaries, excluding those above
	Medium	Land capability class IV that is not under cultivation
	Low	Land capability classes V to VIII that is not under cultivation

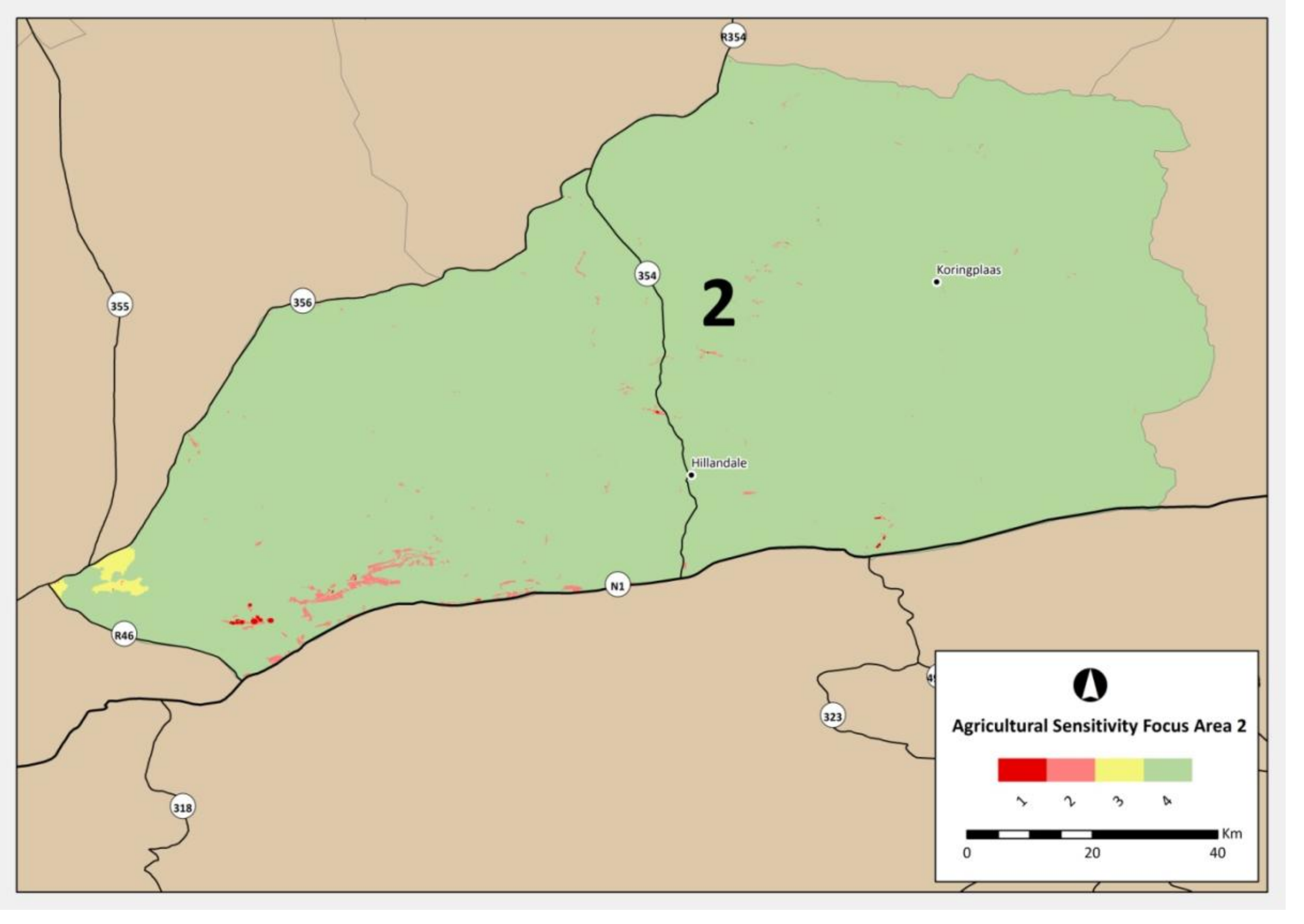
* The field crop boundaries data set does not include a specific category for any other irrigated land. It is presumed that all irrigated land is included in these 3 categories. All irrigated land must be part of the very high sensitivity category.

6.1 Four tier sensitivity maps

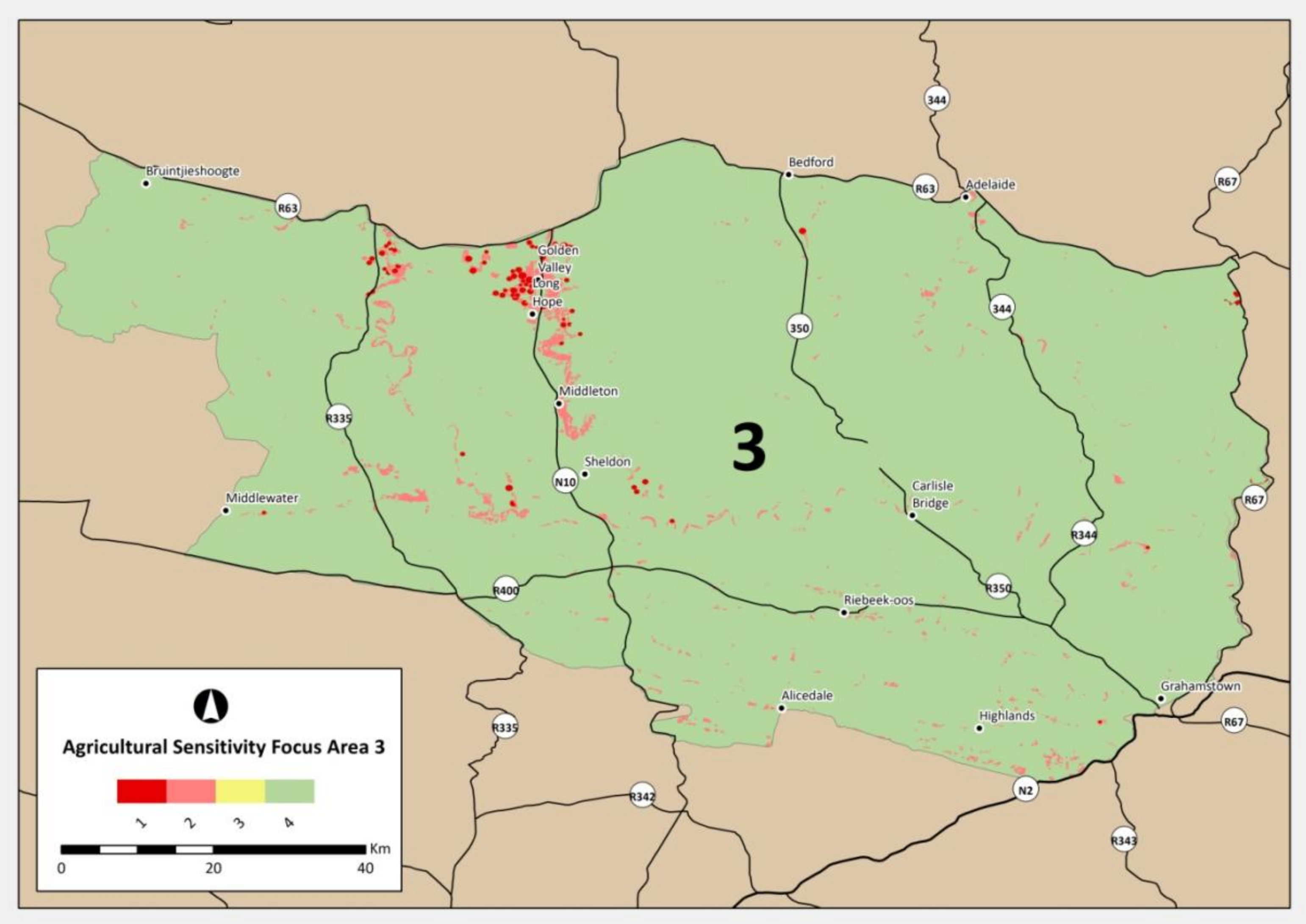
6.1.1 Overberg focus area 1



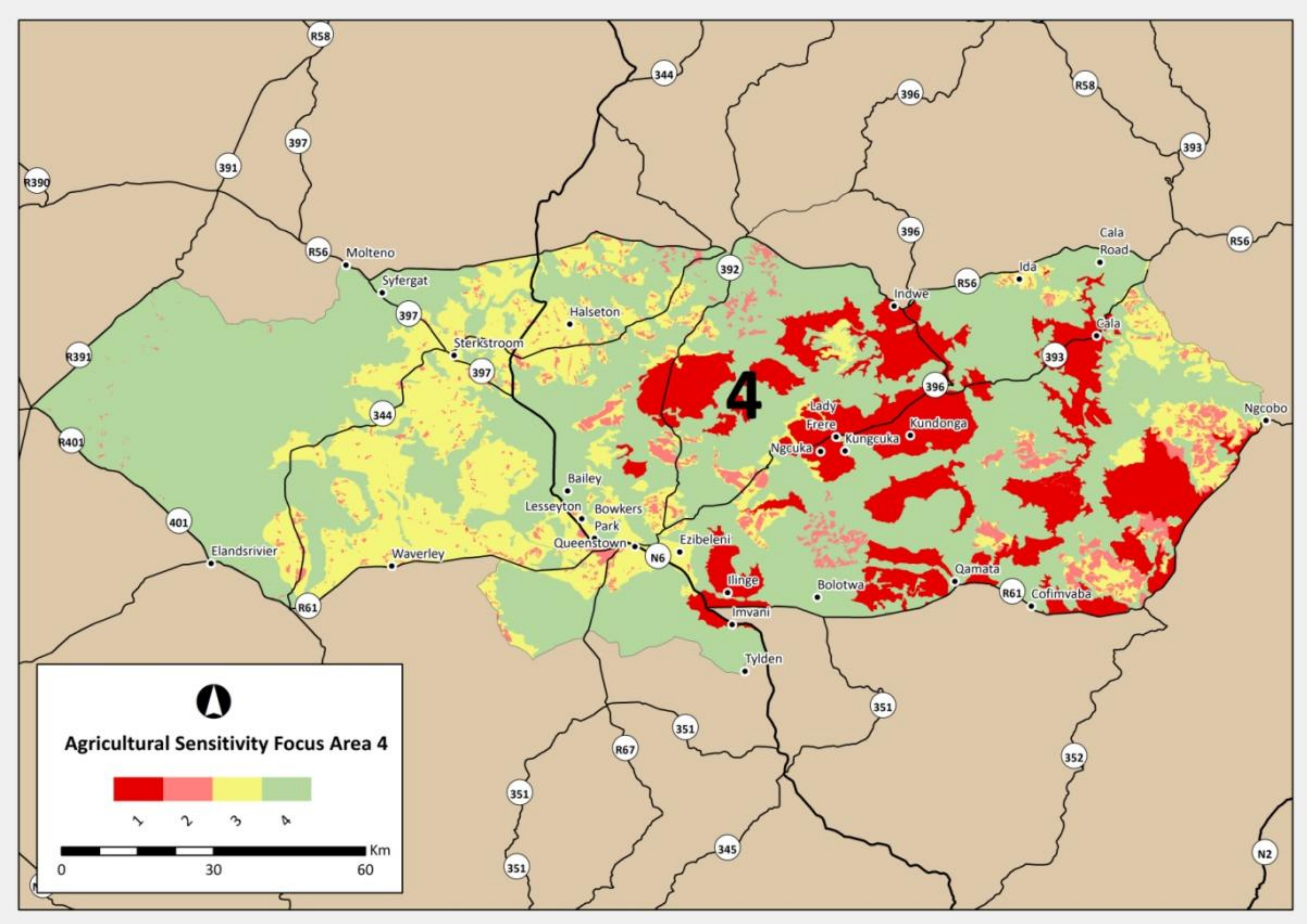
6.1.2 Komsberg focus area 2



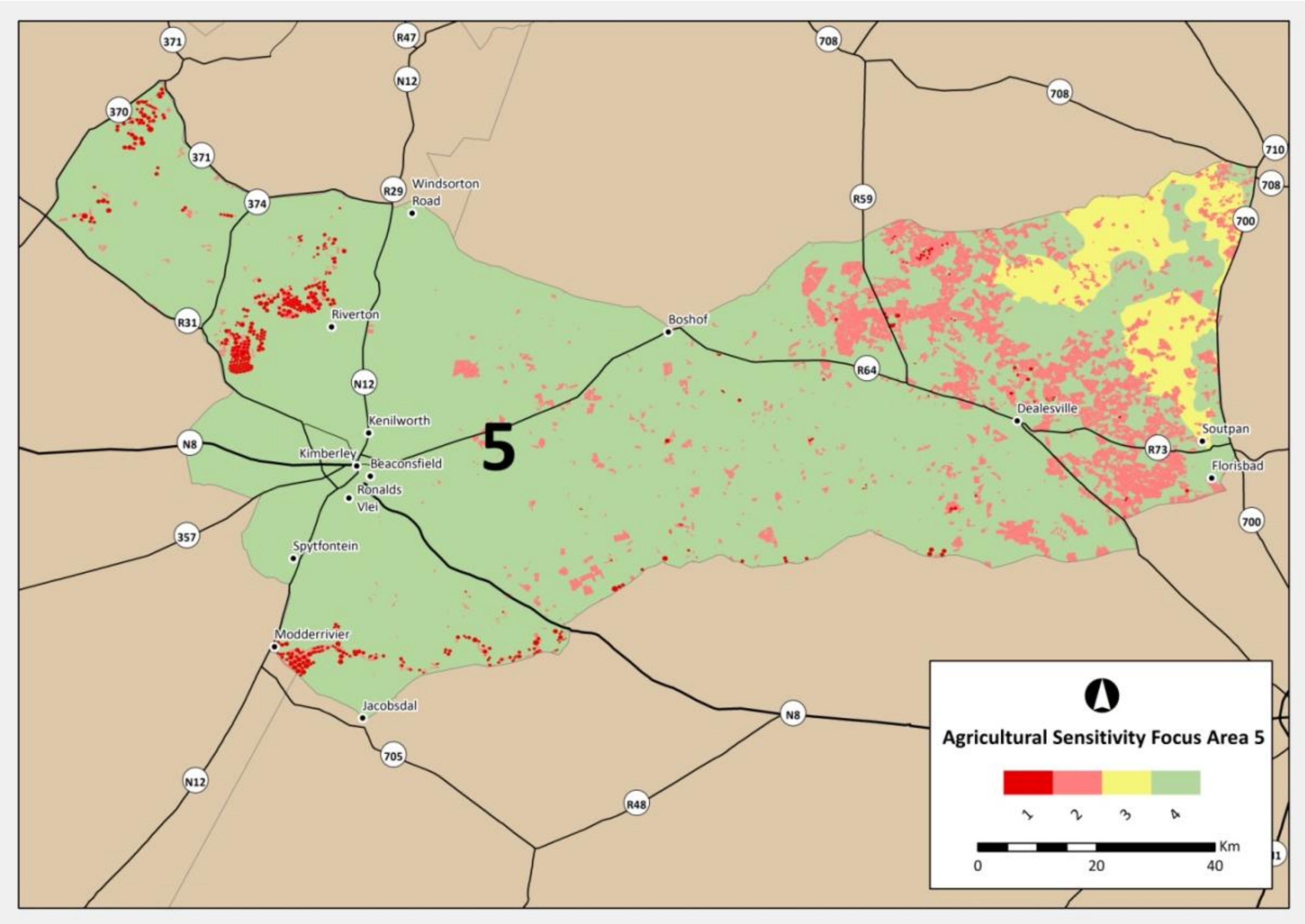
6.1.3 Cookhouse focus area 3



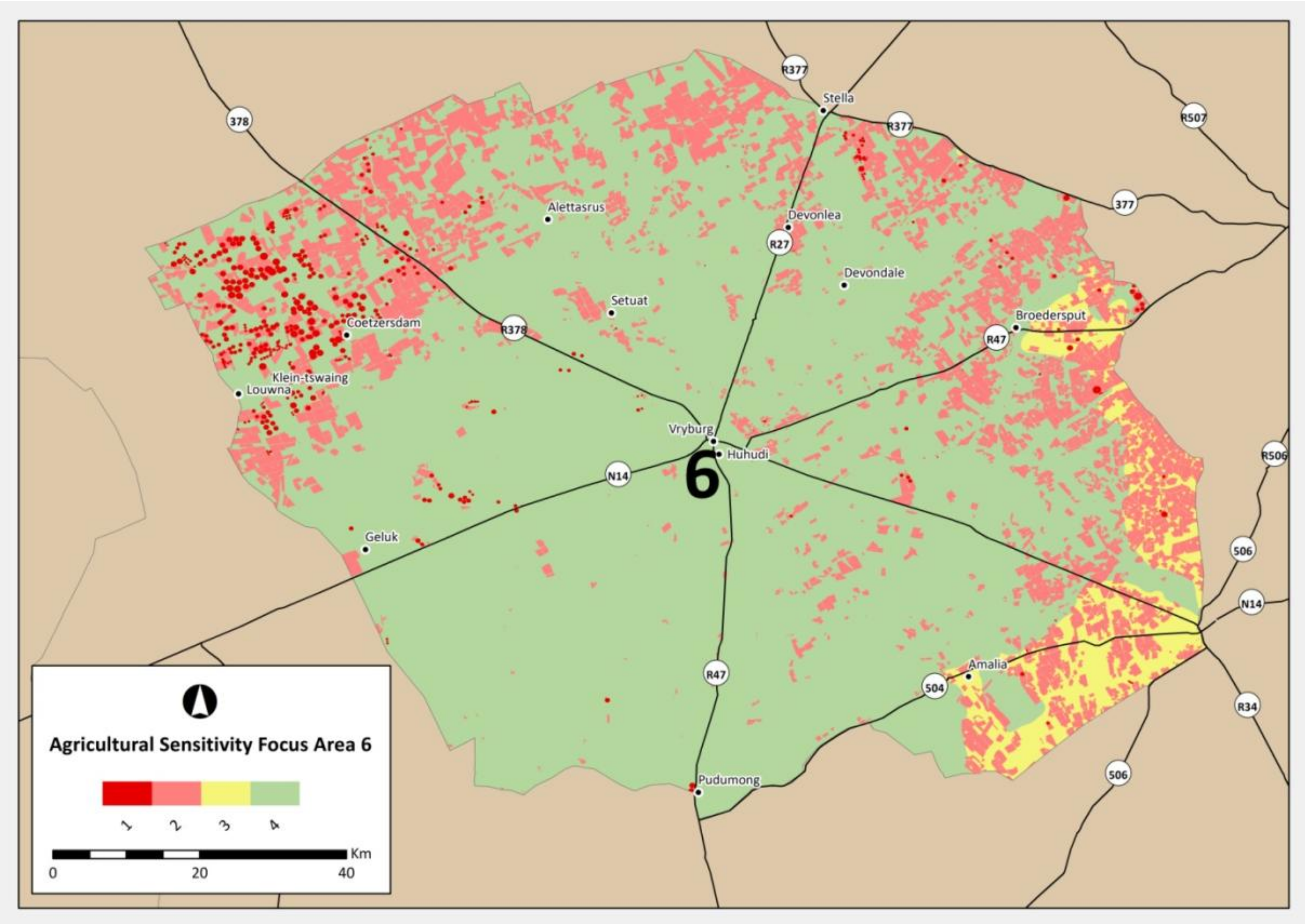
6.1.4 Stormberg focus area 4



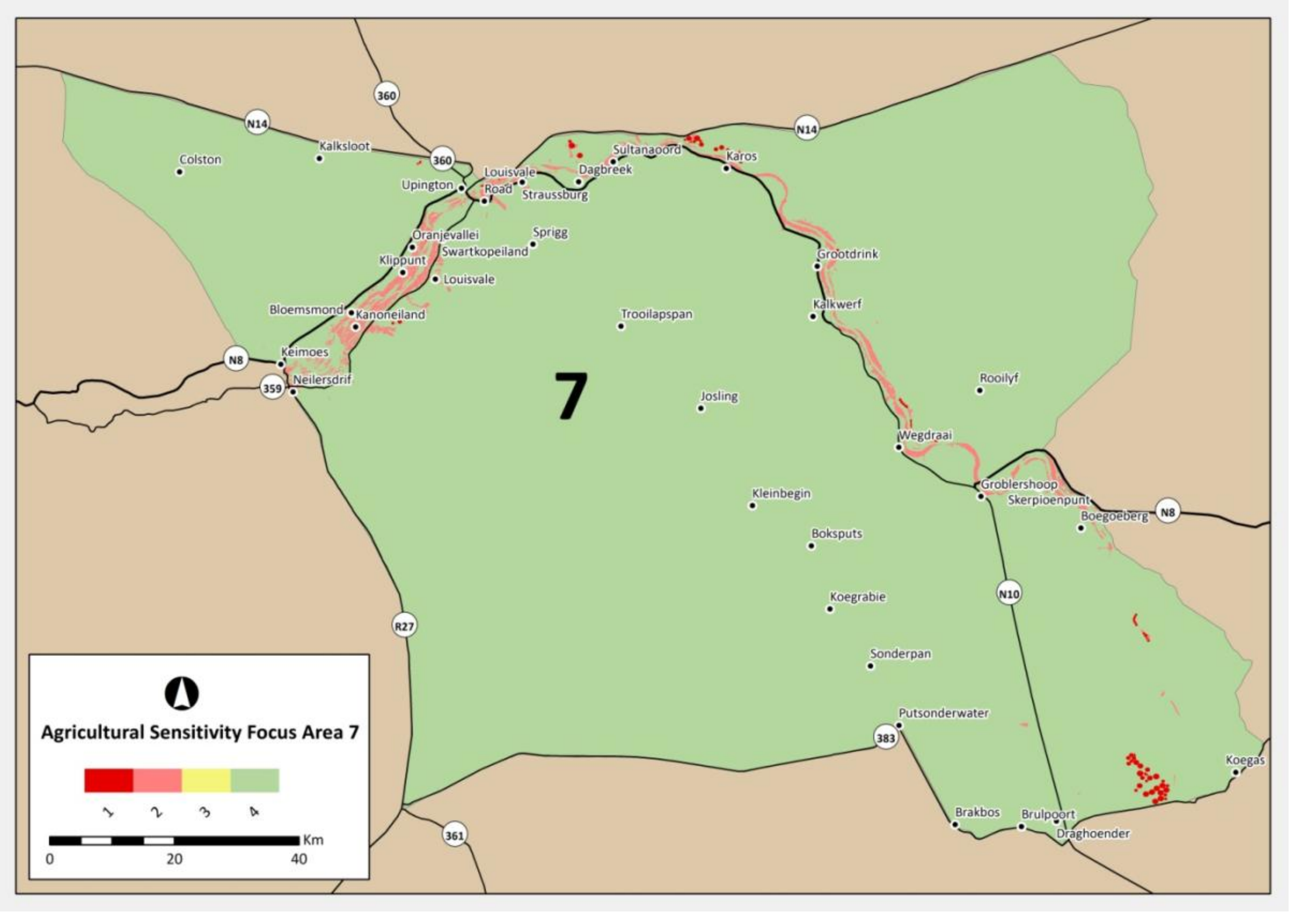
6.1.5 Kimberley focus area 5



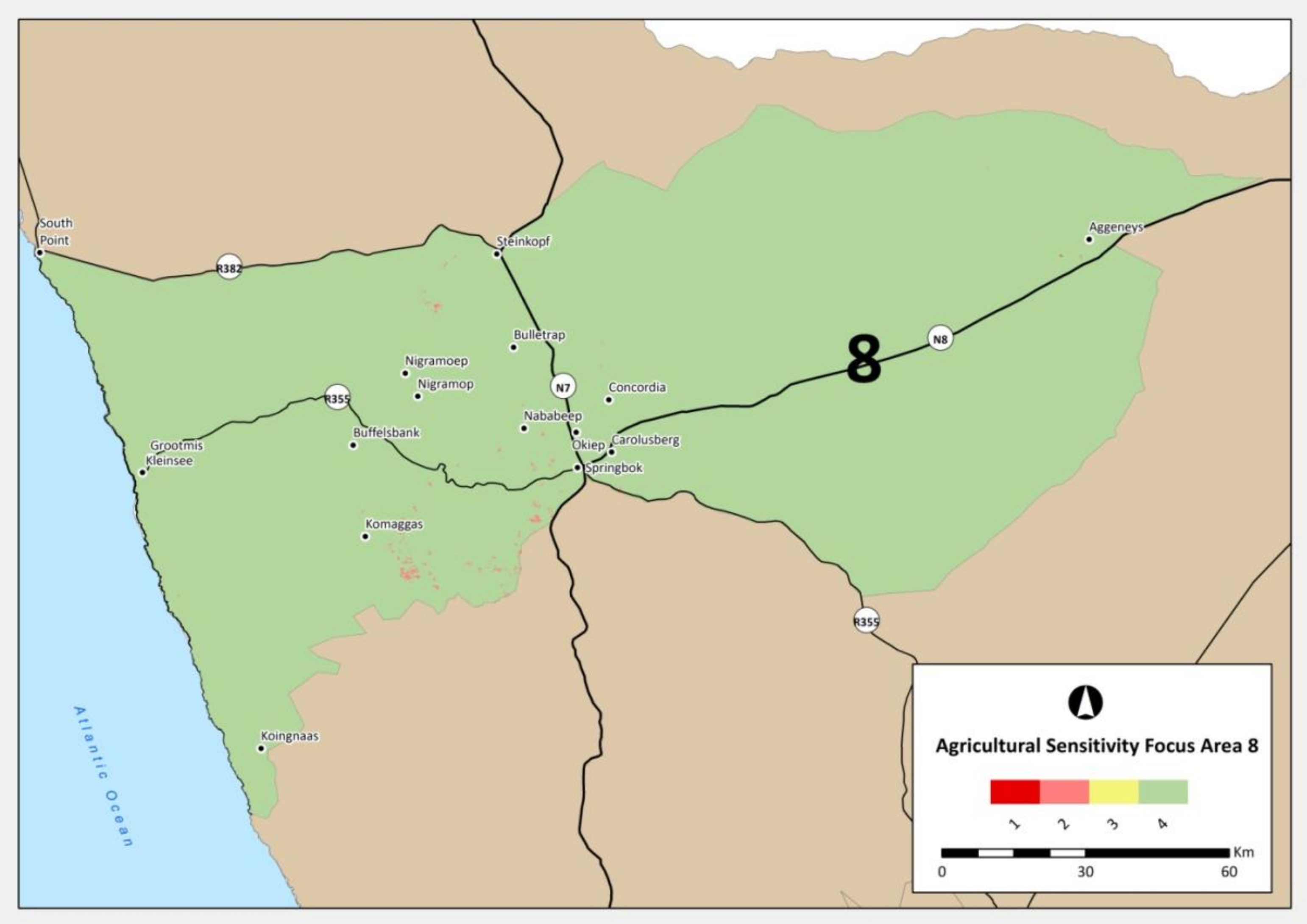
6.1.6 Vryburg focus area 6



6.1.7 Upington focus area 7



6.1.8 Springbok focus area 8



7 INTERPRETATION AND IMPLEMENTATION OF SENSITIVITY MAPS

It is recommended that the 4-tier sensitivity mapping presented above forms the basis of the protocols that allow and limit renewable energy development on agricultural land. These recommendations aim to reach a compromise between preservation of high potential agricultural land and renewable energy development, discussed in section 2.3. They are set up with the assumption that renewable energy development is desirable in each of the focus areas, and with the following aims:

- So that renewable energy development is not entirely precluded from any of the focus areas;
- To focus preservation of agricultural land onto that land which is agriculturally most valuable;
- To absolutely minimize the loss of arable land; and
- To incentivise all renewable energy development towards lowest potential land, wherever possible.

This is considered to be a reasonable compromise which will effectively preserve the agricultural land that matters, but still allow wind energy to be developed in the country.

The protocols are to be used to inform and govern authorisation decisions for every individual development. They must therefore be applicable to a single development. Cumulative allowable development footprints per focus area cannot on their own be used in this way and therefore a system such as the proposed one is necessary.

The basis of this protocol is set out below with renewable energy developments being allowed according to the criteria set out in Table 7.

Table 7: Criteria limiting the development of renewable energy in different categories of agricultural sensitivity. Colours indicate the 4-tier levels of agricultural sensitivity introduced above.

Criteria (land capability class and category of crop boundary)	Allowable development footprint in hectares per Mega Watt generation capacity	
	Within field crop boundaries	Outside field crop boundaries
I, II, III, Irrigation, horticult/viticult, shadenet	0	0
IV	0.20	0.35
V	0.25	2.50
VI	0.30	2.50
VII	0.35	2.50
VIII	0.40	2.50

Allowable development refers to the hectares of a particular category of land that can be directly footprinted by a renewable energy development. Footprint is understood in this context as the area that is directly occupied by all infrastructure, including roads, hard standing areas for cranes, buildings, substations etc, that is associated with the renewable energy facility during its operational phase, and that results in the exclusion of that land from potential cultivation or grazing. It excludes all areas that were already occupied by roads and other infrastructure prior to the establishment of the energy facility, but includes the surface area required for widening existing roads. It excludes the corridor underneath overhead power lines, but includes the pylon footprints. It therefore represents the total land that is actually excluded from agricultural use by the energy facility.

The values included in Table 7 are provisional values. Emphasis at this stage should not be on the values themselves but on the principles of such a system, and the outcomes thereof for authorisation which are discussed below. The actual values will require further investigation and discussion to ensure their suitability in terms of the new land capability data when that becomes available.

DAFF has suggested that within the non-arable land capability classes (V - VIII) grazing capacity be used as a further distinguishing criteria. This would seem to be unnecessary as the small proportion of available land required for renewable energy development (see Table 1) is not a significant threat to the availability of grazing resources in the country, which are not nearly as scarce or threatened as arable land resources. There does not, therefore, seem to be justification for imposing limits on renewable energy development on such land (over and above the demand limits given in Table 1). A lack of limits on low sensitivity land also contributes positively to the preservation of high potential agricultural land because it incentivises all renewable energy development onto low sensitivity land.

The choice of this system can be justified in terms of the arguments presented in sections 2 and 4, and is summarised as follows:

Very high	Includes all high capability arable land, high productivity land and land into which significant agricultural investment has been made. This is high potential agricultural land that is critical to preserve.
High	This land is not as preservation worthy as the very high category, but it is land that has been cultivated and so will include preservation worthy land that falls outside of land capability classes I to III. It will include unique agricultural land, as well as some more marginal land. Very limited development is allowed on this land and is steered towards the more marginal of it, through increasing allowable development in lower land capability classes. This category allows for the development of small footprint wind energy in focus areas 1 and 4, but it keeps the loss of agriculturally valuable land to a minimum.
Medium	This is likely to be more marginal arable land, but use of it for renewable energy development is still very limited, with the effect that most development is steered to even lower sensitivity land.
Low	This is not arable land and is therefore not particularly preservation worthy. It is this land onto which most of the renewable energy footprint, including all solar projects, should be steered. The proposed protocol aims to do this.

The criteria is designed to have the following outcomes:

- All renewable energy development is excluded from very high sensitivity land unless a developer can prove to the satisfaction of the competent authority that the footprint of the energy facility is on land that is unsuitable for sustainable crop production. High sensitivity land may also be used in cases where off-sets that increase agricultural production have been agreed to by the competent authority;
- Solar developments, which have a much larger footprint than wind, are excluded from high and medium sensitivity land, unless a developer can provide proof that the footprint of the energy facility is on land that is unsuitable for sustainable crop production. High sensitivity land may also be used in cases where off-sets that increase agricultural production have been agreed to by the competent authority;
- All renewable energy developments will be allowed and incentivised to locate on low sensitivity land; and
- A low footprint of wind energy development will be allowed on certain cultivated land but will be required to minimise its footprint on such land and will be incentivised to use the lowest potential of such land available. This will make wind energy development in the Overberg and Stormberg focus areas possible.

It is important that renewable energy development is incentivised to go to those areas that have been identified as most suitable for development and that result in the least negative impacts. One way to incentivise this is to streamline the authorisation process in the REDZs.

The most effective streamlining will be achieved if approval of projects is based on compliance with clearly defined criteria such as presented above. If this were the case, then a detailed agricultural study should not be required to support decision making for approval. It is important to note in this regard that decision making is not bypassed or given over to a different authority, it is simply made at the stage of establishing the criteria and does not therefore have to be repeated for each individual development. This brings about much greater efficiency. It also provides transparency for developers so that they know up-front how to locate and lay out facilities in order to minimise agricultural impacts and thereby achieve agricultural approval.

Proof of compliance with all agreed upon criteria would be required for authorisation. It is recommended that within the REDZs, such proof of compliance would take the place of the current DAFF guidelines.

In addition to the criteria stipulated above, for applications in high sensitivity areas, there is an additional concern that needs to be addressed. That is the fragmentation of agricultural land. The layout, particularly of wind farms with their access roads and distributed footprint, can lead to the division of fields and to the isolation of portions of land into non-viably small areas for cultivation. Such fragmentation leads to an effective additional loss of agricultural land over and above that lost to the direct footprint. A layout designed with this issue in mind, can avoid fragmentation.

Therefore, the signed off compliance for all high sensitivity areas would need to include a check on this. It is recommended that such compliance ensures that the proposed layout of all energy facility infrastructure has taken all reasonable steps to minimise fragmentation of agricultural land and disturbance of cultivation practices due to the division of existing fields, particularly by turbines and access roads. It has taken all reasonable steps to optimise placement of all infrastructure but particularly roads, turbines and hard standing areas along existing field crop boundaries and to minimise the length of roads and number of turbine placements that intrude into existing fields.

Criteria on standard topsoil management and erosion control measures would be written into the Environmental Management Plans of each project (see Section 7).

Only applications that seek to depart from the criteria would need to prove, by way of a reliable and detailed agricultural specialist study, that there is justification for a departure in the specific case. Departure would be justified by proving that the footprint of the energy facility is on land that is unsuitable for sustainable crop production. Due to the low resolution of land capability data, there may be areas of land that are unsuitable for sustainable crop production within higher land capability classes. Such land could be suitable for renewable energy development if identified through a specialist agricultural study. It is also possible that departure may be justified by off-sets of increased agricultural production, but these would need to be negotiated on a case by case basis.

Basing approval on simple compliance with clearly defined criteria, as long as it effectively serves the purpose of preserving high potential agricultural land, would not only streamline the process for renewable energy developers, but would also make the authorisation less onerous and time consuming for DAFF as the decisions would be clear and would not need to include complex assessment of detailed agricultural studies.

The recommended protocols above place no limit on the proportion of an agricultural unit or farm portion that may be used for renewable energy development. This is in contradiction to the current requirements in terms of the Subdivision of Agricultural Land Act, and to DAFF's current authorisation protocols. This Act seeks to prevent subdivision of agricultural units into portions too small to be economically viable as farming land. It includes criteria that defines “too small” such as that subdivided units must be large enough to support grazing of at least 60 large stock units. It is recommended that such limits are set aside in the REDZs. This recommendation is justified by the following:

- The motivation behind the Act is preservation of the economic viability of individual farm portions. However, as has been shown in section 2, rental to energy facilities greatly increases the economic returns per hectare of land and therefore the economic viability of farms, particularly small and marginal ones. Many farms exist that are already too small or too marginal for other reasons to be economically viable. Rental to energy facilities offers a way for such farms to achieve independent economic viability; and
- Such a limitation has the potential to exclude renewable energy developments from certain low potential land on which it would be desirable to locate them so as to steer them away from higher potential land. It may therefore have the negative outcome of increasing development pressure on higher potential agricultural land.

8 IMPACTS AND MITIGATION

The negative impacts of renewable energy development (both solar and wind) on agriculture may be listed as:

1. Loss of agricultural land use due to direct occupation by the footprint of the energy facility infrastructure, including roads. This takes affected portions of land out of agricultural production;
2. Loss of agricultural land use due to fragmentation of agricultural land. Energy facility infrastructure can lead to the division of fields and isolation of portions of them into non-viably small areas for cultivation. Such fragmentation leads to an effective additional loss of agricultural land over and above that lost to the direct footprint;
3. Erosion due to alteration of the land surface run-off characteristics and susceptibility to wind erosion. Alteration of surface characteristics may be caused by construction related land surface disturbance, vegetation removal, the establishment of hard standing areas and roads, and the presence of panel surfaces. Erosion causes loss and deterioration of soil resources;
4. Erosion may also be caused by disturbance to existing contour banks and drainage systems that were established to control run-off and erosion;
5. Degradation of vegetation beyond the direct footprint due to constructional disturbance, dust and vehicle trampling;
6. Loss of topsoil due to poor topsoil management (burial, erosion, etc) during construction related soil profile disturbance (levelling, excavations, road surfacing etc.) and resultant decrease in that soil's capability to support plant growth;
7. Disturbance to agricultural practices and management during construction;
8. Disturbance of cultivation practices due to the division of existing fields by turbines and access roads; and
9. Prevention of crop spraying by aircraft over land occupied by turbines.

Impact number 9 is the only one that is specific to wind farms. All impacts can apply across all eight focus areas. Mitigation measures for all impacts are generic and apply across all focus areas. Mitigation measures should form part of the recommended protocols discussed in the previous section. Recommended mitigation measures, per impact listed above are:

1. Minimize the footprint of disturbance by utilising existing roads for the energy facility wherever possible;
2. The layout design must be done to avoid the division of fields and the isolation of portions of land into non-viably small areas for cultivation. Placement of all infrastructure but particularly roads, turbines and hard standing areas should be positioned along existing field crop boundaries and the length of roads and number of turbine placements that intrude into existing fields, must be minimised wherever possible;

3. Implement an effective system of run-off control, where it is required, that collects and safely disseminates run-off water from all hardened surfaces and prevents potential down slope erosion. Soil surface stabilising measures must be used if necessary on all areas that are highly susceptible to erosion. Where soils are highly susceptible to wind erosion, the extent of areas cleared of vegetation must be minimized. Cleared areas should be subdivided if possible by leaving strips of undisturbed vegetation across them. The effectiveness of the run-off control system and the occurrence of any erosion on site or downstream must be monitored. Corrective action must be implemented to the run-off control system in the event of any erosion occurring;
4. The layout of the energy facility should be done so as to avoid disturbance to any existing contour banks. If any disturbance to contour banks occurs, they must be restored to the same specifications (height, slope, and spacings between banks) as prior to disturbance, and to the satisfaction of a soil conservation specialist. The integrity of the contour bank run-off control system as a whole must be maintained, monitored and repaired in the event of any erosion occurring due to breaks in its integrity;
5. Restrict all vehicle traffic within the footprint of disturbance and control dust during construction;
6. If an activity will mechanically disturb below surface in any way, then any available topsoil should first be stripped from the entire surface to be disturbed and stockpiled for re-spreading during rehabilitation. Topsoil stockpiles must be conserved against losses through erosion by establishing vegetation cover on them. Dispose of all subsurface spoils from excavations where they will not impact on undisturbed land. During rehabilitation, the stockpiled topsoil must be evenly spread over the entire disturbed surface. Erosion must be controlled where necessary on newly topsoiled areas, which are likely to be susceptible to erosion;
7. No mitigation possible;
8. Same mitigation as number 2 above; and
9. If crop spraying by aircraft is ever required, it can be agreed that if necessary the wind farm will shut down 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.

9 CONCLUSIONS

Agricultural authorisation is one of several issues slowing the roll-out of renewable energy development for South Africa. The focus of this study has been to identify opportunities for improving the efficiency of agricultural authorisation while minimizing negative impacts on agriculture, the most important of which is loss of high potential agricultural land. The study is motivated by the need to find solutions that will facilitate renewable energy development and at the same time ensure preservation of critical agricultural land resources.

It should be noted that *high potential agricultural land* is understood to include all land which can support sustainable levels of crop production. The preservation of such land is a critical issue in South Africa. Arable land is a threatened, very scarce and non-renewable resource that is essential to the well-being of society. From an agricultural production perspective, the country cannot afford to lose any more high potential agricultural land. All non-agricultural development on agricultural land should be sited, wherever possible, on non-arable grazing land.

Energy security and the development of wind energy is also a priority for South Africa. In order to make renewable energy development possible, this study identifies a need for changes to the current DAFF guidelines that inform agricultural authorisation.

The study is based on recognising and identifying different levels of agricultural sensitivity to development. Four levels - very high, high, medium and low are recognised. It proposes establishing clear and transparent criteria that inform and govern decisions of agricultural authorisation and apply to different sensitivity categories. Changes to the DAFF guidelines are recommended at two different levels of sensitivity. The first is land of low agricultural sensitivity.

A large proportion of the land under consideration in the focus areas is land where the climate limits any potential for crop production. Because the agricultural limitation here is climatic and not soil related, there is a high degree of certainty over the low agricultural capability of these areas. From an agricultural impact perspective, such land is ideally suited to renewable energy development and it is to such land that as much of the renewable energy development as possible should be steered. The total proposed renewable energy development in terms of IRP 2010 will at most utilise 0.3% of the land surface of the eight focus areas and does not therefore pose any threat to the country's grazing land resources. It does not therefore make sense to impose agricultural limitations on development of such land. One of the current limitations imposed is a maximum allowable proportion of a farm portion (10%) that can be developed to renewable energy. Instead of preserving the viability of farm portions, this limitation prevents marginal farm portions from achieving economic viability through rental to renewable energy development. This study recommends that no agricultural limitations are imposed on renewable energy development on low agricultural sensitivity land. Furthermore, because of the high certainty around its low agricultural capability, agricultural approval on such land should only require a minimal amount of site information. Agricultural authorisation on low sensitivity land can therefore be significantly streamlined.

The second sensitivity level for which changes are recommended to the DAFF guidelines is for high sensitivity land under cultivation. The current guidelines prohibit any renewable energy footprint on land that has been cultivated within the previous 10 years. From an agricultural perspective it would be desirable if all renewable energy developments could be sited off such land. Unfortunately, there is overlap between the country's best wind energy resources and land used for cultivation, particularly in the Overberg focus area and also in the Stormberg one. This guideline is therefore prohibitory to wind energy development in South Africa. It is considered too stringent and some compromise on this prohibition is considered to be entirely justified. The arguments justifying this are presented in the study. The most important of these are firstly that the areas of land required for wind energy development are very small – at most 0.09% of the surface area of the identified focus areas. Secondly, the economic benefits weigh in favour of some integration of land use between renewable energy and crop production.

The economic benefits in particular speak to the fact that optimal land use decisions should not be made exclusively from one perspective. The current guidelines presume that agricultural land use has priority over any alternative land use, irrespective of the potential societal benefits of such a land use in comparison to those of agriculture. Optimal land use decisions should rather involve an integrated weighing of the costs and benefits, to the country as a whole, rather than to only one sector, whether that sector is energy or agriculture. From the perspective of preserving all potentially arable land for crop production, wind energy development should not take place in the Overberg focus area. From the perspective of renewable electricity supply to the country, or economic development, wind energy development should take place in the Overberg focus area.

The balance of the arguments suggests that it may be in the interests of the country as a whole to sacrifice small amounts of cultivated land so that wind energy generation in the Overberg focus area is possible. This would allow both energy generation and agriculture (with only a very small loss of production land) and would seem to be a more integrated decision than prohibiting renewable energy. However it is also of critical importance that such sacrifice of arable land must be strictly controlled and limited to an absolute minimum.

The system for agricultural authorisation that is recommended in this report, using clear criteria applied to different sensitivity levels, is designed to do exactly that. The system proposes a maximum allowable footprint, scaled appropriately for the size of the development, for different classes of agricultural sensitivity. This system strictly limits development on high potential agricultural land and incentivises its development on land of lower potential. It is important to note that decision making is not bypassed or given over to a different authority, it is simply made at the stage of establishing the criteria and does not therefore have to be repeated for each individual development. It has benefits in terms of efficiency and clarity of agricultural authorisation.

Given the imminent availability of improved land capability data from DAFF, the specification of footprints recommended in this report should be considered provisional. Emphasis at this stage should not be on the specifics but rather on the principles of the system. The specifics will require further investigation and discussion in terms of the new land capability data when that becomes available.

In conclusion this study recommends a system for improving agricultural authorisation for renewable energy development in the proposed REDZs. The recommended system is focused on enabling effective preservation of the country's critical and scarce agricultural land resources, as well as achieving the benefits of renewable energy development in the country.

In the end "farming" electricity might not be so different from farming many other products in South Africa. Renewable energy development represents a change for rural areas, but it may well be a change whose benefits outweigh its costs.

10 SPECIALIST CV

Education

M.Sc. (Environmental Geochemistry)	University of Cape Town	1996 - June 1997
B.Sc. Agriculture (Soil Science, Chemistry)	University of Stellenbosch	1992 - 1995
BA (English, Environmental & Geographical Science)	University of Cape Town	1989 - 1991
Matric Exemption	Wynberg Boy's High School	1983

Professional work experience

I am registered as a Professional Natural Scientist (Pri.Sci.Nat.) in the field of soil science, registration number 400268/12.

Soil Science Consultant **Self employed** **2002 - present**

I run a soil science consulting business, servicing clients in both the environmental and agricultural industries. Typical consulting projects involve:

- Soil specialist study inputs to EIA's, SEA's and EMPR's. These have focused on impact assessments and rehabilitation on agricultural land, rehabilitation and re-vegetation of mining and industrially disturbed and contaminated soils, as well as more general aspects of soil resource management. Recent clients include: CSIR; Savannah Environmental; Aurecon; Red Cap Investments; MBB Consulting Engineers; Enviroworks; Sharples Environmental Services; Mainstream Renewable Power; BioTherm Energy; WKN Windcurrent; Corobrik; Western Cape Provincial Department of Environmental Affairs and Development Planning; Alcan aluminium smelter (Coega); Namaqualand Restoration Initiative; AECI; Afrimat; Tiptrans.
- Soil resource evaluations and mapping for agricultural land use planning and management. Recent clients include: Zewenwacht Wine Estate, Lourensford Fruit Comapny; Thelema Mountain Vineyards; Delaire Wine estate; Newton-Johnson Wines; Spier Estate; Colors Fruit; Kaarsten Boerdery; Amanzi Country Estate (Port Elizabeth); Rudera Wines; Flagstone Wines; Cob Creek Estate (Jeffreys Bay); Solms Delta Wines; Dornier Wines.
- I have conducted several recent research projects focused on conservation farming, soil health and carbon sequestration.
- I have project managed the development of soil nutrition software for Farmsecure Agri Science.

Soil Science Consultant **Agricultural Consultors International (Tinie du Preez)** **1998 - end 2001**
Responsible for providing all aspects of a soil science technical consulting service directly to clients in the wine, fruit and environmental industries all over South Africa, and in Chile, South America.

Contracting Soil Scientist	De Beers Namaqualand Mines	July 1997 - Jan 1998

Completed a contract to make recommendations on soil rehabilitation and re-vegetation of mined areas.

Publications

- Lanz, J. 2012. Soil health: sustaining Stellenbosch's roots. In: M Swilling, B Sebitosi & R Loots (eds). *Sustainable Stellenbosch: opening dialogues*. Stellenbosch: SunMedia.
- Lanz, J. 2010. Soil health indicators: physical and chemical. *South African Fruit Journal*, April / May 2010 issue.
- Lanz, J. 2009. Soil health constraints. *South African Fruit Journal*, August / September 2009 issue.
- Lanz, J. 2009. Soil carbon research. *AgriProbe*, Department of Agriculture.
- Lanz, J. 2005. Special Report: Soils and wine quality. *Wineland Magazine.*

I am a reviewing scientist for the *South African Journal of Plant and Soil*.

10.1 Specialist Declaration

I, Johann Lanz, as the appointed independent specialist hereby declare that I:

- act/ed as the independent specialist in this application;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct;
- do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed;
- have and will not have any vested interest in the proposed activity proceeding;
- have disclosed any material information that have or may have the potential to influence the objectivity of any report or decisions base thereon; and
- am aware that a false declaration is an offence in terms of regulation 71 of GN No. R. 543.

Signature of the specialist:

Name of company:
Johann Lanz – Soil Scientist

Professional Registration (incl number):
South African Council for Natural Scientific Professions, Registration no. 400268/12

Date:
4 June 2014

STRATEGIC ENVIRONMENTAL ASSESSMENT FOR WIND AND SOLAR PHOTOVOLTAIC ENERGY IN SOUTH AFRICA

Appendix A2

Landscape Scoping Assessment Report

Specialists' names:
Quinton Lawson, Bernard Oberholzer
MLB Architects, BOLA Landscape Architects

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ABBREVIATIONS AND ACRONYMS

CSIR	Council for Scientific and Industrial Research
DEA	Department of Environmental Affairs
DEM	Digital Elevation Model
NEMA	National Environmental Management Act
NFEPA	National Freshwater Ecosystem Priority Areas
NGI	National Geospatial Information
NHRA	National Heritage Resources Act
PGWC	Provincial Government of the Western cape
PV	Photovoltaic
SANBI	South African National Biodiversity Institute
SAPAD	South African Protected Areas Database
SEA	Strategic Environmental Assessment
SRTM	Shuttle Radar Topography Mission
VIA	Visual impact assessment

1 APPROACH AND METHODOLOGY

1.1 Background

This Landscape Assessment is one of a series of specialist studies, which form part of a Strategic Environmental Assessment (SEA) to facilitate the efficient rollout of wind and solar PV energy. The SEA, which is being conducted by the CSIR at the request of the Department of Environmental Affairs (DEA), aims to identify geographical areas best suited for the rollout of wind and solar PV energy projects.

Based on development potential and major constraints, Phase 1 of the SEA identified 8 focus areas where further investigation is currently being carried out in Phase II, to refine the focus areas through stakeholder consultation and specialist assessments, including this landscape assessment.

The landscape assessment is a scoping-level study, focused primarily on interpreting existing information, and based on defensible and recognized landscape planning criteria. It is intended that the landscape methodology adopted here will inform future SEA-level landscape assessment studies.

1.2 Study Methodology

Definition: The landscape assessment broadly includes visual, scenic, aesthetic and amenity values, which contribute to the area's overall 'sense of place', and which encompass natural and cultural landscape characteristics.[1]

The methodology for the Landscape Assessment can be divided into 3 broad stages as follows:

- **Stage 1: Landscape Description** (Baseline study)

The study involves a sequence starting with the geological formation of the landscape, which in turn determines landforms within each Focus Area. Given the sub-regional scale of the project, geomorphology tends to be a major factor in determining landscape character and scenic resources. Both natural and cultural landscapes are considered, as well as heritage sites obtained from the scoping-level heritage assessment undertaken as part of the SEA.

- **Stage 2: Landscape Sensitivity** (Absolute sensitivity mapping)

Landscape sensitivity is determined through the identification of natural, scenic and cultural resources which have aesthetic and economic value to the local community, the region and society as a whole. Resources include features of topographic, geological or cultural interest, together with landscape grain or complexity. These aspects, seen together, tend to constitute the area's overall 'sense of place'.

Protected landscapes, such as national parks, nature reserves, game parks or game farms, as well as heritage sites, tend to increase the value and therefore the sensitivity of landscapes.

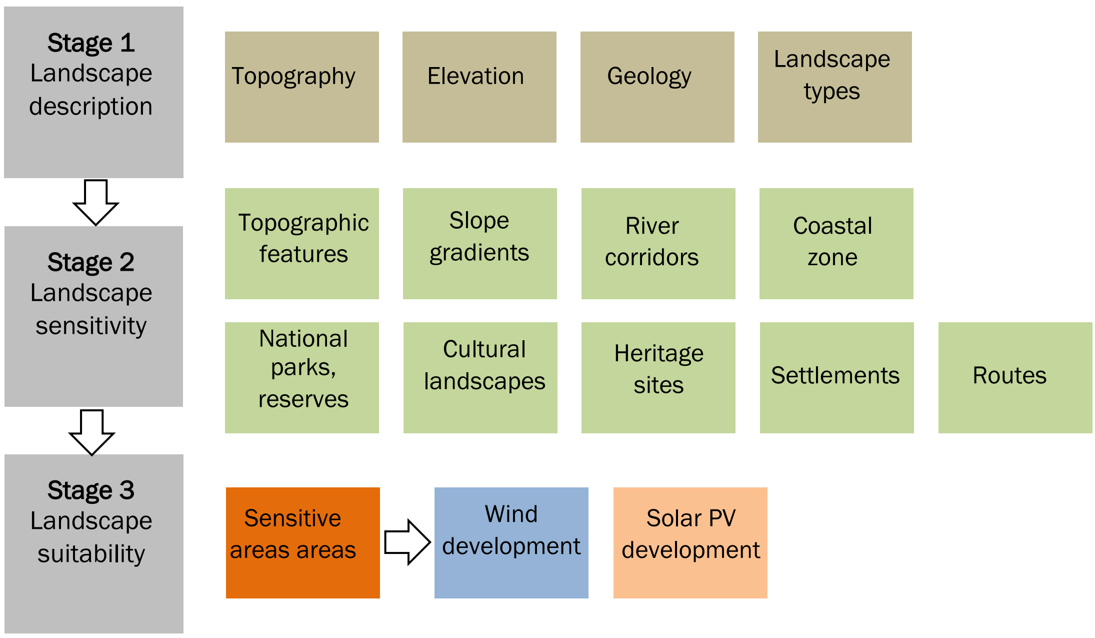
Sensitivity is further determined by receptors within settlements, as well as along national, arterial and scenic routes, and at tourist destinations, such as guest farms and resorts.

- **Stage 3: Landscape Suitability** (Development density limit mapping)

Levels of landscape sensitivity are categorised into very high sensitivity, high sensitivity, medium sensitivity and low sensitivity, and mapped for each Focus Area. The sensitivity levels determine the potential for the location of wind and solar PV energy facilities, described here as 'development density limits'. This includes recommendations for the configuration and clustering of wind and solar energy facilities to mitigate impacts on scenic and cultural landscapes.

[1] Oberholzer, B. 2005. Guideline for involving visual and aesthetic specialists in EIA processes. CSIR Report No. ENV-S-C 2005 053. Provincial Government of the Western Cape, DEADP.

Figure 1 Methodology diagram



1.3 Data Sources

A list and description of data sources on which the landscape assessment was based, and from which sensitive features/criteria were extracted, is given in Table 1.1, and assumptions and limitations in Table 1.2 below.

Table 1.1 Data Sources

Data title	Source and date of publication	Data Description
1:1000000 Geological Map of SA	Geological Survey, 1984. 4 sheets.	Geological information.
1:500 000 topographical maps of South Africa	Surveys and Mapping (several sheets with various dates).	Topographical and cadastral information.
South African Protected Areas	Dept. Environmental Affairs, 2014.	National Parks and Protected Areas.
Heritage and Scenic Resources: Inventory and Policy Framework for the Western Cape	S. Winter and B. Oberholzer, May 2013. For DEADP, Provincial Government of the Western Cape.	Survey and rating of heritage and scenic resources in Western Cape.
Heritage data for Focus Areas	Wouter Fourie, PGS Heritage 2014.	Shape files, KML files of heritage sites.
Water sources, land cover, vegetation types	South African National Biodiversity Institute (SANBI BGIS) 2011-2013.	Shape files.
Topographic data set v4.1 (used for viewshed mapping)	NASA SRTM (Shuttle Radar Topographic Mission).	Topographic data with resolution of 90x90m and vertical accuracy of 16m.
Game farms in E. Cape	Eastern Cape Protected Areas Expansion Strategy, 2012.	Shape files.
Game farms in North-West	‘Exempt farms’.	Shape files.

[1] Viewsheds have been calculated for national parks and for SALT (South African Large Telescope) in Sutherland. Raster viewsheds calculated using a rendering program to project light rays from the boundaries of national parks, 2.5 m above the DEM terrain, (ht. of a viewer from a game-viewing vehicle). 17m ht. of the telescope platform was used in the case of SALT.

1.4 Assumptions and Limitations

Table 1.2 Landscape Study Assumptions and Limitations

Limitation	Included in the scope of this study	Excluded from the scope of this study	Assumption
Level of mapping detail	1: 500 000 topographical maps, and 1:1 000 000 geological survey maps.	1:250 000 and 1:50 000 topographical maps.	1:500 000 mapping was adequate for a regional scale suitability study. 1:50 000 scale maps are better suited for site selection and micro-siting of wind and solar PV energy facilities.
Information on cultural landscapes	Information obtained from W. Cape Heritage and Scenic Resource mapping, and from the Heritage Specialist.	Detailed analysis of local areas using historical airphotos or Google Earth imagery.	Some level of additional heritage assessment would probably be required on an individual project basis in terms of the NHRA.
Information on private reserves, game/ guest farms and resorts.	Limited information was included where these facilities were known.	Detailed survey of private reserves / game farms.	This type of detailed information would be needed on an individual project basis.
Viewsheds of National Parks and nature reserves	It was only possible to prepare generalised viewsheds (and view shadows) given that the location of possible wind and solar farms is not known at this stage.	The viewsheds used in the maps do not take into account the location or height of possible wind or solar facilities.	It is assumed that individual viewsheds would need to be done on a project by project basis, once the actual siting and height of proposed wind or solar facilities are known.
Powerlines and sub-stations not included in the study.	Some mitigations indicated in Section 6.1	Visual criteria or buffers not included in the study.	Some level of visual and heritage assessment of powerlines and substations would need to be considered in terms of NHRA.

1.5 Relevant Regulatory Instruments

Table 1.3 Landscape and Visual Regulatory Framework

Instrument	Key objective
International Instrument	
Ramsar Convention (The Convention of Wetlands of International Importance (1971 and amendments)	Protection and conservation of wetlands, particularly those of importance to waterfowl and waterfowl habitat.
National Instrument	
National Environmental Management Act (NEMA) (Act 107 Of 1998: Regulations in terms of Ch. 5.	Activities requiring authorisation and the procedure to be followed, including proposed engineering and infrastructure projects.
Integrated Coastal Management Act (ICM Act) (Act 24 of 2008)	Protection of the coastal zone including land within 1 km of the High Water Mark (HWM) to 'protect the ecological integrity, natural character and the economic, social and aesthetic value of coastal public property'.
National Heritage Resources Act (Act 25 of 1999 NHRA)	Includes protection of national and provincial heritage sites, as well as areas of environmental or cultural value, and proclaimed scenic routes.
Protected Areas Act (PAA) (Act 57 of 2003, Section 17)	Includes protection of natural landscapes.

Provincial Instrument	
Land Use Planning Ordinance (LUPO)	Local authority zoning schemes can be used to protect natural and cultural heritage resources through 'Conservation Areas', 'Heritage Overlay Zones' and 'Scenic Overlay Zones' including scenic routes.
Provincial Government of the Western Cape (PGWC), 2006: Strategic Initiative to Introduce Commercial and Land Based Wind Energy Development to the W. Cape.	A broad guiding framework for the location of wind energy facilities based on the sensitivity and capacity of landscape types and the scale of the project.

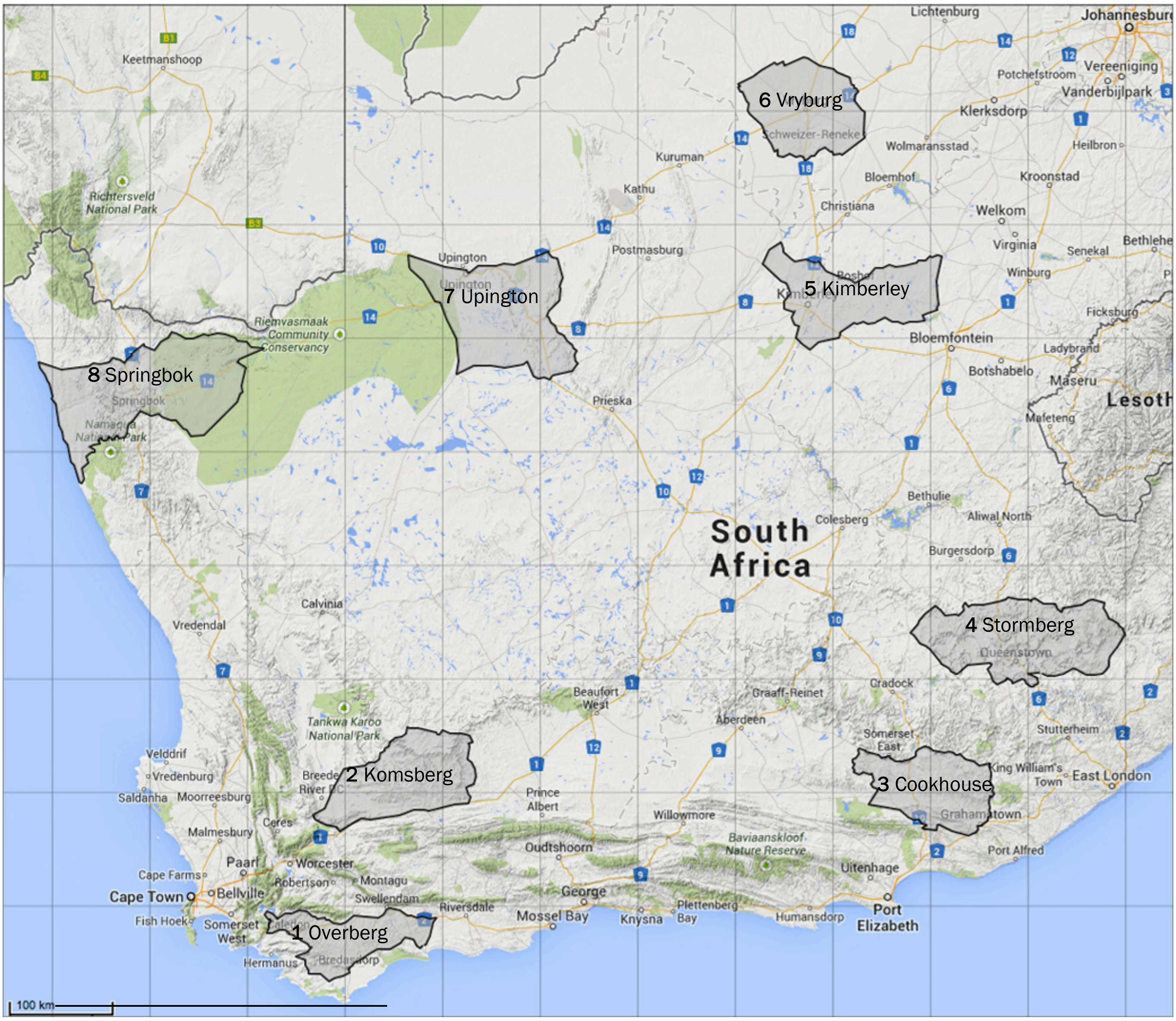
2 FOCUS AREAS DESCRIPTION

Landscape characteristics for each of the focus areas were based on desktop studies, reconnaissance visits and knowledge of the focus areas from previous studies for wind and solar energy facilities undertaken in the past by the authors.

As landforms play a major role in determining scenic resources at a regional scale, emphasis was placed on understanding the geomorphology of the landscape, with input by an engineering geologist[2]. A number of useful publications, listed below, were also consulted[3].

A location plan of the 8 focus areas is shown below, and descriptions with key plans and transects of each focus area follow.

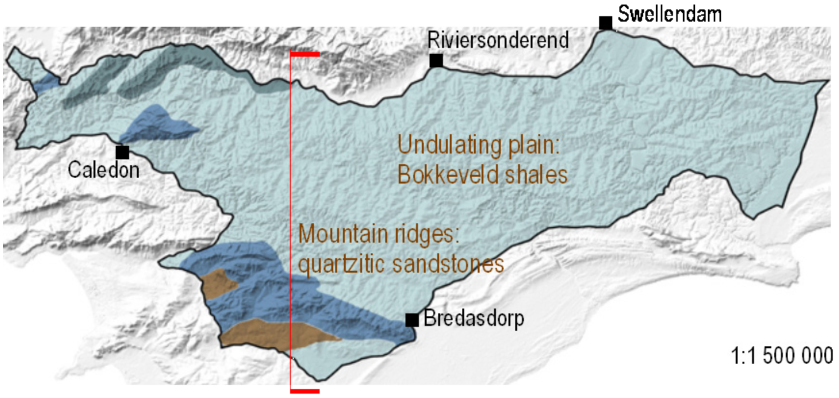
Figure 2 Location Plan of Focus Areas



[2] M. van Wieringen, Engineering Geologist, May 2014. Personal communication.

[3] N. Norman and G. Whitfield, 2006. Geological Journeys. Struik.
M. Viljoen and W. Reimold, 1999. An Introduction to South Africa's Mining Heritage. Mintek.

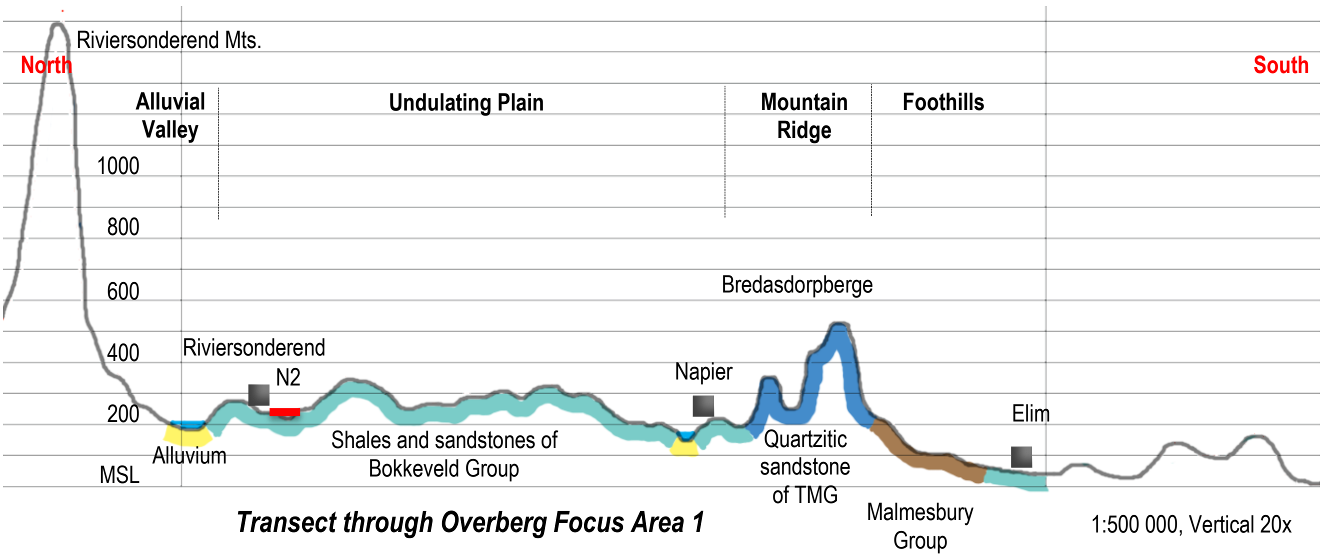
Overberg Focus Area 1



Regional context:
The Overberg focus area belongs to the winter rainfall area of the Western Cape Province, an area framed by the Cape Fold Mountains to the north. Also known as the 'Ruens', the focus area is typically wheat land – the breadbasket of the region, while vineyards and orchards are confined to the river valleys. The N2 National Road, part of the 'Garden Route', forms the northern boundary, and the Agulhas Plain lies to the south.

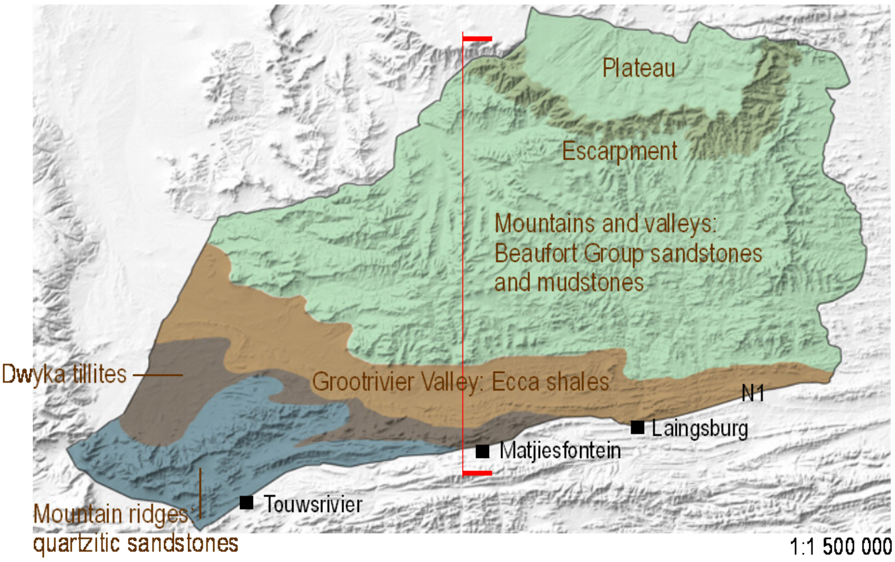
Geomorphology:
The focus area consists of 2 broad landscape types:
1) The rugged mountains composed of resistant quartzitic sandstones of the Table Mountain Group and the Witteberg Group, which lie to the west and south; 2) The larger area of shales and sandstones belonging to the Bokkeveld Group, which form the gently rolling landscape typical of the area. Being softer materials, the shales have become weathered and incised by rivers, such as the Breede River, flowing to the coast. Alluvium occurs in the wide valley of the Riviersonderend River, being a valuable agricultural area.

Landscape features:
The prominent sandstone peaks and ridges to the west and south constitute the main scenic resources of the area, being important also for water catchment and biodiversity, and therefore having high conservation value. The expansive rolling wheat lands have their own rural charm, revered in writings and paintings of the area. The historical pattern of settlements, notably Caledon, Napier, Bredasdorp and Swellendam, are located at the foot of mountains, near sources of water, agricultural soils and transport routes, in response to the landscape. The Breede River, important for recreation, and the Bontebok National Park, are among some of the visually sensitive resources of the fcus area.



Transect through Overberg Focus Area 1

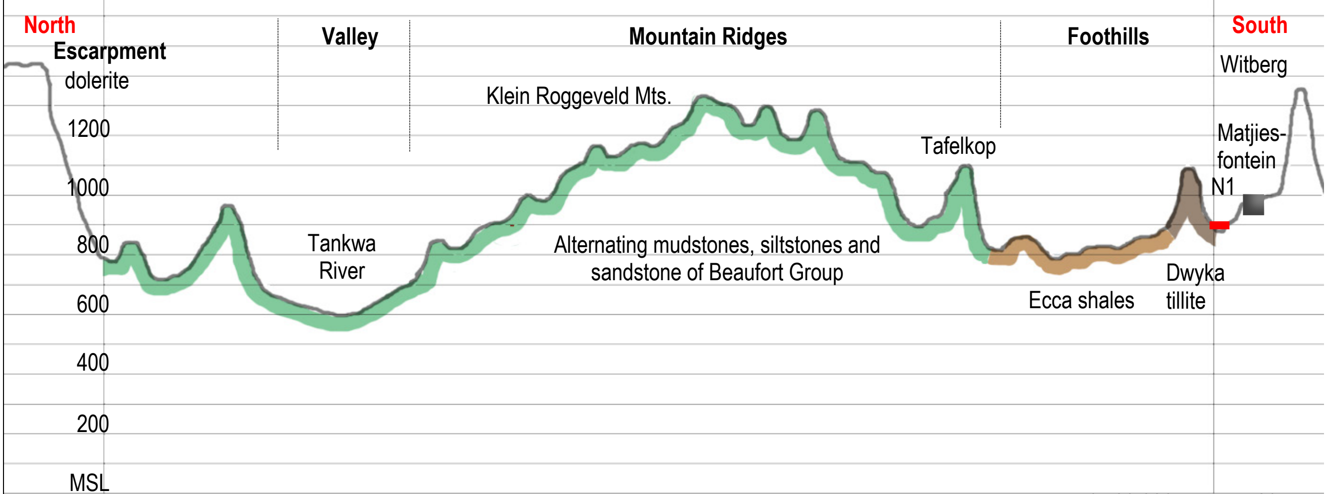
Komsberg Focus Area 2



Regional context:
The Komsberg focus area straddles the border between the Western Cape and Northern Cape provinces, a semi-arid inland area in the rain shadow of the Cape Fold Mountains to the south. It comprises three main landscape regions, being the Ceres Karoo to the west, the Klein Roggeveld and Komsberg ranges in the middle, and the Moordenaars Karoo to the east. The N1 National Road forms the southern boundary.

Geomorphology:
The focus area consists of 4 landscape types: 1) The largest portion to the north and east, is covered by rocks of the Beaufort Group, part of the Karoo Sequence, a variable landscape with the more resistant sandstones forming the ridges of the Komsberg and Klein Roggeveld ranges, and the softer mudstones the lower lying areas. 2) The Ecca shales of the Grootrivier Valley. 3) The Dwyka tillites, a geological feature of the area. 4) The Bontberg mountain north of Touwsrivier formed by the more resistant Witteberg quartzitic sandstones.

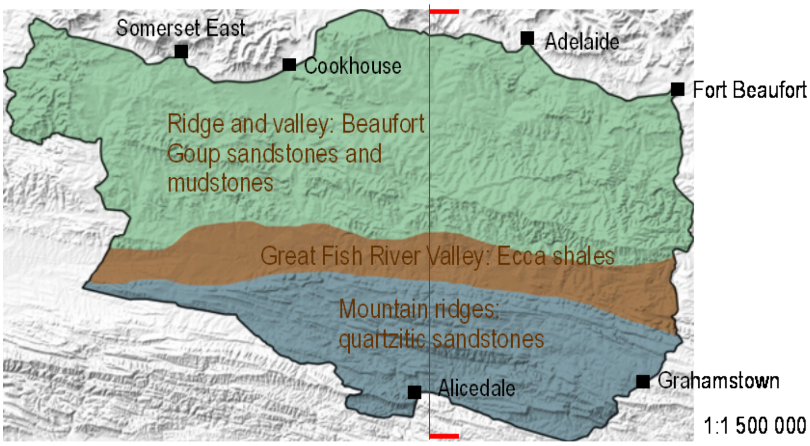
Landscape features:
The prominent sandstone ridges constitute the main scenic features and skylines of the area. The scarp and plateau area of the Komsberg is particularly visually sensitive in relation to the Sutherland Observatory just north of the focus area. The broken topography of the Moordenaars Karoo on the other hand, results in more contained local viewsheds, which are less visually exposed. The Bontberg and a nature reserve near Touwsrivier are visually sensitive, as is the Matjiesfontein Provincial Heritage Site. The N1 and the R354, which links Matjiesfontein with Sutherland, are important visual corridors.



Transect through Komsberg Focus Area 2

1:500 000, Vertical 20x

Cookhouse Focus Area 3



Plateau Undulating plain:

Regional context:

The Cookhouse focus area is located in the Eastern Cape, with the Suurberg mountains to the south. Broad plains are bounded by the Coetzeesberg and Winterberg Mountains forming an escarpment to the north. The N10 National Road, linking Port Elizabeth with the interior, passes through the middle of the area, and the N2 forms the south-eastern boundary at Grahamstown.

Geomorphology:

The focus area consists of 3 broad landscape types:

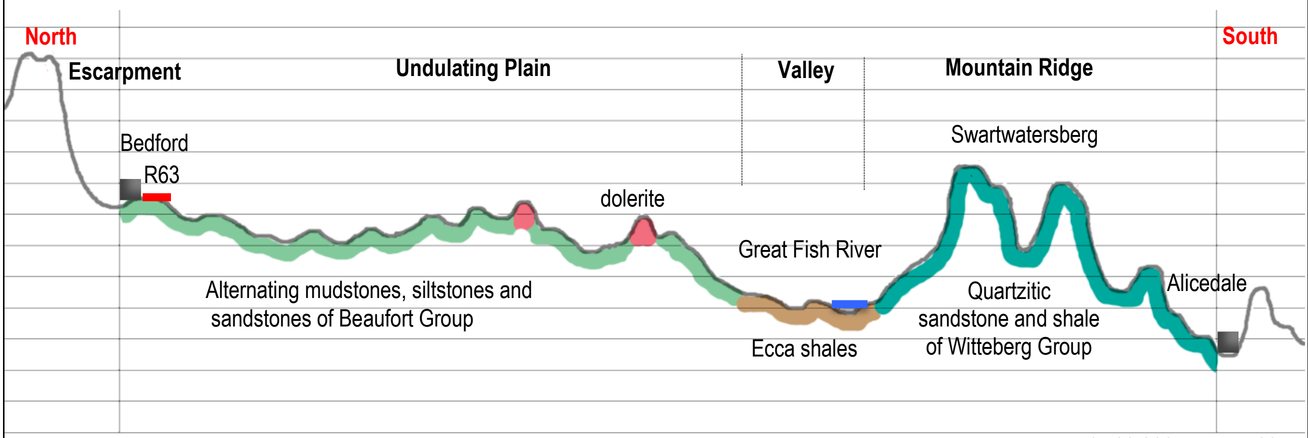
1) The northern portion covered by rocks of the Beaufort Group, with the more resistant sandstones, and a few dolerite dykes forming the ridges, and the softer mudstones and siltstones in the lower lying areas;

2)The soft Ecca shales, which have been eroded by the meandering Great Fish River to form a broad valley;

3) The quartzitic sandstones of the Witteberg Formations typically forming the southern ridges, such as those of the Swartwatersberg.

Landscape features:

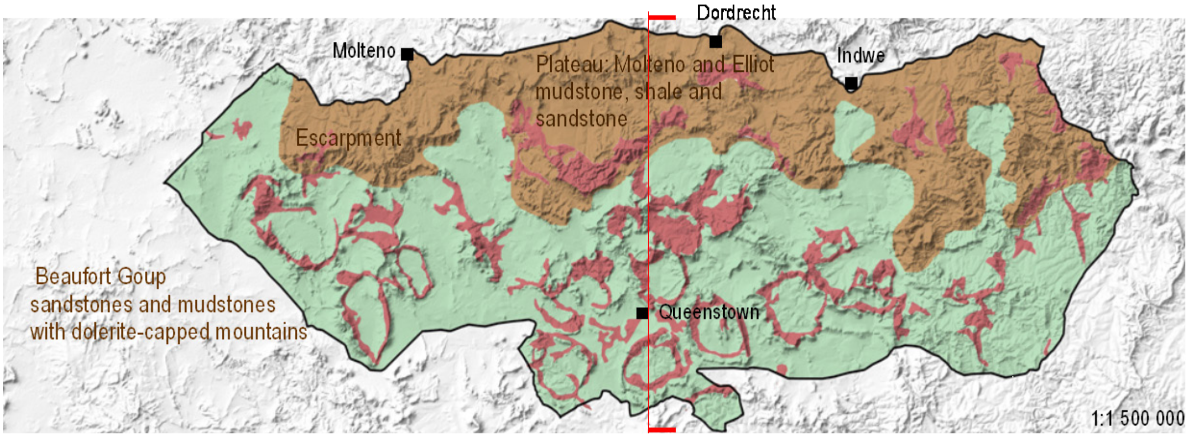
Prominent sandstone and dolerite ridges constitute the main scenic features and skylines of the area. The broad valleys of the Great Fish and Koonap Rivers, and their tributaries, provide more contained viewsheds, which are less visually exposed. Historic settlements, such as Grahamstown in the south, and a number of frontier towns on the northern perimeter, have heritage importance. Several scenic passes and poorts occur on the N10, the N2 and the R67 Routes (Ecca Pass). The Addo Elephant National Park lies to the south of the focus area.



Transect through Cookhouse Focus Area 3

1:500 000, Vertical 20x

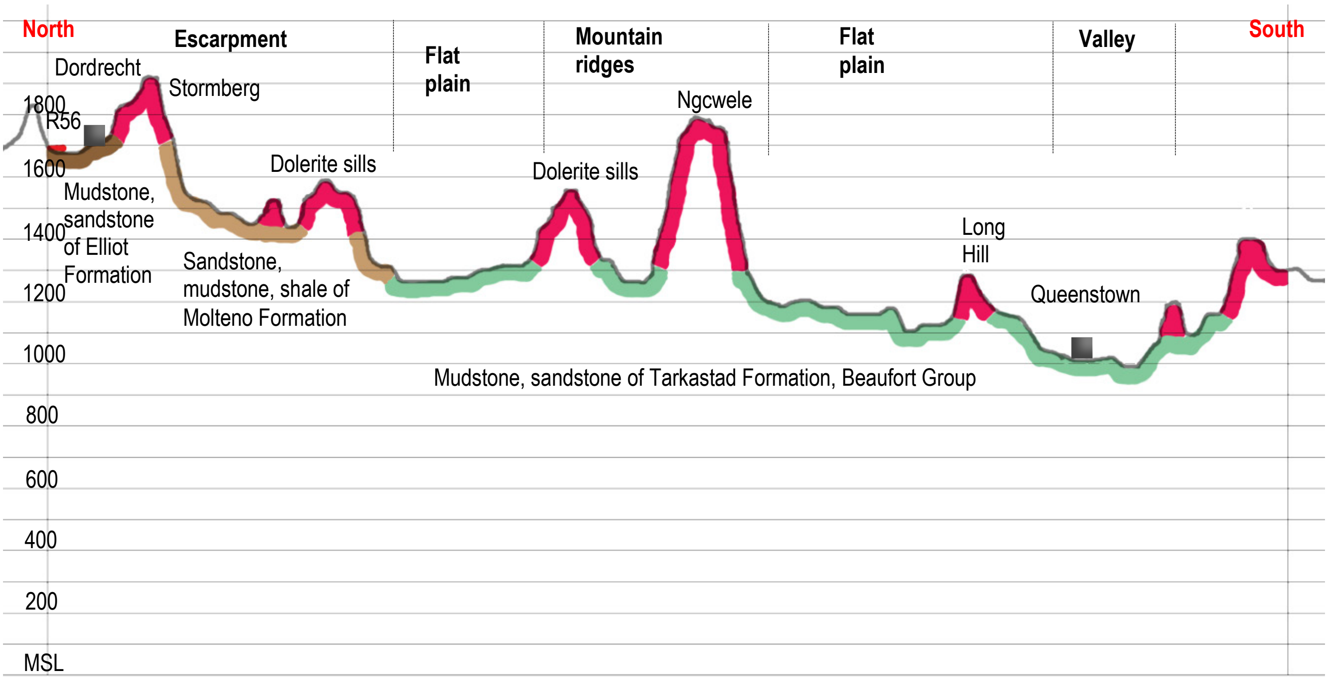
Stormberg Focus Area 4



Regional context: The Stormberg focus area is located in the heart of the Eastern Cape, reaching to the foot of the great Drakensberg range of mountains in the north-east. The eastern portion is a topographically varied landscape with numerous rural settlements peppered across the ridges and valleys. The western portion is flatter, drier and more sparsely populated, and is fringed by the Bamboesberg and Stormsberg ranges forming an escarpment to the north. The N6 traverses the middle of the focus area, with Queenstown as the main town in the south, and Molteno, Dordrecht and Indwe strung along the R56 on the northern perimeter.

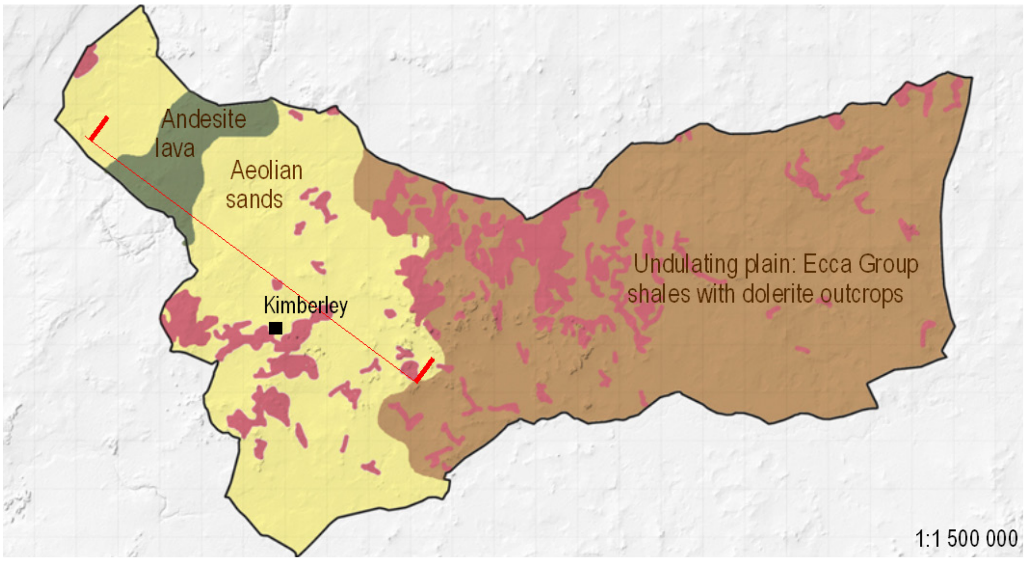
Geomorphology:
The focus area consists of 2 broad landscape types:
1) The alternating mudstones, siltstones and sandstones of the Beaufort Group, responsible for the varied topography of the bulk of the focus area. These are intruded by dolerite sills and dykes forming the distinctive peaks and ridges so typical of the area.
2) The rocks of the Beaufort Group are overlaid to the north by the mudstones, shales and sandstones of the Molteno and Elliot Formations rising up to a plateau. The uppermost Clarens sandstone formation, noted for its cave features, occurs more to the north, with only small patches within the focus area. All of these formations belong to the greater Karoo Sequence.

Landscape features:
The area owes its scenery mainly to the doleritic landforms – plateaux, mesas and ridges with steep cliff faces, usually on one side. In places the dolerite sills have become dish-shaped, forming ring-like outcrops clearly visible on the topographic map in the southern portion of the focus area. The more resistant sandstones of the Molteno Formation tend to form plateau areas to the north, where vleis, or tarns, often occur on the impermeable substrate. A patchwork of small coal mines, most of which have been abandoned, also occur in the Molteno Formation coal beds. The doleritic landforms and scarp faces, as well as the numerous passes and poorts have great scenic value, and views towards the Drakensberg Mountains in the north-east, notably from the R56 Route, are impressive, particularly with winter snow.



Transect through Stormberg Focus Area 4

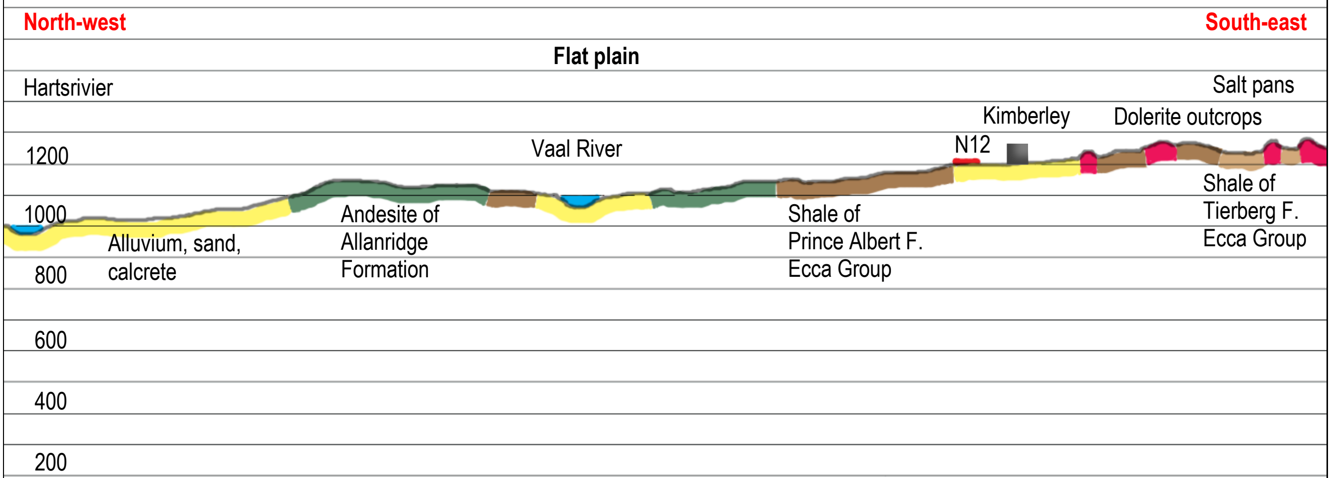
Kimberley Focus Area 5



Regional context:
The Kimberley focus area straddles the boundary between the Northern Cape and the Free State, forming part of Griqualand West, an area of grass and scrub steppe. The area is a relatively flat to gently undulating plain at about 1200m above sea level. The N12 National Road passes roughly through the middle of the focus area at Kimberley, while the larger city of Bloemfontein lies some 150km to the south-east on the N8 National Road.

Geomorphology:
The focus area consists of 3 broad landscape types: 1) The eastern portion composed of shales of the Ecca Group, intruded in places by dolerite. Patches of hardpan calcrete result in the characteristic salt pans of this area. 2) The western portion includes andesite lavas of the Ventersdorp Supergroup. 3) Much of the area is covered by a layer of aeolian sands. Diamond prospecting and mining are prevalent in the area, particularly along the terraces of the Vaal River, the diamonds originating from the Kimberlite pipes and dykes.

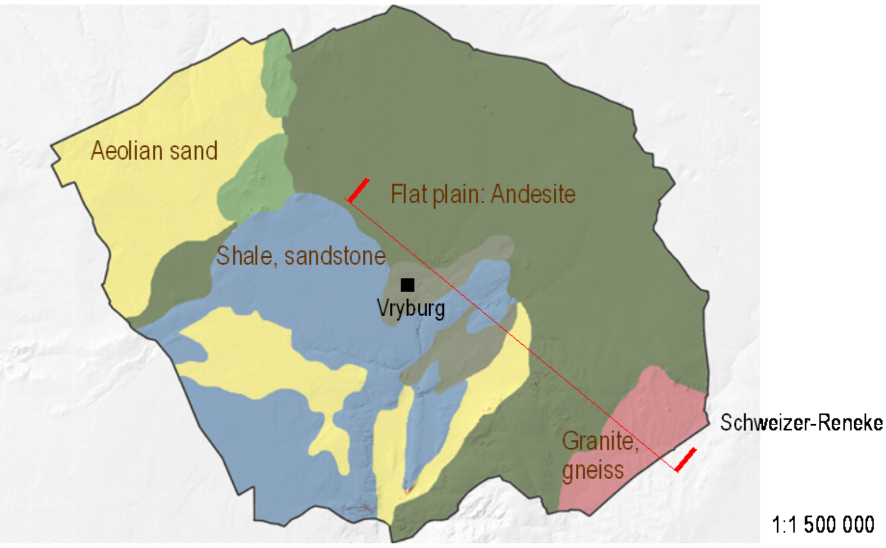
Landscape features:
Except for the dolerite outcrops there are few topographic features in the expansive landscape. The minimal topography and visual enclosure means that any development is visible for long distances. In the east the salt pans are a characteristic feature in an area where other drainage features are absent. In the west the Vaal River is an important landscape feature. The N12, N8, R31 and R64 Routes are important arterials and visual corridors. Kimberley is considered an important historical diamond mining town.



Transect through Kimberley Focus Area 5

1:500 000, Vertical 20x

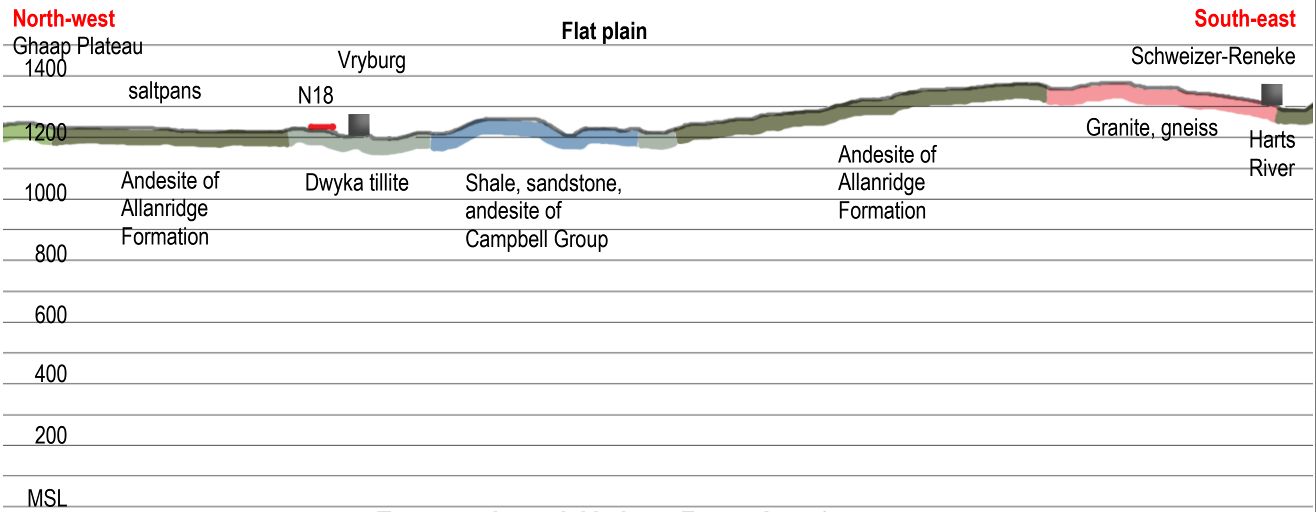
Vryburg Focus Area 6



Regional context:
The Vryburg focus area lies in the flat and expansive heart of the Free State Province at 1200-1300m elevation - an area of dry winters and summer thunderstorms. Routes from Vryburg, in the centre of the focus area, spread out like spokes of a wagon wheel, notably the N14 towards Gauteng, and the N18 to Mafikeng in the north-east and Kimberley in the south.

Geomorphology:
The focus area consists of several landscape types. Most of the northern and eastern portions of the focus area are composed of andesite lavas of the Ventersdorp Supergroup, as well as more resistant granite and gneiss. The south-western quadrant contains shales, sandstones, dolomite and andesite of the Griqualand West Sequence. Areas to the west and north-west are covered by more recent sand and limestone of the Kalahari Group.

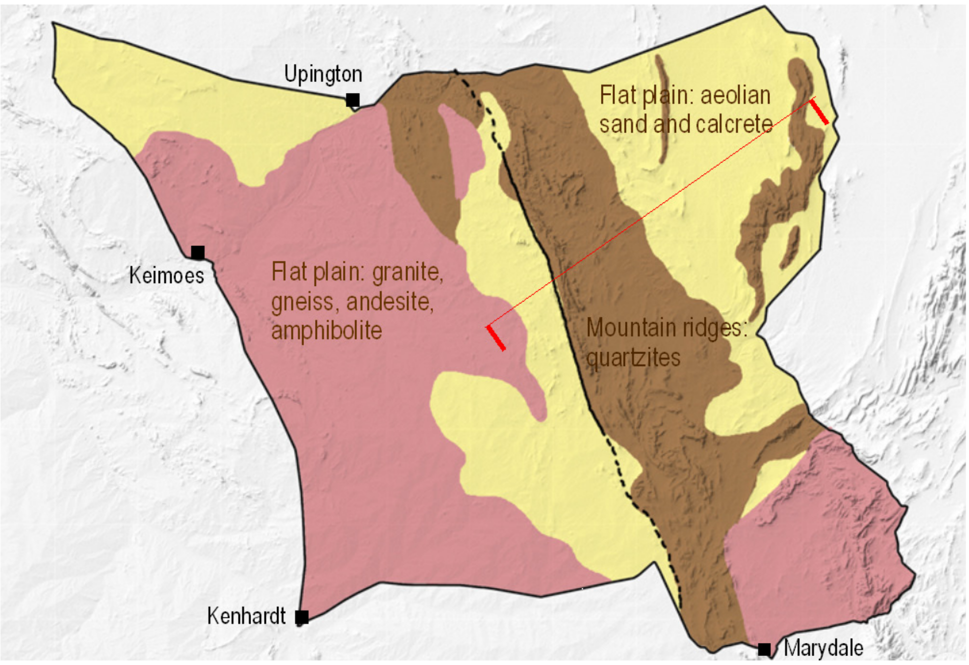
Landscape features:
The blue cosmic sky and broad horizons are as much a feature of the Free State landscape as the subdued topography. Salt pans, which dot the area, and 'fonteine' are important features in the dry landscape with its generally ephemeral drainage courses. The Leon Taljaard Nature Reserve lies outside Vryburg.



Transect through Vryburg Focus Area 6

1:500 000, Vertical 20x

Upington Focus Area 7

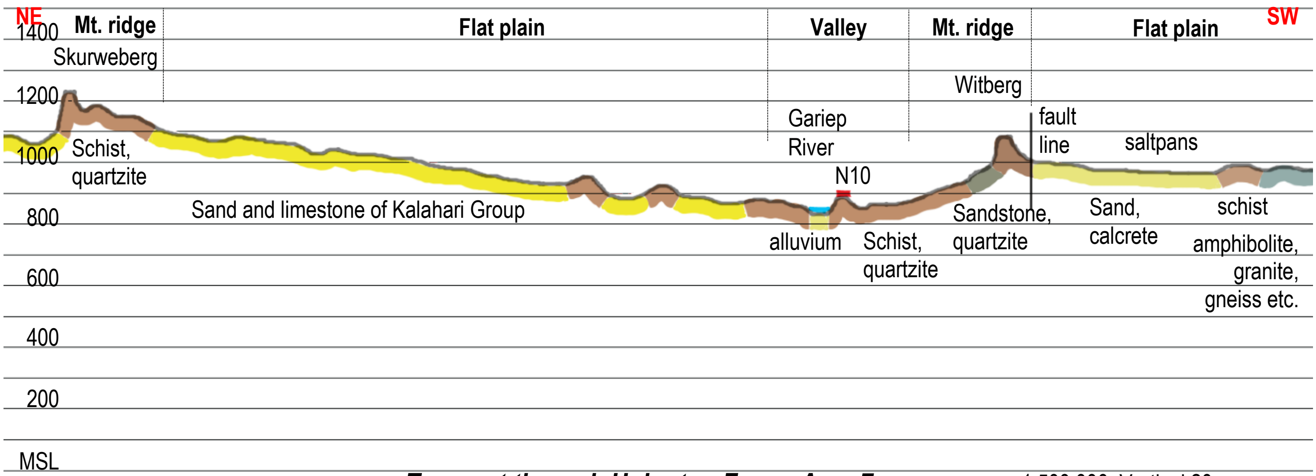


1:1 500 000

Regional context:
The Upington focus area is located in the Northern Cape Province on the Gariep River (Orange River), the elevation ranging from 800m in the river valley to 1000m on the plateau, and reaching 1200m on the low mountains. Upington, the main town in the focus area, has become something of a solar energy centre in the country. The N10 and the N14 National Roads, which cross each other at Upington, follow the Gariep River in places.

Geomorphology:
The focus area consists of several landscape types. The relatively flat landscape belies the complex geology below the surface. A fault line runs down the middle dividing the focus area into two broad geological types – granite, gneiss, andesite and amphibolite in the western portion, and schist, quartzite and sandstone in the eastern portion, the hard quartzites forming the low mountain ridges, such as the Skurweberg and Witberg. However much of the area is covered by a layer of sand interspersed with calcrete or limestone. Reddish longitudinal sand dunes, running in a NW-SE direction, are a characteristic feature of these areas. To the west of Upington, on the northern banks of the river are gneiss and dark amphibolite rock outcrop features.

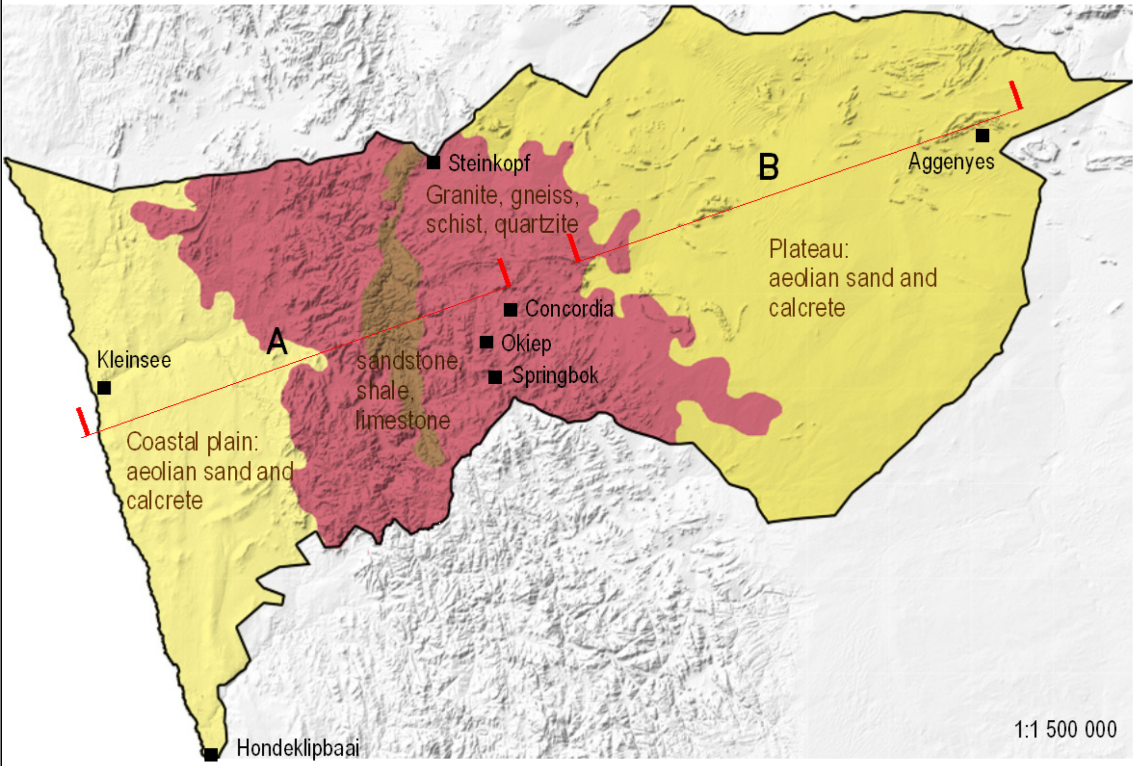
Landscape features:
The broken ridgelines of the Skurweberg, the Witberg (white quartzites) and Bakensberg provide some of the few topographic features in the area, and are therefore visually sensitive. The Gariep River and its associated floodplain creates a linear green oasis in a dry land, providing the main landscape feature of the focus area. Vineyards are cultivated along this narrow belt, irrigated from the river by a system of canals. Between Upington and Keimoes the river splits into a labyrinth of channels and islands, many of which are linked by footbridges. Smaller features of interest in the area include the salt pans, the red dunes and the granite / gneiss rock outcrops. The N10 and N14 are important visual corridors, particularly where these follow the Gariep River.



Transect through Upington Focus Area 7

1:500 000, Vertical 20x

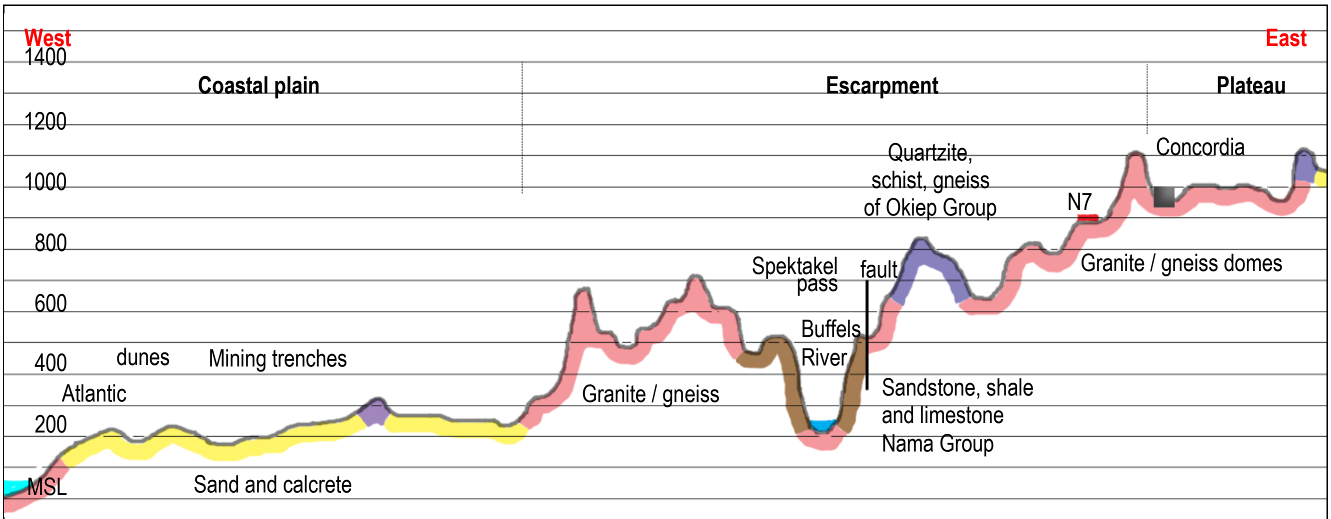
Springbok Focus Area 8



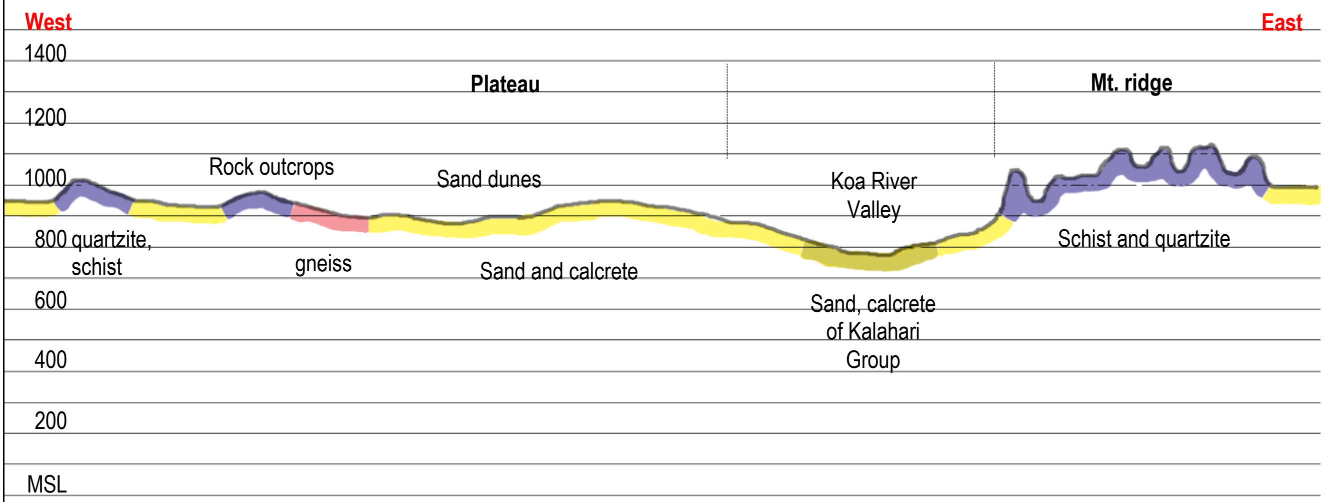
Regional context:
The Springbok focus area is located in the Northern Cape Province some 50km south of the Gariep River (Orange River), bordering on the Richtersveld to the north and the Atlantic to the west. The elevation ranges from about 200m on the coastal plain to 1000m on the plateau to the east. The main towns are Springbok and Steinkopf on the N7 National Road, which links the Western Cape with Namibia to the north. Nababeep, Okiep and Concordia are historic copper mining towns, which together with Springbok, is the oldest mining district in South Africa. (With reserves dwindling, the mines are now being closed down after more than 150 years of mining). Kleinzee and Hondeklipbaai are recreational settlements at the coast.

Geomorphology:
As in the case of the Upington area, the Namakwa focus area is underlain by large domes of granite and gneiss, which have been eroded along the escarpment edge to form an intensely rugged topography. Predictably, the most pronounced and scenic topography is provided by the more resistant quartzitic, gneiss and schist rocks belonging here to the Okiep Group. A north-south fault line to the east of the N7 defines an area of flat-topped sedimentary sandstone, shale and limestone overlaid on the granite. On the coastal plain and on the plateau the rocks are mostly hidden by more recent sands of aeolian and alluvial origin, interspersed with calcrete.

Landscape features:
The coastal zone is of scenic and archaeological importance, and although the coastal plain is generally flat, there are a number of dune features and rock outcrops. The area has been intensively mined in the past for diamonds and many of the open cast trenches remain. The rugged mountainous escarpment further inland, consists of granite and gneiss domes, giving the area its distinctive scenery. The deeply incised landscape has visually sensitive ridgelines, and includes a number of scenic passes and poorts, such as the Spektakel Pass. The flat plateau to the east is larger in scale and visually expansive, interspersed here and there by hilly outcrops of quartzite and schist, such as the Aggeneysberg, adding interest to a relentless landscape. The broad dry Koa valley to the west of Aggeneys is an ancient course of the Gariep River (Orange River). The Goegap Nature Reserve to the east of Springbok occupies mountainous terrain and would therefore be visually sensitve for some distance. The Namaqua National Park is located on the southern boundary of the focus area.



Transect A through Springbok Focus Area 8 1:500 000, Vertical 20x



Transect B through Springbok Focus Area 8 1:500 000, Vertical 20x

3 ABSOLUTE SENSITIVITY MAPPING

3.1 Identification of absolute sensitivity criteria (visual)

This section provides indicators for sensitive landscape features in two separate (wind and solar PV) absolute sensitivity maps for each study area. (See Maps 1.1 to 8.1 below).

The criteria for determining absolute sensitivity were partly based on those from PGWC (2006)[4]. (See also Appendix A). However the fact that wind turbines have increased in size in recent years needs to be taken into account. Criteria and sensitivity indices from the Strategic Environmental Framework (SEF) for wind farms were also noted[5]. A wide range of international sources dealing with wind farm buffers were examined, such as those from Scotland and elsewhere[6].

The draft report by the PGWC (2006) indicates the following:

A. Commercial Wind Energy development should be excluded from:

- Areas of high aesthetic landscape value, particularly national parks and provincial nature reserves and other wilderness areas: and
- Areas where technical and safety considerations apply.

B. Wind energy should be encouraged:

- At strategic locations identified in a Regional Wind Plan (RWP) to be prepared by the relevant planning authority;
- Where they are well located in terms of visual impact, technical and safety criteria and landscape, environmental and planning criteria;
- In appropriate urban and industrial “brownfield” sites;
- Where visual disturbance to the landscape has already occurred (e.g. power transmission lines); and
- At the local scale where energy facilities could provide power to small users.

The criteria established in this section are similar for all the focus areas, although local conditions and viewsheds needed to be taken into account when determining buffers for each area. The recommended buffers should be seen as nominal for SEA mapping purposes and subject to local viewsheds and micro-siting considerations.

Key features and criteria are given below in Table 3.1 for wind energy, and Table 3.2 for solar PV energy.
The criteria involving ridgelines, scarps, prominent elevations and geological features were mapped using topographical and geological maps and were based partly on interpretation and synthesis of these features by the visual specialists.

[4] Provincial Government of the Western Cape and CNdV, 2006. A Strategic Initiative to Introduce Commercial and Land Based Wind Energy Development to the Western Cape.
[5] Environomics and MetroGIS, 2011. Strategic Environmental Framework for the Optimal Location of Wind Farms in the Coastal Provinces of South Africa. Prepared for DEA and GIZ.
[6] Scottish Natural Heritage, Dec. 2009. Siting and Designing Wind farms in the Landscape. www.snh.org.uk

Table 3.1 Wind Energy Criteria

Description of feature/ criteria	Source	Very high sensitivity	Sensitive	Mod. sensitive	Focus areas	Map
Landscape/ Scenic Features						
Ridgelines / scarps/ prominent elevations/ geological features	1:500 000 topo map	500m [1]	-	-	All	
Steep slopes	SRTM DEM data	>1:4	1:4 1:10	-	All	
Major rivers/ water bodies	1:500 000 topo map	1 km [2]	-	-	1, 3, 4, 5, 6, 7, 8	
Perennial rivers	SANBI-NFEPA	-	250m	500m		
Wetlands						
Ramsar Sites	SAPAD 2014	5km	10km	15km	1 (buffer)	
Coastal zone	NGI shapefiles	1 km [3]	2 km	4 km	8	
Protected Areas/ Heritage Features/ Sensitive Receptors						
National Parks	SAPAD 2014	5km [4]	10km (within viewshed)	15km (within viewshed)	1, 3b, 5b, 8b	
Protected landscapes/ nature reserves/ botanical gardens	SAPAD 2014	3km [4]	5km (within viewshed)	10km (within viewshed)	1, 2, 3b, 4, 6, 8	
Private reserves/ game farms	SAPAD 2014 and Google Maps Eastern Cape Protected Areas Expansion Strategy - 2012 North West Game Farm layer	2km	5km (within viewshed)	7km (within viewshed)	1b, 2, 3, 4, 6, 7b	
Cultural/ rural landscapes	Heritage specialists	As demarcated	500m[5] (within viewshed)	1km (within viewshed)	1, 2, 3, 4, 6, 7, 8	
South African Large Telescope (SALT)	1:500 000 topo map 25 km radius	Viewshed as shown	-	-	2	
Heritage/ archaeological sites/ battle sites/ cemeteries	Heritage Specialists	As demarcated	500m[5] (within viewshed)	1km (within viewshed)	All	
Towns/ villages/ settlements	AfriGIS 2013 SG.towns	2 km [6]	4 km [6]	6 km [6]	All	
National roads	NGI	1 km	3 km [8]	5 km [8]	All	
Provincial/ arterial routes	NGI	1 km	-	3 km [8]	All	
Scenic routes/ passes/ poorts	1:500 000 topo map	1 km	3 km [8]	5 km [8]	1, 2, 3, 4, 8	
Passenger rail lines	NGI	1 km	3 km [8]	5 km [8]	1,2b,3,4,5,6,7	

[1] The distance could vary at the micro-siting stage depending on site- specific conditions.

[2] Where minor rivers, wetlands and pans have scenic value, buffers should be applied in the micro-siting.

[3] The 1km setback is based on Integrated Coastal Management Act. Could be more on scenic or pristine coastlines depending on viewsheds.

[4] Development within 10 km of National Parks and 5 km of Protected Areas requires authorisation in terms of NEMA.

[5] Buffer depends on the type of heritage resource and needs to be determined by a heritage specialist.

[6] Excludes rural kraals.

[7] Not included in landscape mapping.

[8] Buffers should be related to viewsheds.

Table 3.2 Solar PV Criteria

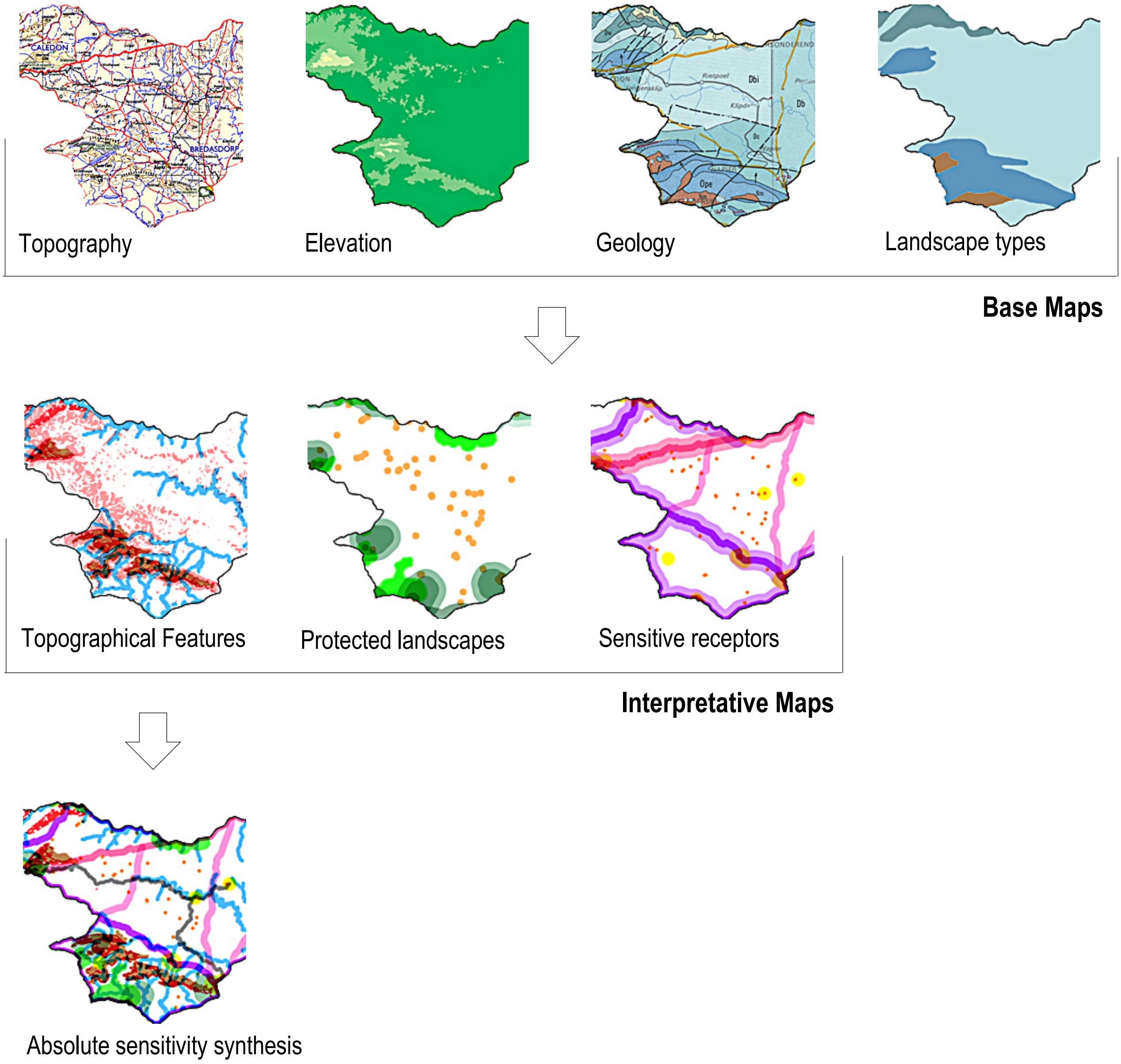
Description of feature/ criteria	Source	Very high sensitivity	Sensitive	Mod. sensitive	Focus areas	Map
Landscape/ Scenic Features						
Ridgelines / scarps/ prominent elevations/ geological features	1:500 000 topo map	250 m [1]	-	-	All	
Steep slopes	SRTM DEM	>1:4	1:4 1:10	-	All	
Major rivers/ water bodies	1:500 000 topo map	1 km	-	-	1, 3, 4, 5, 6, 7, 8	
Perennial rivers/ Wetlands [2]	SANBI-NFEPA	-	250 m	500 m		
Ramsar Sites	SAPAD 2014	2.5 km	5 km	7.5 km	1b (buffer)	
Coastal zone	NGI shapefiles	1 km [3]	2 km	4 km	8	
Protected Areas/ Heritage Features/ Sensitive Receptors						
National Parks	SAPAD 2014	2.5 km [4]	5 km (within viewshed)	7.5 km (within viewshed)	1, 3b, 5b, 8b	
Protected landscapes/ nature reserves/ botanical gardens	SAPAD 2014	1.5 km [4]	3 km (within viewshed)	5 km (within viewshed)	1, 2, 3b, 4, 6, 8	
Private reserves/ game farms	SAPAD 2014 and Google Maps Eastern Cape Protected Areas Expansion Strategy - 2012 North West Game Farm layer	1 km	2 km (within viewshed)	3 km (within viewshed)	1b, 2, 3, 4, 6, 7b	
Cultural/ rural landscapes	Heritage specialists	As demarcated	500 m (within viewshed) [5]	1 km (within viewshed) [5]	1, 2, 3, 4, 6, 7, 8	
South African Large Telescope (SALT)	1:500 000 topo map 25 km radius	Viewshed as shown	-	-	2	
Heritage/ archaeological sites/ battle sites/ cemeteries	Heritage specialists	As demarcated	500m (within viewshed) [5]	1km (within viewshed) [5]	All	
Towns/ villages/ settlements	AfriGIS 2013 SG.towns	500m [6]	1 km [6]	2 km [6]	All	
National roads	NGI	500m	1 km [8]	2 km [8]	All	
Provincial/ arterial routes	NGI	250m	-	1 km [8]	All	
Scenic routes/ passes/ poorts	1:500 000 topo map	500m	1 km [8]	2 km [8]	1, 2, 3, 4, 8	
Passenger rail lines	NGI	500m	1 km [8]	2 km [8]	1,2b,3,4,5,6,7	

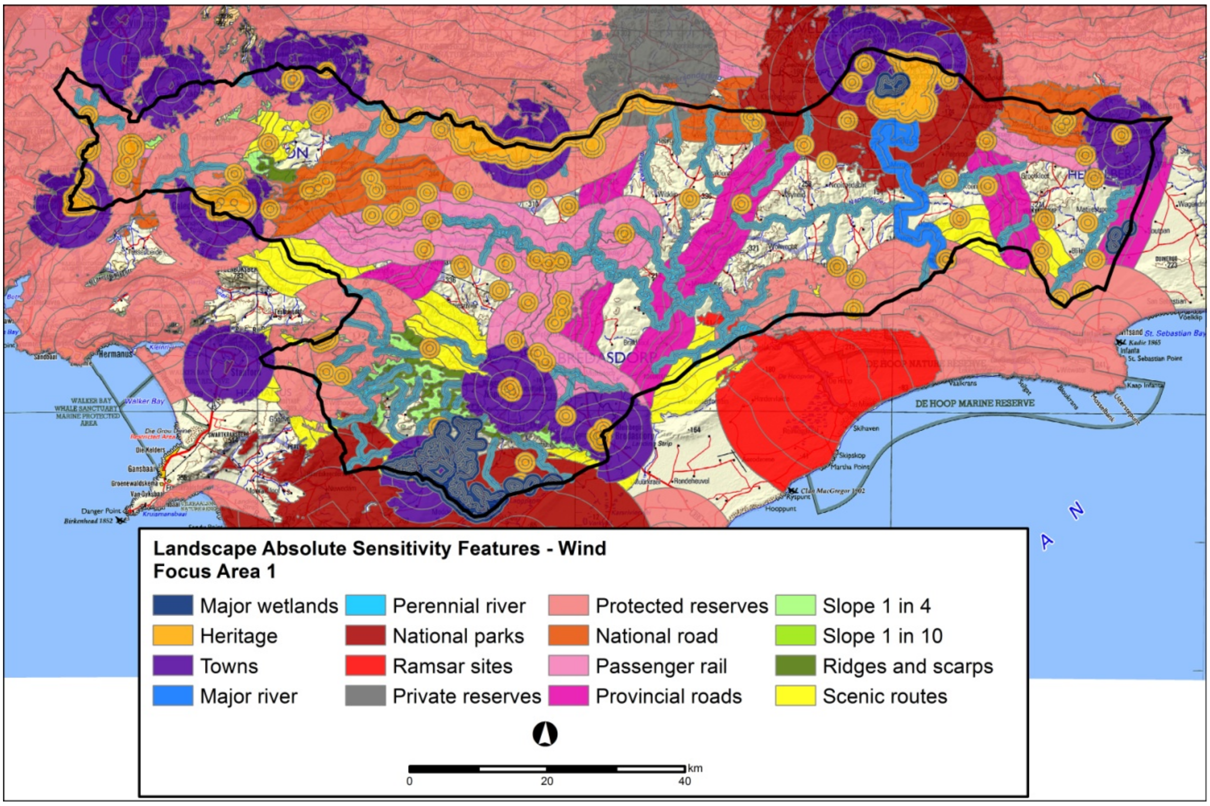
[1] The distance could vary at the micro-siting stage depending on site- specific conditions.
[2] Where minor rivers and tributaries have not been indicated, buffers should be applied in the micro-siting.
[3] Based on Integrated Coastal Management Act. Could be more on scenic or pristine coastlines depending on viewsheds.
[4] Development within 10 km of National Parks and 5 km of Protected Areas requires authorisation in terms of NEMA.
[5] Buffers depend on the type of heritage resource and need to be determined by a heritage specialist.
[6] Excludes rural kraals.
[7] Not included in landscape mapping.
[8] Buffers should be related to viewsheds.

3.2 Absolute sensitivity maps

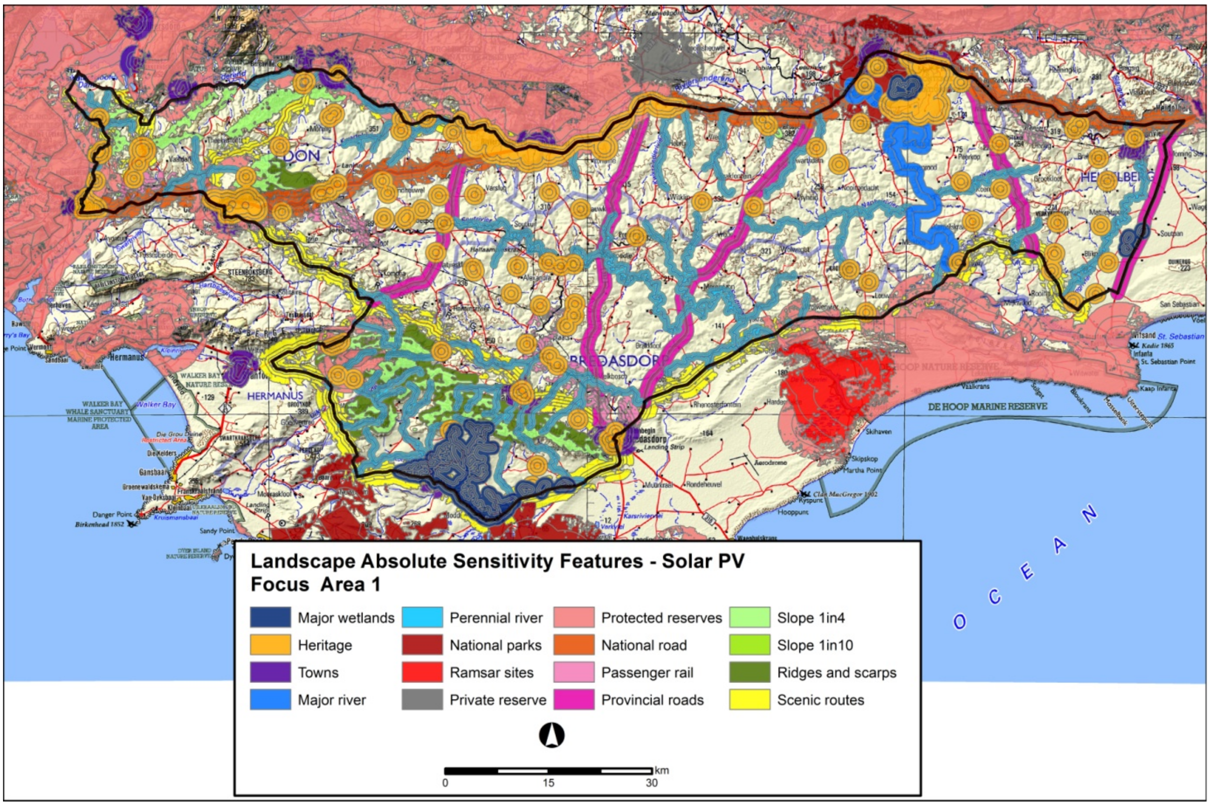
Separate absolute sensitivity maps (for wind and solar PV), for each focus area are attached. (Maps 1.1 to 8.1). The layers making up these maps are illustrated in Figure 3 Below.

Figure 3 Sensitivity mapping layers

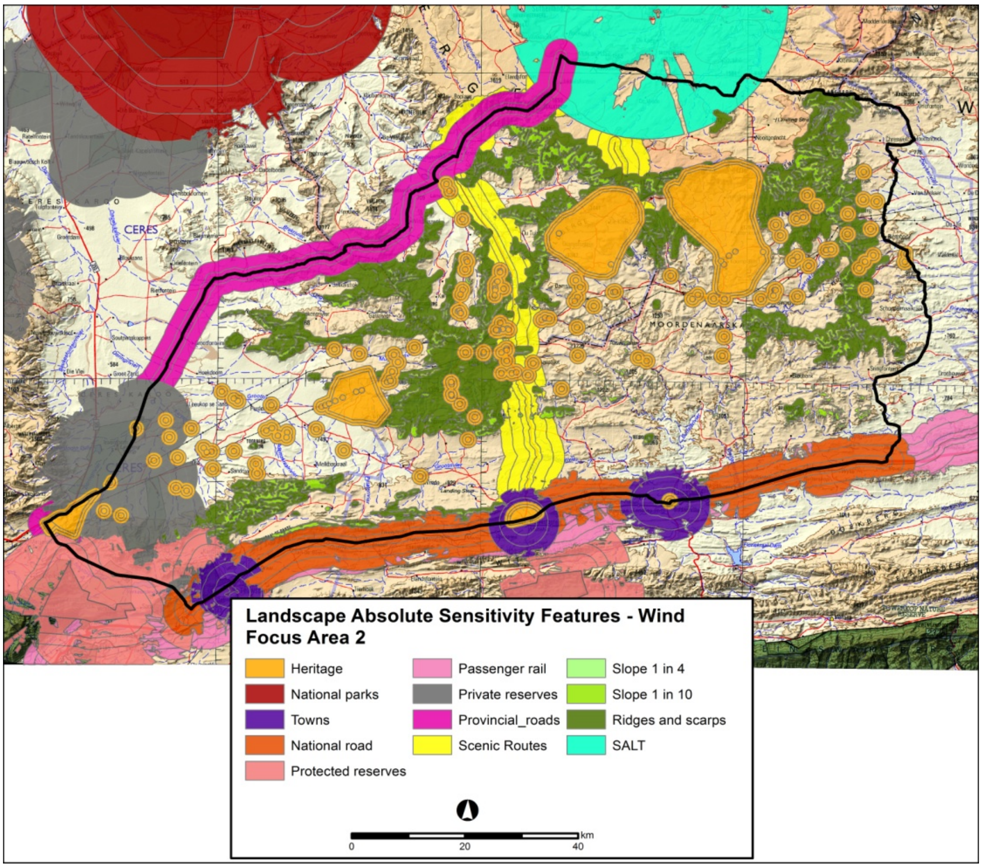




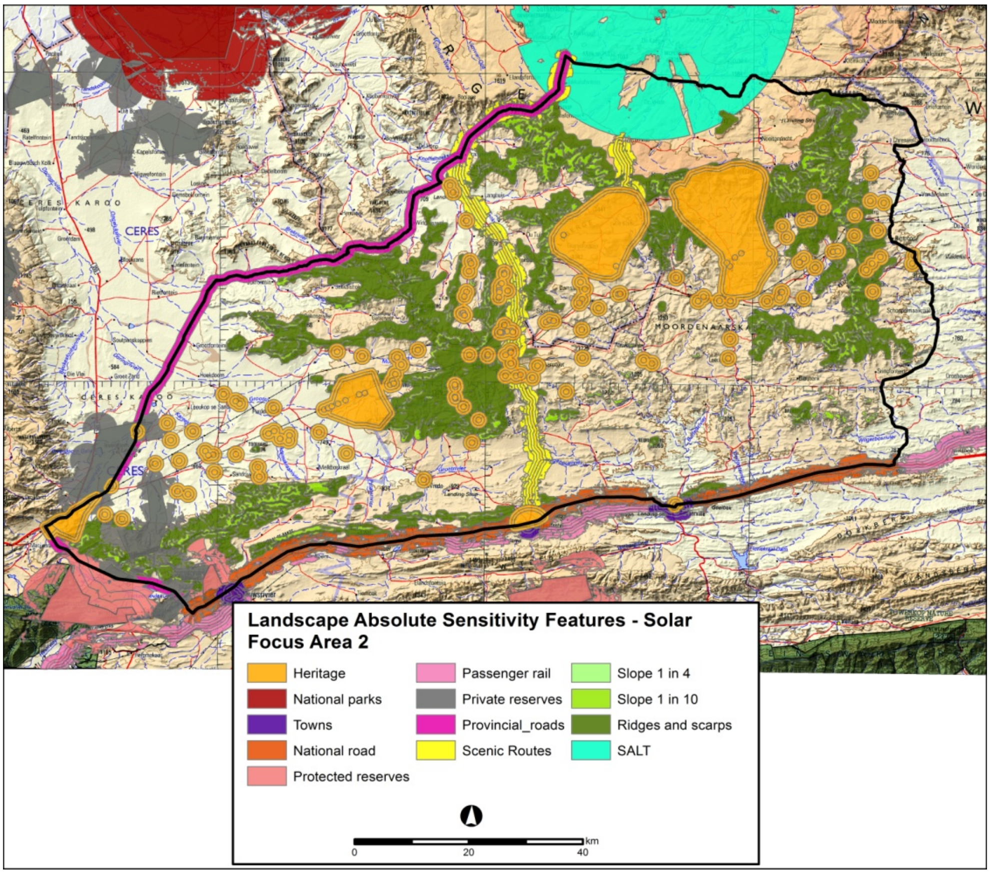
Map 1.1W : Overberg Focus Area 1 • Absolute Sensitivity WIND



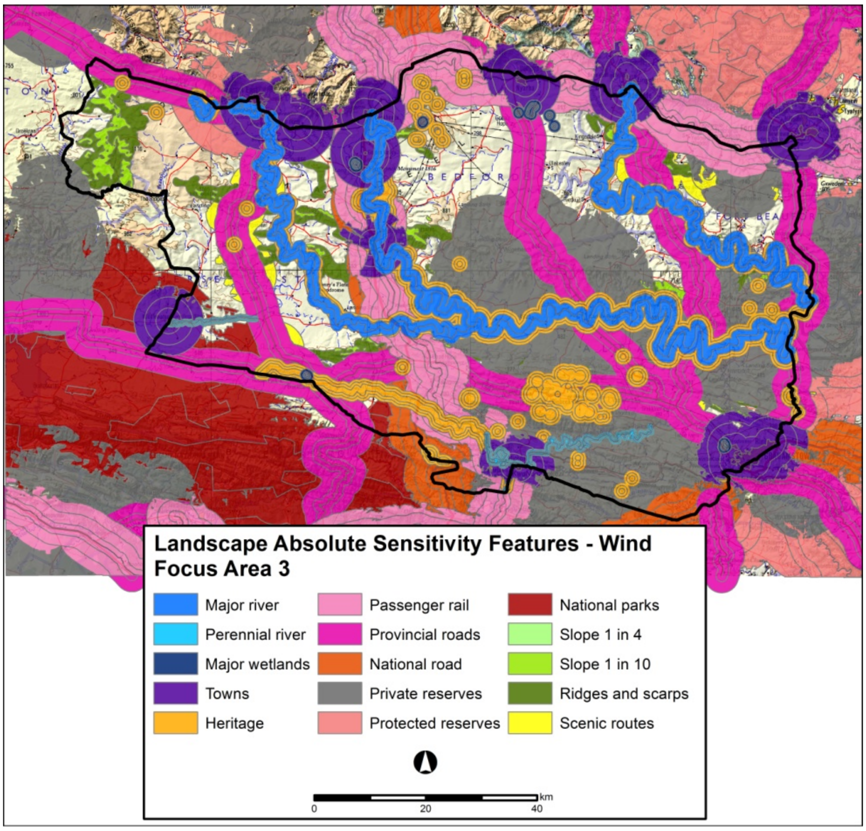
Map 1.1S : Overberg Focus Area 1 • Absolute Sensitivity SOLAR PV



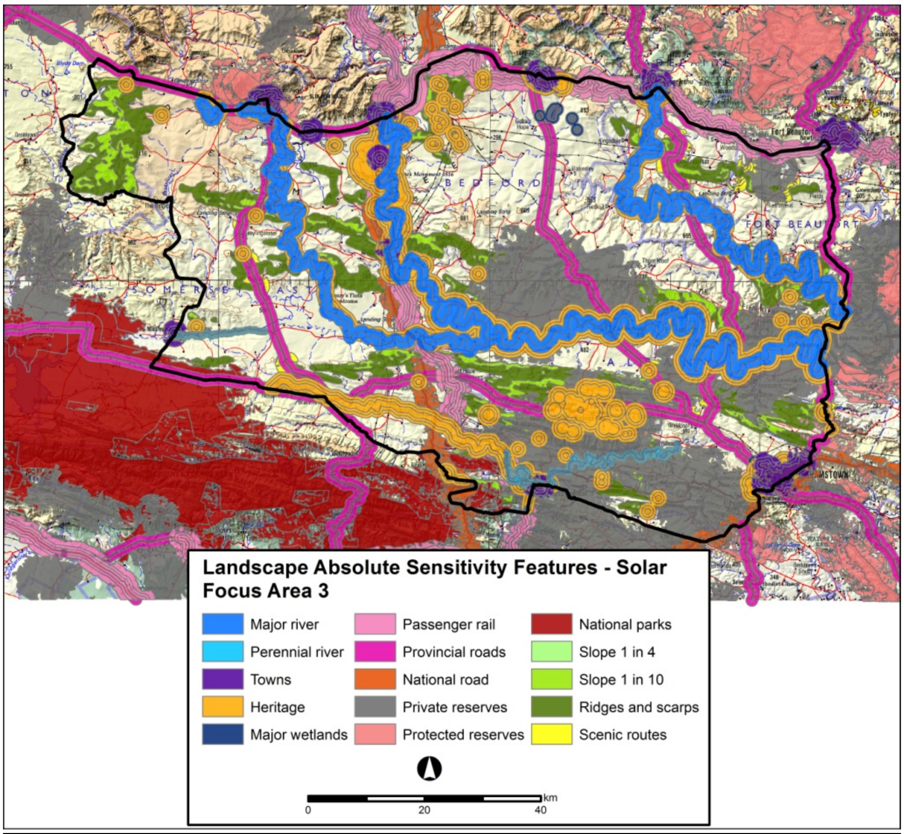
Map 2.1W : Komsberg Focus Area 2 • Absolute Sensitivity WIND



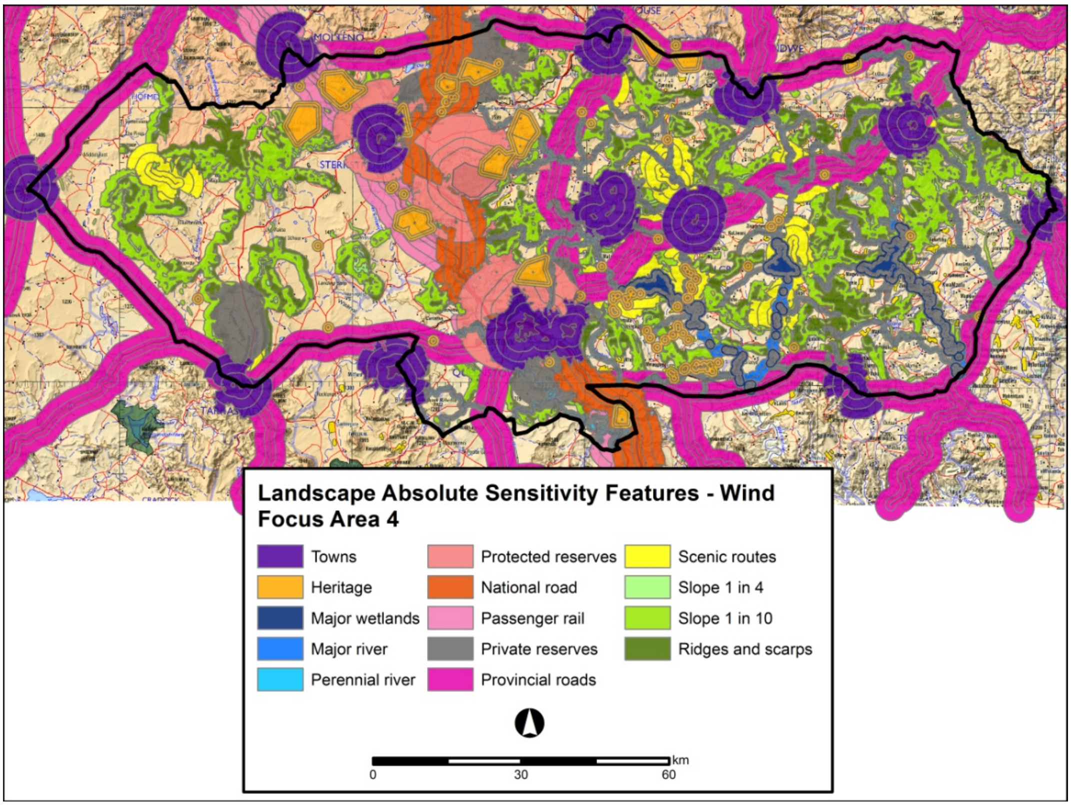
Map 2.1S : Komsberg Focus Area 2 • Absolute Sensitivity SOLAR



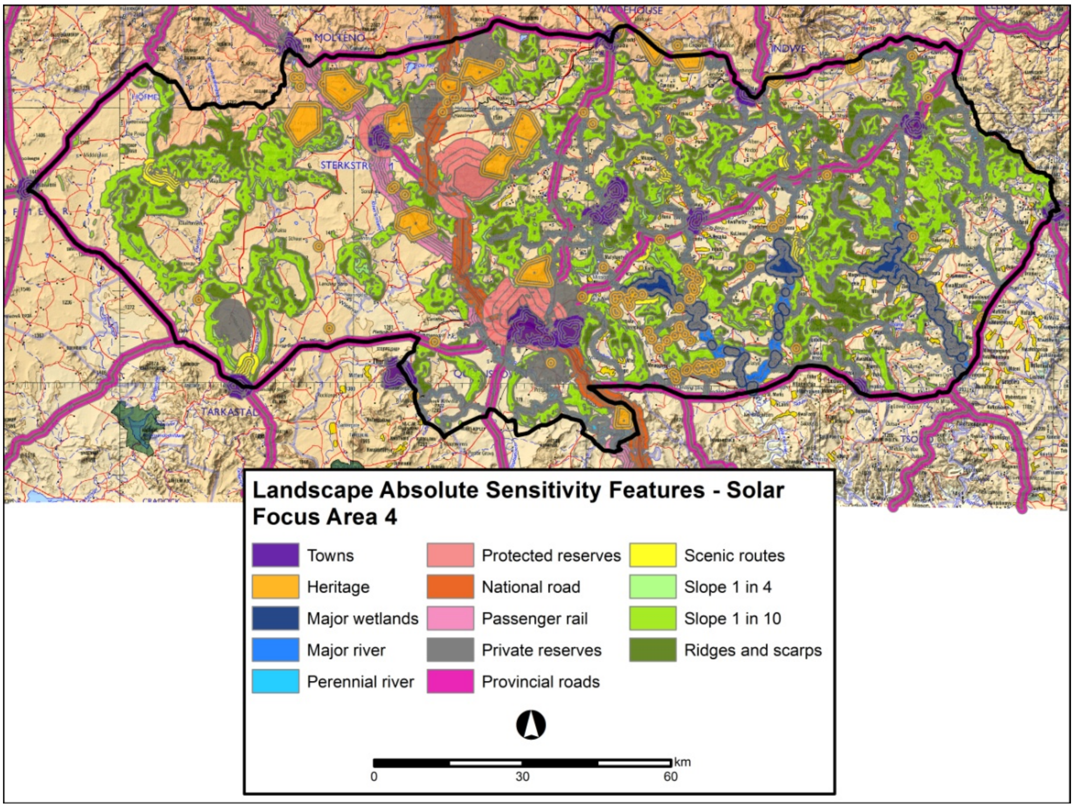
Map 3.1W : Cookhouse Focus Area 3 • Absolute Sensitivity WIND



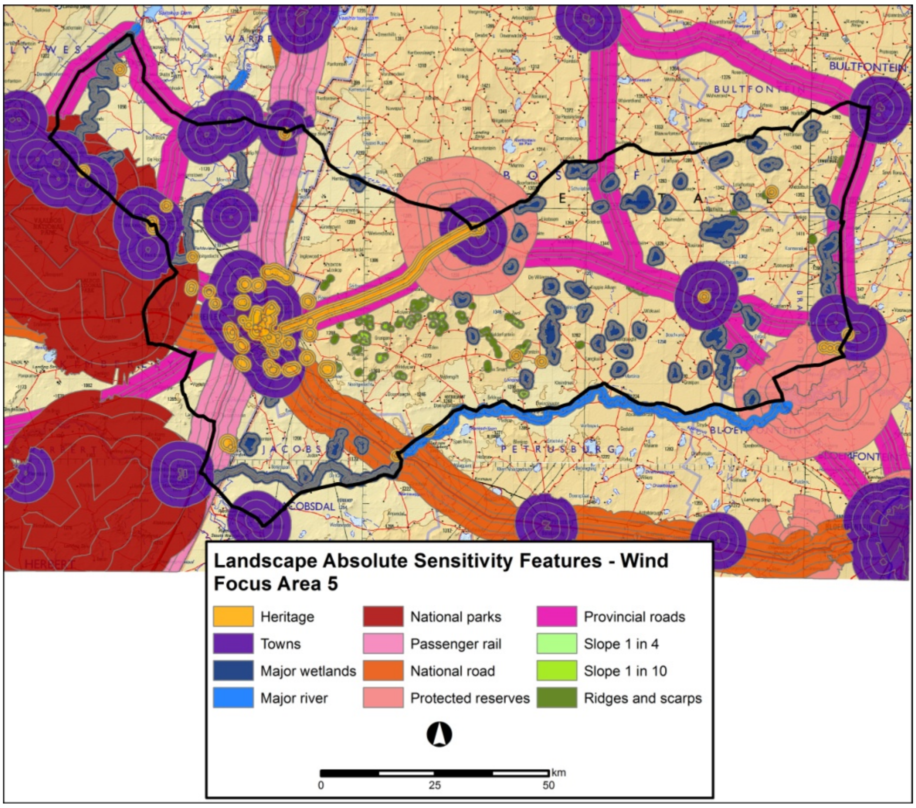
Map 3.1S : Cookhouse Focus Area 3 • Absolute Sensitivity SOLAR



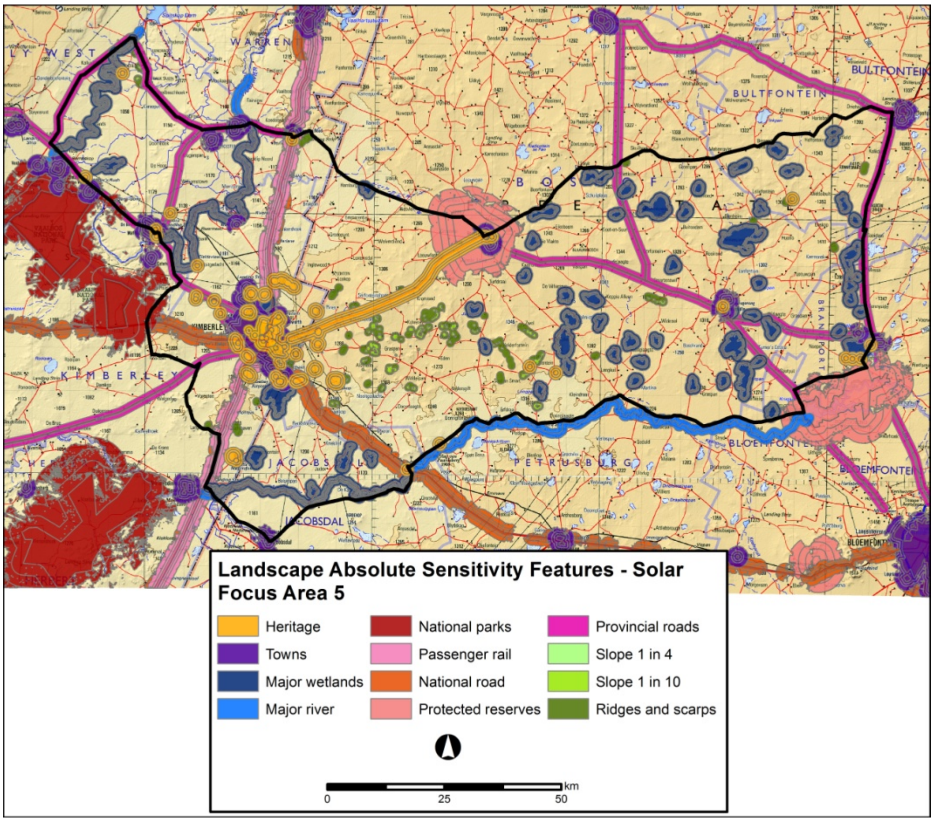
Map 4.1W : Stormberg Focus Area 4 • Absolute Sensitivity WIND



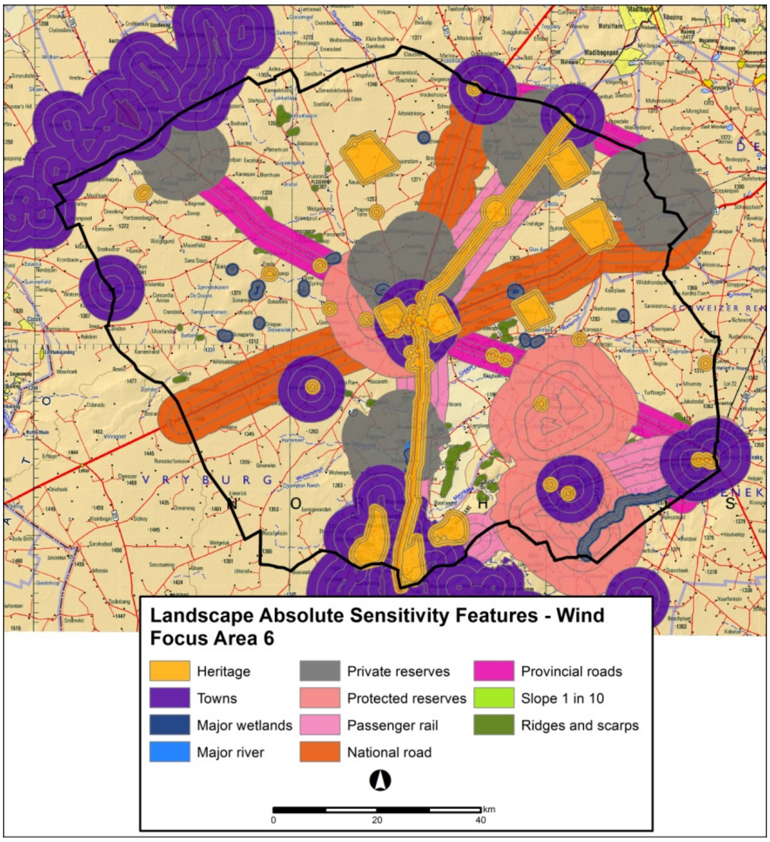
Map 4.1S : Stormberg Focus Area 4 • Absolute Sensitivity SOLAR PV



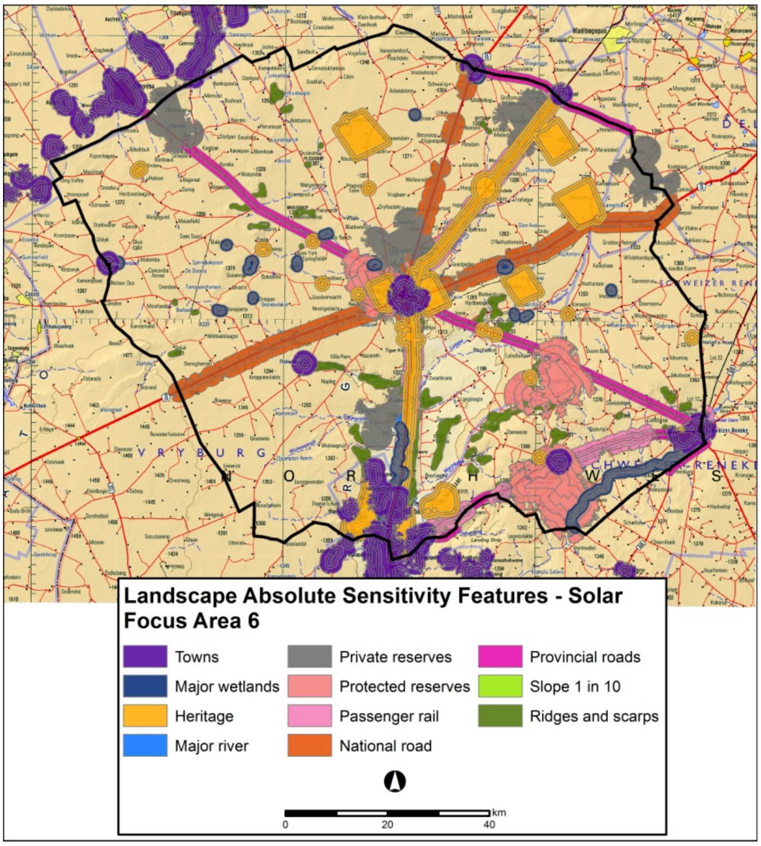
Map 5.1W : Kimberley Focus Area 5 • Absolute Sensitivity WIND



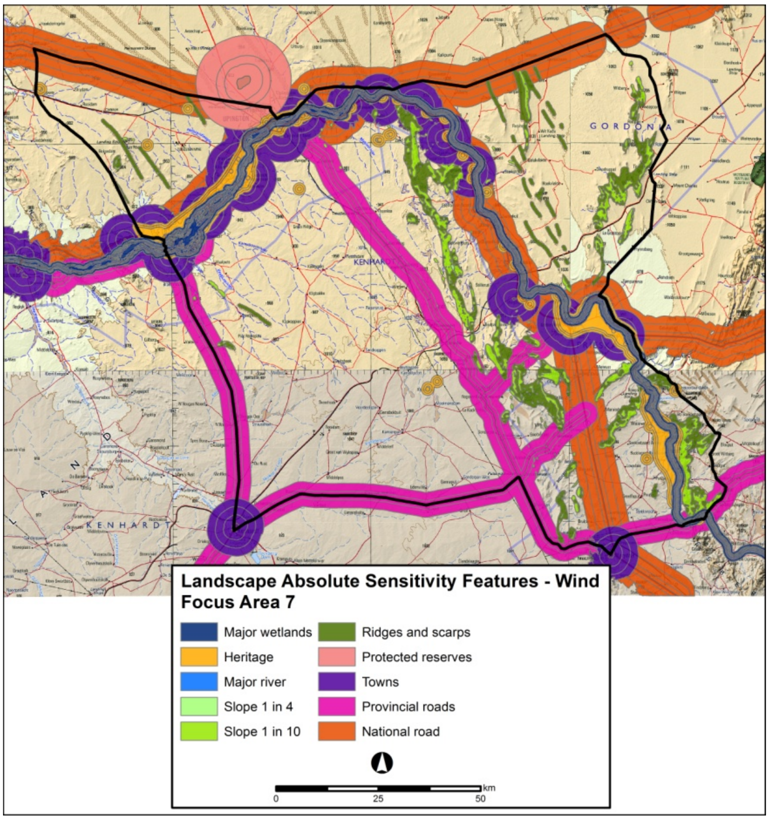
Map 5.1S : Kimberley Focus Area 5 • Absolute Sensitivity SOLAR PV



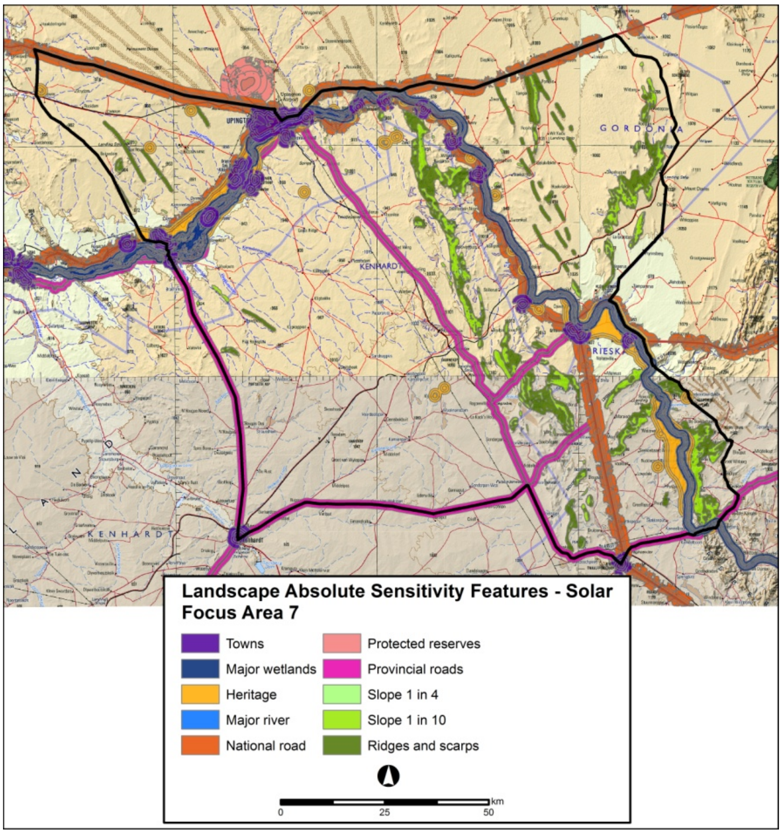
Map 6.1W : Vryburg Focus Area 6 • Absolute Sensitivity WIND



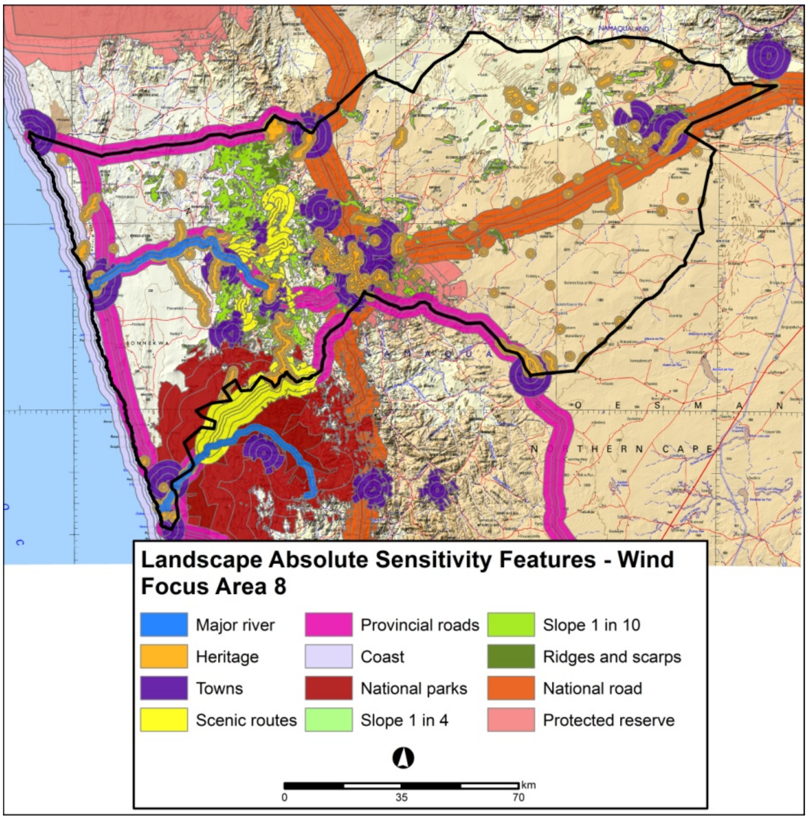
Map 6.1S : Vryburg Focus Area 6 • Absolute Sensitivity SOLAR PV



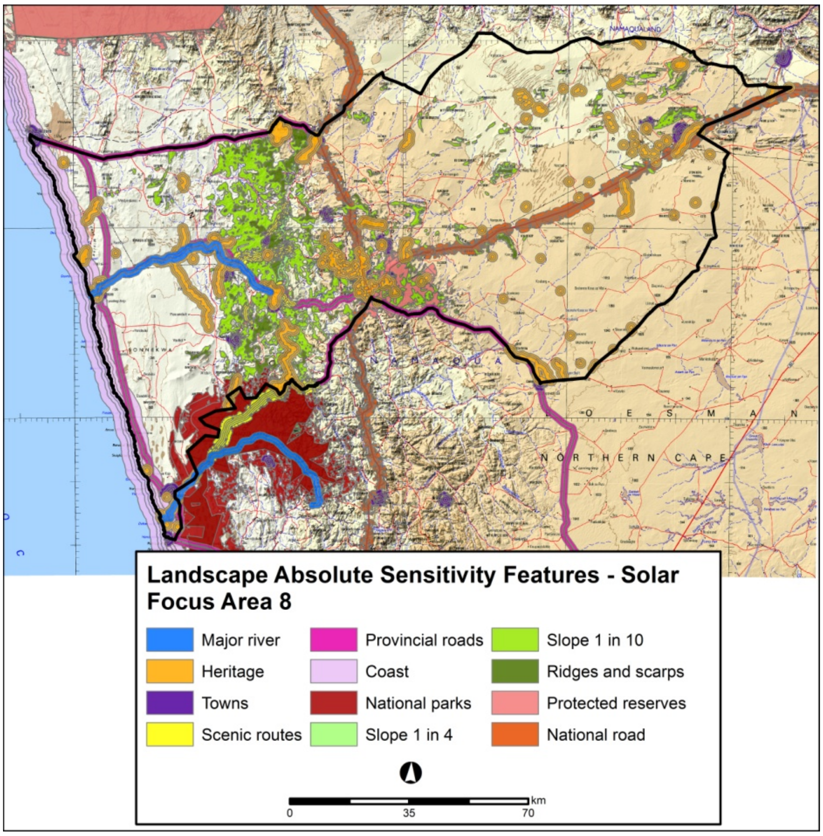
Map 7.1W : Upington Focus Area 7 • Absolute Sensitivity WIND



Map 7.1S : Upington Focus Area 7 • Absolute Sensitivity SOLAR PV



Map 8.1W : Springbok Focus Area 8 • Absolute Sensitivity WIND



Map 8.1S : Springbok Focus Area 8 • Absolute Sensitivity SOLAR PV

4 DEVELOPMENT DENSITY LIMIT MAPPING

This section provides an interpretation of the landscape sensitivities listed above to produce two separate (wind and solar PV) development density threshold maps for each study area. (See Maps 1.2 to 8.2 below).

4.1 Criteria for determining development density limits

Criteria as set out in Table 4.1 are an attempt to ensure consistency and enable the process to be duplicated elsewhere. Threshold criteria include the following:

Level 1: *Very high sensitivity areas*

- Visually sensitive or scenically valuable resources, such as skyline ridges and other prominent topographic features, which have been identified as probably not being suited for development owing to their aesthetic or scientific values;
- Protected areas (national parks, nature reserves, botanical or biosphere reserves, private reserves, game farms);
- Cultural landscapes, heritage and archaeological sites; and
- Settlements, scenic routes, tourism facilities and other sensitive receptors.

Level 2: *High sensitivity areas*

- Complex terrain with high topographic variation and landscape dissection, which significantly limits the size of development that is considered suitable in these areas;
- Intimate landscape scale and fine-grain texture of fields etc;
- High level of landscape and scenic constraints; and
- Close proximity of protected areas and sensitive receptors (as listed in Level 1 above).

Level 3: *Medium sensitivity areas*

- Moderately complex terrain with some topographic variation and landscape dissection, which may limit the size of development that is considered suitable in these areas;
- Medium landscape scale and texture;
- Moderate level of landscape and scenic constraints; and
- Intermediate proximity of protected areas and sensitive receptors (as listed in Level 1 above).

Level 4: *Low sensitivity areas*

- Relatively even terrain, flat to gently rolling topography and slopes less steep than 1:10 gradient, which is considered suitable for the largest size development;
- Large, expansive landscape scale and coarse-grain texture;
- Few landscape and scenic constraints; and
- Absence of protected areas and few sensitive receptors (as listed in Level 1 above).

The same criteria apply to both wind and solar PV development, although buffers vary to accommodate the differences in scale between these technologies.

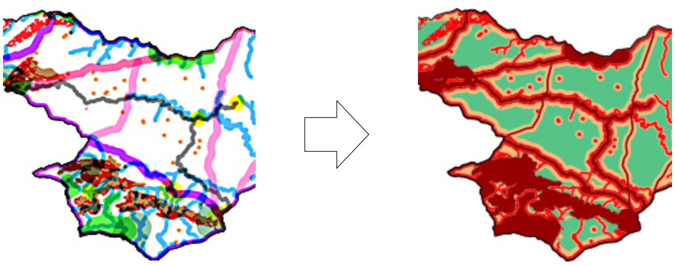
Table 4.1 Development Density Threshold Criteria: Summary

Development density limit	Landscape characteristics
Level 1 Very high sensitivity (dark red on map)	Visually sensitive resources with major visual constraints.
Level 2 High sensitivity areas (red on map)	Complex terrain with high level constraints and close proximity of protected areas / sensitive receptors.
Level 3 Medium sensitivity areas (orange on map)	Moderately complex terrain with moderate level constraints and intermediate proximity of protected areas / sensitive receptors.
Level 4 Low sensitivity areas (green on map)	Relatively even terrain with few constraints and few sensitive receptors.

4.2 Development density limit maps

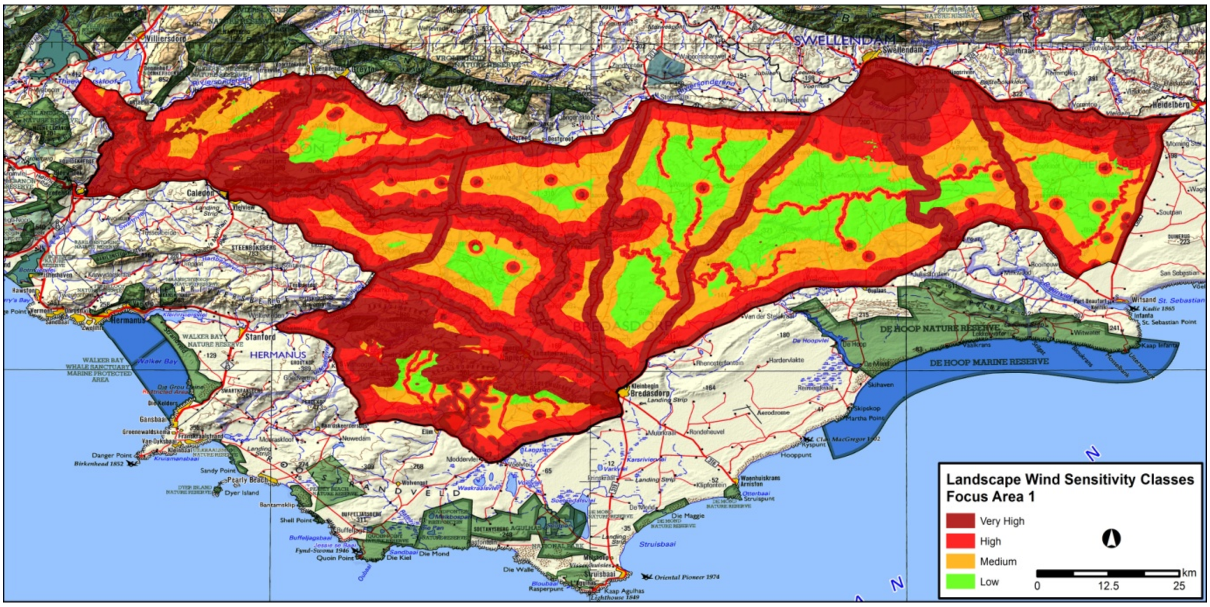
Separate wind and solar PV development density maps for each focus area are indicated below. (Maps 1.2 to 8.2). These are determined from the 'absolute sensitivity' maps as illustrated in Figure 4 below.

Figure 4 Development density synthesis maps

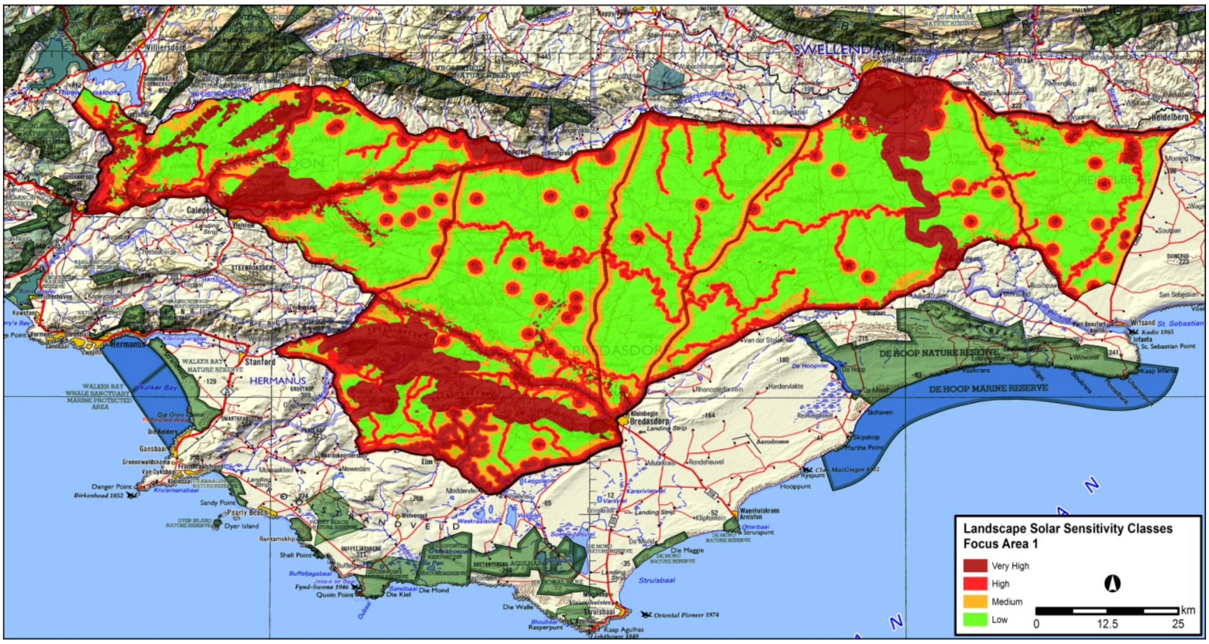


Absolute sensitivity map

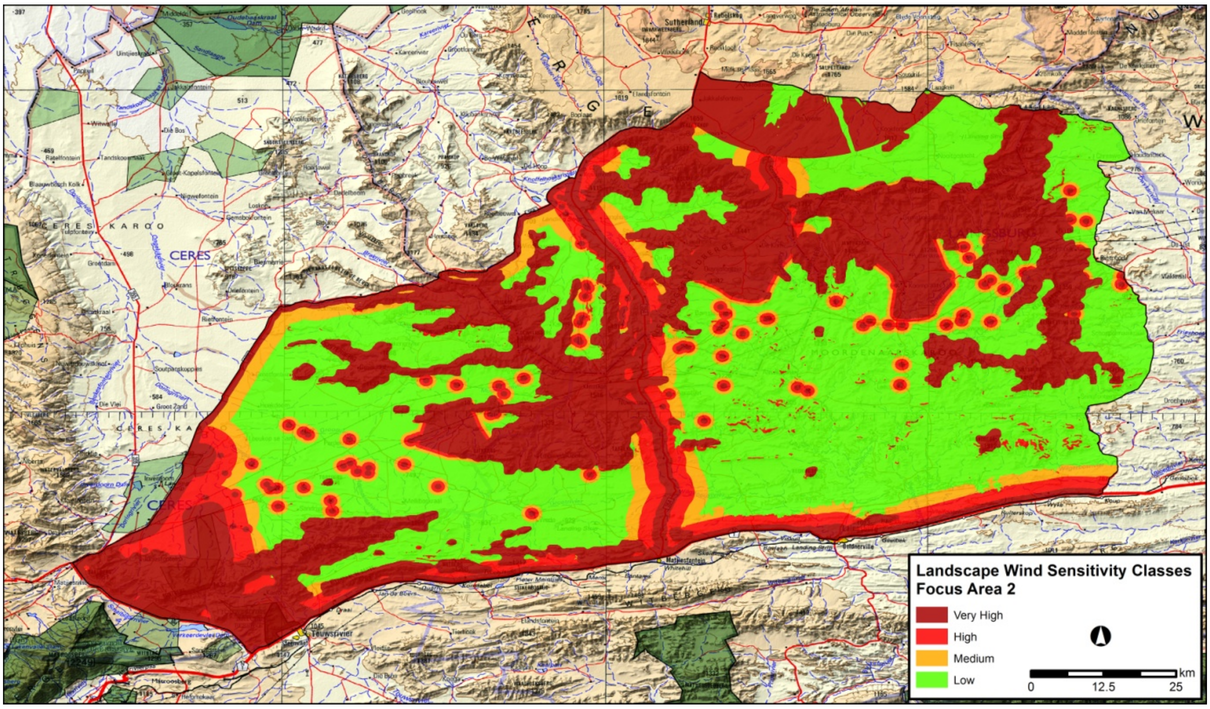
V. high, high, medium and low development density limits



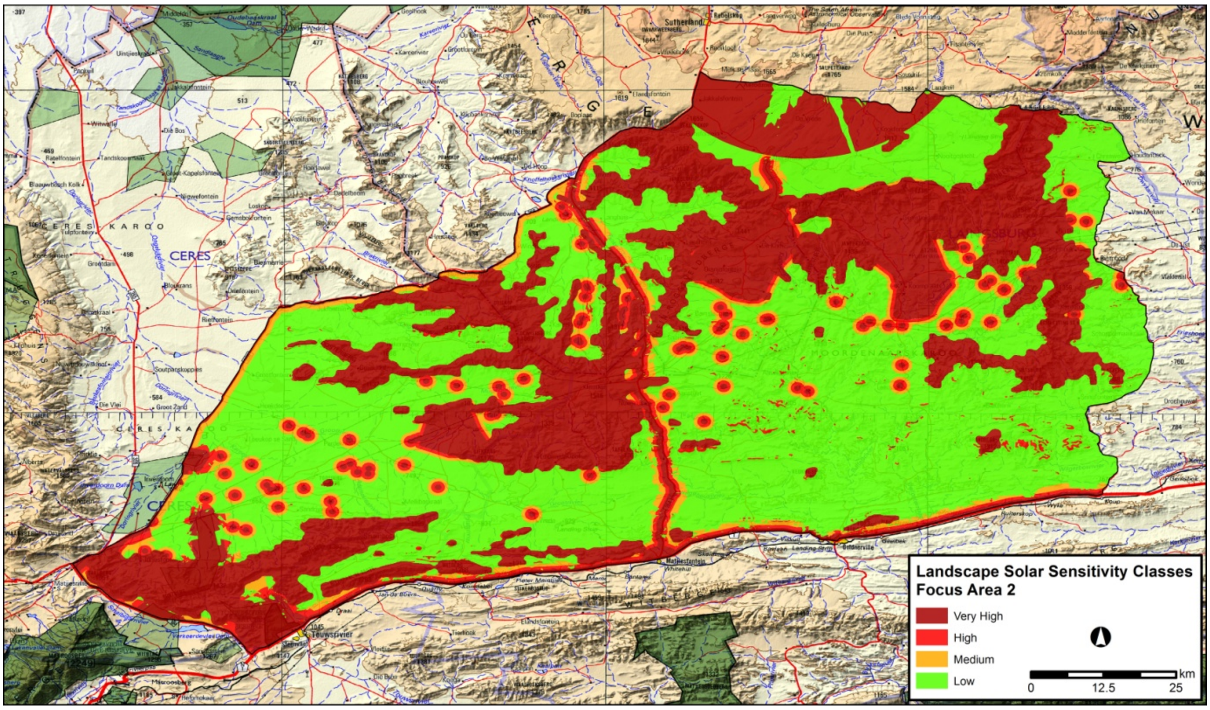
Map 1.2W : Overberg Focus Area 1 • Development Density WIND



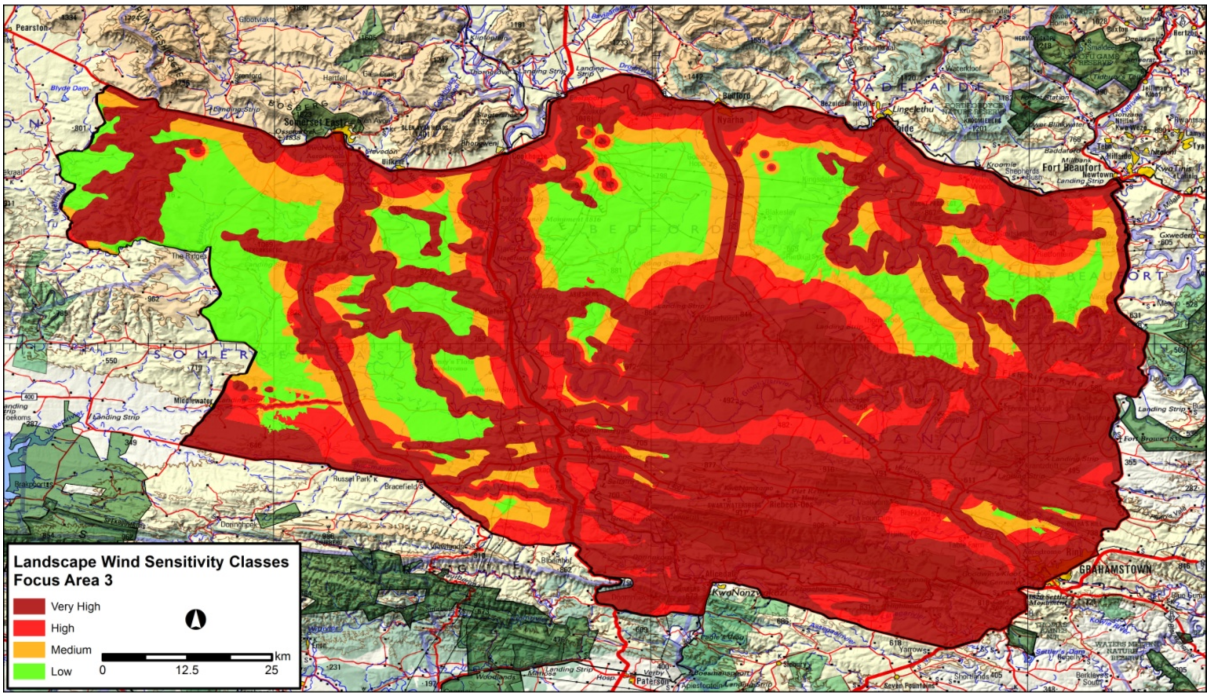
Map 1.2S : Overberg Focus Area 1 • Development Density SOLAR PV



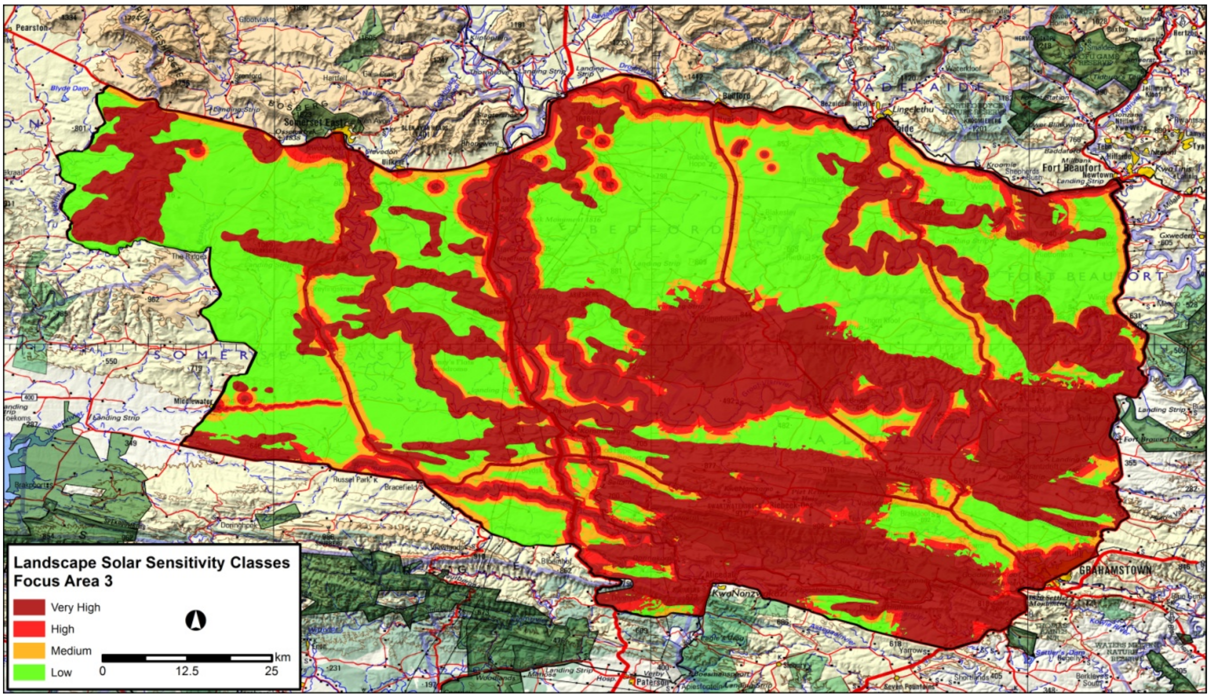
Map 2.2W : Komsberg Focus Area 2 • Development Density WIND



Map 2.2S : Komsberg Focus Area 2 • Development Density SOLAR PV

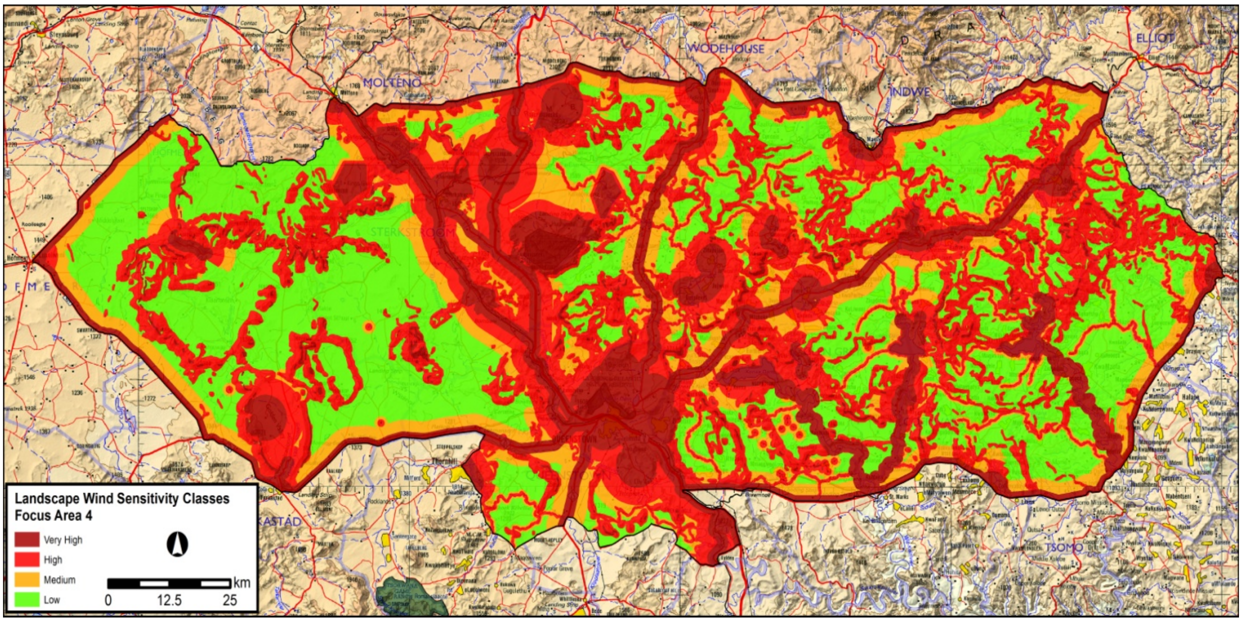


Map 3.2W : Cookhouse Focus Area 3 • Development Density WIND

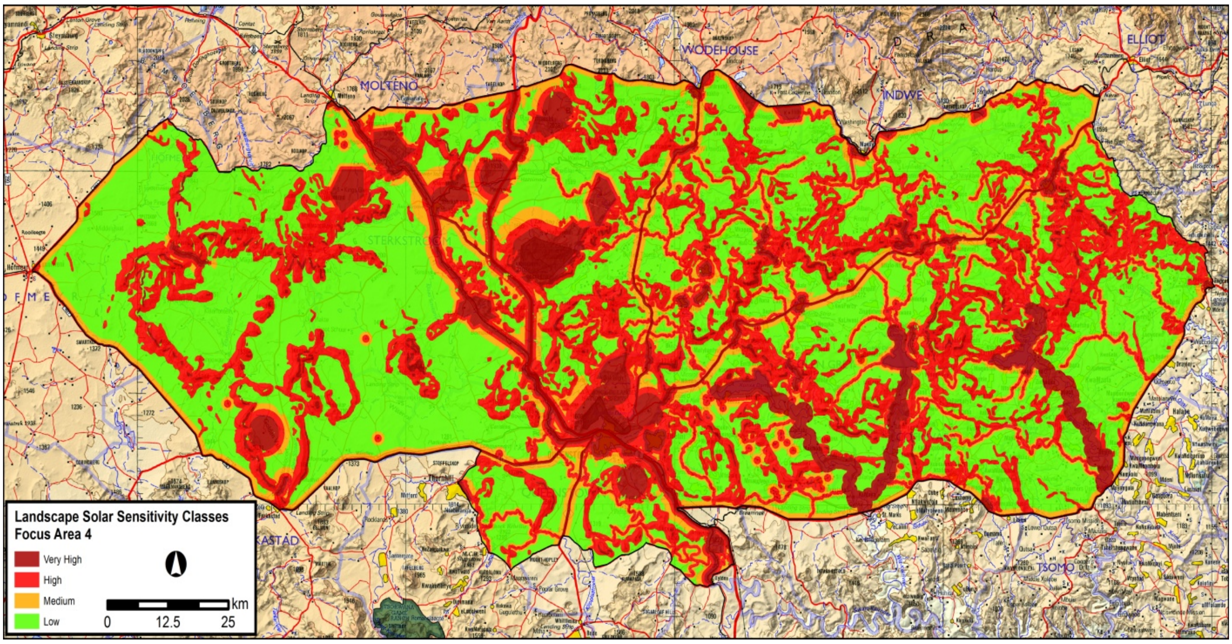


Map 3.2S : Cookhouse Focus Area 3 • Development Density SOLAR PV

For legends see Tables 3.1 and 3.2

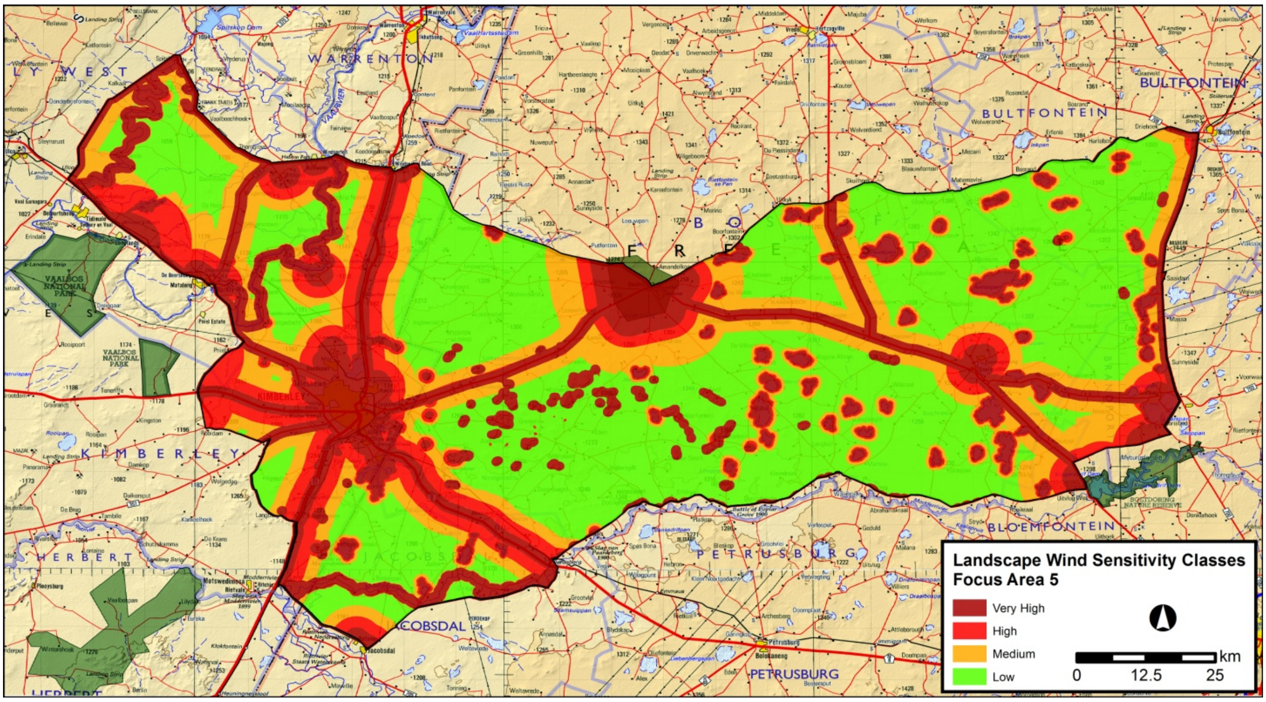


Map 4.2W : Stormberg Focus Area 4 • Development Density WIND

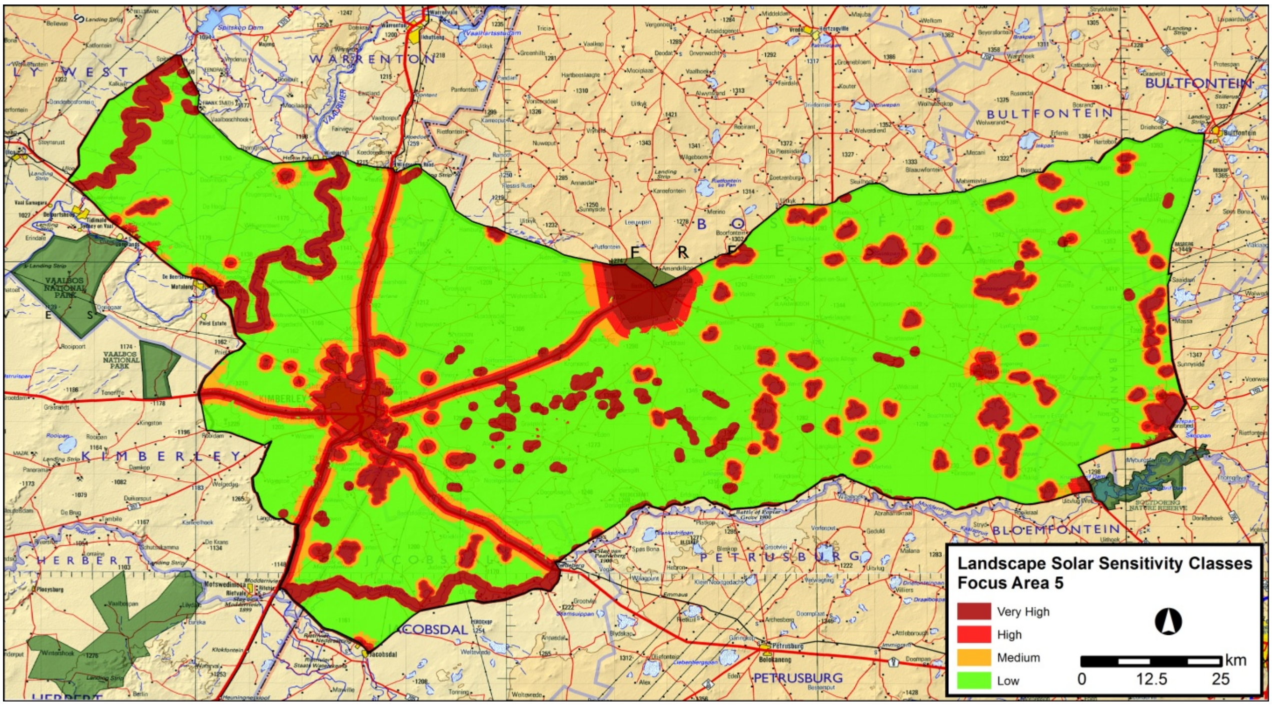


Map 4.2S : Stormberg Focus Area 4 • Development Density SOLAR PV

For legends see Tables 3.1 and 3.2

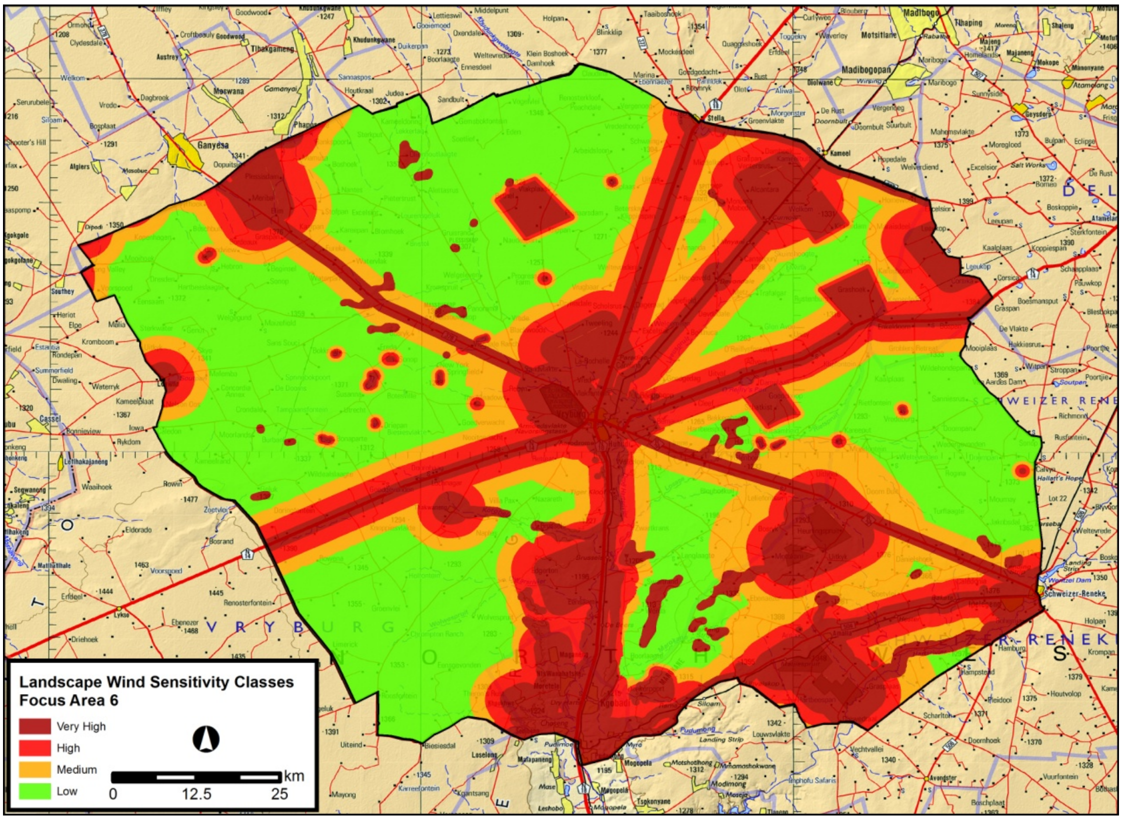


Map 5.2W : Kimberley Focus Area 5 • Development Density WIND

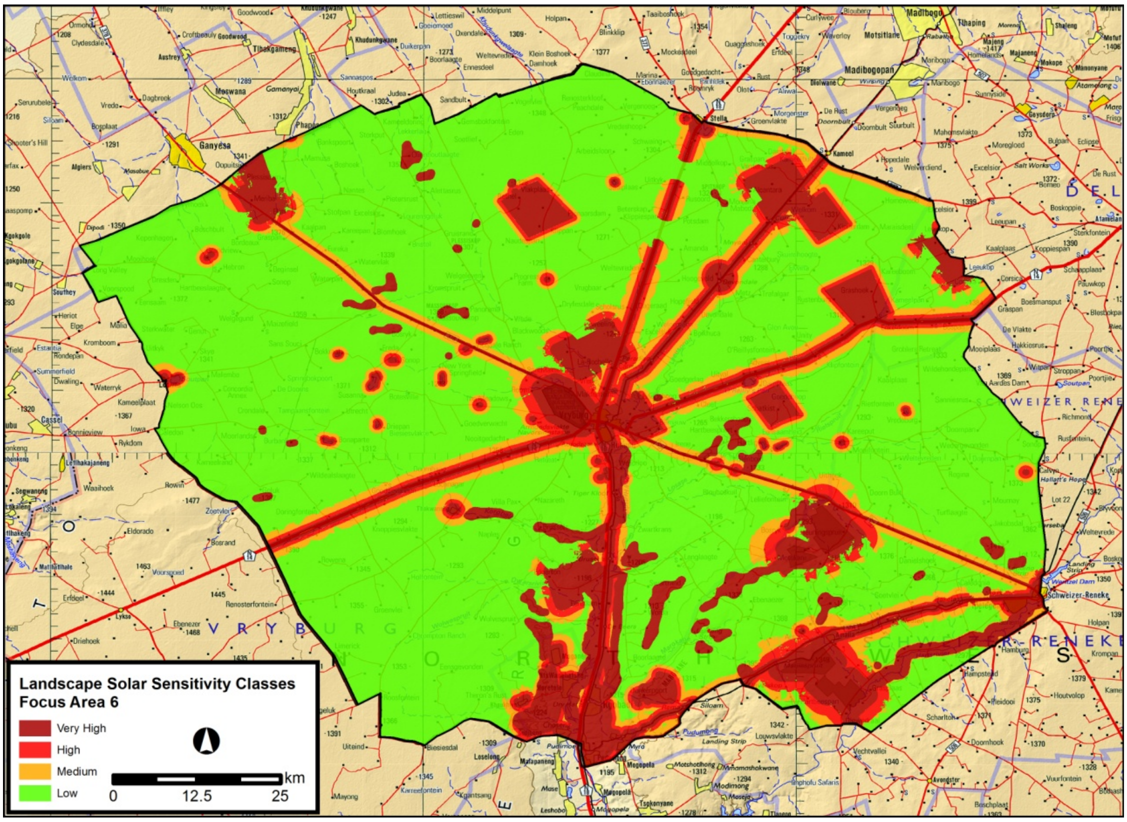


Map 5.2S : Kimberley Focus Area 5 • Development Density SOLAR PV

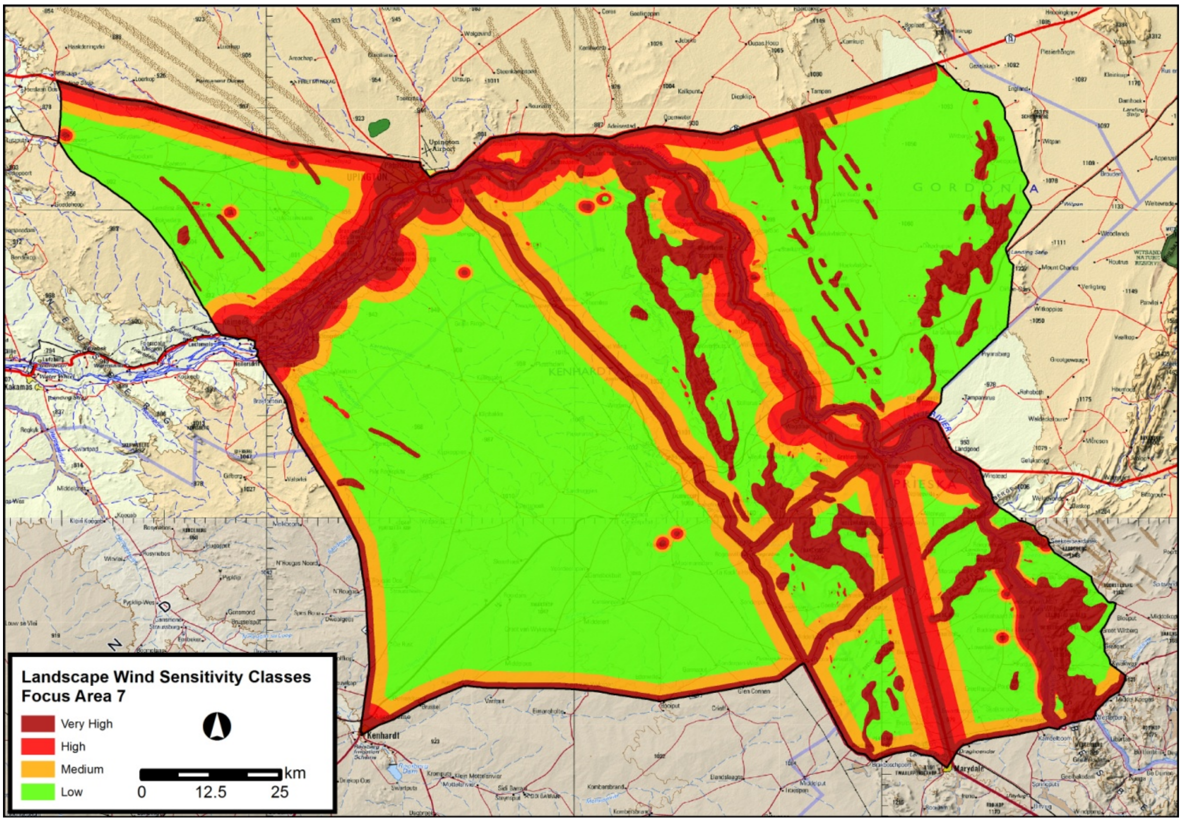
For legends see Tables 3.1 and 3.2



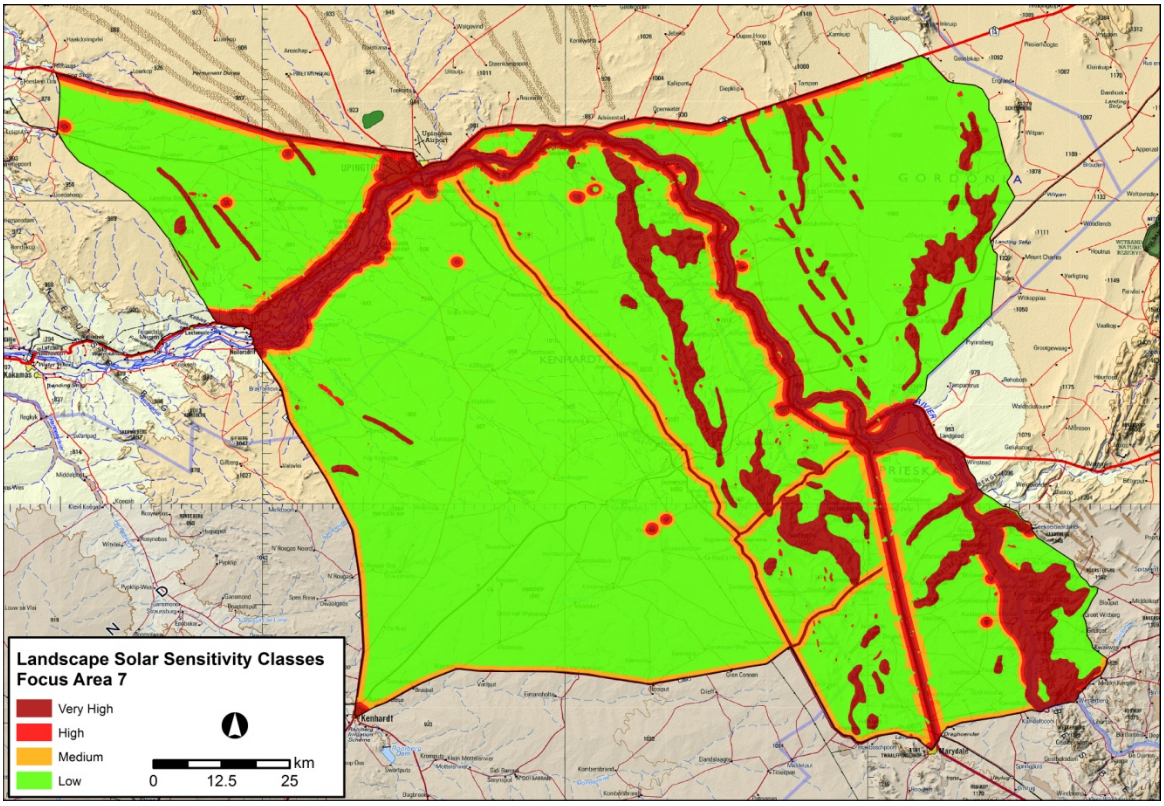
Map 6.2W : Vryburg Focus Area 6 • Development Density WIND



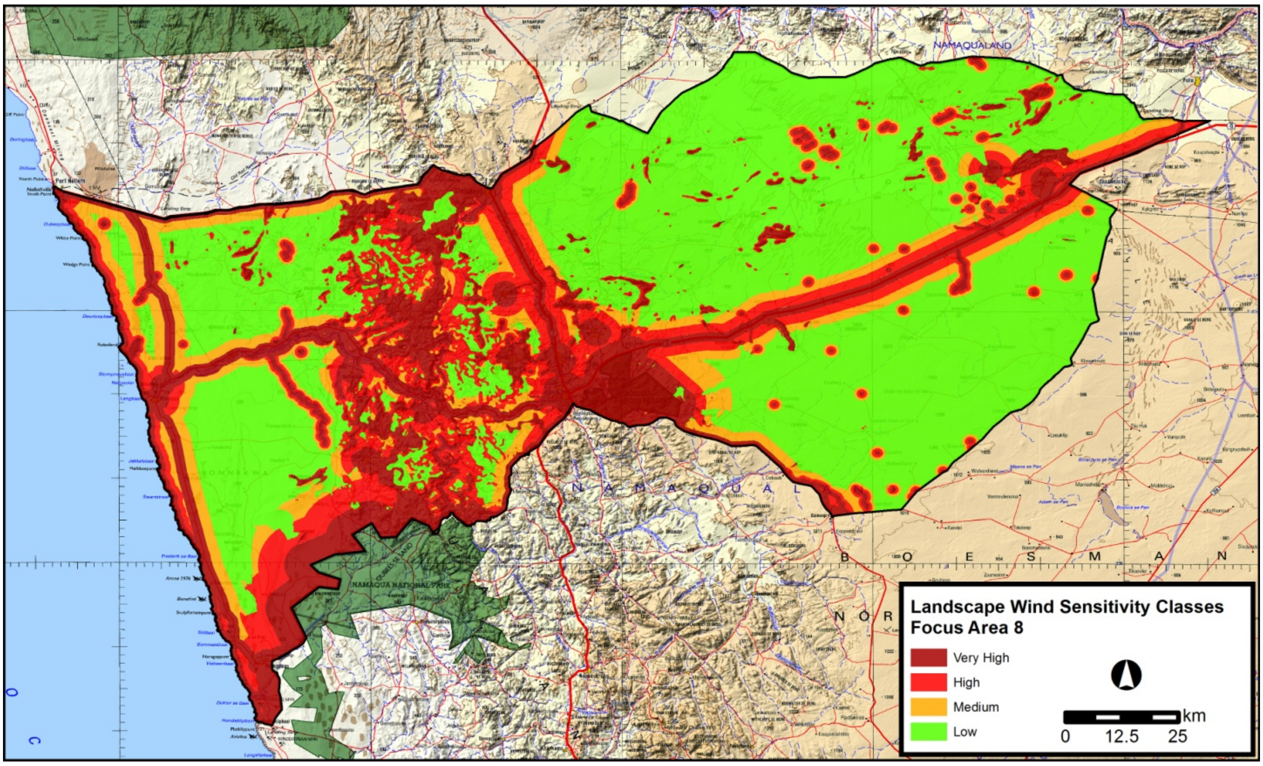
Map 6.2S : Vryburg Focus Area 6 • Development Density SOLAR PV



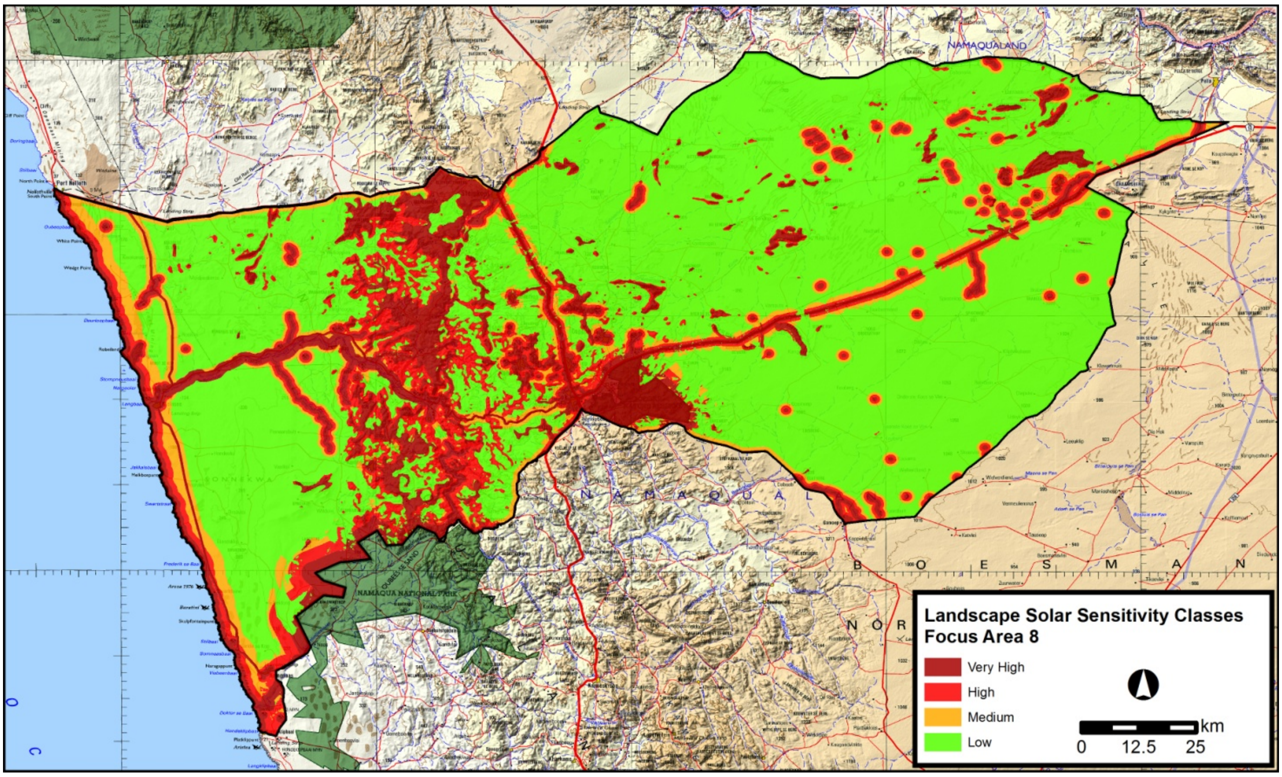
Map 7.2W : Upington Focus Area 7 • Development Density WIND



Map 7.2S : Upington Focus Area 7 • Development Density SOLAR PV



Map 8.2W : Springbok Focus Area 8 • Development Density WIND



Map 8.2S : Springbok Focus Area 8 • Development Density SOLAR PV

For legends see Tables 3.1 and 3.2

5 INTERPRETATION AND IMPLEMENTATION OF DENSITY LIMIT MAPS

5.1 Interpretation of the development density limit maps

This section provides a guideline on the interpretation and implementation of the development density threshold maps as well as permit requirements (where applicable) for the focus areas. The guideline for development density for each threshold level is indicated in Table 5.1 below.

Table 5.1 Guideline for Development Density for Wind and Solar PV Energy

Threshold	Development density	Assessments required [1]
Level 1 Very high sensitivity	No wind or solar PV development recommended.	Full specialist VIA required to motivate for development.
Level 2 High sensitivity	Limited development on a small scale subject to setback, clustering and spacing considerations.	Micro-siting by visual specialist if proposed development falls within the guideline for density limits. Full specialist VIA required to motivate for deviation if guideline for density limits are not met.
Level 3 Mod. sensitivity	Development on a moderate scale subject to setback, clustering and spacing considerations.	
Level 4 Low sensitivity	Development generally permitted subject to micro-siting considerations.	

[1] See also Section 5.4 below.

5.2 Development clustering

Development density clustering is related to both the size and spacing of the wind or solar PV facilities, and the type of terrain (the receiving environment), as well as viewsheds. These together determine an acceptable development density in terms of mitigating cumulative visual impacts.

A preferred clustering of wind and solar PV energy facilities is based on the parameters in Tables 5.2 and 5.3 below[7], as well as on the criteria outlined in Table 4.1, namely:

- Landscape characteristics / scenic constraints (including terrain complexity);
- Protected areas and heritage sites (including cultural landscapes); and
- Sensitive receptors (including settlements and routes).

These criteria are combined to determine the appropriate size of clusters, their approximate footprint, and recommended buffers between clusters, for wind energy and solar PV energy in Tables 5.4 and 5.5. Figures 5 and 6 indicate clustering in relation to development density limits.

[7] See notes on wind energy facilities in Appendix A, attached.

Table 5.2 Wind farm parameters (see Appendix B)

Parameter	Size	Notes
Height of turbine hub	120 m	Turbine heights range from 80 - 120m+. 120m is fairly common.
Diameter of rotor	130 m	Rotor diameter is usually about 1.1 to 1.2x hub height.
Total height of hub/rotor	185 m	Height to the tip of the rotor.
Turbine spacing Spacing between rows	5D = 650 m 7D = 910 m	Distance between turbines (D) is a function of rotor diameter. Min. preferred spacing is 3D and between rows 5D. More optimum spacing is 5Dx7D. Spacing depends on terrain and wind conditions.
Average area / wind turbine	± 60 ha	Based on spacing above, area required is approx. 650 x 910.
Max. wind farm size	140 MW	Based on Government bidding process.
Average no. turbines	± 60	Based on approx. 2.3 MW / turbine. Depends on turbine capacity.
Overall footprint of wind farm	± 36 km^2	Based on 60 turbines each requiring 60 ha.
Preferred max. no. wind farm phases	3	Based on risk of creating industrial complexes in rural or wilderness areas, i.e. cumulative impacts.
Aver. no. turbines for 3 phases	± 180	Based on ± 60 turbines per allowable 140 MW phase.
Overall footprint for 3 phases	± 108 km^2	Based on average 36 km^2 / phase.
Setback from external boundary	± 280 m	Setback is 1.5 times toppling distance, based on LUPO.
Proposed buffer between clusters	6 km	Relates to clustering and creating identifiable groups of turbines.
Previously proposed buffer between wind farms outside the focus areas	30 km	Based on PGWC (2006) guidelines. Relates to cumulative visual impacts. Could be less depending on viewsheds.

Table 5.3 Solar farm parameters

Parameter	Size	Notes
Max. solar farm / cluster size	75 MW	Based on current Government bidding process
Approx. overall area / MW	2.5 ha	Could vary depending on MW capacity.
Approx. overall footprint of solar farm	± 200 ha	Could vary depending on site constraints and other infrastructure.
Preferred max. no. solar farm phases	4	Suggested limit for solar farm size to avoid cumulative impacts and risk of creating industrial landscapes in rural or wilderness areas.
Net footprint for 4 phases	± 800 ha or 8 km^2	Based on ± 200 ha/ phase. Excludes buffers between clusters. (May vary depending on site constraints).
Setback from boundaries	30 m	30 m usually required from farm boundaries in zoning schemes.
Proposed buffer between solar farm clusters	3 km	Relates to clustering of development and cumulative visual impacts. Could vary depending on viewsheds.

Table 5.4 Size and spacing of wind farm clusters (see Figure 5)

Development density limit [1]	Recommended cluster limit [2]	Approx. footprint/ cluster [3]	Buffer between clusters [4]
Very high sensitivity	Not considered suitable for development		
High sensitivity	Small clusters up to 15 turbines/ cluster	± 9 km^2	6 km if within same viewshed as another cluster
Medium sensitivity	Medium clusters up to 30 turbines/ cluster	± 18 km^2	
Low sensitivity	Large clusters up to 60 turbines/ cluster	± 36 km^2	

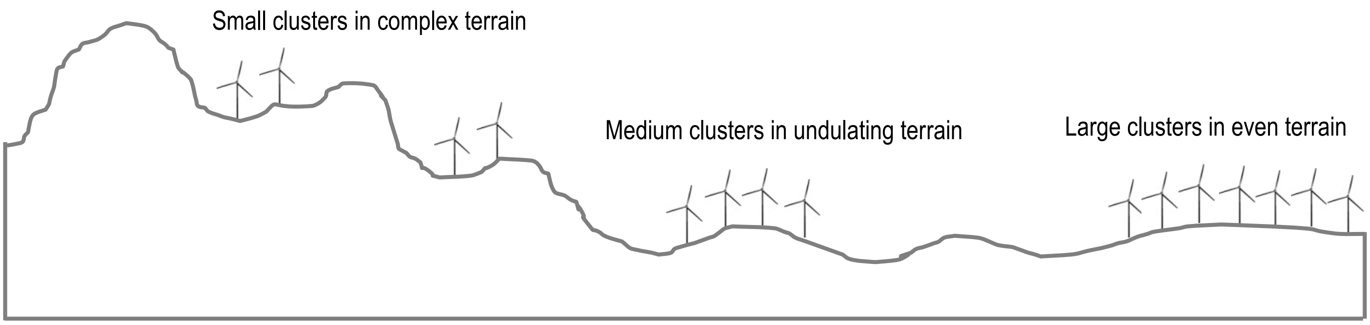
[1] See Table 4.1 for development density criteria.
[2] Each phase of the wind farm could have several clusters, the sizes of which would depend on the density limit.
[3] Assumes average area of 60 ha per turbine, (see Table 5.2). This would vary depending on site constraints.
[4] Buffers only applicable if the total number of turbines exceed the cluster limit.

Table 5.5 Size and spacing of solar PV farms

Development density limit [1]	Recommended solar PV cluster size limit [2]	Buffer between solar PV clusters [3]
Very high sensitivity	Not considered suitable for development	
High sensitivity	Small clusters up to 25 ha (10 MW)	3 km if within same viewshed as another cluster
Medium sensitivity [5]	Medium clusters up to 100 ha (35 MW)	
Low sensitivity [5]	Large clusters up to 200 ha (75 MW)	

[1] See Table 4.1 for development density criteria.
[2] Each solar farm could have several phases, the sizes of which would depend on the density limit.
[3] Buffers only applicable if the total area of a solar PV development exceeds the cluster limit.

Figure 5 Spacing of wind farm clusters



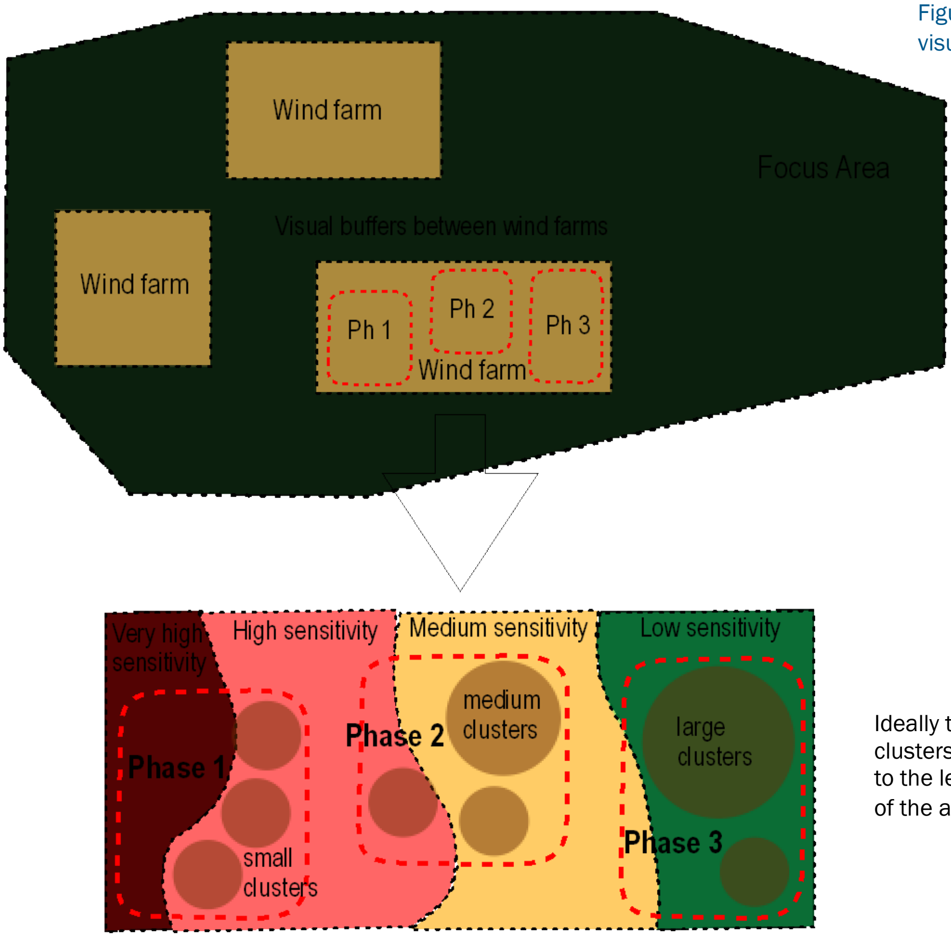


Figure 6 Cluster size in relation to visual sensitivity

Focus area with a number of wind farms with phases of 140 MW.

Ideally the size of wind farm clusters should vary according to the level of visual sensitivity of the area.

5.3 Integration of wind and solar development thresholds

Clustering and spacing between clusters within wind or solar PV farms has been suggested in Section 5.2 above to minimise cumulative visual impacts. Similar criteria can be used in the spacing between wind and solar PV farms, where these are located within the same viewshed, as indicated in Table 5.6 below.

Table 5.6 Recommended Buffer between Wind and Solar Energy Farms

Wind energy	Solar PV Energy	High sensitivity	Medium sensitivity	Low sensitivity
		25 ha solar PV cluster limit	100 ha solar PV cluster limit	200 ha solar PV cluster limit
High sensitivity	15 turbine wind cluster limit	3 km buffer if within same viewshed		
Medium sensitivity	30 turbine wind cluster limit			
Low sensitivity	60 turbine limit wind cluster			

6 GENERAL COMMENTS AND DISCUSSION

6.1 Key Impacts and Mitigation

This section lists key impacts with site-specific descriptions and mitigation measures.

Table 6.1 Impacts and Mitigations for each Focus Area

Site	Key impacts	Site specific description	Mitigation
Overberg focus area 1	1. Potential visual impact on scenic mountain landforms.	Swartberg (north of Caledon), Akkedisberg, Bredasdorpberg, Soetmuisberg.	Avoid development on scenic mountain features and sensitive skylines.
	2. Potential visual impact on national park, nature reserves and tourist facilities.	Bontebok National Park, Salmonsdam, Geelkop, Heuning-berg nature reserves. Caledon Wild Flower Garden and spa.	Avoid development within viewshed of protected landscapes. Shield navigation lights at night.
	3. Potential visual impact on recreation activities, guest camps and nature experience of Breede River.	Breede River Valley between Swellendam and Malgas.	Avoid visibility of turbines, substations and powerlines within Breede River corridor.
	4. Potential visual impact on mission villages and historic settlements, and related cultivated landscapes.	Genadendal, Elim, Greyton, Napier, Swellendam and related historical farmland.	Maintain recommended visual buffers. Avoid powerlines across sensitive cultural landscapes.
	5. Potential visual impact on scenic routes and rural quality of the Overberg.	N2 National Road, Malgas ferry, Akkadisberg Pass, R316 to Bredasdorp, R406 to Genadendal and Greyton, 'flower route' via Elim.	Maintain recommended visual buffers. Screen substations. Avoid powerlines crossing scenic routes and N2.
Komsberg focus area 2	1. Potential visual impact on the scarp rim and mountain ridges skyline.	Komsberg escarpment, and Klein Roggeveld and Bontberg mountains.	Maintain recommended visual buffers from edge of the escarpment rim and ridgelines.
	2. Potential visual impact on scenic routes and wilderness quality of the area.	N1 National Road, R354 between Matjiesfontein and Sutherland, and Komsberg Pass.	Maintain recommended visual buffer along routes. Locate substations out of view. Avoid powerlines across N2 and R354. Confine powerlines to a single corridor.
	3. Potential visual impact on historical settlements and farmsteads.	Matjiesfontein Provincial Heritage Site. Saaiplaas homestead.	Avoid development within a 5km viewshed of Matjiesfontein. Maintain visual buffers around farmsteads.
	4. Potential visual impact on the Sutherland Astronomical Observatory, which requires dark skies at night.	The Observatory on the Komsberg Plateau, vulnerable to interference from lights at night.	Impacts on the Observatory to be taken into account before development considered.

Site	Key impacts	Site specific description	Mitigation
Cookhouse focus area 3	1. Potential visual impact on mountain ridge skylines and steep slopes.	Suurberg, Swartwatersberg, Niekerksberg, Ariesberg, Mount Prospect and Fish River Rand.	Maintain recommended visual buffers from edge of scarps and ridgelines.
	2. Potential visual impact on scenic river corridors and gorges.	Great Fish River and Koonap River at the Fish River Rand.	Maintain recommended visual buffer along these stretches of river. Avoid powerlines crossing the rivers.
	3. Potential visual impact on scenic passes and poorts.	Road poorts through the Niekerksberg, Mount Prospect, Fish River Rand and Swartwatersberg.	Maintain recommended visual buffers along road passes and poorts. Avoid powerlines across scenic roads.
	4. Potential visual impact on protected landscapes, game farms and the rural quality of the area.	Andries Vosloo Kudu Nature Reserve, and all identified game farms.	Maintain buffers around nature reserves and game farms, and use screen planting where feasible.
Stormberg focus area 4	1. Potential visual impact on the characteristic mountain landforms, including scarps.	Dolerite peaks and ridges throughout the focus area. The escarpment, incl. the Bamboesberg and Stormberg.	Maintain recommended buffers along scarp edges and ridgelines, and around prominent dolerite landforms.
	2. Potential visual impact on nature reserves and guest farm tourist facilities, and wilderness experience.	Lawrence de Lange NR, Black Eagle Private NR, Roydon Private NR and Game Lodge. Guest farm near Sterkstroom.	Avoid development within viewsheds of protected landscapes. Shield navigation lights at night.
	3. Potential visual impact on scenic passes and poorts, and on the rural quality of the area.	Boesmanshoek Pass, Penhoek Pass, Cala Pass, Mackay's Nek Pass, Nonesi's Nek Pass, Indwe Poort and other poorts along the N6 and arterial roads.	Maintain recommended visual buffers along these road passes and poorts. Avoid powerlines across scenic roads.
	4. Potential visual impact on rural settlements and traditional kraals.	Widespread, almost contiguous rural settlements across the eastern portion of the focus area.	Maintain recommended visual buffers. Consider smaller-scale solar PV and wind energy facilities.
Kimberley focus area 5	1. Potential visual impact on the expansive landscape and sense of place.	Flat plains punctuated by dolerite outcrops and saltpans.	Avoid development on dolerite outcrops and saltpans in the otherwise featureless landscape.
	2. Potential visual impact on national park and nature reserves, and wilderness experience.	Vaalbos National Park, Soetdoring Nature Reserve adjacent to the focus area.	Avoid development within viewsheds of protected landscapes. Shield navigation lights at night.
	3. Potential visual impact on Vaal River cultural and recreational landscape.	Vaal River Valley and Barkley East area, including mining history.	Maintain recommended visual buffers. Avoid powerlines across the river.
	4. Potential visual impact on national road, historical rail line and battle sites.	N12 and N8 National Roads and adjacent rail lines. Several Boer War battle sites.	Maintain recommended visual buffers. Avoid powerlines across national roads and battle sites.

Site	Key impacts	Site specific description	Mitigation
Vryburg focus area 6	1. Potential visual impact on skylines of plains and broad horizons. 2. Potential visual impact on nature reserves and wilderness experience. 3. Potential visual impact on national and arterial roads (visual corridors).	Flat plains punctuated by low, subtle topographic features, mainly south of Vryburg. Leon Taljaard NR, and other reserves on the R34 and R504 SE of Vryburg. N18 and N14 National Roads, R34, R504, R377 and R378 arterial roads.	Avoid locating development on prominent landscape features, saltpans and drainage courses. Avoid development within view-sheds of protected landscapes. Shield navigation lights at night. Maintain recommended visual buffers. Avoid powerlines across national and arterial roads.
Upington focus area 7	1. Potential visual impact on the expansive desert experience. 2. Potential visual impact on Gariep River (Orange River) recreational and agricultural landscape. 3. Potential visual impact on national and arterial roads (visual corridors).	Flat plains punctuated by quartzitic and schist ridges incl. Skurweberg, Langberg, Witberg, Bakensberg and Asbesberg ranges. Gariep River valley, particularly braided river and cultivated farmlands between Upington and Keimoes. N14 and N10 Routes, particularly where these run adjacent to the Gariep River and vineyards.	Maintain recommended buffers for ridgelines, sand dunes and saltpans. Avoid development and power-lines within local viewshed of Gariep River corridor. Maintain recommended visual buffers. Avoid powerlines across national roads and cultural farming landscapes.
Springbok focus area 8	1. Potential visual impact on the rugged peaks and ridges of the escarpment and other outcrops. 2. Potential visual impact on the national park and nature reserve, and related wilderness experience. 3. Potential visual impact on rivers and their tributaries in the arid landscape. 4. Potential visual impact on national and arterial roads, and scenic passes. 5. Potential visual impacts on historic settlements and mining towns.	Granitic escarpment incised by drainage lines, ranging from north to south across the focus area, and the Aggeneys Mts. To the east. Namaqua National Park on the southern boundary, and Goegap Nature Reserve near Springbok. Buffels and Doring River corridors, and numerous tributaries, and steep scenic gorges of the escarpment. N7 and N14 National Roads, the coastal road, R382, and R355 incl. the Spektakel Pass. The Wildeperdhoek and Messelpad Passes on the southern boundary. Steinkopf historic mission settle-ment. Nababeep, Okiep and Concordia historic copper mining towns.	Avoid development and powerlines on the visually prominent peaks, ridges and outcrops. Avoid development within viewsheds of protected landscapes. Shield navigation lights at night. Maintain recommended visual buffers. Avoid powerlines across rivers, tributaries and gorges. Maintain recommended buffers. Avoid powerlines across national, coastal and scenic routes / passes. Maintain recommended visual buffers. Avoid powerlines intruding on historic settlements.

6.2 General comments

Table 6.2 Overall suitability and comments on focus areas

Site	Overall Suitability	Comment
Overberg focus area 1	Areas to the west, between Bot River and Caledon, as well as to the south of the R316 linking Caledon with Bredasdorp, have high levels of landscape constraints and are therefore generally unsuitable for wind or large-scale solar PV development. Areas in the eastern portion of the focus area have fewer constraints and are potentially more suitable from a landscape / visual perspective.	The two areas, (to the west and south), including north of the N2, should possibly be excluded from the focus area, although small-scale solar PV facilities could be considered because of their relatively small footprint.
Komsberg focus area 2	Most of the landscape constraints in the focus area are related to the topographic features of the Komsberg Mountain Escarpment, the Klein Roggeveld Range, and the Bontberg to the south. The eastern portion has fairly broken terrain with moderate sensitivity, while the western portion has more even terrain with fewer lanscape constraints. The plateau area to the north is visually sensitive because of the Sutherland Astronomical Observatory.	Special care needs to be taken with any proposed development on the Komsberg Plateau, because of the visual sensitivity of the Sutherland Observatory, particularly to lights at night.
Cookhouse focus area 3	Most of the landscape constraints are located in the southern and far eastern portions of the focus area, including the Swartwatersberg and Fish River Rand areas, and should generally be avoided. The northern and western portions on the other hand have fewer constraints, and therefore less visual sensitivity.	The southern and eastern portions should possibly be excluded from the focus area because of their visual and scenic sensitivity.
Stormberg focus area 4	Characteristic landforms of the focus area are the dolerite-capped peaks, koppies and ridges, which have scenic value and tend to be visually sensitive. These create a fairly fragmented pattern within the focus area, with the western portion having fewer constraints. The numerous rural settlements in the eastern portion would make large-scale wind farms difficult, but smaller scale development could be considered.	In terms of landscape constraints, wind energy development would be more likely west of the N6 and R56 linking Queenstown with Molteno. A wind farm has already been constructed in this area SE of Molteno.
Kimberley focus area 5	Except for an area around the Vaal River corridor and Kimberley, most of the focus area would be suitable for wind or solar PV energy development, from a landscape and visual perspective.	The siting of development would need to take the numerous salt pans and minor topographic features into account.
Vryburg focus area 6	Except for areas around the major settlements and the nature reserves, most of this focus area would again be suitable for wind and solar PV energy development from a landscape and visual perspective.	The siting of development would need to take the drainage courses and salt pans, as well as a few minor topographic features into account. These tend to be micro-siting considerations.

Site	Overall Suitability	Comment
Upington focus area 7	The areas with the largest degree of landscape constraints tend to concentrate along the Gariep River corridor with its associated cultivated farmland on alluvial soils, particularly between Upington and Keimoes. The N10 and N14 National Roads have some scenic value where they follow the Gariep River. There are few constraints over the rest of the focus area.	The siting of development would need to take the quartzite and schist ridgelines into account, as these provide interest in an otherwise flat landscape. Sand dunes and salt pans tend to be special features, which need to be protected.
Springbok focus area 8	Most of the landscape constraints occur in the mountainous escarpment area to the west of the N7, the rugged topography, steep slopes and stream courses tending to be scenically valuable and visually sensitive. The other major constraints are the visual buffers for the Namaqualand National Park and the Goegap Nature Reserve. The plateau area to the east has few visual constraints, except for the Aggeneys mountain and other smaller landscape features.	The siting of development would need to take the quartzite and schist outcrops into account, as these provide interest in the relatively flat landscape, as do the scenic passes and poorts. The coastline, sand dune features, salt pans and historic mining settlements also need to be considered in the siting of development.

7 CONCLUSIONS AND FURTHER RECOMMENDATIONS

The landscape specialist study covers a fairly broad range of environmental considerations, including landscape character, geomorphology, scenic resources, protected landscapes and sensitive receptors, along with cultural landscapes and heritage resources provided by the heritage specialists.

A methodology and criteria were developed to determine landscape sensitivity, and in turn development density limits for both wind and solar PV energy development.

Through a process of refining the criteria and testing these in terms of spatial mapping, a reasonably robust method has been developed that can be easily replicated both within the defined focus areas, and for other areas which may be considered in the future.

A relatively even distribution of development density parcels were identified for very high, high, medium and low sensitivity. The study revealed that for the most part adequate opportunities exist in the focus areas for both wind and solar PV energy facilities, and that visual impacts can be partly mitigated.

Larger areas tend to be available for solar PV energy development than for wind energy development, because of the smaller buffers required for solar farms.

The study further revealed that in a few cases certain portions of the focus areas should ideally be excluded from development.

It is recommended that extended or additional focus areas be investigated, if and when required, using the same methodology and criteria, which should enable fairly rapid results.

It is further recommended that powerlines and substations be seen as an integral part of wind and solar energy projects, and that criteria, including buffers, be established for these.

8 APPENDIX A: CRITERIA FOR WIND FARMS (PROVINCIAL GOVERNMENT OF THE WESTERN CAPE, 2006)

Recommended Criteria Thresholds for Regional & Site Level Assessment

No.	Criteria (Distance from)	Threshold Value	Notes/Data Source [See Note (1)]
1.	**Urban Areas**	800m from urban edge	Urban edge lines assumed where necessary for rural towns with no formal urban edge. This distance adequately covers noise and flicker criteria
2.	**Residential Areas** (including rural dwellings)	400m	Threshold adequately covers noise and flicker criteria. All rural dwellings mapped from 1:50 000 series, but these are not comprehensive or up to date.
3.	**Transport Routes**		
3a.	National Roads	3km	Should depend on scenic value of route. Can be reduced.
3b.	Local Roads	500m	Review if high scenic value.
3c.	Provincial Tourist Route	4km	Statutory scenic drives.
3d.	Local Tourist Route	2,5km	Assumption made for local importance. Could be reduced.
3e.	Railway Lines	250m	No distinction drawn between passenger and goods lines. Also, rail corridors usually visually disturbed. Safety consideration.
4.	**Transmission Lines**		
4a.	Major Power Lines	250m	Excludes gas lines (Safety considerations)
4b.	Cell Phone Masts + Communication Towers	500m	No data available/provided. To be mapped at project level.
4c.	Radio + Navigation Beacons	250m	Digitised from aeronautical maps
5.	**Key Infrastructure/Airports**		
5a.	Airport with Primary Radar	25km	To be confirmed with agency at regional level.
5b.	Local Airfield	2,5km	To be confirmed with appropriate agency at local level.
5c.	National Security Sites (e.g. Koeberg)	15km	To be reduced where possible subject negotiations with agency concerned
6.	**National Parks + Provincial Nature Reserves**	2km	Increased from 1km international standard
7.	**Protected Areas**		
7a.	Mountain Catchments	500m	Not mapped. No defined info available. See slope.
7b.	Protected Natural Environment	2km	Or as per statutory protection
7c.	Private Nature Reserves (Open Space Zone II)	500m	Data not consistently available (not all mapped) Deal with at local level
7d	Heritage and Cultural Sites	500m	Includes fossil sites, nation (+ provincial) monument sites, graves and memorial sites.
8.	**Coast & Rivers**		
8a.	Distance to Coastlines of Undisturbed Scenic Value	Approx. 3 -4km	Negotiable, may include areas of low scenic value = landscape assessment.
8b.	Distance to Rivers	500m	Only perennial rivers used at regional level.
8c.	Distance to 1:100 Year Floodline	200m	Info not available. (restore at local level)
9.	**Sensitive Areas (Avian)**		
9a.	Distance to Major Wetlands (Ramsar Sites)	2km	Assumed to increase bird safety.
9b.	Distance to Local Wetlands	500m	Bird safety.
9c.	Distance to Bird Habitats or Avian Flight Paths where known	1km	Increased from 500m. Assumed specific breeding sites dealt with at EIA level.
10.	**Topographical**		
10.a	Elevation and slopes	Expl.. 1:4 slopes & high mountain features	Map at local level
10b.	Distance from Ridge Lines	500m	Required and local scale.
11.	**Vegetation**		
11a.	Distance to Important Indigenous/Remnant Vegetation	—	Mapped at local scale, not considered critical for regional criteria.

NOTE: These thresholds have been derived from international experience, but adapted to South African conditions. They should not be seen as fixed and may need to be refined in the context of the distinctive landscape and other special characteristics of the particular area under review.

9 APPENDIX B: PARAMETERS FOR WIND ENERGY FACILITIES

Height of wind turbines:

These vary as indicated in the table below, with the 120m turbines being used as a standard size for the purpose of the landscape assessment.

Categories of height and rotor diameter for wind turbines

	Hub height[1]	Rotor diam. [2]	Total height
medium	80m	100m	130m
med-large	100m	120m	160m
large	**120m**	**130m**	**185m**
very large	140m	160m	220m

[1] Based on common wind turbine sizes
[2] Rotor diameter based on approx. 1.2x hub height

Spacing between turbines:

Spacing can vary depending on terrain and wind conditions, as indicated in the table below. The spacing was used to determine approximate wind farm footprints.

Spacing and footprint for 120m wind turbines with 130m rotors

	Configuration column/row[1]	Average Spacing[2] (D = rotor diam.)	Footprint ha/turbine
Close spacing	3D x 5D	3Dx130m = 390m 5Dx130m = 650m	25ha
Medium spacing	**4D x 8D or 5D x 7D**	**5Dx130m = 650m 7Dx130m = 910m**	**59ha**
Wider spacing	6D x 10D	6Dx130m = 780m 10D x 130m = 1 300m	101ha

[1] The 1st figure is the distance between turbines and the 2nd figure is the distance between rows.
[2] As a rule of thumb, it was assumed that turbines in wind farms are spaced 5-9 rotor diameters apart in the prevailing wind direction, and 3-5 rotor diameters apart perpendicular to the prevailing wind.

Footprint of wind energy farms:

The wind energy bidding process allows for 140 MW wind farms and therefore this size was used to inform the approximate net footprint of wind farms, without considering variations in the landscape.

Size and footprint of wind farms

	Megawatts	No. of turbines[1]	Net footprint[2]
Small wind farm	35 MW	± 15	9 km^2
Medium wind farm	70 MW	± 30	18 km^2
Medium-large wind farm	**140 MW**	**± 60**	36 km^2
Large wind farm (2 phases of 140 MW each)	280 MW	± 120	72 km^2
Very large wind farm (3 phases of 140 MW each)	420 MW	± 180	108 km^2

[1] Based on approx. 2.3 MW per turbine
[2] Based on nominal 60ha per turbine with medium spacing.

10 SPECIALIST SHORT CV

QUINTON LAWSON (MLB ARCHITECTS)

Partner, MLB Architects and Urban Designers
Professional Architect, B.Arch (Natal)
Professional Member of the SA Council for the Architectural Profession
(SACAP) Reg. No. 3686
Member of the Cape Institute for Architects (CIA)
Member of the Impact Assessment Review Committee, Heritage Western Cape

Experience:

- Worked on large scale architectural and urban design projects since 1978.
- Lectured at UCT on computer and visual assessment techniques.
- Specialist expertise in visual modeling, viewshed mapping and photographic montages.
- Worked in association with BOLA on numerous visual impact assessments, including wind energy farms, solar PV and CSP energy facilities in several provinces.

In association with:

BERNARD OBERHOLZER (BOLA LANDSCAPE ARCHITECT)

Principal, Bernard Oberholzer Landscape Architect / Environmental Planner
Professional Landscape Architect, B.Arch (UCT), MLA (Pennsylvania)
Professional Member of the SA Council for the Landscape Architectural
Profession (SACLAP) Reg. No. 87018
Fellow of the Institute of Landscape Architects of SA (ILASA)
Advisor to the Stanford Heritage Committee

Experience:

- Has worked on numerous large scale landscape projects and land use suitability studies since 1976.
- Has lectured at UCT, mainly on terrain analysis, and produced a book on *Reading the Landscape*, including landscape classification and mapping.
- Has specialist expertise in landscape assessments and visual impact assessments, including wind energy farms, solar PV and CSP energy facilities.
- Prepared the *Guideline for Involving Visual and Aesthetic Specialists in EIA Processes*, with the CSIR for the Provincial Government of the W. Cape.
- Prepared a landscape and scenic resource survey of the W. Cape for the PSDF, and a landscape heritage survey for the Overstrand Municipality, working in association with heritage specialists.

10.1 Specialist Declaration

We, Quinton Lawson and Bernard Oberholzer, as the appointed independent specialist hereby declare that we:

- act/ed as the independent specialist in this application;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct;
- do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed;
- have and will not have any vested interest in the proposed activity proceeding;
- have disclosed any material information that have or may have the potential to influence the objectivity of any report or decisions base thereon; and
- are aware that a false declaration is an offence in terms of regulation 71 of GN No. R. 543.

Signatures of the specialists:

Name of company:	MLB Architects, in association with BOLA
Professional Registration (incl number):	SACAP 3686 SACLAP 87018
Date:	02 June 2014
Revision 1:	14 July 2014
Revision 2:	15 Aug. 2014

STRATEGIC ENVIRONMENTAL ASSESSMENT FOR WIND AND SOLAR PHOTOVOLTAIC ENERGY IN SOUTH AFRICA

Appendix A3

Heritage Scoping Assessment Report

Specialists' names:
Wouter Fourie - PGS Heritage
John Almond - Natural Viva cc
Jayson Orton - ASHA Consulting (Pty) Ltd

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ABBREVIATIONS AND ACRONYMS

AIA	Archaeological Impact Assessment
amsl	above mean sea level
APHP	Association of Professional Heritage Practitioners
ASAPA	Association of Southern African Professional Archaeologists
BID	Background Information Document
BP	Before Present
CSIR	Council for Scientific and Industrial Research
DEA	Department of Environmental Affairs
GIS	Geographic Informatuon System
HIA	Heritage Impact Assessment
HSRC	Human Sciences research Council
HWC	Heritage Western Cape
Ma	Millions of years old
MPRDA	Minerals and Petroleum Resources Development Act
NEMA	National Environmental Management Act
NHRA	National Heritage Resources Act
NID	Notice of Intent to Develop
PIA	Palaeontological Impact Assessment
PGWC	Provincial Government Western Cape
PHRA	Provincial Heritage Resources Authority
PSSA	Palaeontological Society of South Africa
RE	Renewable Energy
REDZ	Renewable Energy Development Zone
RHRA	Responsible Heritage Resources Authority
SAHRA	South African Heritage Resources Agency
SAHRIS	South African Heritage Resources Information System
VIA	Visual Impact Assessment

DEFINITIONS

✓ *Archaeological resources*

This includes:

i. material remains resulting from human activity, which are in a state of disuse and are in or on land, and which are older than 100 years including artefacts, human and hominid remains and artificial features and structures;
ii. rock art, being any form of painting, engraving or other graphic representation on a fixed rock surface or loose rock or stone, which was executed by human agency and which is older than 100 years, including any area within 10m of such representation;
iii. wrecks, being any vessel or aircraft, or any part thereof which was wrecked in South Africa, whether on land, in the internal waters, the territorial waters or in the maritime culture zone of the republic as defined in the Maritimes Zones Act, and any cargo, debris or artefacts found or associated therewith, which is older than 60 years or which SAHRA considers to be worthy of conservation;
iv. features, structures and artefacts associated with military history which are older than 75 years and the site on which they are found.

✓ *Background scatter*

An exposure of archaeological material whose distribution is more strongly conditioned by natural forces than by human agency.

✓ *Cultural significance*

This means aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance

✓ *Development*

This means any physical intervention, excavation, or action, other than those caused by natural forces, which may in the opinion of the heritage authority in any way result in a change to the nature, appearance or physical nature of a place, or influence its stability and future well-being, including:

i. construction, alteration, demolition, removal or change in use of a place or a structure at a place;
ii. carrying out any works on or over or under a place;
iii. subdivision or consolidation of land comprising a place, including the structures or airspace of a place;
iv. constructing or putting up for display signs or boards;
v. any change to the natural or existing condition or topography of land; and
vi. any removal or destruction of trees, or removal of vegetation or topsoil

✓ *Earlier Stone Age*

The archaeology of the Stone Age between approximately 2.5 million and 300 000 years ago.

✓ *Fossil*

Remains of ancient organisms (animals, plants, fungi or microbes) preserved within rocks. Trace fossils are sedimentary structures within rocks that record the activities or behaviour of ancient organisms (e.g. fossil burrows, trackways or stromatolites).

✓ *Heritage*

That which is inherited and which forms part of the National Estate (Historical places, objects, fossils, etc. as defined by the National Heritage Resources Act 25 of 1999).

✓ *Heritage resource*

This means any place or object of cultural significance (but see definition of palaeontological below).

- ✓ *Holocene*

The most recent geological time period which commenced approximately 12 000 years ago.

- ✓ *Iron Age (Early Farming Communities)*

The archaeology of the last 1800 years up to the 1800's associated with iron working and farming activities such as herding and agriculture.

- ✓ *Later Stone Age*

The archaeology of the last approximately 30 000 years, associated with fully modern people.

- ✓ *Middle Stone Age*

The archaeology of the Stone Age between approximately 300 000 and 30 000 years ago, associated with early modern humans, at least in its latter third.

- ✓ *Palaeontological*

Any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site which contains such fossilised remains or trace.[1]

- ✓ *Single layered cultural landscapes*

Single layered refers to the presence of a single heritage related theme associated with an area. The layering in a landscape refers to different aspects that add to the overall significance of a landscape. One layer could be associated with farming development, another with the development of religion and its structures, and a further one with community development or historical trade. All these layers will add to the significance of a heritage site. [2]

- ✓ *Temporal depth*

Refers to the time span of human occupation that is evident in a cultural landscape or heritage site.

- ✓ *Townscapes*

Townscapes refer to the physical, social and cultural characteristic of a built environment and how it is perceived.

[1] N.B. This definition, as included in the NHRA, is unscientific and is not acceptable to professional palaeontologists, who do not exclude fossils within materials of economic importance such as coal, limestone or road material. Furthermore, fossil-rich sediments that are intimately associated with targeted economic deposits, that are disturbed during mining but not mined for their own sake are indeed protected by the NHRA and should trigger a palaeontological heritage assessment (e.g. fossil plant-rich sandstone beds associated with coal seams.

[2] Julian Smith & Associates Contentworks Inc. 2004. *Definition and Assessment of Cultural Landscapes of Heritage Value on NCC Lands*. Developed for The Design and Land Use Division, Capital Planning and Real Asset Management Branch, National Capital Commission, Government of Canada.

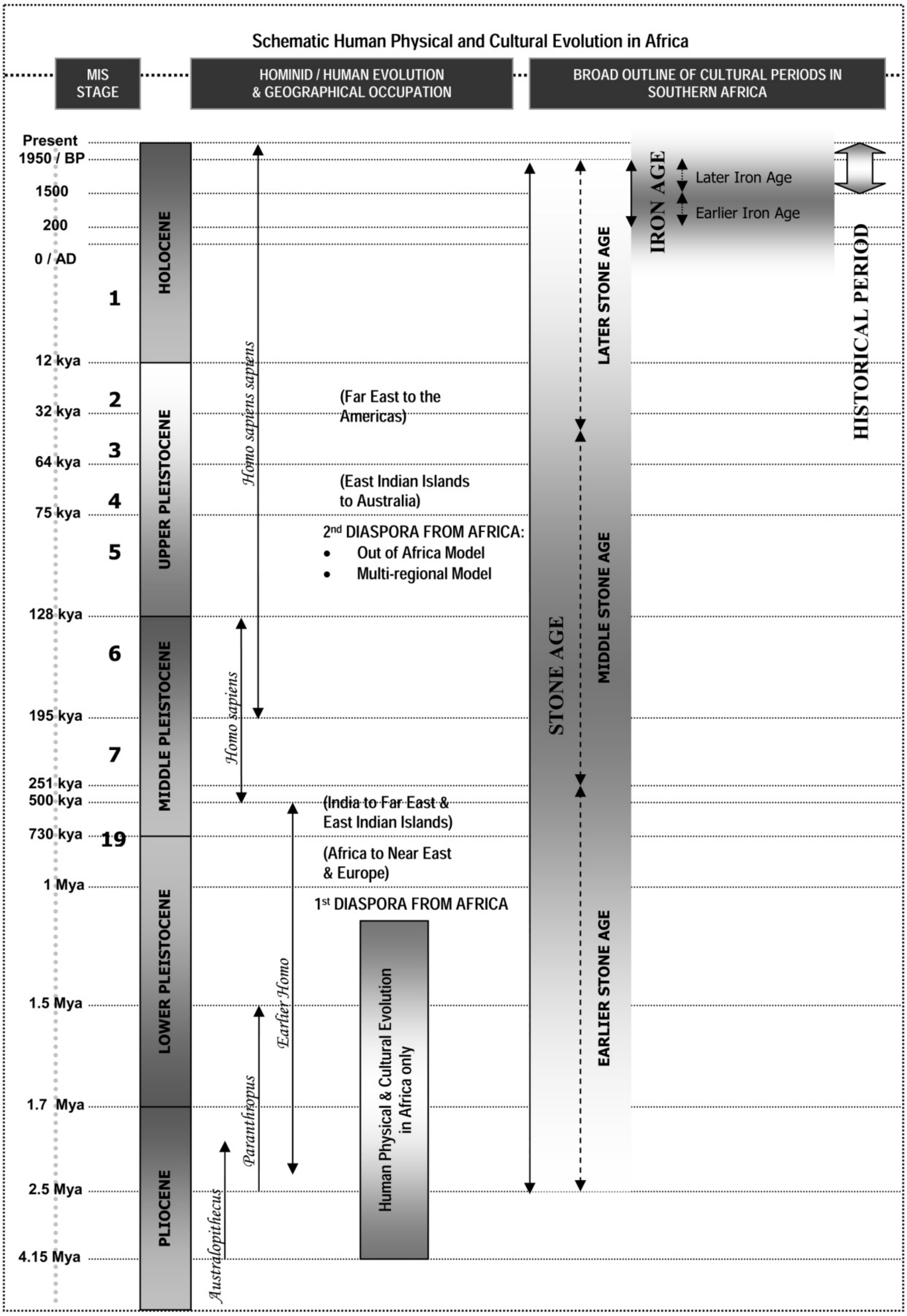

Figure 1 – Human and Cultural Time line in Africa.[3]

[3] Morris, D. 2009. *Archaeological Impact Assessment on Portion of Erf 2003, Erf 1, Windsorton, Northern Cape. Department of Archaeology*. McGregor Museum.

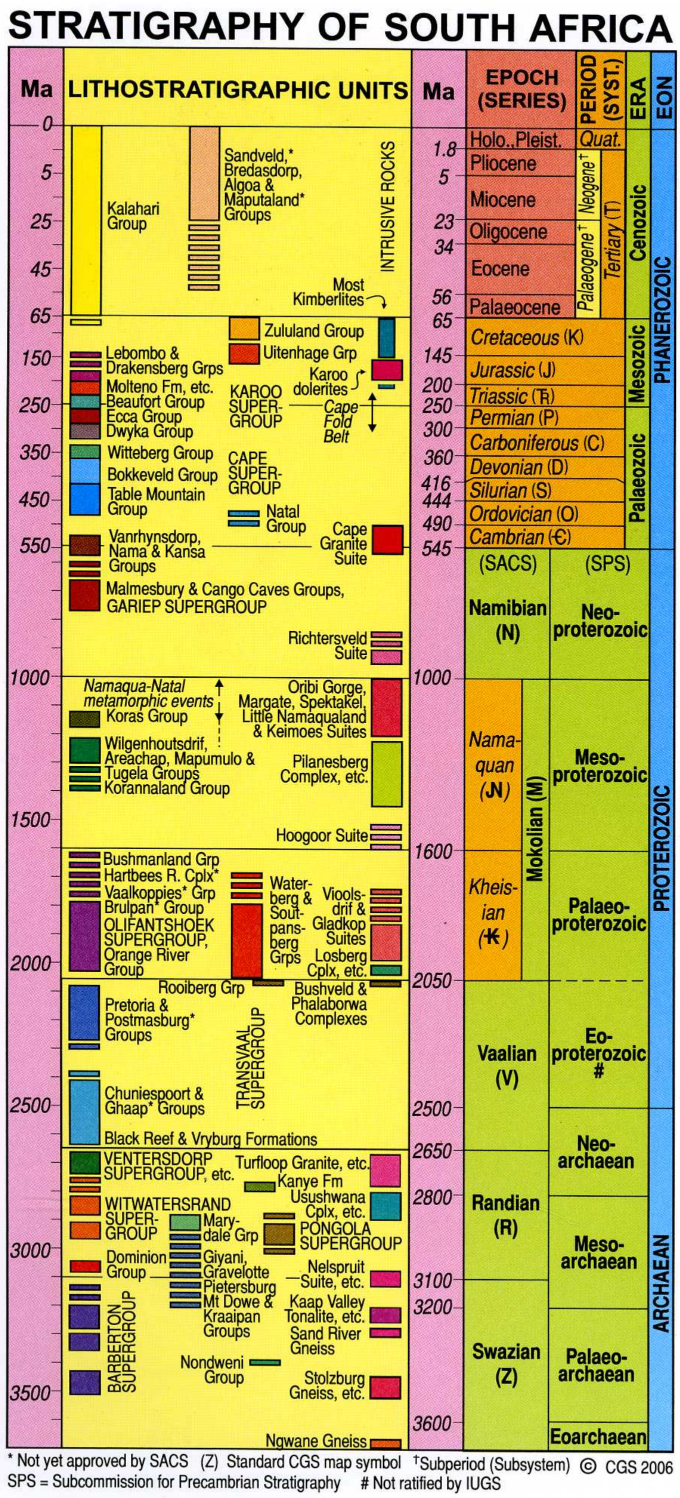

Figure 2 – Outline stratigraphy of the RSA showing the major rock units and their relative ages (in practice, the vast majority of fossils are confined to sediments deposited over the last 550 million years).[4]

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[4] Johnson, M. R. *et al.* 2006. *The geology of South Africa*, xii + 691 pp. The Geological Society of South Africa, Johannesburg and the Council for Geoscience, Pretoria.

1 APPROACH AND METHODOLOGY

1.1 Background

The Department of Environmental Affairs (DEA) appointed the CSIR to undertake a Strategic Environmental Assessment (SEA) aiming to identify geographical areas best suited for the roll-out of wind and solar PV energy projects. These areas are referred to as Renewable Energy Development Zones (REDZs). It is envisaged that wind and solar PV development will be incentivised and streamlined in the REDZs as the SEA process provides a platform for co-ordination between the various authorities responsible for issuing authorisations, permits or consents. Based on development potentials, major constraints and industry inputs, Phase I of the wind and solar PV SEA identified eight focus areas. Phase II – the present phase – is now investigating these areas in greater detail (see **Figure 3**). Phase II entails the refinement of these focus areas through broad stakeholder consultation as well as specialist assessments. PGS Heritage was appointed by the CSIR to undertake a scoping-level specialist heritage (including cultural/historical, archaeological and palaeontological) assessment for eight focus areas identified through the DEA wind and solar PV energy process. Refinement of the areas includes sensitivity mapping, as well as the possible enlargement, reduction or elimination of the identified focus areas.

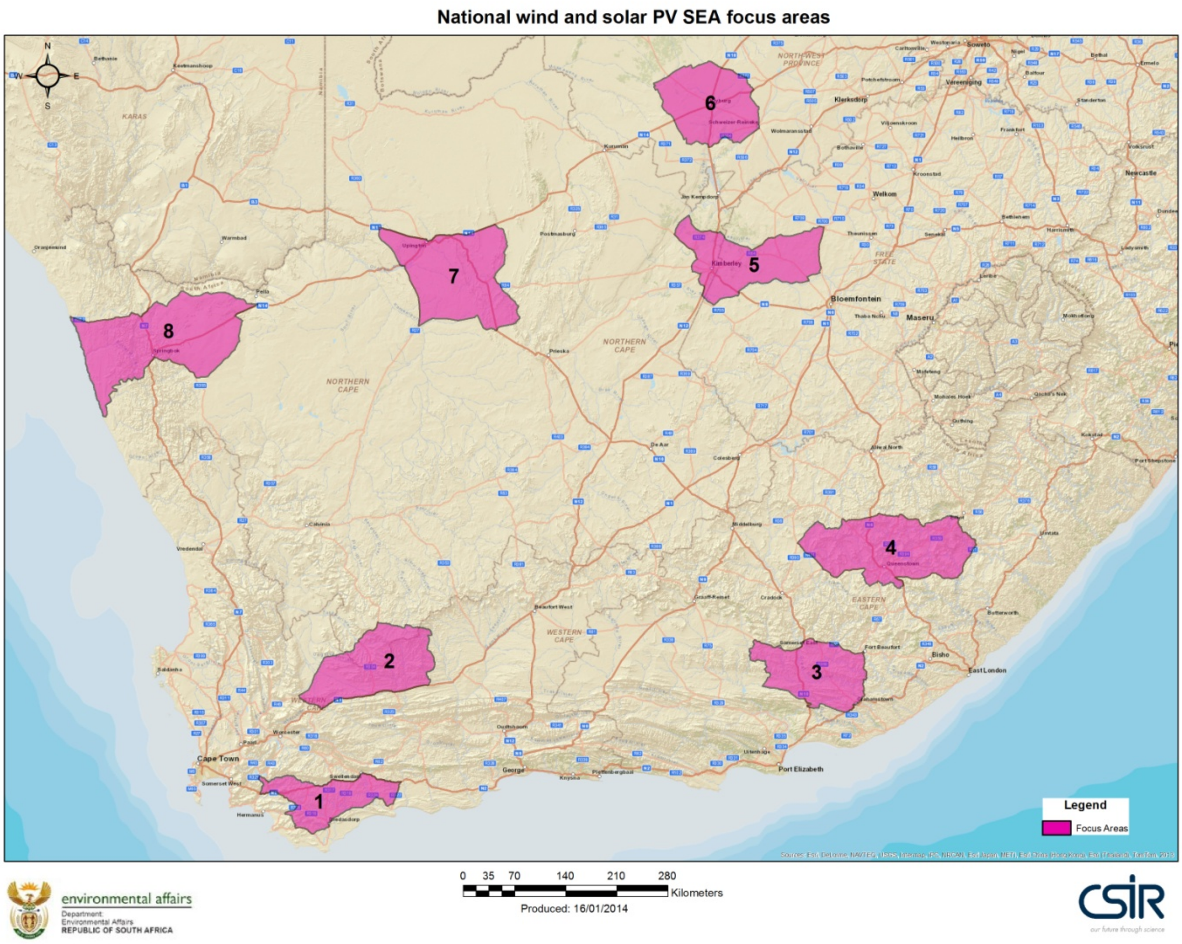

Figure 3 – National wind and solar PV SEA focus areas

1.2 Study methodology

1.2.1 Scope of Study

The heritage assessment needs to identify and consider cultural/historical, archaeological and paleontological resources and sensitivities. This will be done through the development of an assessment methodology that will be guided by the *Minimum standards for undertaking the archaeological and palaeontological component of heritage impact assessments*[5], Section 38(3) of the National Heritage Resources Act No. 25 of 1999 (NHRA), and Heritage polices and guidelines.

The aim of this study is to do a scoping-level mapping and description of the heritage resources and features present in each of the focus areas after which each of the delineated features will be assigned an absolute sensitivity according to the rating scale provided for the study. A set of guidelines on the interpretation and implementation of the four tier sensitivity map will then enable the reader to determine the specific sensitivities and possible impacts on heritage resources, and type of assessments required as a minimum in each of the sensitivity classes.

1.2.2 Methodology

The methodology developed for this study aims to provide a guide that will be reproducible for future SEAs, and focuses on the following main components which are explained below:

a) *Evaluation of the national legislative background and of international policies and guidelines;*
b) *Collection of relevant heritage data;*
c) *Develop the criteria for the rating system to be utilised in the mapping;*
d) *Data analysis and mapping to develop a set of absolute maps;*
e) *Identification of specific impact sensitivities for each focus area; and*
f) *Development of guidelines for the focus areas.*

a) Evaluation of the national legislative background and of international policies and guidelines

The existing legislation and policies provide a background against which the evaluation, grading and management of heritage resources can be carried out in this study. South African heritage resources are protected nationally under Sections 3, 34-36 and 38 of the NHRA and its regulations, and provincially in KwaZulu-Natal by the Kwa Zulu-Natal Heritage Act (No. 10 of 1997), and in the Western Cape through provincial regulation PN298 (2003)[6]. South Africa has also signed into power the World Heritage Convention Act (No. 49 of 1999) that enforces and implements the World Heritage Convention[7] on the proclamation and management of World Heritage Sites.

Guidelines and policies were utilised as background to extract information on minimum standards[8,9], best practice and accepted methodologies for the determination of management standards such as reporting content, permitting processes, buffer distances, and terminologies.

b) Collection of relevant heritage data;

The preliminary research was based on gathering of data from secondary sources to develop data that could be captured into a Geographic Information System (GIS) providing a spatial representation of the

[5] South African Heritage Resources Agency, 2007. *Minimum standards for undertaking the archaeological and palaeontological component of heritage impact assessments*. South African Heritage Resources Agency. Archaeological, Palaeontological and Meteorite Unit.

[6] PN298 – Regulations by Heritage Western Cape under Section 25(2)(h) of the NHRA.

[7] Unesco, 1972. *Convention Concerning the Protection of the World Cultural and Natural Heritage*, adopted by the General Conference of United Nations Education, Scientific and Cultural Organization (Unesco) on 16 November 1972.

[8] SAHRA, 2007. *Minimum Standards: Archaeological and Palaeontological Components of Impact Assessment Reports.* p. 14

[9] South African Heritage Resources Agency, 2013. *Minimum Standards: Palaeontological Component of Heritage Impact Assessment Reports*. South African Heritage Resources Agency. Archaeological, Palaeontological and Meteorite Unit.

position of known heritage resources throughout each of the Focus Areas. A team of research interns was tasked with gathering data and collating it into data sets for GIS use. As no National Survey has been conducted for the country and regional repositories have in most cases not yet moved to digitization of the available data, the researchers focussed on the list of sources as expanded in Section 1.3 of this report.

The analysis of palaeontological sensitivity within the various Focus Areas presented here is based largely on the 1: 1 000 000 scale geological maps. Most PIAs use the relevant finer-scale 1: 250 000 maps as a basis. A preliminary palaeosensitivity map for the RSA based on 1: 250 000 maps is available on the SAHRA website[10]. A considerable portion of the underlying sensitivity data for the SAHRA mapping project was provided by one of the present authors (J.E. Almond) and the two systems are largely congruent. The palaeosensitivity maps in this report incorporate additional data from palaeontological field studies within each Focus Area. For example, in some areas rock units that were generally regarded as being of high sensitivity have been “downgraded” to take high levels of weathering and deformation into account (e.g. Bokkeveld Group in Focus Area 1). A higher emphasis is placed here on unmapped superficial sediments (e.g. Late Caenozoic alluvium) that have proved fossiliferous in field studies (e.g. Pleistocene mammal remains, reworked petrified woods from the underlying Karoo Supergroup bedrocks). Geological heritage - including geological sites of scientific and cultural importance as well as rare geological specimens – also forms part of the National Estate (National Heritage Resources Act (NHRA), 1999 (Section 3)). However, as yet no comprehensive databases of geoheritage resources are available at the national or provincial level (See Section 3.1).

c) Develop the criteria for the rating system to be utilised in the mapping

In developing the assessment and rating criteria for heritage sensitivity the team relied heavily on Section 3(2) of the NHRA that provides a guideline on the type of heritage resources included within the National Estate, as well as on Section 3(3) that guides the criteria for evaluating cultural significance.

d) Data analysis and mapping to develop a set of absolute maps

The data gathered was represented in three possible GIS sets:

- *Point – Structures, cemeteries, archaeological sites,*
- *Line – such as railway lines and rivers*
- *Polygon – Areas such as cultural landscapes, and larger heritage sites*

After initial mapping each of the data sets were then buffered utilising the QGIS[11] Geoprocessing buffer application. The buffer distances were developed by firstly evaluating South African studies[12] and then incorporating international studies[13,14] which focussed on buffer distances for development from heritage resources. The development of the buffering criteria is discussed in Section 3.1 of this report.

The types of heritage resources included in the National Estate as provided in Section 3(2) of the NHRA include:

a) places, buildings, structures and equipment of cultural significance;
b) places to which oral traditions are attached or which are associated with living heritage;
c) historical settlements and townscapes;

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10 http://www.sahra.org.za/map/palaeo
11 QGIS Development Team, 2013, QGIS Geographic Information System – Dufour V2.0. Open Source Geospatial Foundation Project.
12 Provincial Government of the Western Cape (PGWC), 2006. *Strategic Initiative to Introduce Commercial Land Based Wind Energy Development to the Western Cape: towards a regional methodology for wind energy site selection*.
13 Jerpåsen, G.B. and Larsen, K.C. 2011. Visual impact of wind farms on cultural heritage: A Norwegian case study. *Environmental Impact Assessment Review* 31 (2011) 206–215
14 Unesco, 2009. *World Heritage and Buffer Zones.* Published in March 2009 by UNESCO World Heritage Centre[15] Moveable objects include items like artefacts, fossils, meteorites, geological specimens, paintings, ethnographic objects, books and records.

- d) *landscapes and natural features of cultural significance;*
- e) *geological sites of scientific or cultural importance [these are excluded from the present study as there is as yet no comprehensive national or provincial database of significant geological sites available];*
- f) *archaeological and palaeontological sites;*
- g) *graves and burial grounds, including—*
    - i. *ancestral graves;*
    - ii. *royal graves and graves of traditional leaders;*
    - iii. *graves of victims of conflict;*
    - iv. *graves of individuals designated by the Minister by notice in the Gazette;*
    - v. *historical graves and cemeteries; and*
    - vi. *other human remains which are not covered in terms of the Human Tissue Act (No. 65 of 1983);*
- h) *sites of significance relating to the history of slavery in South Africa;*
- i) *movable objects*[15] *[excluded from this study because by their nature they are not tied to any particular place on the landscape]*

By implementing the requirements for the grading of heritage resources as contemplated in Section 7 of the NHRA and its Regulation 43[16], identified heritage sites and areas were given a sensitivity rating based on their known heritage significance, rarity, extent of current research on heritage resource type, extent of mitigation potentially required, and the potential cost of implementation of such mitigation measures.

This rating system was then linked to the four tier sensitivity rating system as required for the SEA study.

e) Identification of specific impact sensitivities for each focus area

Identification of impacts focused on a large amount of South African literature, that included HIAs, AIAs and PIAs, the Overstrand Heritage Survey[17], the Western Cape Heritage and Scenic Resources study[18], and the Western Cape Province's study on wind development.[19]

International studies such as those completed by Jerpåsen and Larsen[20], Lund-Iversen and Lindblom[21], and Kellet[22] assisted in aligning the current study with international trends.

f) Development of guidelines for the focus areas

Cognisant of the requirements of Section 38 of the NHRA, and the Regulations[23] as promulgated under the National Environmental Management Act (NEMA, No. 17 of 1998), a set of development guidelines were formed and linked to the sensitivities as identified in this study.

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[15] Moveable objects include items like artefacts, fossils, meteorites, geological specimens, paintings, ethnographic objects, books and records.

[16] Government Gazette No 6820, Notice 694 dated 30 May 2003

[17] Overstrand Heritage Landscape Group, 2009. *Overstrand Heritage Survey*. Prepared for the Overstrand Municipality.

[18] Winter, S. et al. 2013. *Heritage and Scenic Resources: Inventory and Policy Framework.* A Study prepared for the Western Cape Provincial Spatial Development Framework

[19] PGWC. 2006. *Strategic Initiative to Introduce Commercial Land Based Wind Energy Development to the Western Cape: towards a regional methodology for wind energy site selection*. p.16

[20] Jerpåsen and Larsen, Visual impact of wind farms on cultural heritage. p.16

[21] Lund-Iverseen, M. and Lindblom, I. 2012. *Strategic Heritage Assessment for Wind Power*. Paper presented at the IAIA12 Energy Future: The Role of Impact Assessment, Porto, Portugal 27 May - 1 June 2012

[22] Kellett, J. 1990. *The Environmental Impact of Wind Energy Developments.* The Town Planning Review, Vol. 61, No. 2 (Apr., 1990), pp. 139-155

[23] NEMA 2010 EIA Regulations

1.3 Data Sources

The scope of the data gathered for this archaeological and paleontological strategic level scoping assessment focused on heritage data already available and transferable to spatially representable data. The primary data sources utilised for this study are listed in

Table 1.

Table 1 - Data sources utilised for the study

Data title	Source and date of publication	Data Description
1:1 000 000 Geological Maps	Council for Geoscience, Pretoria1984.	GIS-based geological maps utilised for the identification of the outcrop areas of rock units (groups, formations) that are known to be fossiliferous and hence palaeontologically sensitive.
1:50 000 topographical map – Vector data	Chief Directorate: Surveys and Mapping. Cape Town. Scale 1:50,000. Mowbray, South Africa: Chief Directorate: Surveys and Mapping. topographical maps. 1984-2004.	Georeferenced electronic maps that can be utilised to identify known heritage resources.
Land Surveyor General 1:50 000 topographical map – Raster data	Chief Directorate: Surveys and Mapping. Cape Town, Scale 1:50,000. Mowbray, South Africa: Chief Directorate of Surveys and Mapping. 2003	GIS based data in the form of line, point or polygon data from which information with regards to heritage resources can be derived.
Academic Publications	Academic publications as cited in this report.	A large section of the background research was based on data collected and listed in academic publications.
South African Heritage Resources Information System (SAHRIS)	http://www.sahra.org.za/sahris, 2014[24]	Data extracted is in the form of HIAs, AIAs and PIAs, as well as numerous documents on heritage finds, declared sites, etc. These reports were evaluated to identify sites or areas of heritage significance.
Garmap Africa Series 2011 Southern Africa Topo & Rec, TeleAtlas Africa	Garmin Africa. 2011	GIS based data sources containing most data depicted in the 1:50 000 topographical maps, but augmented with Points of Interest (PoI) such as museums, memorials and monuments.
Google Earth	2014 Google Earth, Accessed April 2014	Satellite photographs are of value in identifying areas with good exposure of potentially fossiliferous bedrocks.
Genealogical Society of South Africa - Cemetery database	Genealogical Society of South Africa. 2014	Data set containing cemeteries and graves documented over the whole of South Africa. The data are, however, not comprehensive.
Natura Viva cc palaeontology database	Dr. John Almond, Natura Viva cc, Cape Town. 2014	Extensive resource comprising numerous PIAs (many not available on SAHRIS), tabulations of fossil data associated with sedimentary formations in South Africa, unpublished reports (field excursions, research reports), library of scientific literature.

[24] Note that for the Western Cape Province only reports dating prior to 2009 are included in the SAHRIS database.

1.4 Limitations for this study

Table 2 provides a list of assumptions and limitations for this study.

Table 2 – List of assumptions and limitations

Heritage Issue	Included in the scope of this study	Limitation	Way forward
Heritage data of sites only available as hard copy and not in electronic format	-	National Museums data sets of heritage resources not electronically available	Available hard-copies to be consulted during heritage studies as required for proposed wind and solar PV projects
Identification of as yet undocumented heritage resources	The study identified heritage resources from primary and secondary published data sources only	As yet unrecorded heritage resources could not be identified	Field surveys to be conducted during heritage studies as required for proposed wind and solar PV projects
Delineation of cultural landscapes	Cultural landscapes were delineated on a macro scale only	Incorporation of viewsheds into the delineation of cultural landscapes was problematic as this will require detailed analysis and site visits to determine the extent of each landscape	Detailed cultural landscape analysis to be done if a development is to take place in demarcated areas.
Geological heritage - including geological sites of scientific and cultural importance as well as rare geological specimens (e.g. designated stratotype sections[25], unusually good exposures of rock units and geological contacts, outstanding examples of geological phenomena)	-	Databases for special, conservation-worthy geological sites (or "geosites") in South Africa are currently being compiled by the Geological Society of South Africa and SAHRA.	
Resolution of geological map database for the identification of palaeontological resources	Rock units represented on the published 1: 1 000 000 scale geological map of South Africa, with a strong emphasis on bedrock.	Rock units only represented on 1: 250 000 or 1: 50 000 scale geological maps could not be incorporated. Younger superficial sediments (e.g. alluvium, soils, surface gravels, pans) that are not usually mapped but may be highly sensitive in palaeontological terms are not all included.	Palaeosensitivity maps at 1: 250 000 scale can be consulted on the SAHRIS website and should be used as an additional resource in parallel with this report. Sensitivity ratings shown there may differ in some respects to those presented in this report, with the latter placing more emphasis on local field data[26].

[25] Stratotype sections are key exposures of a given rock unit (e.g. sedimentary formation) that have been selected by the South African Committee for Stratigraphy, Pretoria, as defining and exemplifying that rock unit for stratigraphic purposes.
[26] The palaeosensitivity ratings shown in the present report are necessarily provisional and will need to be updated on the basis of new field-based data. Developers and heritage managers are strongly encouraged to consult with experienced palaeontological heritage practitioners at an early planning stage for advice on potential fossil heritage issues and the level of assessment studies that may be required.

Heritage Issue	Included in the scope of this study	Limitation	Way forward
Levels of bedrock weathering and tectonic deformation (which have a major influence on fossil preservation) are not indicated on geological maps.	Unweathered, undeformed bedrocks	Highly weathered / highly deformed bedrocks that are not identified as such on maps can lead to overestimation of palaeontological significance, since their original fossil heritage has often been destroyed.	Where adequate field data is available (e.g. Focus Area 1) the sensitivity of weathered and deformed bedrocks has been ranked as low. In other cases, a precautionary approach is adopted.

1.5 Relevant Regulatory Instruments

Table 3 provides a list of regulatory instruments that guides the identification, classification, and management of heritage resources at the international, national and provincial scales.

Table 3 - List of regulatory instruments

Instrument	Key objective
International Instrument	
Convention Concerning the Protection of the World Cultural and Natural Heritage, 1972	Signatories to this Convention recognize the duty of ensuring the identification, protection, conservation, presentation and transmission to future generations of the cultural and natural heritage.
The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance, 2013	The Burra Charter provides guidance for the conservation and management of places of cultural significance (cultural heritage places).
National Instrument	
National Heritage Resources Act (NHRA), No.25 of 1999 and its regulations	Provides for the identification, conservation, protection and promotion of our heritage resources for present and future generations.
The World Heritage Convention Act (No 43 of 1999)	To provide for the incorporation of the World Heritage Convention into South African law; The enforcement and implementation of the World Heritage Convention in South Africa.
National Environmental Management: Protected Areas Act (57 of 2003)	To provide for the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes; for the establishment of a national register of all nationally, provincially and locally protected areas – specific relevance is in relation to World Heritage Sites.
National Environmental Management Act, 1998 (Act No. 107 of 1998)	Provides for the protection of the environment through co-operative environmental governance by establishing principles for decision-making on matters affecting the environment, institutions that will promote co-operative governance and procedures for co-ordinating environmental functions exercised by organs of state; To provide for certain aspects of the administration and enforcement of other environmental management laws – this includes interaction with the NHRA and the protection of heritage as part of the environment.
Provincial Instrument	
PN298 – Regulations by Heritage Western Cape under Section 25(2)(h) of the NHRA, 2003	Regulating process of permitting for heritage resources and consultation regarding protected areas.

2 FOCUS AREAS – HERITAGE DESCRIPTION

Section 2 provides a general background description of the heritages resources within each of the focus areas. This background description is summarised in **Table 4** .

Table 4 - Short heritage description of the eight focus areas

Focus Area	Brief description
Overberg focus area 1	***General setting*** The Overberg focus area extends over an area of 5273 km^2, stretching from Botrivier and the Theewaterskloof Dam in the west to just short of Heidelberg in the east. The northern and southern extent are demarcated by Swellendam, Riviersonderend and Greyton in the north, and Bredasdorp and Elim in the south. The Overberg focus area is dominated by the Cape Fold Mountains to the north, while the Swartberg, Akkedis, Soetmuis and Bredasdorp Mountains break the Bokkeveld shales in the south western section to create an undulating landscape characterised by wheat fields and providing the backdrop for an interaction of human and natural activity to create the region's characteristic cultural landscapes. Settlements were drawn to the foot hills where the inhabitants could utilise the local water sources and rich soils for agriculture, and where transport routes crossed rivers. Most towns are partly included in the focus area boundary and include Botrivier, Caledon, Napier, Greyton, Swellendam, Bredasdorp, Riviersonderend and Elim. ***Palaeontology*** A wide range of bedrock units are represented in focus area 1, ranging from Late Precambrian to Late Caenozoic in age. However, potentially fossiliferous sediments of the most widespread unit, the Bokkeveld Group, are now too weathered and deformed to contain more than sporadic fossil remains in most areas. Most of the remaining rock units are of low to medium palaeontological sensitivity. The few palaeontologically sensitive issues within focus area 1 include: • Possible primitive fish and invertebrate faunas within post-glacial mudrocks of the Cederberg Formation (Table Mountain Group) – but these have not yet been recorded here. • Early Cretaceous fluvial sediments of the Kirkwood Formation (Uitenhage Group), Heidelberg Basin, cropping out towards the eastern end of the focus area near Heidelberg. This formation is important for its well-preserved fossil wood, other plants and rare dinosaur remains. • Late Caenozoic (Tertiary – Quaternary) fluvial sediments associated with older drainage systems, such as the Breede River near Swellendam and southwards, including extensive areas of terrace gravels along their banks. These may contain important mammalian and other fossil remains. ***Heritage*** The towns of Botrivier, Caledon, Napier, Greyton, Swellendam, Bredasdorp, Riviersonderend and Elim all have heritage significance and with their natural setting provide cultural landscapes of varying significance. Keeping with studies done for the Western Cape[27], and the Overstrand[28] the themes identified during the research were: • Palaeontology • Pre-colonial archaeology and early inhabitants of the Western Cape • Early Colonial History and settlement • Early contact and contestation • Cultivation and agricultural production • Religion • Routes and transport • Military history • Town and village formation

[27] Overstrand Heritage Landscape Group, *Overstrand Heritage Survey*. p.17
[28] Winter et al., *Heritage*. p.17

Focus Area	Brief description

	• Regional architecture
	• Outstanding scenic beauty
	
	Identified heritage resources and landscapes include:
	• Numerous cemeteries dating back to the early 1800's
	• Archaeological sites – mostly restricted to isolated artefacts or low density scatters of Earlier Stone Age material known to occur in the area[29]
	• Monuments/Memorials
	• Mission stations – Genadendal and Elim
	• Cultural landscapes
	  o The herder landscape around the Breede River[30]
	  o Bot River Valley, Bot River settlement and historical railway precinct
	  o Caledon Hot Springs (historical development)
	  o Elim (just on the border of the study area)
	  o Hagedisberg Outspan
	  o Riviersonderend Valley
	  o Buffelsjagrivier Valley, including the Bontebok National Park[31]

Site	Brief description
Komsberg focus area 2	***General setting*** The extent of the Komsberg focus area is 8871 km^2 starting in the west at the Karoopoort Outspan on the R355 between Ceres and Calvinia, and Touwsriver on the N1. It stretches east past Laingsburg into an area of the Karoo known as the Koup, where its eastern boundary is demarcated by a district road linking the Koup train station, in the south east corner, with Houdenbeck via Van de Lindeskraal. The northernmost extent of the focus area is just south of Sutherland and it extends to Matjiesfontein in the south. The area is dominated by the Saal and Bontberg mountain ranges in the west, while the Tankwa Karoo stretches from the Karoopoort towards the Rooster and Koedoesberg mountains in the centre of the focus area. The Moordernaars Karoo is bisected by the Komsberg Mountains to the north. ***Palaeontology*** Focus area 2 is underlain by a wide range of sedimentary bedrock units of the Cape and Karoo Supergroups, many of which are well-exposed and known to contain fossil material of Middle to Late Palaeozoic age. Most of the potentially fossiliferous superficial deposits (e.g. Caenozoic alluvium) are not shown on the published geological maps. Palaeontologically sensitive issues within focus area 2 include: • Important fossil fish, vascular plant, non-marine bivalve and trace fossil assemblages of Middle Devonian age from the Upper Bokkeveld Group (Bidouw Subgroup) and lowermost Witteberg Group (Wagen Drift Formation) in the south-western corner of the focus area; • Early Carboniferous non-marine fish and plants from the upper Witteberg Group (Lake Mentz Subgroup) in the Ceres Karoo; • Early to Middle Permian fish, mesosaurid reptiles, invertebrates, trace fossils and plant remains (including petrified wood) from the Lower Ecca Group (Prince Albert, Whitehill and Collingham Formations) in the Ceres and Tanqua Karoo areas; • Well-preserved petrified wood and trace fossil assemblages, possibly with associated fish and bivalves, from the upper Ecca Group (Waterford Formation) along the Roggeveld Escarpment, as well as in the Klein Roggeveld and Koup regions; • Sparse but palaeontologically important Middle Permian continental fossil assemblages of

[29] Goodwin, A.J.H. and Riet Van Lowe, C. 1929. The Stone Age cultures of South Africa. Annals of the South African Museum 27.
[30] Arthur, C. 2008. *The Khoekhoen of the Breede River Swellendam : an archaeological and historical landscape study*. Masters dissertation. University of Cape Town
[31] Arthur, *The Khoekhoen. p.22*

Site	Brief description
	the Lower Beaufort Group (Adelaide Subgroup, Abrahamskraal and Teekloof Formations) that underlies most of the central and northern portions of the focus area. Key elements include a wide range of tetrapods (e.g. amphibians, reptiles, therapsids or "mammal-like reptiles"), trace fossils (including vertebrate burrows, trackways), and plants that are assigned to the *Eodicynodon* and *Tapinocephalus* Assemblage Zones; and • Consolidated alluvial sediments associated with older drainage systems such as the Groot, Tanqua, Buffels and Wilgehout Rivers that may contain important Pleistocene mammalian remains as well as reworked Beaufort Group fossil wood. ***<u>Heritage</u>*** Archaeological research in the Tankwa and Moordenaars Karoo has seen an upsurge in activity since 2010 due to infrastructure development and the interest in renewable energy. This is evident form the number of cases registered on SAHRIS. Due to the harsh environment, archaeological sites in this area tend to be associated with inland water such as pans and rivers where high density Middle and Later Stone Age artefact scatters provide traces of hunter-gatherer occupation. Intact base camps of hunter-gathers have only been documented in a few instances[32], probably due to the low frequency of research and the vast expanse of the area in question. Rock art in the focus area is in most instances confined to the mountainous areas as can be attested by the finds in the Swartruggens Mountains[33] and the rock art sites situated in the Karoopoort area on the south-western boundary of the focus area.[34] The expansion of colonial settlement during the 18th and 19th centuries saw an increase in the population of the Karoo that resulted in the appearance of farmsteads (consisting of farmhouses, kraals and earth dams as the core of the settler farm unit) and small settlements such as Touwsrivier, Matjiesfontein and Laingsburg, while in areas like the Komsberg and Ekkraal valleys interaction between early settlers and the natural landscape shaped the area and produced an unique cultural landscape.[35] Settlements and features just outside the focus area such as the provincial Heritage Site of Matjiesfontein and Monument Cemetery some 10 kilometers to the west on the southern side of the N1 shows the unique cultural landscape of human habitation and infrastructure intermingling with dry flat landscapes juxtaposed against mountains. Matjiesfontein train station was established in 1878 but a town was only laid out in 1884; it was garrisoned during the South African War by British forces. [36,37] Recent discoveries such as previously undocumented British fortifications that included reboubts and gun platforms associated with the South African War[38] have shown that further discovery as part of heritage studies will not be uncommon and background research can add to the understanding of the area's rich history. Themes identified during the research were: • Palaeontology • Pre-colonial archaeology and early inhabitants of the Western Cape

[32] PGS Heritage, 2010. *Heritage walkdown of the Gamma-Kappa 765kV transmission line: Section –Kappa-Omega*.
[33] Hall, S. and Mazel, A. 2005. The Private Performance of Events: Colonial Period Rock Art from the Swartruggens. *Kronos*, No. 31 (November 2005)
[34] PGS, *Heritage walkdown. p.23*
[35] Hart, T. and Webley, L. 2013. *Heritage Impact Assessment, Revised report on Phase 1 of the Roggeveld Wind Farm*. ACO Associates
[36] Winter, et al. *Heritage.* p.17
[37] Fransen, H. 2006. *Old Towns and Villages of the Cape: A Survey of the Origin and Development of Towns, Villages, and Hamlets at the Cape of Good Hope, with Particular Reference to Their Physical Planning and Historical Townscape*. Jonathan Ball Publishers.
[38] Orton, J. and Halkett, D. 2011. *Heritage Impact Assessment for the proposed Photovoltaic Solar Energy Facility on the Remainder of farm Jakhalsvalley 99, Sutherland Magisterial District, Western Cape.* Unpublished report prepared for the Environmental Evaluation Unit by the Archaeology Contracts Office, University of Cape Town.

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<tr><th>Site</th><th>Brief description</th></tr>
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Early Colonial History and settlement
Early contact and contestation
Historical Cultivation and agricultural production
Religion
Routes and transport
Military history
Town and village formation
Regional architecture
Outstanding scenic beauty

Identified heritage resources and landscapes include:

Numerous cemeteries dating back to the early 1800's
Archaeological sites – Middle and Later Stone Age
Historical sites
South African War sites
Cultural landscapes

Localised cultural landscapes in the kloofs at the foot of the escarpment (agricultural, historical and pre-colonial)
Matjiesfontein Provincial Heritage Site (historical village)[39]
Karoopoort Provincial Heritage Site[40]

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<tr><td>Cookhouse focus area 3</td><td>
<u>General setting</u>
Focus area 3 covers 7385km². The northern boundary follows the R63 road to the south of the Winterberg Mountains. Starting just west of Somerset East, it skirts the towns of Bedford and Adelaide and extends to Fort Beaufort. The eastern boundary then extends southwards to Grahamstown. From Grahamstown the southern border of the focus area follows the foothills of the Suurberg Mountains in a northwesterly direction passing Alicedale. The western boundary of the focus area links the R400 and R63 to the southwest of Somerset East. The Great Fish River traverses the north-eastern part of the focus area.

<u>Palaeontology</u>
Focus area 3 lies within the poorly-studied south-eastern portion of the Main Karoo Basin. Large outcrop areas of Permian Ecca Group and Lower Beaufort Group sediments are potentially fossiliferous but exposure levels here are often very poor due to soil and vegetation cover. Focus area 3 includes the type areas of several Cape and Karoo Supergroup sedimentary rock units, increasing its heritage significance. Most of the potentially fossiliferous superficial deposits (e.g. Caenozoic alluvium) are not shown on the published geological maps. Palaeontologically sensitive issues within focus area 3 include:

Thin packages of lagoonal mudrocks within the Witpoort Formation (Witteberg Group) that have yielded diverse fossil assemblages of vertebrates (several fish groups including placoderms, sharks, bony fish, lampreys as well as rare tetrapods), invertebrates (e.g. eurypterids and scorpions), vascular plants, seaweeds and trace fossils that provide a rare glimpse of wildlife close to the south pole in Late Devonian times (c. 360 Ma). Key Witpoort Formation fossil localities close to Grahamstown on the south-eastern edge of the focus area include Waterloo Farm and Howieson's Poort;
Early Carboniferous fish, plant and trace fossil assemblages from the upper Witteberg Group (Lake Mentz and Kommadagga Subgroups), for example in the Kommadagga

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[39] SAHRA Site Reference: 9/2/058/0001. *Declaration as Provincial Heritage Site: Gazette date – 12.07.1975*. See http://www.sahra.org.za/sites/920580001
[40] SAHRA Site Reference: 9/2/021/0005. *Declaration as Heritage Heritage Site: Gazette date – 24.04.1981*. See http://www.sahra.org.za/sites/920210005

Site	Brief description
	Subgroup type area to the west of Riebeek East; • Early to Middle Permian fish, aquatic reptiles (mesosaurids), crustaceans, trace fossils and drift wood from the Lower Ecca Group (especially the Whitehill Formation); • Important but poorly-known terrestrial biotas of Middle to Late Permian age from the Lower Beaufort Group (Koonap, Middleton and Balfour Formations) that underlies almost the entire central and northern sectors of the focus area. Fossils recorded here include diverse vertebrates (reptiles, therapsids, amphibians, fish), freshwater molluscs, trace fossils, petrified wood and other plants of the *Glossopteris* Flora of Gondwana. These fossils define five successive assemblage zones (*Tapinocephalus*, *Pristerognathus*, *Tropidostoma*, *Cistecephalus* and *Dicynodon*) that preceded the End Permian Mass Extinction Event in the Main Karoo Basin; and • Thick alluvial deposits of Pleistocene and younger age along the Koonap, Great Fish, and Little Fish Rivers (largely unstudied) may contain important vertebrate and other fossil remains. Consolidated (calcretised) alluvium exposed in dongas in many other areas within the focus area (e.g. near Cookhouse) contain locally abundant assemblages of well-preserved fossil wood (reworked from the Lower Beaufort Group) as well as sporadic Pleistocene mammal fossils (e.g. mineralised teeth). ***Heritage*** This focus area has a deeply layered heritage with available data spanning the Earlier Stone Age to recent struggle history. The pre-colonial archaeology spans the Earlier, Middle and Later Stone Ages. Sites probably associated with the ancestors of the San and Khoekhoen pastoralists, like those Sampson[41] has documented in the Zeekoe valley further afield in the in the Great Karoo, also appear to occur in this Focus Area[42]. The original contact zone between the Khoekhoen and the Xhosa in the eastern part of the focus area was loosely determined by the Great Fish River as can be attested by the Khoekhoen place names in the western parts of the Eastern Cape.[43] Following the start of colonialisation of the area, at first by the Trekboers and subsequently through formal annexation by the British colonial government, an era of turmoil and intermittent conflict ensued between 1779 and 1879.[44] The Nine Wars (flair ups) making up the Frontier War in the parts of the Old Eastern Cape resulted in the expulsion of the Xhosa tribes firstly from west of Grahamstown in the area between the Bushman's River and Great Fish River and then by 1820 from the area to the west of the Kat River with the settlement of British farmers in the Albany district between Grahamstown and the Great Fish River.[45] Conflict between Frontier Boers and the Colonial authorities also resulted in further conflict as is evident in the Slagtersnek Rebellion sparked by the Slagtersnek hangings in 1815, just 10 kilometres to the south of Cookhouse.[46] Themes identified during the research were: • Palaeontology • Pre-colonial archaeology and early inhabitants of the Eastern Cape • Early Colonial History and settlement

[41] Sampson, G. 1992. Stylistic boundaries among mobile hunter-gatherers in the Zeekoe Valley, Eastern Cape. Washington, Smithsonian Institution Press.
[42] Webley, L., Halkett, D. and Hart, T. 2009. *Heritage Impact Assessment of a proposed Wind Energy Facility to be situated on portions of farms Arolsen 69, Farm 148, Farm 148/1; Rooidraai 146, Baviaans Krans 151, Baviaans Krantz 151/2, Klip Fonteyn 150/2, Roberts Kraal 281, Zure Kop 74/1, Zure Kop 74/2, Van Wyks Kraal 73, Van Wyks Kraal 73/2 and Van Wyks Kraal 73/3 in the Cookhouse District, Eastern Cape*. Unpublished report prepared for Savannah Environmental (Pty) Ltd. ACO Associates cc.
[43] Halkett, D. and Webley, L. 2010. *Heritage Scoping Assessment of a proposed Wind Energy Facility to be situated on farms in the Cookhouse District, Eastern Cape*. ACO Associates.
[44] Gon, P. 1982. *The Last Frontier War*. Military History Journal Vol 5 No 6 - December 1982
[45] Robson, L. and Oranje, M. 2012 . Strategic Military Colonisation: The Cape Eastern Frontier 1806–1872. *Scientia Militaria - South African Journal of Military Studies*. , vol. 40, no. 2, pp. 46-71.
[46] Bedford History, 2014. http://www.bedford.co.za/page/bedford_history. Accessed 28 May 2014

Site	Brief description
	• Early contact and contestation • Historical cultivation and agricultural production • Religion • Routes and transport • Military history • Town and village formation • Regional architecture • Outstanding scenic beauty Identified heritage resources and landscapes include: • Numerous cemeteries dating back to the early 1800's • South African War battle sites • Archaeological sites • Monuments/Memorials • Cultural landscapes o *Cookhouse and Great Fish River Valley* o *Small agricultural landscapes in river valleys* o *Historical settlement of Somerset East, Bedford, Alicedale, Adelaide, Riebeeck Oos (typical historical grid layout)*

Site	Brief description
Stormberg focus area 4	***General setting*** The Stormberg focus area is situated in the north Eastern Cape and covers an area of 12074 km^2. The focus area starts in the west at Hofmeyer in the foot hills of the Bamboesberg Mountains, encompasses Tarkastad and Queenstown in the south, and Encobo in the far east. Indwe, Dortrect, and Molteno form the northern-most boundary of the focus area. ***Palaeontology*** Focus area 4 lies within a key area for fossils of the Triassic and Jurassic Periods within the upper part of the Karoo Supergroup (Upper Beaufort Group and Stormberg Group) of the Main Karoo Basin. Most of the focus area is underlain by potentially fossiliferous sedimentary bedrocks but these are often poorly exposed at the surface due to cover by vegetation, soil and other superficial deposits (e.g. scree, alluvium). Numerous Early Jurassic dolerite intrusions have often compromised fossil preservation along their margins through thermal metamorphism (baking of surrounding bedrocks). Palaeontologically sensitive issues within focus area 4 include: • Diverse terrestrial and freshwater biotas of the *Cynognathus* & *Lystrosaurus* fossil assemblage zones are preserved within the Katberg and Burgersdorp Formations underlying the southern and central portions of focus area 4. Fossil groups include amphibians, true reptiles, therapsids ("mammal-like reptiles"), palaeoniscoid fish, freshwater bivalves, trace fossils (including tetrapod trackways and burrows) and vascular plants (*Dicroidium* Flora, including petrified wood). The tetrapod faunas are among the richest known from Gondwana in the Early Triassic Period and record the gradual recovery of vertebrate life on land following the catastrophic End Permian Mass Extinction Event; • The Molteno Formation , which contains minor coal seams, has yielded the richest Mid-Triassic (c. 220 million year old) fossil floras recorded anywhere in the world, as well as some of the oldest known dinosaur trackways and diverse fossil insect remains. The formation occurs widely in the northern part of the focus area, including the type area around Molteno, while several key fossil sites are located near Indwe; • Late Triassic to Early Jurassic "red beds" of the Elliot Formation, occurring along the north-central margin of the focus area, are famous for their important fossil vertebrate fauna including a range of early dinosaurs (prosauropods, sauropods, ornithischians,

Site	Brief description
	plus trackways), advanced therapsids and even rare primitive mammals; and • Older consolidated alluvial deposits along river systems such as the Elandsrivier in the western part of the focus area may contain important Pleistocene vertebrate remains. An example is the fossil skull of a Late Pleistocene (*c.* 36 000 BP) anatomically modern *Homo sapiens* from donga deposits near Hofmeyr. ***<u>Heritage</u>*** The rich heritage layering of the Stormberg focus area flows from the pre-colonial time when the San utilised the foot hills and the mountains of the Stormberg range as a base for hunting and gathering. Such evidence can be seen through the large number of known rock art sites dispersed across farms such as:[47] • Jedwood • Rockwood • Rheebok Fontein • Annan Water • Uyl Hoek • Rietfontein • Ida • Coldstream • Leeuwenfontein • Stafelbers Kloof • Hex Rivier • Kings Glen • Uitkyk • Commanage The landscape is rich in rainfall and grazing and ripe for agricultural utilisation. This resulted in the establishment of the Xhosa empire which was characterised by struggles over these rich resources between clans. The British Empire stepping into the fray was the spark igniting the area of Lesotho and resulting in the Gun War that spilled over from the Maloti's into the Eastern Cape mountainous areas. The Thembu and associated clans grouped together to resist the colonial ambitions; at the battle of Gqwaru Hills on 14 November 1880 the Thembu's chief defeated a 200 strong colonial force.[48] The rebellion was eventually suppressed and the abaThembu's land redistributed under white farmers. The Bulhoek Massacre memorial site, commemorating the killing of the members of the American Church of God and the Saints of Christ member who refused to disperse after a mass protest, is situated on the southern boundary of the Stormberg focus area some 30 kilometres to the south west of Queenstown.[49] The foot print of the South African War is evident in skirmish sites at Schoemanskop, Modderfontein and the railway line toward Dordrecht[50], and memorials and blockhouse lines between Molteno, Sterkspruit, Dordrecht and Queenstown. [51,52] Walter Sisulu was born in 1912 at Qutubeni, situated in the centre of the focus area close to the Lubisi Dam. Sisulu moved from Qutubeni and settled in Johannesburg where in '*1943, Sisulu,*

[47] Woodhouse Rock Art Collection, http://repository.up.ac.za/handle/2263/595. Accessed 10 April 2014
[48] Human Sciences Research Council (HSRC). *National Liberation Route – Sites Associated with Unsung Heroes and Heroines in the Eastern Cape.* Website: http://liberationheritage.co.za/page/liberation-heritage-website#. Accessed 19 August 2014
[49] HSRC, National Liberation Route. p.28
[50] Smith, R.W. 2004. Modderfontein, 17 September 1901. *Military History Journal* Vol 13 No 1 - June 2004
[51] Cloete, P.G. 2000. *The Anglo-Boer War a Chronology*. J.P van der Walt and Sons. Pretoria
[52] Hall, D. 1999. *The Hall handbook of the Anglo Boer war*, 1899-1902.

Site	Brief description
	Nelson Mandela and Oliver Tambo joined with Anton Lembede, AP Mda and others to found the ANC Youth League.'[53] On the southern border of the focus area lies Qamata Mountain associated with tradition and custom as the place of rain utilised in time of drought as a place for rain making dances.[54] Themes identified during the research were: • Palaeontology • Pre-colonial archaeology and early inhabitants of the Eastern Cape • Early Colonial History and settlement • Early contact and contestation • Cultivation and agricultural production • Religion • Routes and transport • Military history • Traditional settlement patterns and land use • Town and village formation • Regional architecture • Outstanding scenic beauty Identified heritage resources and landscapes include: • Numerous cemeteries dating back to the early 1800's • Archaeological sites • Rock art sites • Monuments/Memorials • Cultural landscapes o Mission stations - Nyaba Maria Mission, St Cyprions Mission o *General landscape of traditional settlements (settlement pattern)* o Traditional rain making sites – Qamata.

Site	Brief description
Kimberley focus area 5	***General setting*** The Kimberley focus area is dominated by vast expanses of dry grass land inter-dispersed with rock ridges, out crops and koppies spanning 9603km^2. The focus area stretches from just outside Delpoorsthoop in the west and then south towards Barkly-West, Kimberley and Jacobsdal. The southern boundary follows the Modder River east toward the eastern-most towns of Florisbad and Bultfontein. Boshof and Windsorton lie along the northern boundary of the focus area. ***Palaeontology*** The palaeontological resources in focus area 5 have received very little scientific attention. To a great extent they can only be inferred from the rock units represented there on geological maps. Most of the potentially fossiliferous superficial deposits (e.g. Caenozoic alluvium) are not shown on the published geological maps, however, while fossil-rich bedrocks are often mantled with superficial deposits (calcrete, soils) or baked by dolerite intrusions. Palaeontologically sensitive issues within focus area 5 include: • Outcrop areas of the Lower Ecca Group (Prince Albert and Whitehill Formations) in the vicinity of Kimberley contain important post-glacial fossil assemblages of marine reptiles (mesosaurids), invertebrates (e.g. crustaceans), fish, trace fossils and driftwood. However, most of the outcrop area is mantled by superficial deposits (e.g.

[53] HSRC, National Liberation Route. p.28
[54] HSRC, National Liberation Route. p.28

Site	Brief description
	calcrete, soil) or has been baked by dolerite intrusion. Important Ecca fossil material has been collected from the subsurface in diamond mining areas (e.g. Kimberley Big Hole, Bultfontein); • Small outcrop areas of the Lower Beaufort Group (Adelaide Subgroup) towards the eastern margins of focus area 5 contain vertebrates and other fossil remains of the latest Permian *Dicynodon* Assemblage Zone; • Ancient alluvial "High Level Gravels" associated with the Vaal River (e.g. Windsorton – Barcly West area) have yielded vertebrate fossils of considerable palaeontological interest. The "Older" Vaal River Gravels (Windsorton Formation) contain sparse mammalian faunas of Miocene-Pliocene age. A wide range of Pleistocene mammal remains (bones, teeth) as well as Acheulean stone tools are recorded from the "Younger" Vaal River Gravels or Rietputs Formation of Middle Pleistocene age (Cornelian). They include various equids and artiodactyls as well as African elephant and hippopotamus. Diverse fossils of Quaternary mammals and a range of other vertebrate groups (including fish amphibians, reptiles and birds) are also associated with ancient river sediments of the Modder River along the southern edge of the focus area, for example at Erfkroon[55], *c.* 60 km WNW of Bloemfontein (28° 52' S, 25° 36' E) and might also be encountered along the Rietrivier as well, to the east of Douglas; and • The Middle Pleistocene to Early Holocene fossil site at Florisbad[56,57,58,59], *c.* 45 km NNW of Bloemfontein (28° 46' S, 26° 04' E[60]), has been nominated as National Heritage Site. This area has yielded the type assemblage for the Florisian Land Mammal Age (*c.* 400-100 000 BP), associated with thermal spring deposits. An impressive range of extinct mammal taxa includes *Megalotragus* (Giant Hartebeest), *Pelorovis* (Giant Long-horned Buffalo) and *Equus capensis* (Cape Zebra) as well as the skull of Florisbad Man (possibly *Homo heidelbergensis*), the last dated 260 000 BP. Key Pleistocene fossil pollen data have also been collected here. ***<u>Heritage</u>*** A scan of archival documentation and databases has shown that although the historical events around Kimberley from the discovery of diamonds (1866)/diamond rush (1871)[61] to the Siege of Kimberley (1899-1900)[62] dominates the landscape and history, the palaeontological history of the study area reaches back 300 million years to the Palaeozoic-age Dwyka Ice Age. Glacial markings occur at the Provincial Heritage site of Nooitgedacht Glacial Pavements on the Vaal River just north west of Kimberley[63] as well as at Driekopseiland[64]. Together with the glacial pavements a vast number of rock engravings are present adding to the multifaceted history of the area.[65]

55 Churchill, S.E., Brink, J.S., Hutchison, R.A., Rossouw, L., Stynder, D., Hancox, P.J., Brandt, D., Woodborne, S., Loock, J.C., Scott, L. & Ungar, P. 2000. Erfkroon: a new Florisian fossil locality from fluvial contexts in the western Free State, South Africa. *South African Journal of Science* 96: 161-163.
56 Brink, J.S. 1987. The archaeozoology of Florisbad, Orange Free State. *Memoirs of the National Museum, Bloemfontein* 24: 1-151.
57 Dreyer, T.F. 1935. A human skull from Florisbad, Orange Free State, with a note on the endocranial cast, by C.U. *Ariens Kappers. Koninkljke Akademie van Wetenschappen te Amsterdam* 38: 3-12.
58 Dreyer, T.F. 1938. The archaeology of the Florisbad deposits. *Argeologiese Navorsinge van die Nasionale Museum, Bloemfontein* 1: 65-77.
59 Kuman, K., Inbar, M. & Clarke, R.J. (1999) Palaeoenvironment and cultural sequence of the Florisbad Middle Stone Age Hominid site, South Africa. *Journal of Archaeological Science* 26:1409-1425.
60 The given co-dinates are taken from the SAHRIS database on Florisbad and refer to an extensive spring mound site thus seconds have not been provided. The site certainly lies within the Focus Area.
61 Meredith, M. 2007. *Diamonds, Gold, and War: The British, the Boers, and the Making of South Africa*. New York: Public affairs.
62 Phelan, T. 1913. *The Siege of Kimberley*. Dublin: M.H. Gill & Son, Ltd.
63 Slater, G, et al. 1932. The glaciated surfaces of Nooitgedacht, near Kimberley, and the Upper Dwyka boulder shales of the eastern part of Griqualand West (Cape Province), 1929. *Transactions of the Royal Society of South Africa* 20.4
64 Morris, D. 1988. Engraved in place and time: A review of variability in the rock art of the Northern Cape and Karoo. *South African Archaeological Bulletin* 43: 109-120.
65 Beaumont, P. B., and Vogel, J.C. 1989. Patterns in the age and context of rock art in the northern Cape. *The South African Archaeological Bulletin*. Vol. 44, No. 150 (Dec., 1989), pp. 73-81

Site	Brief description
	Just south of Nooitgedacht on the R31 towards Barkley-West lies the Wildebeestkuil Rock Art Centre and Museum where tourists can view an extensive rock art site from walkways.[66] Other Stone Age and palaeontological sites of National significance are Kantien Koppie at Barkley-West[67] and Florisbad Quaternary Research Station 45 kilometres northwest of Bloemfontein[68] The South African War has also left its mark on the landscape with numerous battle fields such as Belmont, Graspan, Modder River and Magersfontein in the Northern Cape Province. The Battle of Magersfontein[69] was fought on 11 December 1899 on the farm Magersfontein some 25 kilometres south of Kimberley inside the focus area boundary. Other Battle fields just to the south of the focus area include, Paardeberg and Poplar Grove. [70] Themes identified during the research were: • Palaeontology • Pre-colonial archaeology and early inhabitants – especially associated with inland water in the arid regions of South Africa • Early Colonial History and settlement • Routes and transport • Military history • Town and village formation • Outstanding scenic beauty Identified heritage resources and landscapes include: • Kimberley town (Victorian settlement and mining landscape) • Wildebeestkuil rock art landscape (prominent landscape feature) • Vaal and Riet River rock art sites (engraved glacial pavements) • Florisbad archaeological and palaeontological site • Erfkroon archaeological and palaeontological site • Kantienkoppie (historic mining and ESA occupation) • Battlefields – Magersfontein. • Cemeteries • Monuments/Memorials

Site	Brief description
Vryburg focus area 6	***General setting*** The Vryburg focus area study area is characterised by wooded grass land and very few ridges and rivers. The total size of the study area is 9241 km^2 and the boundary of the study area from the town of Vryburg in the approximate centre varies between 48 and 65 kilometers in distance. The towns of Stella in the north, Dry Harts in the south, actually just outside the boundary, and Schweizer-Reneke in the east are the best known towns in the study area. ***Palaeontology*** The palaeontological resources in focus area 6 area have received very little scientific attention. To a great extent they can only be inferred from the rock units represented there on geological maps. Most of the potentially fossiliferous superficial deposits (e.g. Caenozoic alluvium) are not shown on the published geological maps, however. Palaeontologically sensitive issues within focus area 6

66 Wildebeest Kuil Rock Art Centre. http://www.wildebeestkuil.itgo.com/. Accessed 30 May 2014
67 Beaumont, P.; McNabb, J. (2000b). "Canteen Kopje: the recent excavations". *The Digging Stick* 17 (3): 3–6.
68 Brink, *The archaeozoology*. p. 30; Dreyer, A human skull. p.30; Dreyer, The archaeology. p. 30
69 Cloete, *The Anglo-Boer War*. p.28
70Cloete, *The Anglo-Boer War*. p.28

Site	Brief description
	include: • Stromatolitic carbonate rocks (limestones, dolomites) of Early Precambrian (Archaean) age in outcrops of the Ventersdorp Group (Kameeldorns, Rietgat and Bothaville Formations) as well as the lower part of the Transvaal Supergroup (Ghaap Group, Vryburg Formation & Schmidtsdrift Subgroup, including the Boomplaas Formation). In the Vryburg area and further south towards Taung these include some of the oldest (> 2.5 billion years) and best-preserved stromatolites (fossil microbial mounds) known from this period; • Precambrian (Proterozoic) stromatolitic carbonates from the Campbell Rand Subgroup (Ghaap Group, Transvaal Supergroup) of the Ghaap Plateau region. These rocks are normally poorly exposed, but outstanding stromatolite occurrences are known from the Ghaap Escarpment in the Boetsap area (outside focus area 6) and may well occur more widely; and • Unmapped Late Caenozoic sediments - including possible Tertiary / Quaternary terrace gravels or other alluvial deposits along major drainage systems (e.g. Droë Harts River), tufa deposits along the Ghaap Escarpment (cf. Taung Pleistocene fossil primate remains outside focus area 6), calcretes and pan sediments - that may contain important mammalian and other fossil remains (e.g. freshwater molluscs, plants, trace fossils). ***Heritage*** The pre-history of the area is evident through the presence of numerous farms with rock engravings, including Verdwaal Vlakte, Bernauw, Schatkist, Wonderfontein[71] and Kinderdam. [72,] The numerous dry pans in the northern section of the study area also increase the probability of finding Stone Age Sites associated with hunter gatherer subsistence[73]. Heritage Resources associated with the South African War can be traced through the presence of blockhouse lines between Taung and Vryburg and onwards towards Madibogo[74], as well as the Vryburg concentration camp situated on the Vryburg Allotment area that is now part of the Leon Taljaard Nature Reserve to the north west of Vryburg.[75] Other areas of significance identified are the Devondale Mission (*circa* pre-1900), Tiger Kloof Institute (*circa* 1904)[76] as well as the farmstead of the first and only president, Gerrit Jacobus van Niekerk, of the republic of Stellaland on the farm Niekerksrus[77] some 36 kilometres northwest of Vryburg. Themes identified during the research were: • Palaeontology • Pre-colonial archaeology and early inhabitants – especially associated with inland water in the arid regions of South Africa • Early Colonial History and settlement • Routes and transport • Military history

[71] van Schalkwyk, J.A. 2012. *Heritage Impact Assessment for the proposed development of a photovoltaic power plant on a portion of the Farm Waterloo 992, Vryburg Region, North West Province.*
[72] Morris. D. 1988. Engraved in Place and Time: A Review of Variability in the Rock Art of the Northern Cape and Karoo. *The South African Archaeological Bulletin* Vol. 43, No. 148 (Dec., 1988), pp. 109-120
[73] van Schalkwyk, J.A. 2013. Basic Heritage Assessment for the proposed Mookodi 132kv Phase 2 Power Lines Development, North West Province.
[74] Cloete, *The Anglo-Boer War*. p.28
[75] Anglo Boere Oorlog/Boer War (1899-1902) British Concentration Camp project. Anglo Boere Oorlog/Boer War (1899-1902) VRYBURG Camp/Kamp. http://www.geni.com/projects/Anglo-Boere-Oorlog-Boer-War-1899-1902-VRYBURG-Camp-Kamp/14136. Accessed 30 May 2014.
[76] Tiger Kloof Institute. History. http://www.tigerkloof.com/index.php/about-us/history. Accessed 30 May 2014.
[77] Personal observation of photo exhibition and captions at the Vryburg Museum, 2014

<table>
<tr><th>Site</th><th>Brief description</th></tr>
<tr><td></td><td>Town and village formation
Identified heritage resources and landscapes include:
Vryburg concentration camp
Tigerkloof Institute
Devondale Mission
Niekerksrus farmstead
Cemeteries
Monuments/Memorials</td></tr>
</table>

<table>
<tr><th>Site</th><th>Brief description</th></tr>
<tr><td>Upington focus area 7</td><td><u>General Setting</u>
The Upington focus area is situated in the northern part of the Northern Cape province and covers an area of 12877 km². From Lutzputs Railway Station in the north-western corner, the western boundary extends to Kenhardt. It continues in the south past Marydale to Westerberg on the Orange River where it stretches over the Orange River towards Poljaspoort before it turns west and joins the Orange River which is followed to Groblershoop. The boundary then continues north to the N14 road and westwards again past Upington.

The Upington focus area is dominated by the Orange River cutting through the arid Northern Cape landscape, providing a central source of water along which most of the settlement has developed through colonial times.

<u>Palaeontology</u>
The palaeontological resources in focus area 7 have received very little scientific attention. To a great extent they can only be inferred from the rock units represented there on geological maps. Most of the potentially fossiliferous superficial deposits (e.g. Caenozoic alluvium) are not shown on the published geological maps, however. Palaeontologically sensitive issues within focus area 7 include:
Stromatolitic carbonate rocks (limestones, dolomites) of Precambrian age (Late Archean to Early Proterozoic) in outcrops of the Transvaal Supergroup (Schmidtsdrift, Campbell Rand and Koegas Subgroups) in the easternmost portion of focus area 7 (Koegas area);
Latest Precambrian quartzites and carbonates of the lower Nama Group (Kuibis Subgroup) in the Gordonia region, between Upington and Ariamsvlei, that contain key fossil assemblages (trace fossils, stromatolites, vendotaenids, simple shells, possible vendobiontans) of the Ediacaran biota;
Small outcrop area of Dwyka Group glacially-related sediments along the N14 west of Upington, with the possibility of non-marine trace fossil and vascular plant assemblages;
Late Tertiary and younger terrace gravels along the banks of the Orange River that may contain important mammalian and other fossil remains (e.g. freshwater molluscs, plants, trace fossils);
Unmapped older alluvial, pan and calcrete successions of Quaternary or greater age along extinct palaeo-drainage systems away from the Orange River that might contain important mammalian remains (e.g. bones, teeth, horncores); and
Possible unmapped, subsurface crater lake infills of Cretaceous / Tertiary age comparable to the Stompoor site south of Kenhardt (outside focus area 7).</td></tr>
</table>

Site	Brief description
	Heritage The settlement history in the Upington focus area dates back to the ESA with Acheulean stone tools excavated at a site 35 kilometres southeast of Upington[78], while MSA period artefacts were found in association with human remains at Zoovoorbij near Keimoes.[79] The LSA dates range between 4300 and 2100 BP when it was succeeded by two contemporary Ceramic LSA industries. The shelters at Zoovoorbij and the nearby Renosterkop (the latter located outside the focus area) show a well-developed assemblage of lithics, fine tempered pottery, and ostrich eggshell beads.[80] As colonial expansion started to push the northern frontier back, new inhabitants encountered San (Bushman) hunter-gatherers and Einiqua Khoekhoen pastoralist groups living in the Middle Orange River area. The Einiqua identity was eventually assimilated into the Koranna who utilised the islands of the Orange River as strongholds from where they launched raids on settlers and tribes of the region alike.[81] Place names like Curries Camp, McTaggart Camp and Kanoneiland bear witness to the early days of colonisation of the Orange River in the focus area[82]. The South African War saw numerous skirmishes that took place in the Kakamas, Keimoes and Upington areas to repel Boer commandos,[83] while the 1914 Rebellion instigated by General Manie Maritz was instigated at the Rebellion Tree that is now a monument on the farm Van Rooisvlei situated in the north-west corner of the focus area.[84] Themes identified during the research were: • Palaeontology • Pre-colonial archaeology and early inhabitants – especially associated with inland water in the arid regions of South Africa • Early Colonial History and settlement • Routes and transport • Military history • Town and village formation Identified heritage resources and landscapes include: • Zoovoorbij archaeological site • Orange River (historical and pre-colonial settlement) • Cemeteries • Monuments/Memorials

Site	Brief description
Springbok focus area 8	***General Setting*** The Springbok focus area is situated in the Namakwa District Municipality in the north western part of the Northern Cape Province and covers an area of 15243 km^2. The focus area stretches from Port Nolloth in the north-west along the Namaqualand coast past Kleinsee to Koingnaas and Hondeklipbaai in the southwest of the focus area. The boundary runs north-eastwards to Springbok

[78] Beaumont, P.B. et al. 1995. *Before the Einiqua: the archaeology of the frontier zone*. A. B. Smith (ed.). Einiqualand: studies of the Orange River frontier p236-264. Cape Town: UCT Press.
[79] Morris, D. & Beaumont, P.B. 1991. !Nawabdanas: archaeological sites at Renosterkop, Kakamas District, Northern Cape. *South African Archaeological Bulletin* 46:115-124.
[80] Smith, A.B. 1995. *Archaeological observations along the Orange River and its hinterland*. A. B. Smith (ed.). Einiqualand: studies of the Orange River Frontier p263-300. Cape Town: UCT Press.
[81] Penn, N. 2005. *The Forgotten Frontier: Colonist and Khoisan on the Cape's Northern Frontier in the 18th Century*. Cape Town: Double Storey Books.
[82] Wilcox, A.R. 1986. *Great River: The Story of the Orange River*. Winterton: Drakensberg Publications.
[83] Legassick, M. 1996. *The will of Abraham and Elizabeth September and the struggle for land in* Gordonia. Journal of African History 37(3): 371-418.
[84] Serfontein, D. 1972. *Ek is maar ene*. Cape Town and Pretoria: Human & Rousseau.

Site	Brief description
	then southeast and again northeast to Aggeneys. The northern boundary runs past Steinkopf back to Port Nolloth. ***Palaeontology*** The palaeontological resources in focus area 8 area have received very little scientific attention. To a great extent they can only be inferred from the rock units represented there on geological maps. Most of the potentially fossiliferous superficial deposits (e.g. Caenozoic alluvium) are not shown on the published geological maps, however. Palaeontologically sensitive issues within focus area 8 include: • Latest Precambrian quartzites and carbonates of the Nama Group (Kuibis and Schwarzrand Subgroups) in the narrow, north-south trending outcrop area to the west of Steinkopf and Springbok. This key latest Precambrian fluvial to marine succession contains key fossil assemblages (trace fossils, stromatolites, vendotaenids, simple shells, possible vendobiontans) of the Ediacaran biota; • Highly fossiliferous sediments of the Miocene to Recent West Coast Group located at 100 m above mean sea level (amsl) or below (and especially below 50 m amsl) along the West Coast. They include shallow marine, estuarine, fluvial, lagoonal and terrestrial coastal (sand dune, calcrete) sediments. Marine fossil assemblages of Miocene to Quaternary age contain a wide range of invertebrates, trace fossils as well as sharks' teeth and other vertebrate remains (whales, seals etc) while important Early Miocene fossil floras occur in palaeochannel settings. Vertebrate fossils, including land mammals and micromamals among others, occur within estuarine, lagoonal, pan, vlei and spring deposits. Most of the narrow, potentially fossiliferous outcrops are unmapped at 1: 250 000 scale - many are mainly subsurface - and, given their vulnerability to development (e.g. mining), remain seriously understudied in scientific terms; • Largely unmapped fossiliferous Cretaceous to Palaeocene crater lake deposits associated with kimberlite and olivine melilitite volcanic pipes, often buried beneath superficial sediments in the Bushmanland area. Fine-grained sediments may preserve plants (leaves, wood), fish, frogs, reptiles, rare dinosaurs (e.g. ornithischian dinosaur *Kangnasaurus* from crater lake deposits at Goebees, *c.* 50 km to the NE of Springbok), insects, ostracods and palynomorphs (fossil pollens and spores); and • Unmapped older alluvial, pan and calcrete successions of Tertiary to Quaternary age along extinct palaeo-drainage systems in the interior such as the Koa River Valley south of Aggeneys. These locally contain important Tertiary mammalian fossils (bones, teeth, horncores; e.g. Pliocene three-toed horse, Hipparion, recorded from a well at Areb, 65 km east of Springbok) and well-preserved petrified woods. The important Miocene fossil site at Bosluis Pan is situated *c.* 25 km outside and SE of focus area 8. Older consolidated alluvium along the Buffels River west of Springbok may contain Late Caenozoic fossil remains. ***Heritage*** The Namaqualand coast, specifically referring to the Sandveld, has a high archaeological potential with research conducted indicating thousands of shell middens present along the coast line, and rare but significant mixed ESA and MSA sites including mineralised bone in the Kleinzee area[85]. ESA, MSA and many LSA sites have been excavated from the coastal zone and indicate a rich cultural sequence in the area.[86],[87]. A very important site is Spoeg River Cave on the coast where the earliest evidence for sheep in South Africa has been found[88].

[85] Orton, J. & Webley, L. 2012. *Heritage impact assessment for the proposed Project Blue Wind Energy Facility, Kleinzee, Namakwa Magisterial District, Northern Cape*. Unpublished report prepared for Savannah Environmental (Pty) Ltd. Diep River: ACO Associates cc.
[86] Dewar, G. 2008. *The archaeology of the coastal desert of Namaqualand, South Africa: a regional synthesis*. Oxford: British Archaeological Reports International Series 1761.
[87] Orton, J. 2012. Late Holocene archaeology in Namaqualand, South Africa: hunter-gatherers and herders in a semi-arid environment. Unpublished D. Phil. thesis. Oxford: University of Oxford.

Site	Brief description

	Inland, archaeological sites are less common but significant rock shelters, sometimes containing rock art, do occur[89,90].
	
	Rock art sites at Kangnas[91], Kromneus, Kraaifontein, Klipfontein and Canariefontein include, cupules, geometric and animal finger paintings[92]. Rock art has also been noted in the Aggeneys area of the focus area by Morris [93], while his description of the possible San massacre site at the Ghaamsberg relates to an area just outside the eastern boundary of the focus area to the east of Aggeneys
	
	Historical heritage features in the landscape include mission stations and fortifications of the South African War that are found around the copper mining towns of Springbok, Okiep and Nababeep.
	
	Together with the old *Messelpad* and *Wildepaardehoek* passes leading to Hondeklipbaai, the Copper mining cultural landscape of Springbok, Okiep, Concordia and Nababeep provides a unique insight into early colonial mining. Central to this area is the Simon van der Stel Copper mine at Carolusberg and the Copper smelting kiln in Springbok, both sites being proclaimed Provincial Heritage Sites.
	
	Themes identified during the research were:
	• Palaeontology
	• Pre-colonial archaeology and early inhabitants –
	  – Numerous occurrences of shell middens in the coastal zones and
	  – Sites close to inland water in the arid regions
	• Early Colonial History and settlement
	• Routes and transport
	• Military history
	• Town and village formation
	
	Identified heritage resources and landscapes include:
	• Copper Mining Landscape that include the Provincial Heritage sites[94] of
	  – Orbicule Koppie, Concordia
	  – Van der Stel's Coppermine, Carolusberg
	  – Copper smelting chimney at Springbok
	  – Old smoke stack at Okiep
	  – Cornish pump building at Okiep
	• Grootmis historical settlement
	• Coastal belt (extremely high density pre-colonial occupation)
	• Memorials
	• Cemeteries

[88] Webley, L.E. 1992. Early evidence for sheep from Spoeg River Cave, Namaqualand. *Southern African Field Archaeology* 1: 3–13.
[89] Webley, L.E. 1992. *The history and archaeology of pastoralism and hunter-gatherer settlement in the north-western Cape, South Africa.* Unpublished PhD thesis, University of Cape Town.
[90] Orton, J. 2013. Geometric rock art in western South Africa and its implications for the spread of early herding. *South African Archaeological Bulletin* 68: 27-40.
[91] Orton, Geometric rock art. p. 37
[92] Rudner, J. & Rudner, I. 1968. Rock-art in the thirstland areas. *South African Archaeological Bulletin* 23: 75–89
[93] Morris, D. 2013. *Heritage Impact Assessment: Proposed Aggeneys Photovoltaic Solar Energy Facility at Bloemhoek near Aggeneys, Northern Cape Province*. McGregor Museum.
[94] SAHRA Heritage Register.

3 ABSOLUTE SENSITIVITY MAPPING

3.1 Identification of absolute sensitivity criteria

The absolute mapping criteria focused on the establishment of an acceptable buffer for a solar PV or wind development in close proximity to heritage features. All accepted standards not enforced by regulation such as the 20 meters buffer from a grave or cemetery required by SAHRA were reviewed for this study. Further attention was given to various South African studies with different recommended buffers such as the threshold limits recommended in the PGWC study (2006) i.e. 500 meters from heritage and cultural sites and up to 1 kilometre from scenic routes and important landscapes. The PGWC[95] study also evaluated two possible methods for determining the suitability of specific areas for wind energy. The first focussing on selected threshold criteria while, the second methodology was a landscape-based assessment method that was evaluated. The outcome of this study resulted in the development of an integrated methodology with proposed distance for the mapping of resources after which an integrated landscape analysis approach was followed towards identifying areas suitable for wind energy developments.

International scenic landscape and cultural landscape studies such as those completed by Jerpåsen and Larsen[96], Baltas and Dervos[97], Lund-Iversen and Lindblom[98], and Kellet[99] also indicated differences in perception and implementation. The case study in Greece focussed on larger scale buffering by proposing a minimum distance from World Heritage monuments of major importance of 3000 meters, as well as the maximum allowed number of turbines per km^2 in the surrounding area.[100] Jerpåsen and Larsen[101], took the holistic approach and urged the focus to be on applying a holistic determination of the cultural landscape "setting" as determined in the Burra Charter[102] that not only includes specialist assessor input but also that of the public and other stakeholders. Such a methodology then moves away from the set threshold criteria towards a holistic cultural landscape assessment integrating cultural heritage, natural landscape and public opinion.

While implementing such an approach on a project of this scale will be the ideal, as recommended in the PGWC[103] and Larsen[104] studies, due to the large extent of the present study, the SEA approach focuses on identifying acceptable thresholds and buffers that will assist with policy and guideline development for the positioning of wind and solar PV projects.

95 PGWC, *Strategic Initiative*. p.17
96 Jerpåsen and Larsen, *Visual Impact.* p. 16
97 Baltas, A.E. and Dervos, A.N. 2012. *Special framework for the spatial planning & the sustainable development of renewable energy resources*. Renewable Energy 48 (201) 358-363.
98 Lund et al. *Strategic Heritage Assessment*. p. 17
99 Kellet, The Environmental Impact. p.17
100 Baltas et al. Special framework. p.38
101 Jerpåsen and Larsen, *Visual Impact.* p. 16
102 ICOMOS. 2013. *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance*.. '*…Setting means the immediate and extended environment of a place that is part of or contributes to its cultural significance and distinctive character*.'
103 PGWC, *Strategic initiative*. p. 17
104 Jerpåsen and Larsen, *Visual Impact.* p. 16

Table 5 provides the development threshold and buffer distances developed for this study.

Geological heritage - including geological sites of scientific and cultural importance as well as rare geological specimens - is listed among the heritage resources that form part of the National Estate in the NHRA (Section 3). However, unlike palaeontological sites, geological sites are not generally protected[105]. Key geological sites of outstanding scientific or cultural importance may be granted formal protection if individually proposed for incorporation on national and provincial heritage registers (NHRA Sections 27, 28).

Provincial Heritage Resources Authorities are required to maintain a register of geological sites of scientific heritage significance (NHRA, Section 30) but first the sites need to be graded according to their heritage significance, a process that is currently being addressed by Heritage Western Cape for their area of jurisdiction. There is as yet no comprehensive national or provincial database of significant geological sites available. The Geological Society of South Africa (GSSA) is now working on this. Obvious candidates would include all the stratotype sections (key exposures of rock formations) identified by the South African Committee for Stratigraphy, Pretoria, as well as numerous "Geosites" of scientific, ecotourism and educational interest publicised by the GSSA[106,107,108].

Comprehensive Heritage Impact Assessment reports should include the identification and mapping of geological sites of scientific or cultural heritage importance within the affected area, an assessment of their significance and potential impacts of the development on them as well as any proposals for mitigation (Section 38 (3)). Due to capacity constraints, geological heritage resources have usually been disregarded so far, both by the heritage management authorities as well as by heritage assessment practitioners and considerable input from the geological community will be required to redress this deficiency.

[105] The term generally protected refers to heritage resources that have their own Section in the NHRA (i.e. structures (S.34), archaeology and palaeontology S. 35) and graves (S.36).
[106] Norman, N. & Whitfield, G. 2006. *Geological journeys. A traveller's guide to South Africa's rocks and landforms*, 320 pp. Struik Publishers, Cape Town.
[107] Norman, N. 2013. *Geology off the beaten track exploring South Africa's hidden treasures*, 256 pp. Struik Nature, Cape Town.
[108] Viljoen, M.J. & Reimold, W.U. 1999. *An introduction to South Africa's geological and mining heritage*, 193 pp. The Geological Society of South Africa and Mintek.

Table 5 - Absolute sensitivity criteria applicable to all focus areas for both wind and solar PV developments

Sensitivity Feature	Data Source	Sensitivity Mapping Application for wind and solar PV
PALEONTOLOGY ABSOLUTE FEATURES		
Florisbad Cranium (outstanding fossil site)	– Henderson Z., Florisbad, South Africa: over 120 000 years of human activity. Nyame Akuma No 44 December 1995. – National Heritage Site Nomination Form for the Florisbad spring mound and surrounding land, submitted by J.S Brink on 11 June 2003. South African Heritage Resource Agency.	– *Very high sensitivity* within 10 km of cranium (fossil skull) site
Florisbad SpringEye (outstanding fossil site)	– Henderson Z., Florisbad, South Africa: over 120 000 years of human activity. Nyame Akuma No 44 December 1995. – National Heritage Site Nomination Form for the Florisbad spring mound and surrounding land, submitted by J.S Brink on 11 June 2003. South African Heritage Resource Agency.	– *Very high sensitivity within 10 km of spring eye*
Erfkroon ModderRiver Erfkroon site (palaeontological feature including known fossil-bearing rock units)	– Churchill et.al., Erkroon: a new Florisian fossil locality from fluvial contexts in the western Free State, South Africa. South African Journal of Science 96, April 2000.	– *Very high sensitivity* within 10 km of the Modder River section demarcated on map

Sensitivity Feature	Data Source	Sensitivity Mapping Application for wind and solar PV
Sensitive Rock units (geological base map) including: • *ADELAIDE* • *ASBESTOS HILLS* • *BOEGOEBERG DAM* • *BOTHAVILLE* • *BRULSAND* • *CAMPBELL RAND* • *CLARENS* • *DRAKENSBERG* • *DWYKA* • *ECCA* • *ELLIOT* • *ENON* • *GHAAP* • *KAMEELDOORNS* • *KOEGAS* • *KUIBIS* • *MATSAP* • *MOLTENO* • *PRINCE ALBERT* • *RIETGAT* • *SCHMIDTSDRIF* • *SCHWARZRAND* • *STALHOEK* • *SULTANAOORD* • *TARKASTAD* • *VRYBURG* • *WHITEHILL* • *WITTEBERG*	1:1 000 000 and 1:250 000 Geological Maps (1984)	– *High* No buffer
Sensitive Rock units (geological base map) including: • *ACHAB* • *AREB GNEISS* • *BIDOUW* • *BREDASDORP* • *CERES* • *CONCORDIA GRANITE* • *DWYKA* • *FORT BROWN* • *GESELSKAP-BANK* • *GLADKOP* • *GRAHAMS-TOWN* • *HARTEBEEST PAN GRANITE* • *HOOGOOR* • *KALAHARI* • *KAMIESKROON GNEISS* • *KAROO DOLERITE* • *KHURISBERG* • *KONKYP GNEISS* • *KOOKFONTEIN* • *KORRIDOR* • *MESKLIP GNEISS* • *MODDERFONTEIN GRANITE/GNEISS* • *NAAB* • *NABABEEP GNEISS* • *NAKANAS* • *NARDOUW* • *NUWEFONTEIN GRANIT* • *RIETBERG GRANITE* • *SKOORSTEENBERG* • *STINKFONTEIN* • *STYGER KRAAL SYENIT* • *TABLE MOUNTAIN* • *TIERBERG* • *VOLKSRUST* • *WATERFORD*	1:1 000 000 and 1:250 000 Geological Maps (1984)	– *Medium* No buffer
HERITAGE ABSOLUTE FEATURES		
Provincial Heritage Site including site with provisional heritage protection	– Provided by the South African Heritage Resources Agency (2014)	– High sensitivity within 500m of the provincial heritage site
Cultural landscape including: • Archaeologically rich coastal belt: Coast line 1km buffer • Hotpsrings • Outspan • Sacred Place • Historical settlements	– Chief Directorate Surveys and Mapping: 1:50 000 Vector data set from the Surveyor General – Google Earth Imagery (2014)	– High sensitivity no buffer

Sensitivity Feature	Data Source	Sensitivity Mapping Application for wind and solar PV
South African War remnants including: • Blockhouses and camps • BW siege • Concentration camps • Fortifications	– Chief Directorate Surveys and Mapping: 1:50 000 Vector data set from the Surveyor General – Google Earth Imagery (2014) – Pieter G. Cloete, 2000. The Anglo-Boer War a Chronology. J.P van der Walt and Sons. Pretoria – Darrell Hall, 1999. The Hall handbook of the Anglo Boer war, 1899-1902	– *High sensitivity within 500 m of SA War remains*
Perennial river	– Chief Directorate Surveys and Mapping: 1:50 000 Vector data set from the Surveyor General	– High sensitivity within 1 km of perennial rivers
Pan	– Chief Directorate Surveys and Mapping: 1:50 000 Vector data set from the Surveyor General	– High sensitivity within 500 m of wetlands
Mountain pass	– Chief Directorate Surveys and Mapping: 1:50 000 Vector data set from the Surveyor General	– *High sensitivity* No buffer
Heritage structure including • Historical sites • Archaeological sites • Battlefield • Buildings, Farmstead and Homestead • Heritage Register • Missions	– Chief Directorate Surveys and Mapping: 1:50 000 Vector data set from the Surveyor General – Garmap SA – Points of Interest (POI) – Google Earth (2014)	– High sensitivity within 500m of Heritage structure
Rock Art sites	– Chief Directorate Surveys and Mapping: 1:50 000 Vector data set from the Surveyor General – Google Earth Imagery (2014)	– Medium sensitivity no buffer

Sensitivity Feature	Data Source	Sensitivity Mapping Application for wind and solar PV
Mountains and ridges	– Chief Directorate Surveys and Mapping: 1:50 000 Vector data set from the Surveyor General – GPS coordinates from Heritage reports available on the South African Heritage Resources Information System (SAHRIS)	– Medium sensitivity no buffer
Monument	– Chief Directorate Surveys and Mapping: 1:50 000 Vector data set from the Surveyor General – Garmap SA – Points of Interest (POI) – Google Earth (2014)	– Very high sensitivity within 500 m of monument
Cemetery	– Chief Directorate Surveys and Mapping: 1:50 000 Vector data set from the Surveyor General – Google Earth (2014) – Genealogical Society of South Africa	– Medium sensitivity within 500 m of cemetery
Protected area	– South Africa Protected Areas Database	– High sensitivity within 1 km of protected area

3.2 Absolute sensitivity maps

The mapping of heritage resources is based on the criteria included in Table 5 (section 3.1). The location data for individual palaeontological sites is highly sensitive due to illegal fossil collection and therefore is not mapped on the Absolute Sensitivity Maps. Furthermore, precise locations of many paleontological features are generally not available and are liable to misinterpretation by encouraging the misconception that known fossil sites are necessarily more sensitive than the intervening, unstudied outcrop areas of the same geological unit. Where the fossil material has been collected, further protection of the original site is often of limited value. Although fossil site data within the study area is obviously highly relevant, the best overall guide to palaeontological sensitivity for future development areas is provided by maps of fossiliferous sedimentary rock units (e.g. formations) that form the basis for this analysis.

3.2.1 Overberg focus area 1

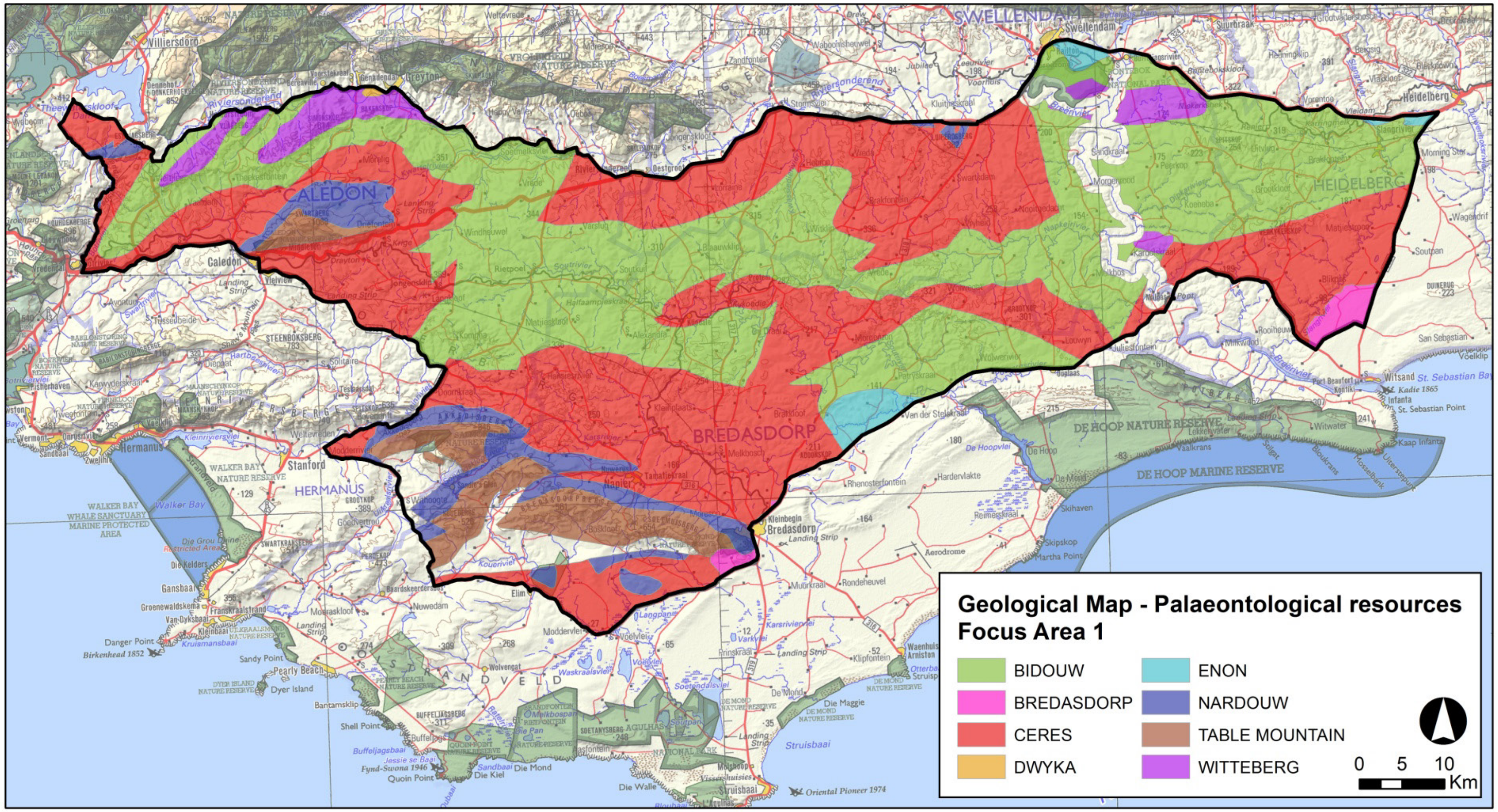

Figure 4 – Geological base map - palaeontological resources – Focus Area 1

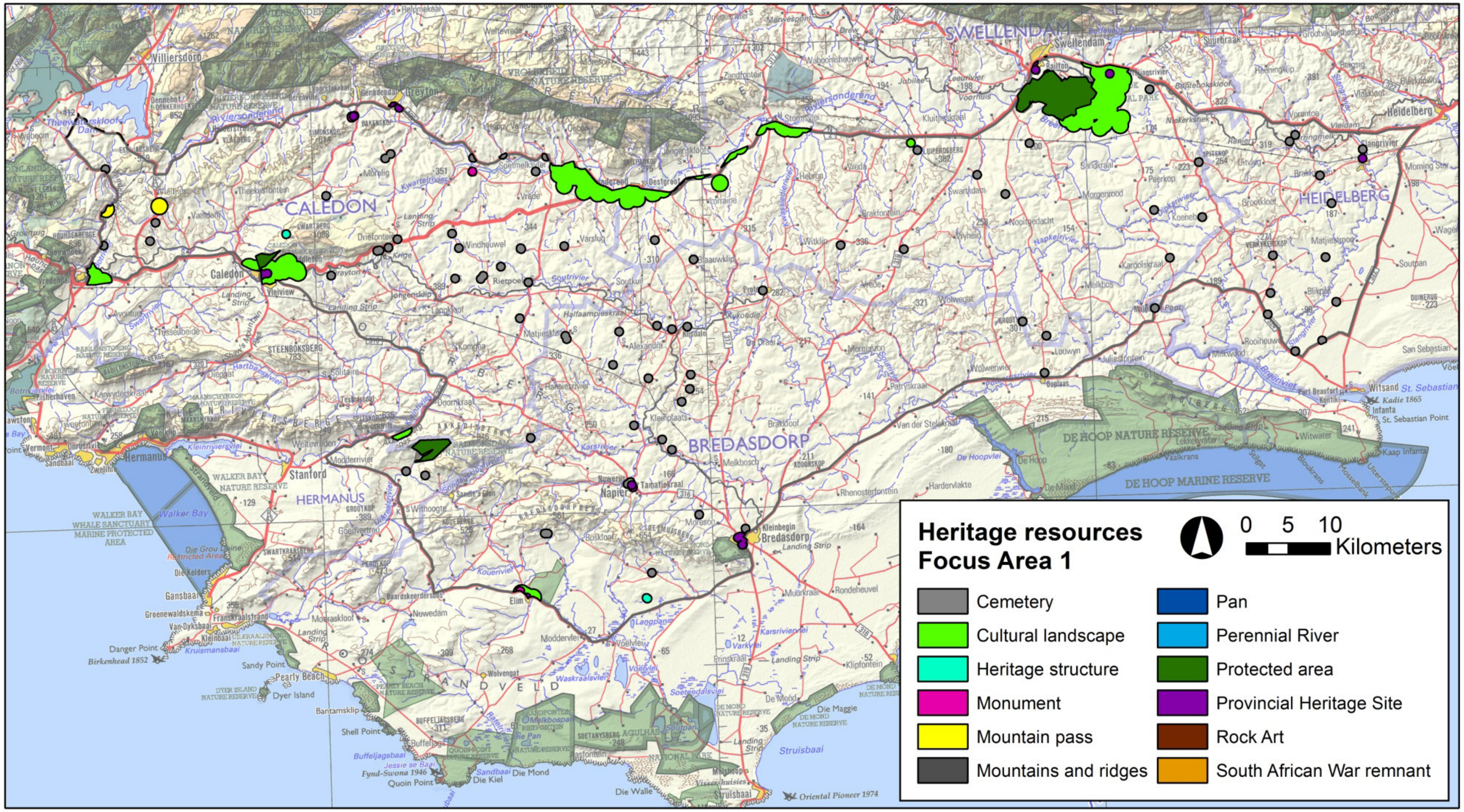

Figure 5 - Heritage resources –Focus Area 1

3.2.2 Komsberg focus area 2

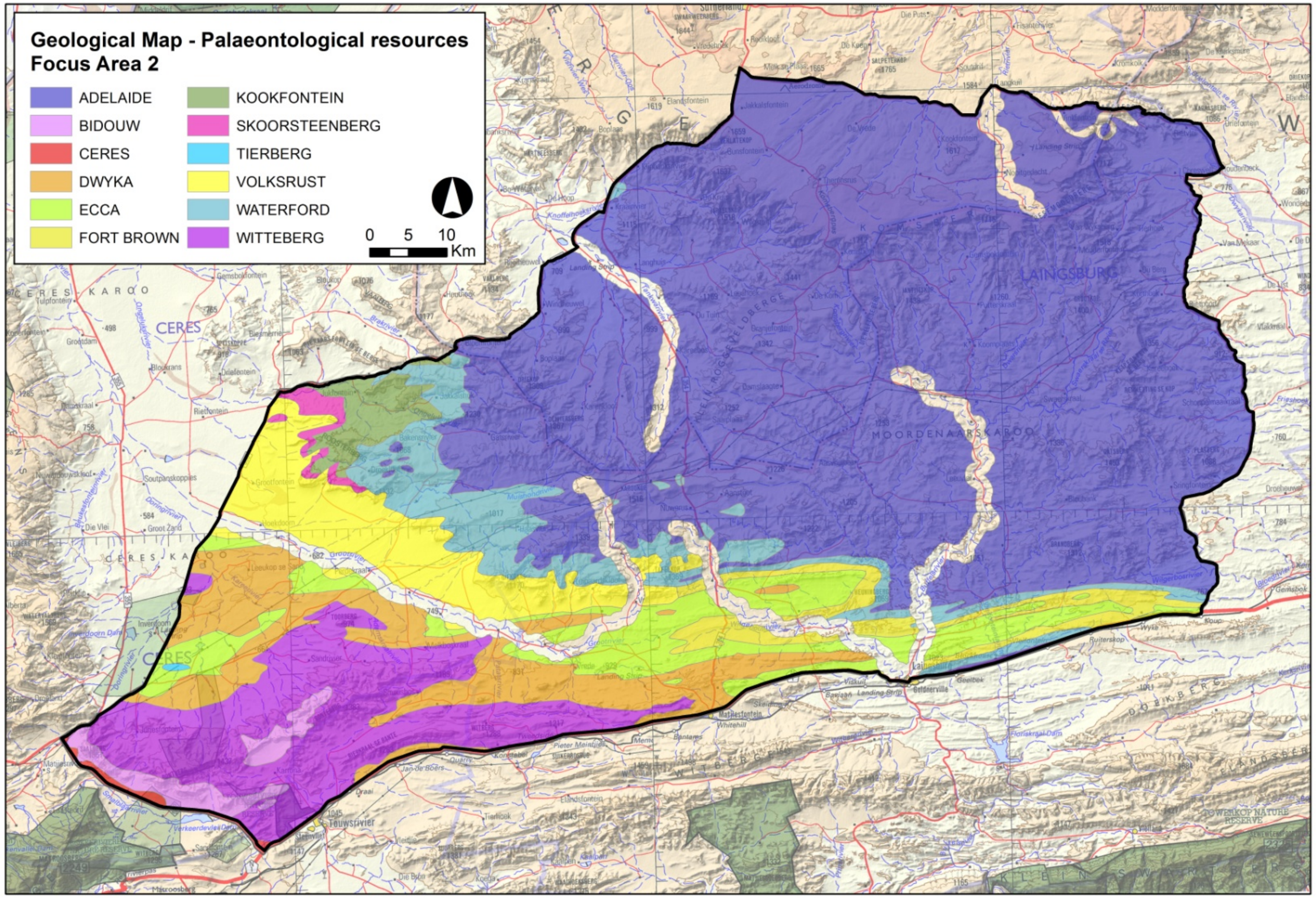

Figure 6 – Geological base map - palaeontological resources – Focus Area 2

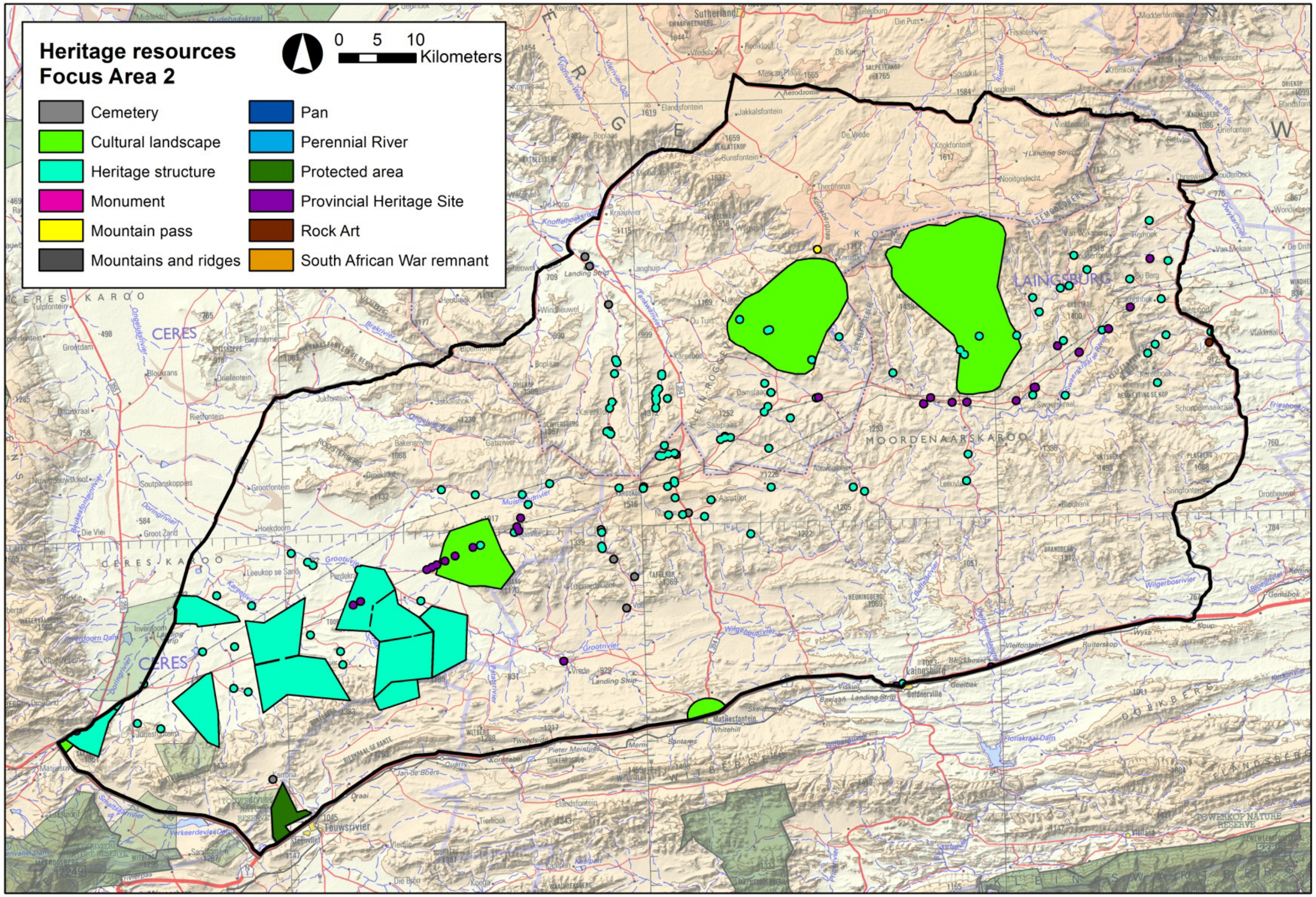

Figure 7 - Heritage resources – Focus Area 2

3.2.3 Cookhouse focus area 3

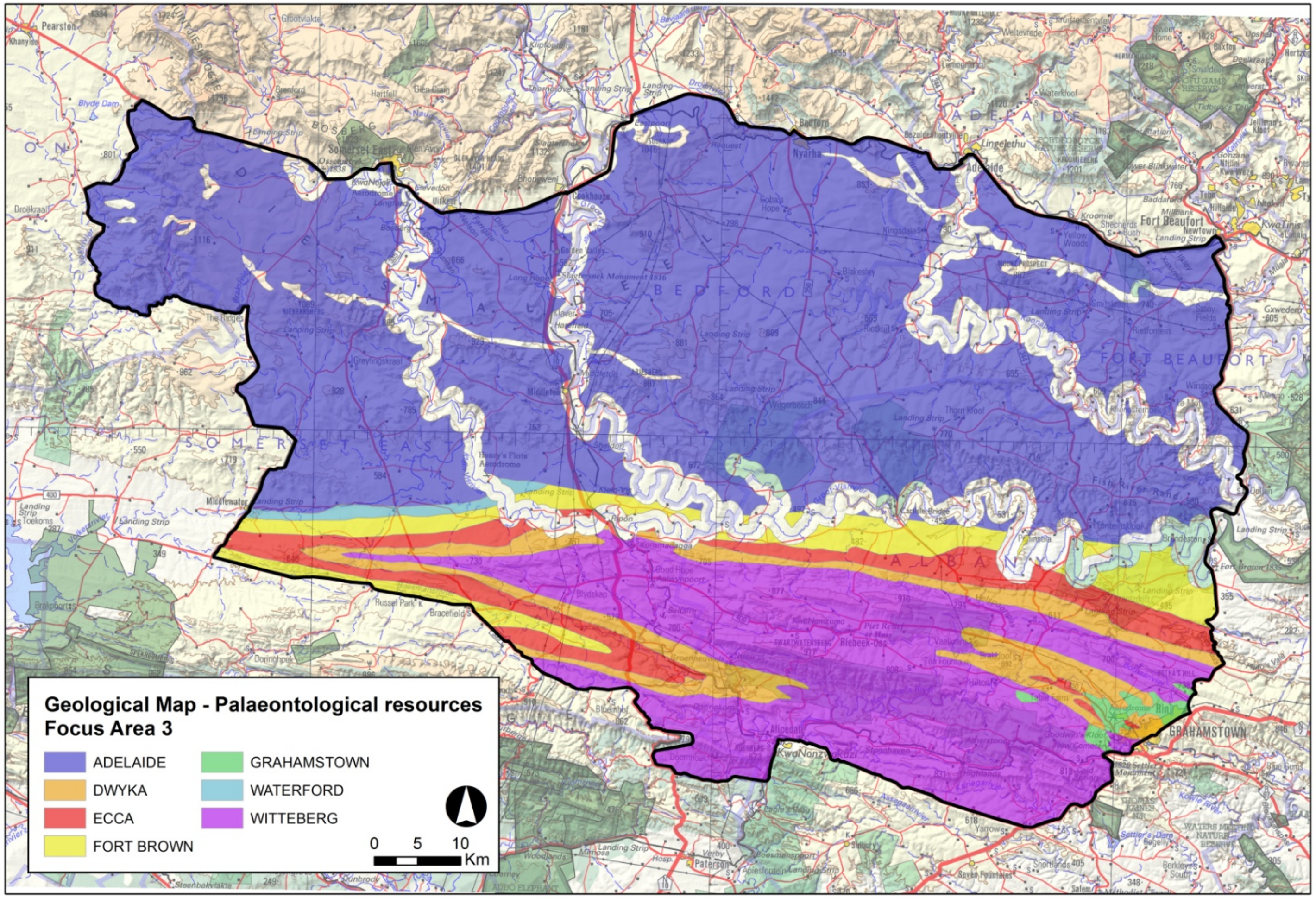

Figure 8 – Geological base map - palaeontological resources – Focus Area 3

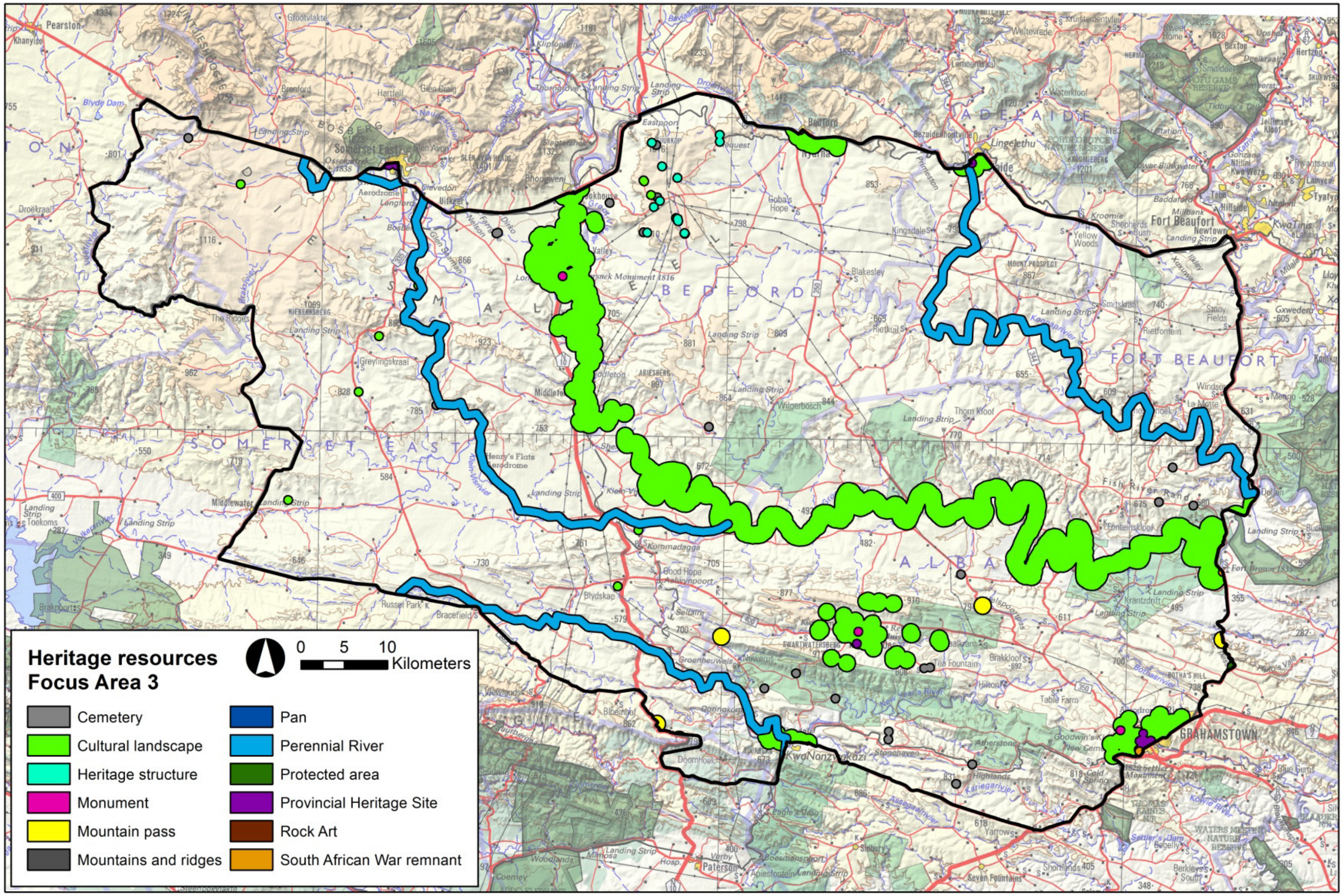

Figure 9 - Heritage resources – Focus Area 3

3.2.4 Stormberg focus area 4

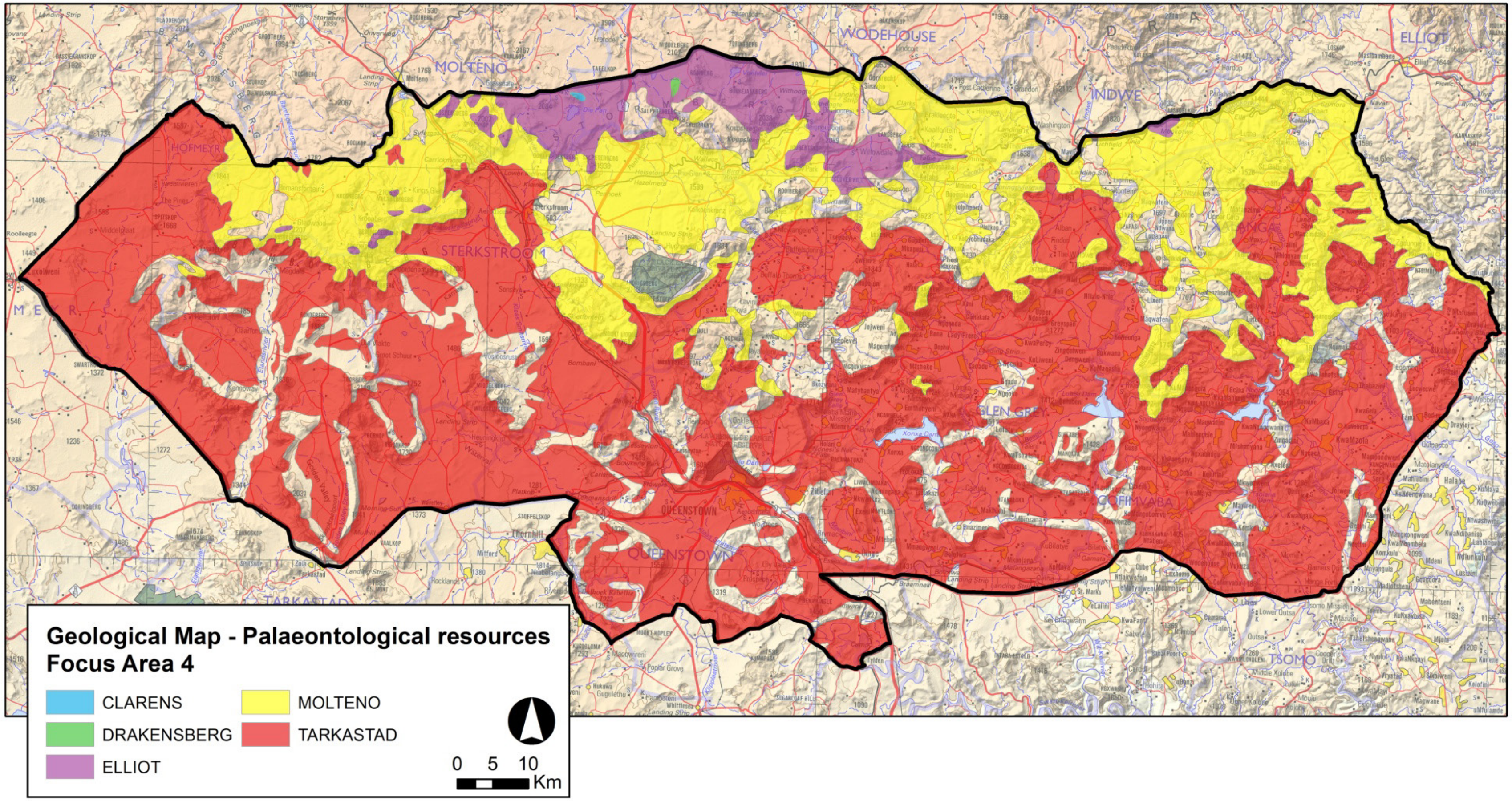

Figure 10 – Geological base map - palaeontological resources – Focus Area 4

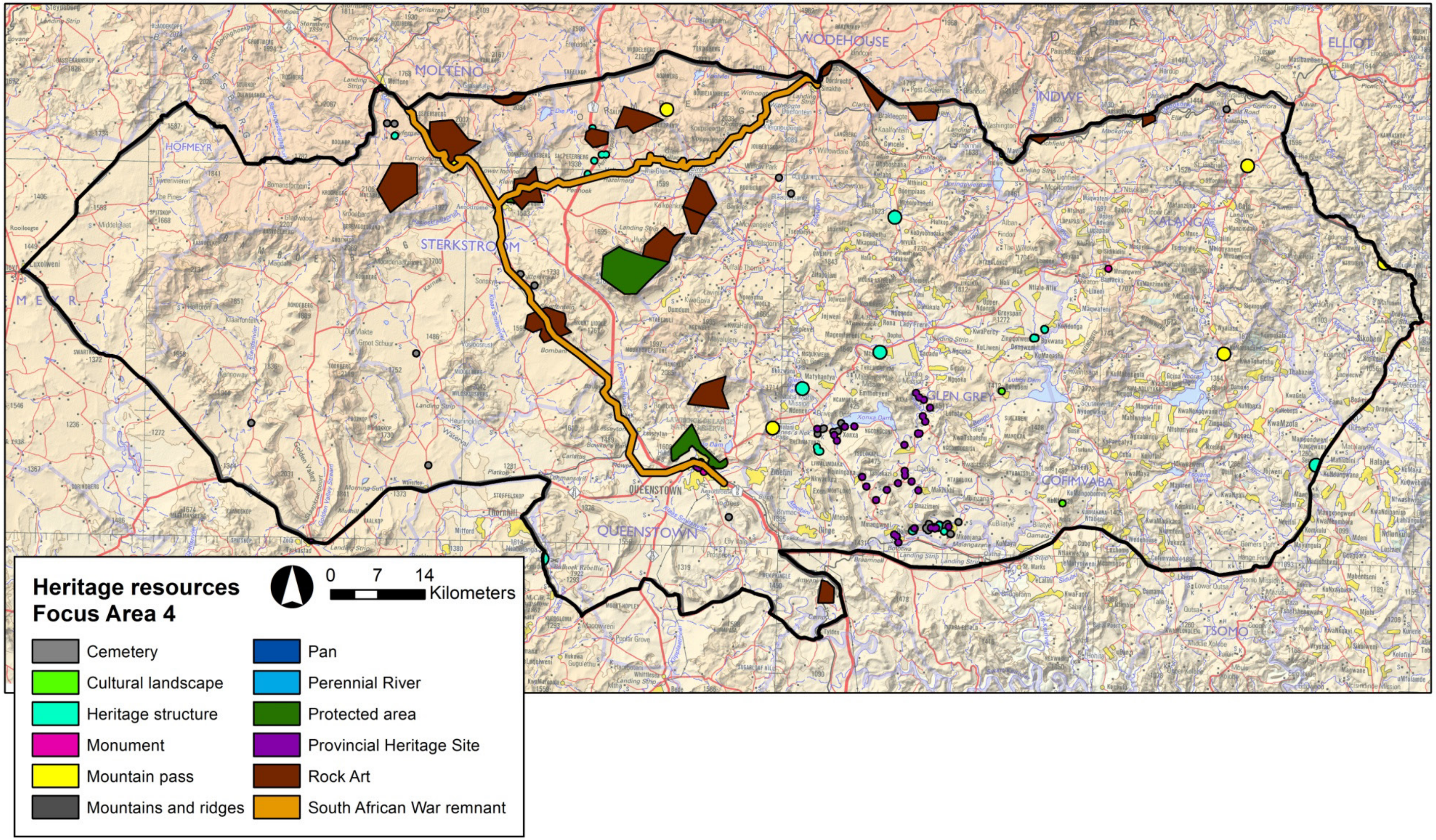

Figure 11 - Heritage resources – Focus Area 4

3.2.5 Kimberley focus area 5

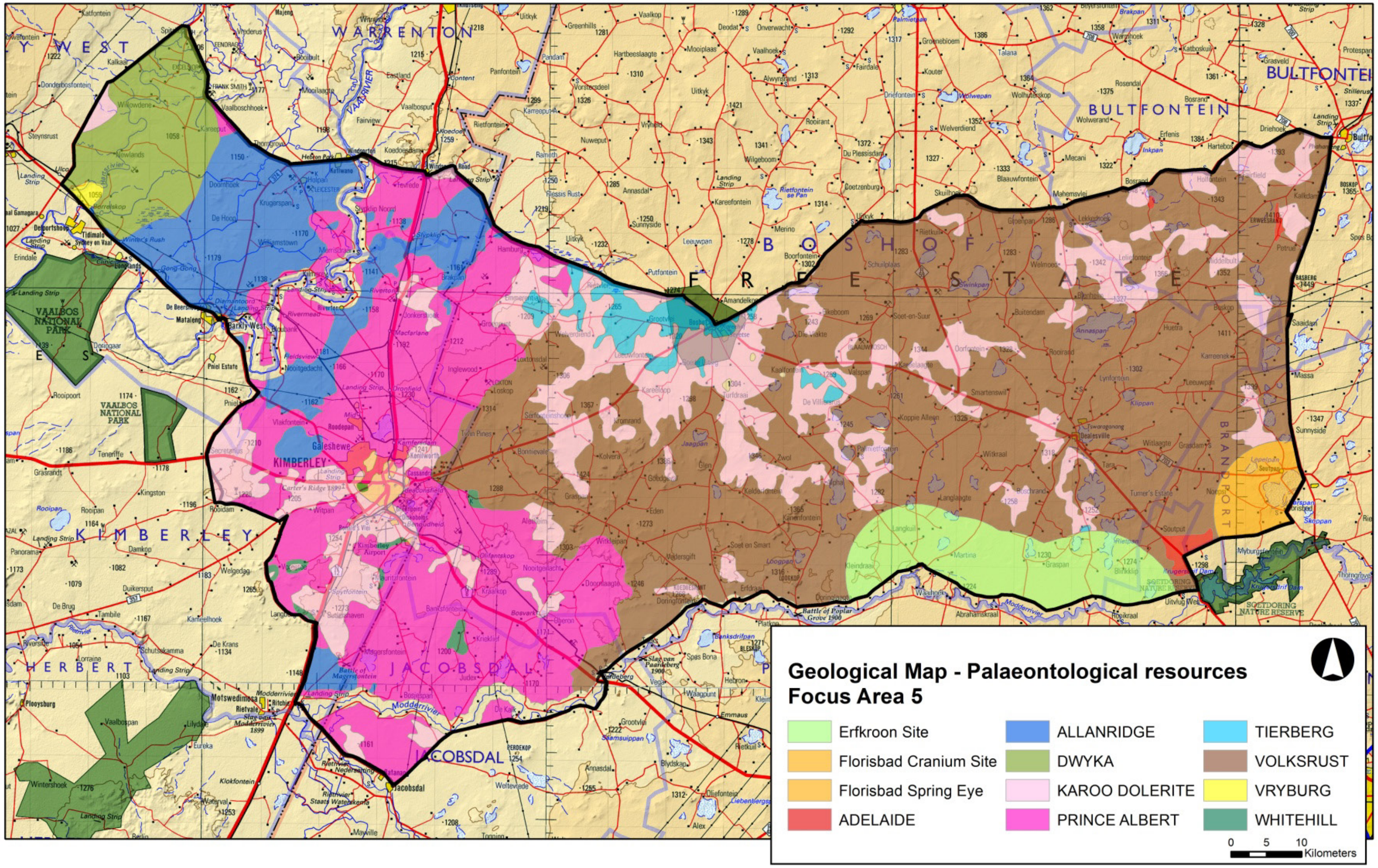

Figure 12 – Geological base map - palaeontological resources – Focus Area 5

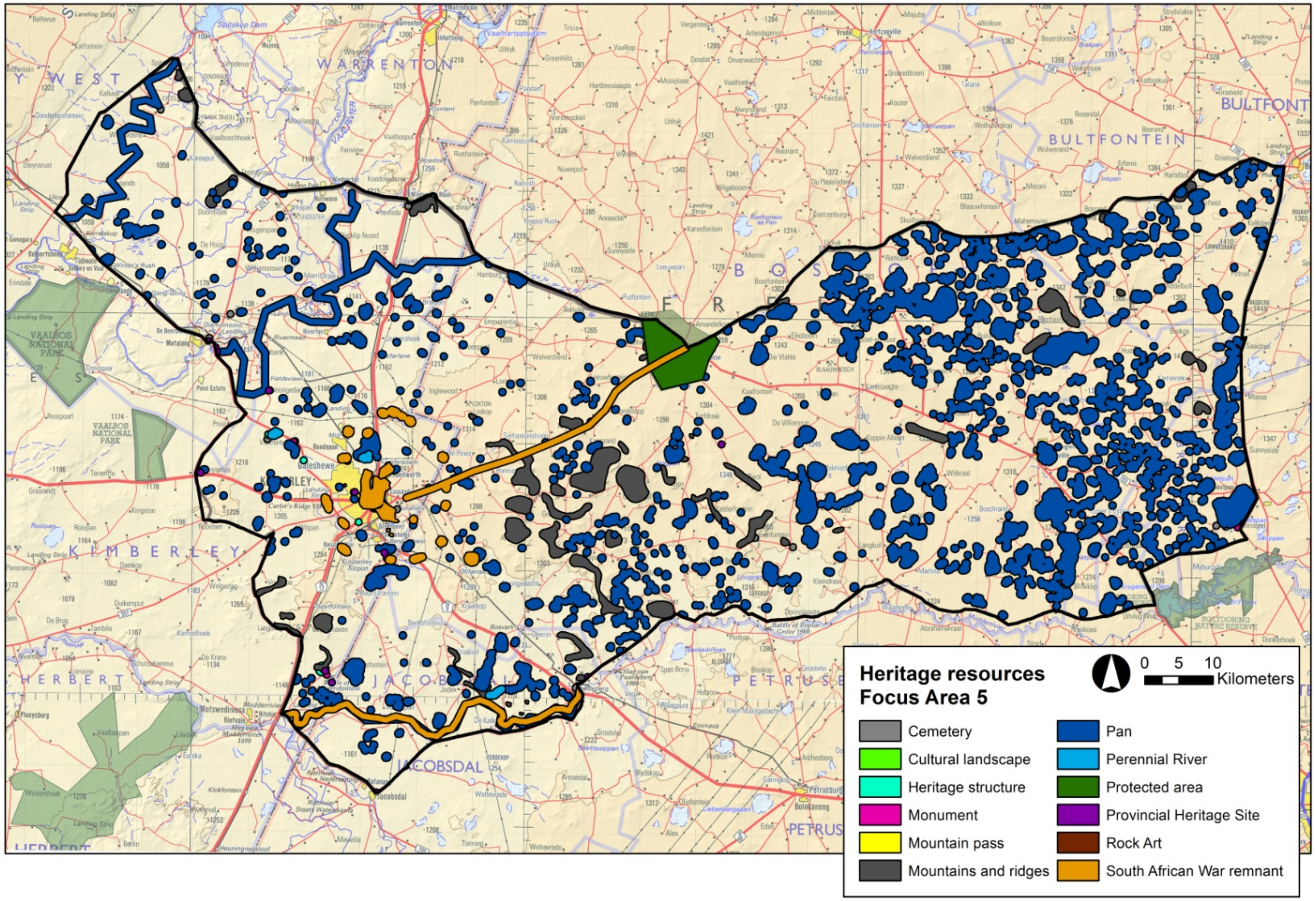

Figure 13 - Heritage resources – Focus Area 5

3.2.6 Vryburg focus area 6

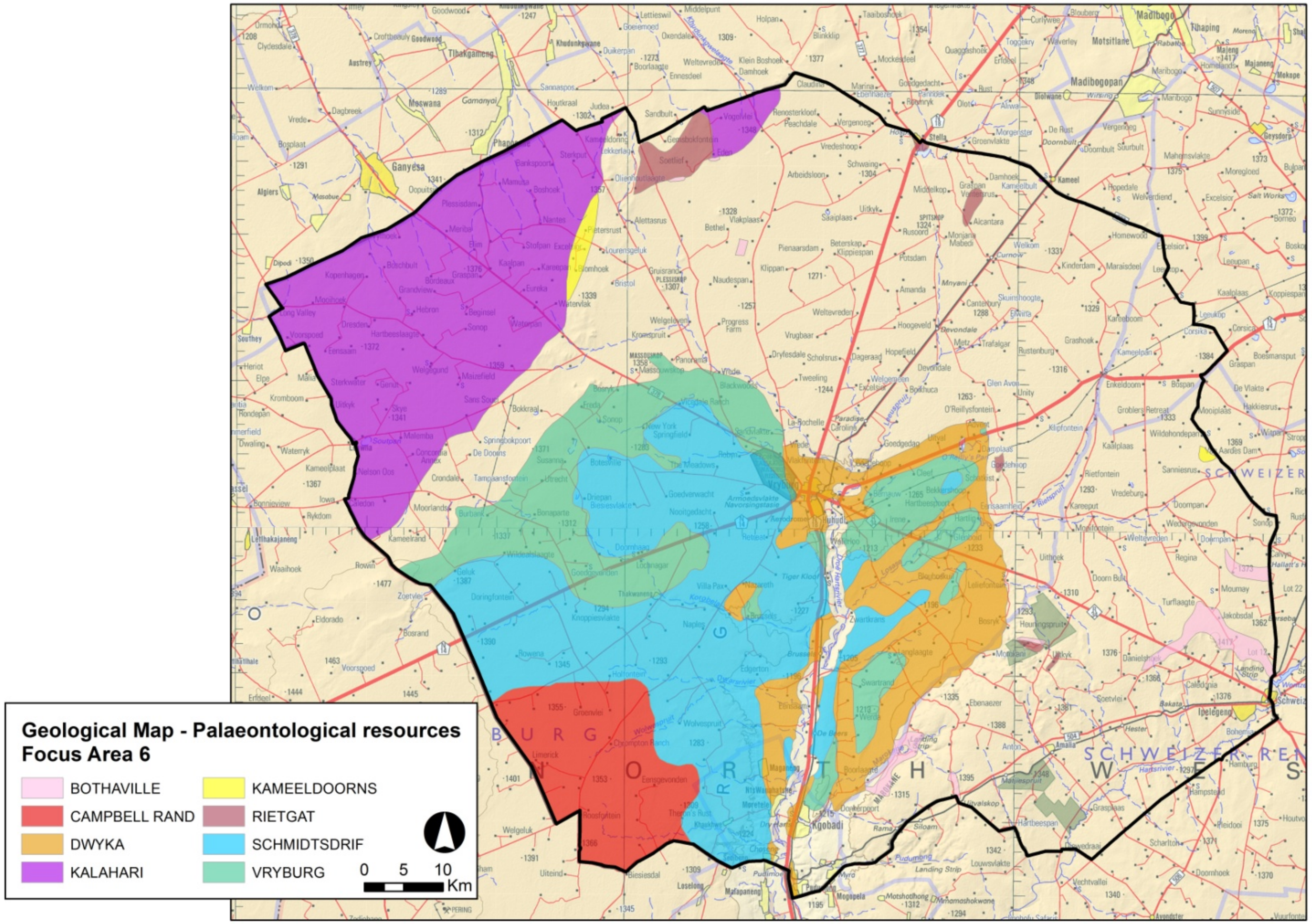

Figure 14 – Geological base map - palaeontological resources – Focus Area 6

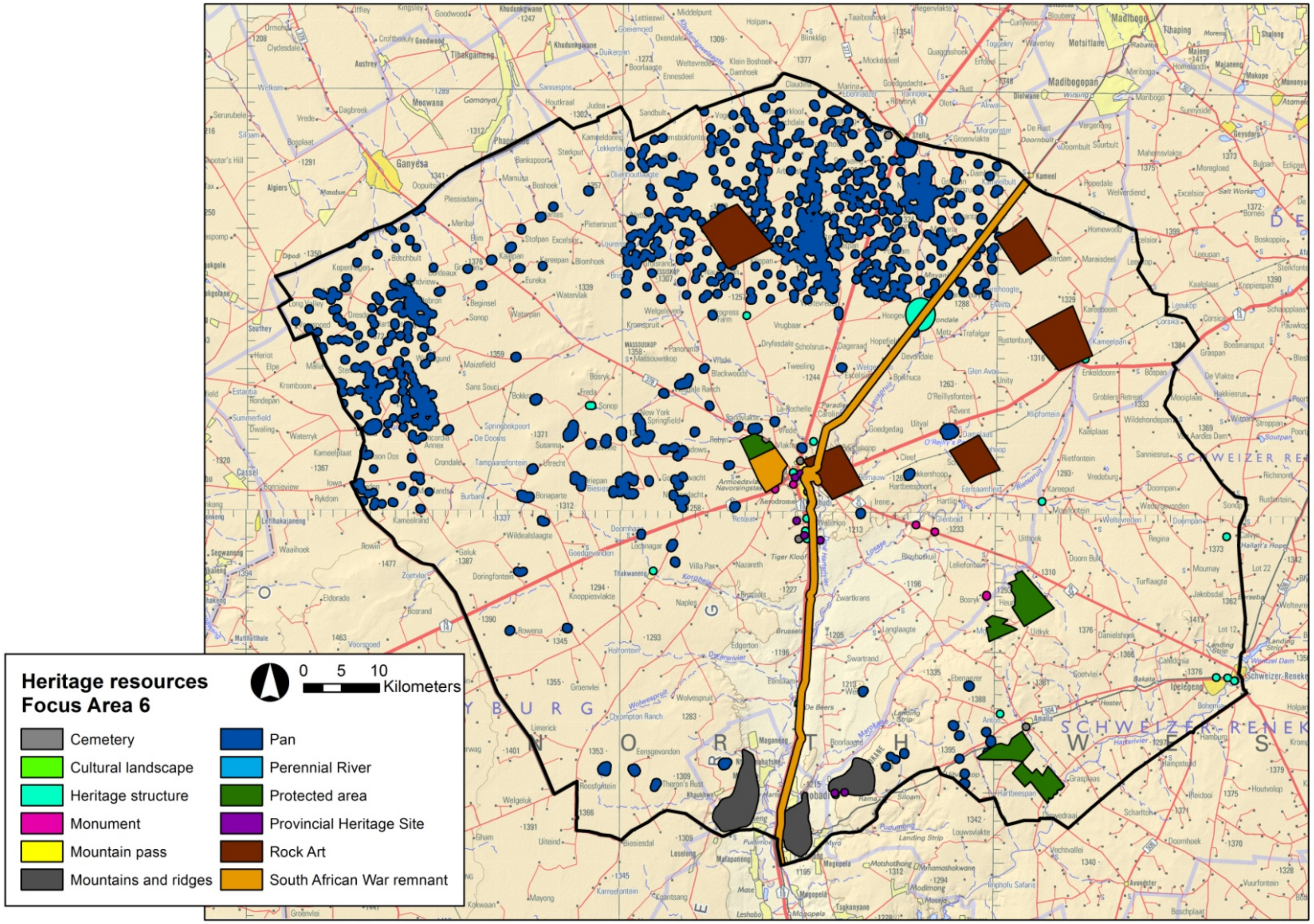

Figure 15 - Heritage resources – Focus Area 6

3.2.7 Upington focus area 7

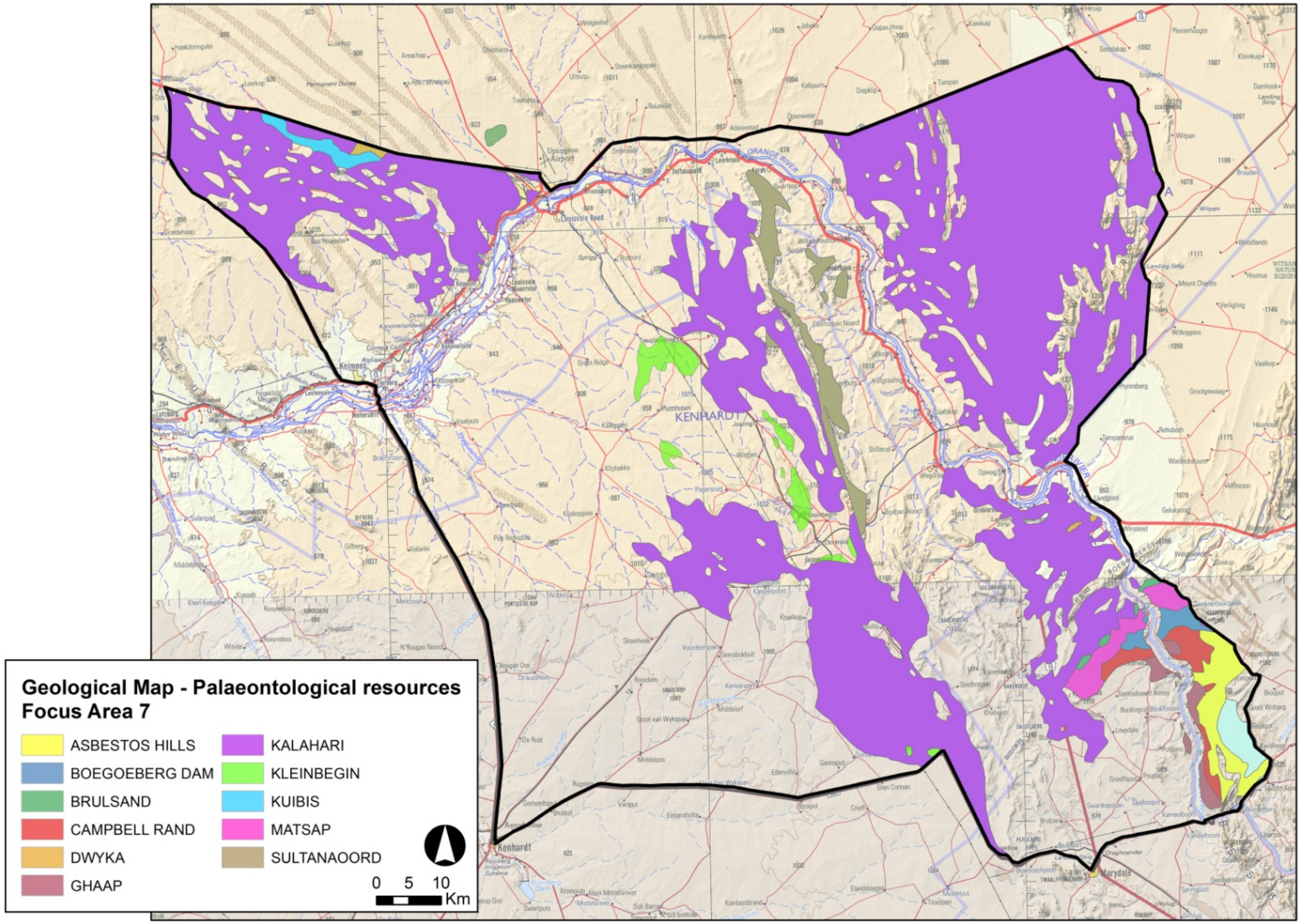

Figure 16 – Geological base map - palaeontological resources – Focus Area 8

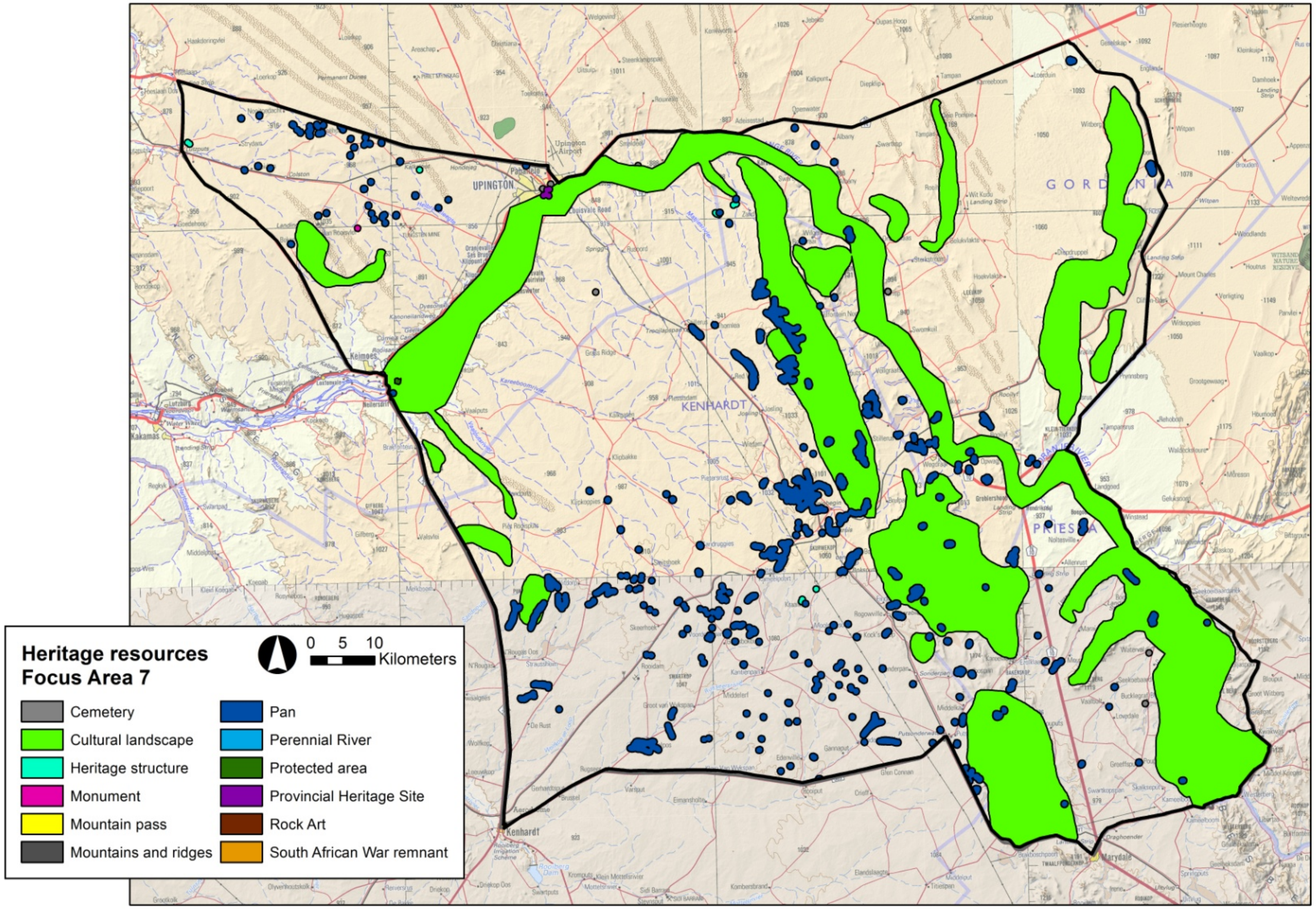

Figure 17 - Heritage map – Focus Area 7

3.2.8 Springbok focus area 8

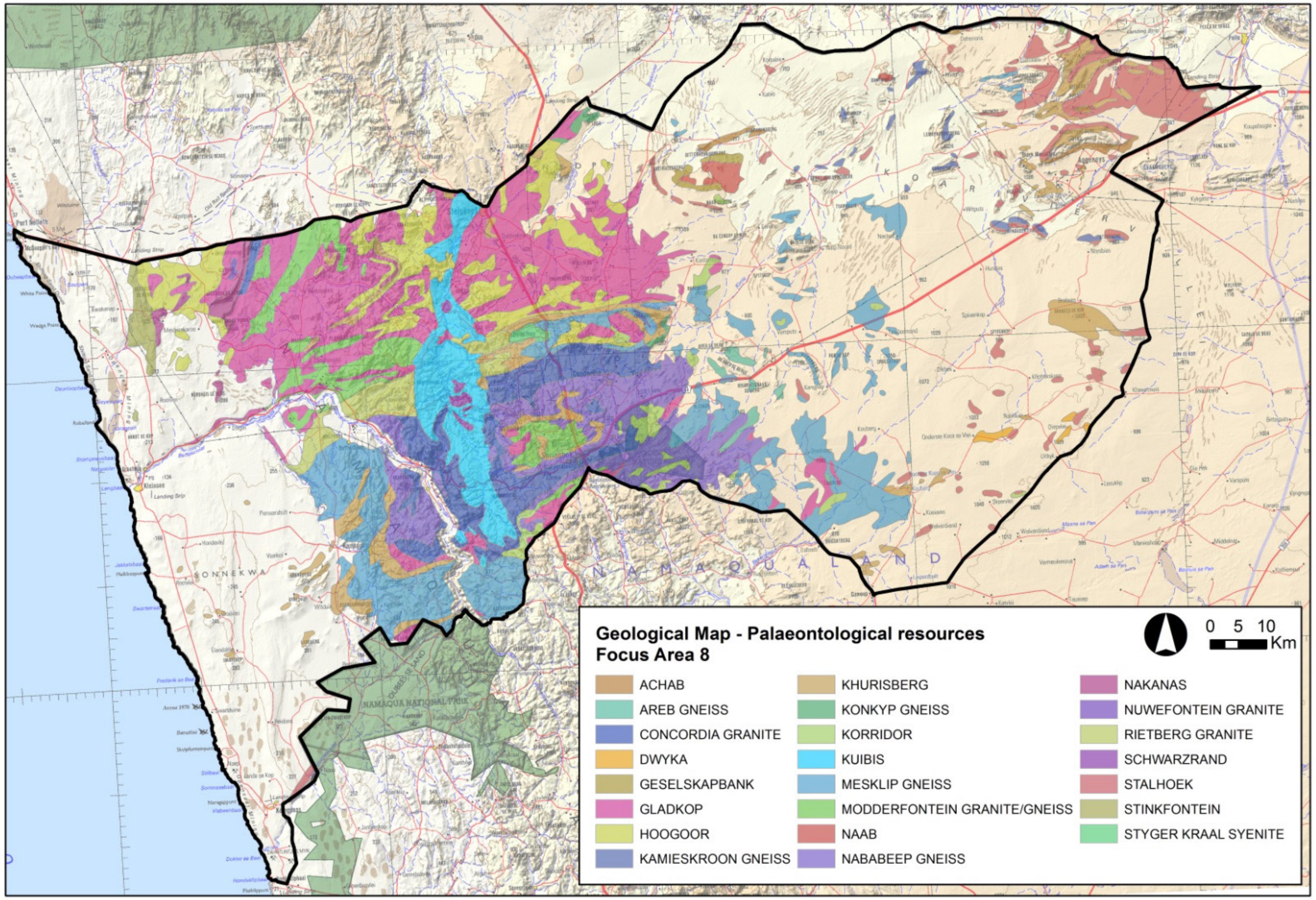

Figure 18 – Geological base map - palaeontological resources – Focus Area 8

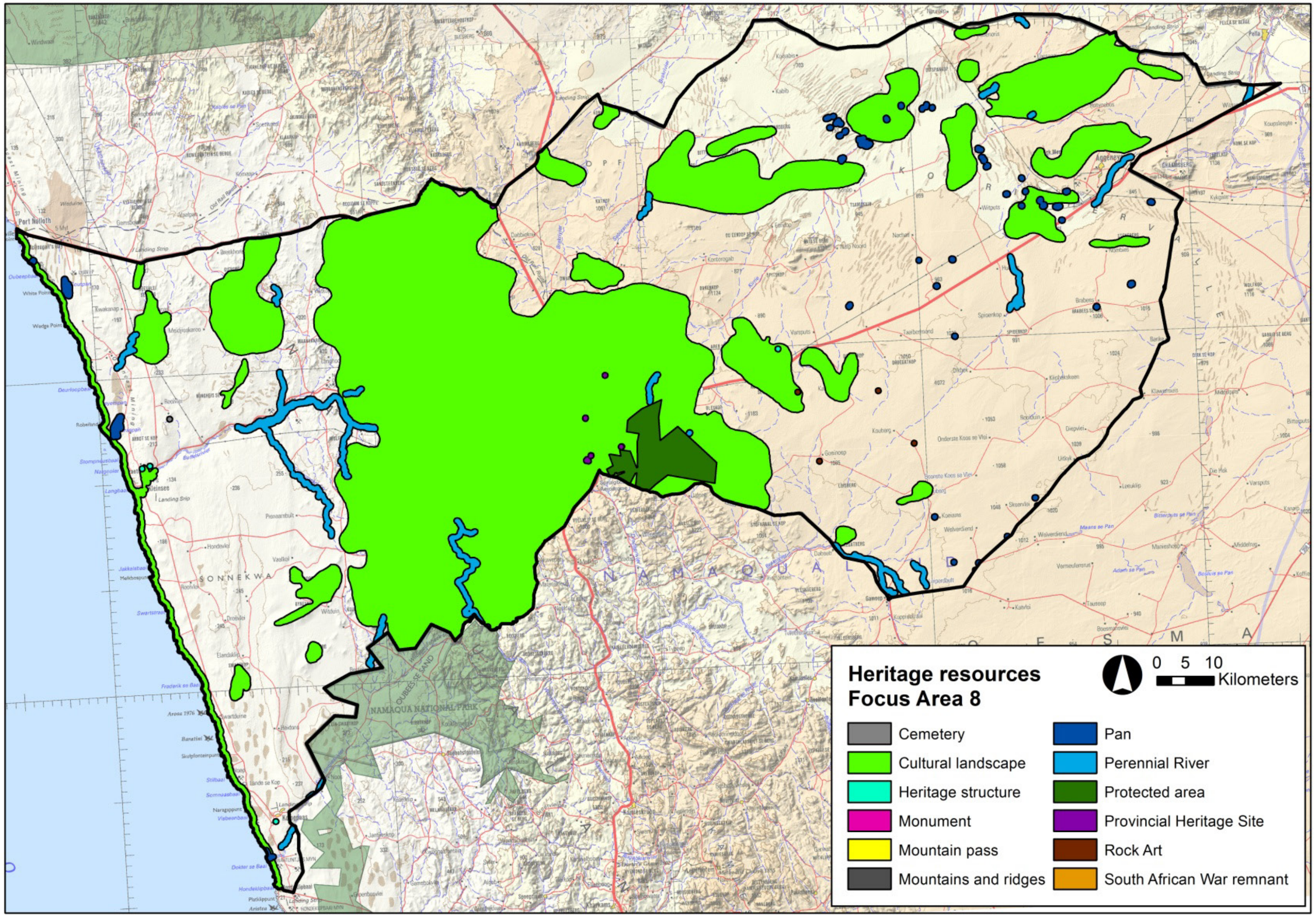

Figure 19 - Heritage resources – Focus Area 8

4 COMPARATIVE SENSITIVITY MAPPING

The comparative sensitivity mapping will follow a four tier sensitivity class approach with

- Dark red: Very High sensitivity,
- Red: High sensitivity,
- Orange: Medium sensitivity and
- Green: Low sensitivity.

Heritage sensitivities, as a function of the ability to accommodate change[109,110], were determined by evaluating a set of criteria that is defined by general heritage significance, and the type of development proposed. These criteria are summarised in Table 6 and include:

a) National Heritage Grading System

Utilising the National Heritage Grading System as described in Regulation 694 of 30 May 2003 as proclaimed under the NHRA, and implementing a tiered system of Grade 1 – National Significance (very high sensitivity), Grade II – Provincial Significance (very high sensitivity), Grade III – Local Significance (high sensitivity)[111]. It should be noted that the criteria evaluated in Grading of fossil heritage resources according to the National Heritage Grading System has not proved acceptable to the professional palaeontological community in South Africa and is not generally implemented in PIAs. One suggestion is to grade all fossil material as of National Significance but this makes weighing up the balance between disparate heritage resources difficult.

b) Scale

Taking into account that heritage resources can be small scale (a single grave or archaeological site) or large scale (cultural landscape/palaeontologically significant strata) – the impact of scale as a function of sensitivity was also taken into account. Scale here also includes depth (of deposit) for archaeological sites.

c) Stakeholders' experience and local knowledge

The experience by the public of heritage resources such as cultural landscapes, monuments and cemeteries was factored into the evaluation. Although difficult to quantify, this factor was based on the experience of the heritage specialists in various projects.[112,113]

d) Rarity

The rarity of a specific type of heritage resource was taken into account in terms of research potential and conservation value.

e) Condition

The current condition of the heritage resource was taken into account when evaluating its level of sensitivity.

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109 North Northamptonshire Joint Planning Unit, 2009. *Environmental Sensitivity Consolidation*.
110 Scott, K.E., Anderson, C., Dunsford, H., Benson, J.F. and MacFarlane, R. (2005*). An assessment of the sensitivity and capacity of the Scottish seascape in relation to offshore windfarms*. Scottish Natural Heritage Commissioned Report No.103 (ROAME No. F03AA06)
111 The Western Cape uses a grading system of 3a, 3b, and 3c for Local Significance. However this system is not implemented nationally.
112 ARCON Architects and Heritage Consultants. 2007. Baboon Point erven 65, 66 & Ptn 4 of Verlorenvlei Farm No. 8, Elands Bay: Heritage Impact Assessment Stage 1; ARCON Architects and Heritage Consultants. 2007. Baboon Point erven 65, 66 & Ptn 4 of Verlorenvlei Farm No. 8, Elands Bay: Supplementary Heritage Impact Assessment Stage 2.
113 Fourie, W and Jacobs, G. 2010. *Phase 2 Heritage Impact Assessment for the proposed Gamma-Omega 765kV Transmission Line.* PGS Heritage and Grave Relocation Consultants. Unpublished report produced for NCC Environmental.

Table 6 - Criteria for determining heritage sensitivity

Criteria	Tend to increase sensitivity	Tend to decrease sensitivity
Significance of Heritage Resource	• Proclaimed National or Provincial Heritage sites • World Heritage Sites • Formally graded sites • Sites of high local significance	• Ungraded sites (i.e. sites not worthy of Grade 3) • Sites with low local significance
Scale	• Multi-component cultural landscapes • Constrained landscapes such as valleys • Settlements and townscapes • Large archaeological l sites • Fossiliferous rocks units with extensive outcrop areas • Temporal depth represented by heritage resource	Single layered cultural landscapes
Experience of the public	• High profile heritage resources • Active heritage association • Cemeteries • Monuments • Settlements and townscapes	
Rarity	• Only a small number exist or have been discovered • Very limited research carried out on the resource	Numerous examples of the same type of heritage resource
Condition	Pristine, undisturbed heritage resources in good context	Disturbed heritage resources or disturbed context

The sensitivities linked to the importance of the heritage resource and its ability to absorb impacts and changes are listed in Table 7.

Table 7 - Heritage resource sensitivity as a function of heritage significance

Mapped colour	Level of sensitivity	Level of significance	Resource type
	Very High	National - Grade I heritage resources	• National Heritage Sites • Provincial Heritage Sites • World Heritage Sites • Cemeteries of historical significance[114] • Battle fields
	High	Provincial - Grade II heritage resources	• Rock Art sites • All Cemeteries • Highly fossiliferous palaeontological Strata • Cultural landscapes
	Medium	Local - Grade III (*Western Cape System this would be Grade 3a*) heritage resources of high significance	• Area with potential to contain heritage resources such as rock art, archaeological sites, and moderately fossiliferous outcrop areas • Cultural landscapes
	Low	Local – Grade III (*Western Cape System this would be Grade 3a and 3b*) heritage resources of medium to low significance (generally protected under the NHRA)	• Historical, archaeological and palaeontological sites or rock units with generally low significance

[114] Cemeteries linked to a historical significant person or episode.

4.1 Very high and High Sensitivity zones

These are areas that are potentially highly sensitive and may need to be avoided or will require a full Heritage Impact Assessment in each focus area, as delineated and buffered in the GIS heritage data set.

Very High Sensitivity Zones	High Sensitivity Zones
Focus area 1 – Overberg	
• National (NHS) and Provincial Heritage sites (PHS)[1] • Bot River Valley, Bot River settlement and historical railway precinct • Elim (just on the border of the study area) • Cape Winelands Biosphere Reserve • Cemeteries	• Caledon Hot Springs (historical development) • Hagedisberg Outspan • Riviersonderend Valley • Buffelsjagrivier Valley • Bontebok National Park • Kogelberg Biosphere Reserve • Hottentots-Holland Mountain Catchment Area • Salmonsdam Provincial Nature Reserve • Caledon Nature Reserve • Memorials
Focus area 2 - Komsberg	
• NHS and PHS • Matjiesfontein (historical village) • Karoopoort (historical and rock art to the north and south) • Cemeteries	• Localised cultural landscapes in the kloofs at the foot of the escarpment (agricultural, historical and pre-colonial) • Touw Local Nature Reserve • Memorials
Focus area 3 – Cookhouse	
• NHS and PHS • Cemeteries	• Cookhouse and Great Fish River Valley • Small agricultural landscapes in river valleys • Thomas Baines Nature Reserve • Ecca Nature Reserve • Andries Vosloo Kudu Nature Reserve • Somerset East Bosberg Nature Reserve • Frontier War and Colonial oppression battle sites and forts such as – Slagtersnek and Fort Brown • Historical settlements of Somerset East , Bedford, Alicedale, Adelaide, and Riebeeck Oos (typical historical grid layouts) • Memorials
Focus area 4 - Stormberg	
• NHS and PHS • Cemeteries	• Traditional rainmaking site at Qamata • Birth place of Walter Sisulu at Qutubeni • Andriesbergen Private Nature Reserve • Koos Ras Nature Reserve • Lawrence de Lange Nature Reserve • Longhill Nature Reserve • Memorials

Focus area 5 – Kimberley	
• NHS and PHS • Florisbad – highly important archaeological and palaeontological site. • Erfkroon - this fossil site along the Modder River should be adequately protected within the proposed 1 km high palaeontological sensitivity zone either side of major river systems • Cemeteries	• Kimberley town (Victorian settlement and mining landscape) • Wildebeestkuil rock art landscape (prominent landscape feature) • Vaal and Riet River rock art sites (engraved glacial pavements) • Kantienkoppie (historic mining and ESA occupation) • Battlefields - Jagersfontein • Soetdoring Nature Reserve • Boshof Nature Reserve • Memorials
Focus area 6 – Vryburg	
• Cemeteries • NHS and PHS	• Vryburg Concentration camp • Eerstbegin Private Nature Reserve • Honingspruit Private Nature Reserve • Leon Taljaard Nature Reserve • Klipkuil Private Nature Reserve • Marokane Private Nature Reserve • Memorials
Focus area 7 – Upington	
• NHS and PHS • Cemeteries	• Orange River (historical and pre-colonial settlement and cultural landscape) • Tierberg Nature Reserve • Memorials
Focus area 8 – Springbok	
• Copper Mining Landscape • PHS including Orbicule Koppie, Concordia, Van der Stel's Coppermine, Carolusberg, Copper smelting chimney at Springbok, Old smoke stack at Okiep, and Conish pump building at Okiep. • Coastal belt (extremely high density pre-colonial occupation) • Cemeteries	• Grootmis historical settlement • Namaqua National Park • Goegap Provincial Nature Reserve • Memorials

4.2 Four tier sensitivity maps

The following maps indicate the relative sensitivities for (1) palaeontology, (2) all other heritage resources (excluding palaeontology), and (3) combined heritage sensitivity.

The combined heritage sensitivity map was developed through a union of palaeontological and heritage sensitivity maps ensuring an overall balanced scoring and incorporation of the identified sensitivities. The underlying principle is that when combining the two data sets the higher sensitivity rating of the two was taken as the combined sensitivity.

4.2.1 Overberg focus area 1

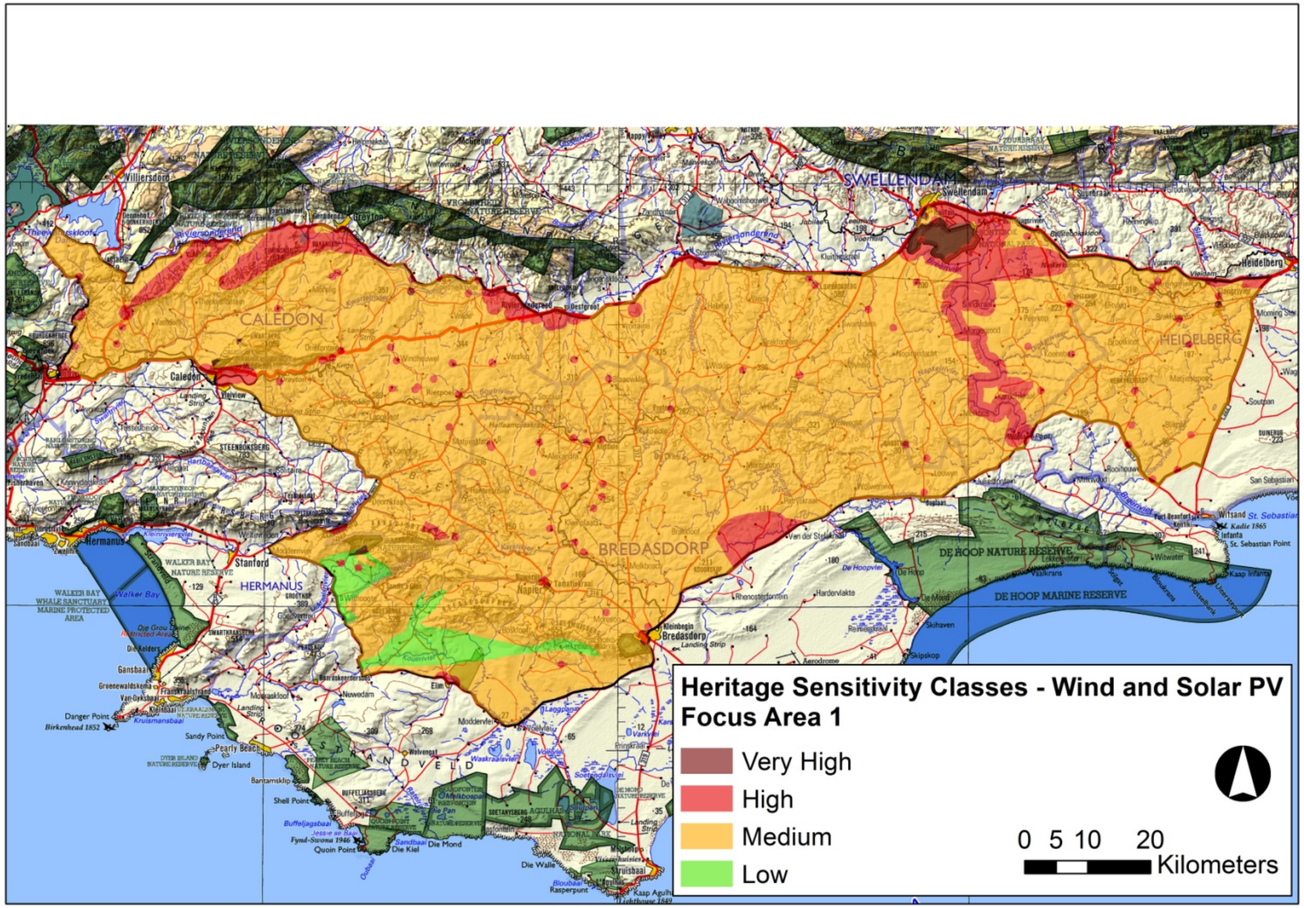


Figure 20 – Combined heritage sensitivity map – Focus Area 1

4.2.2 Komsberg focus area 2

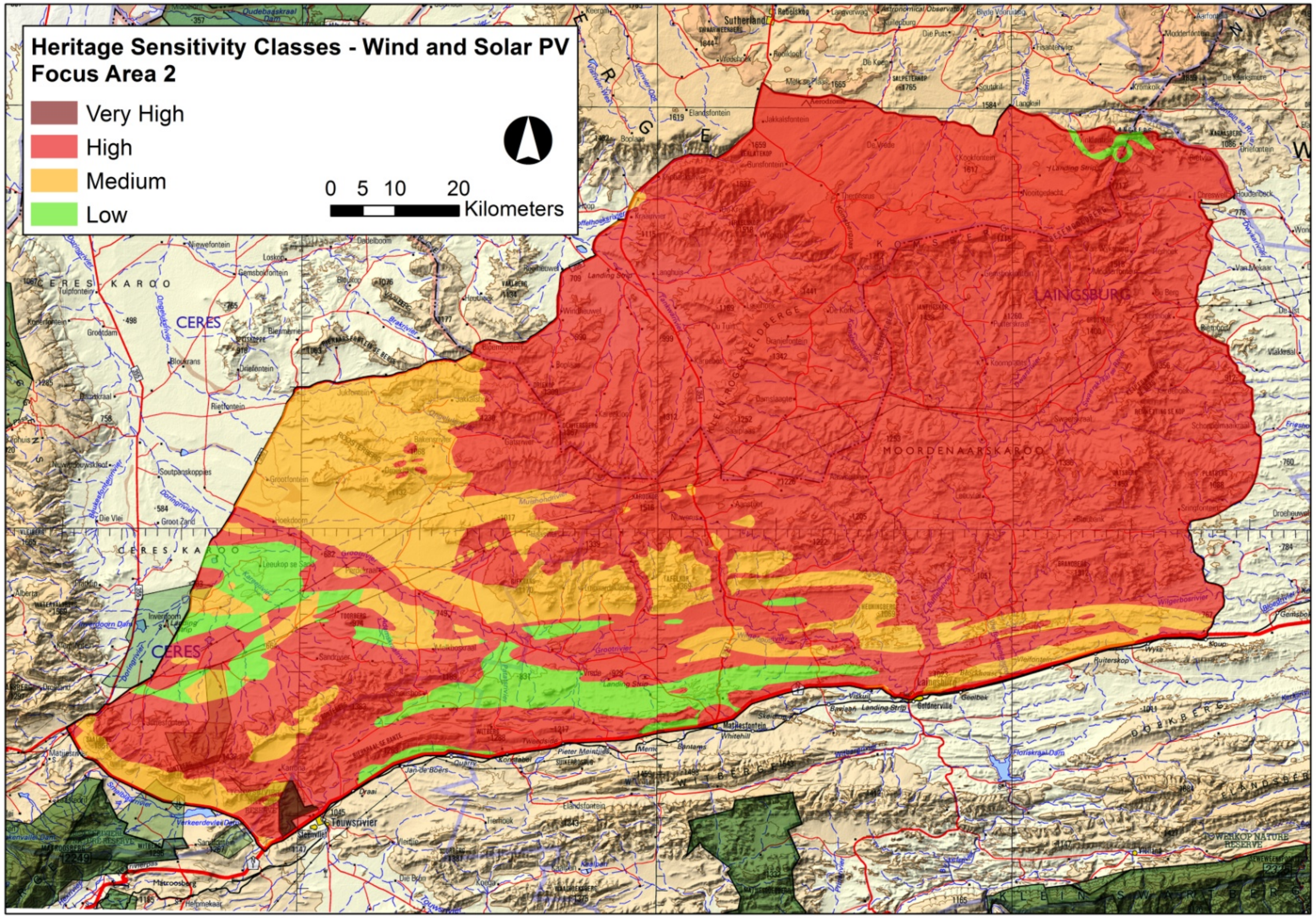


Figure 21 – Combined heritage sensitivity map – Focus Area 2

4.2.3 Cookhouse focus area 3

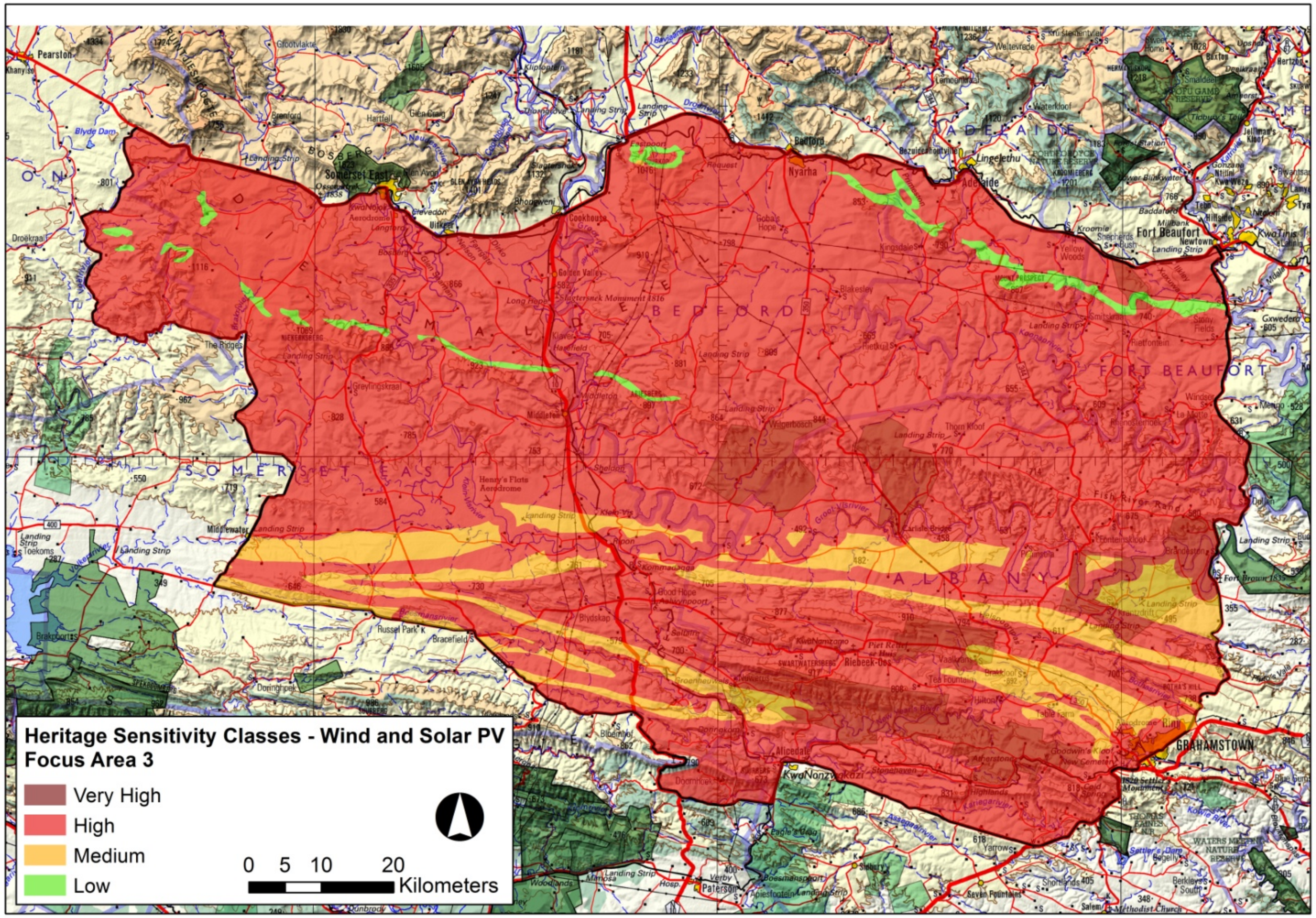


Figure 22 – Combined heritage sensitivity map – Focus Area 3

4.2.4 Stormberg focus area 4

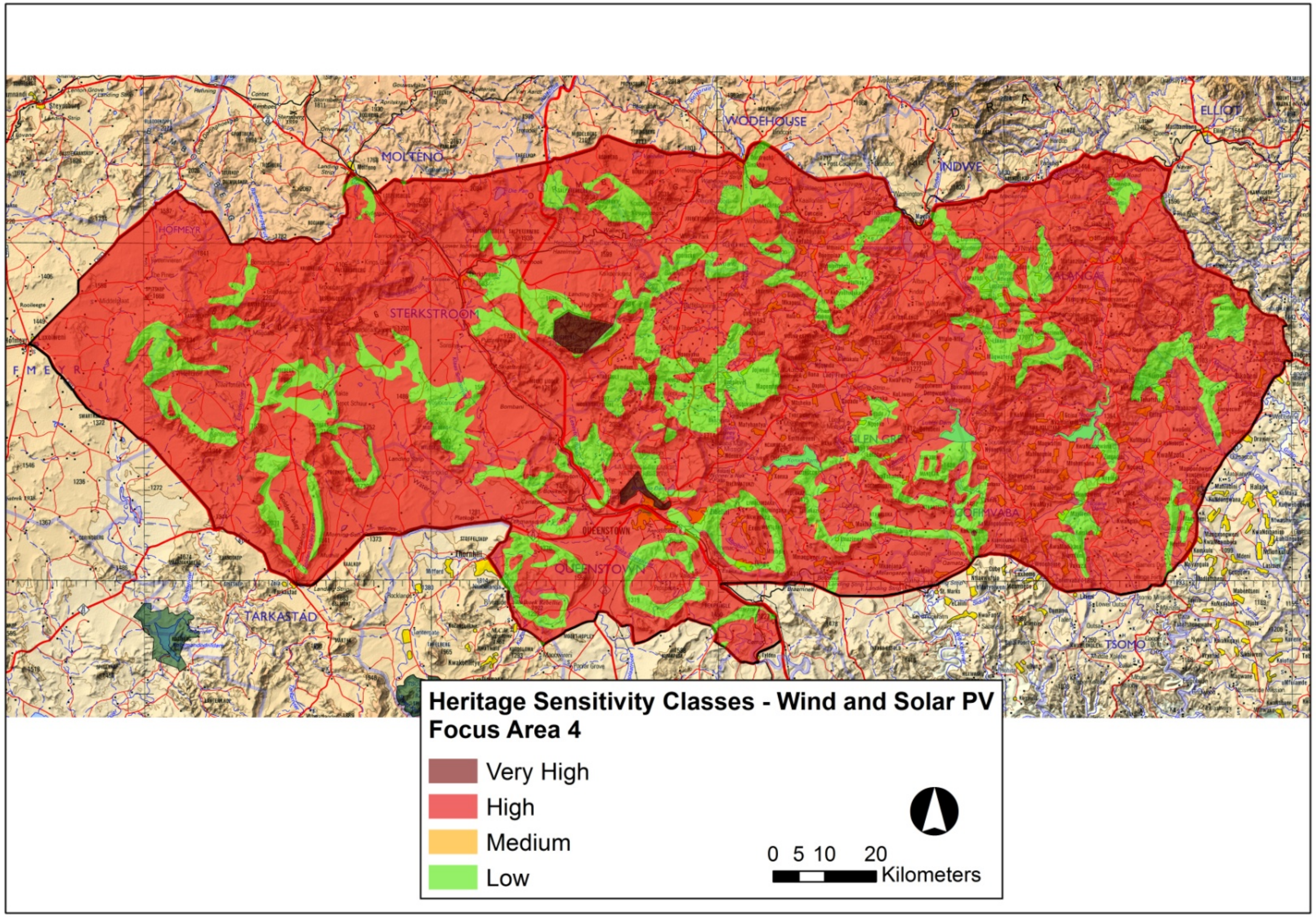


Figure 23 – Combined heritage sensitivity map – Focus Area 4

4.2.5 Kimberley focus area 5

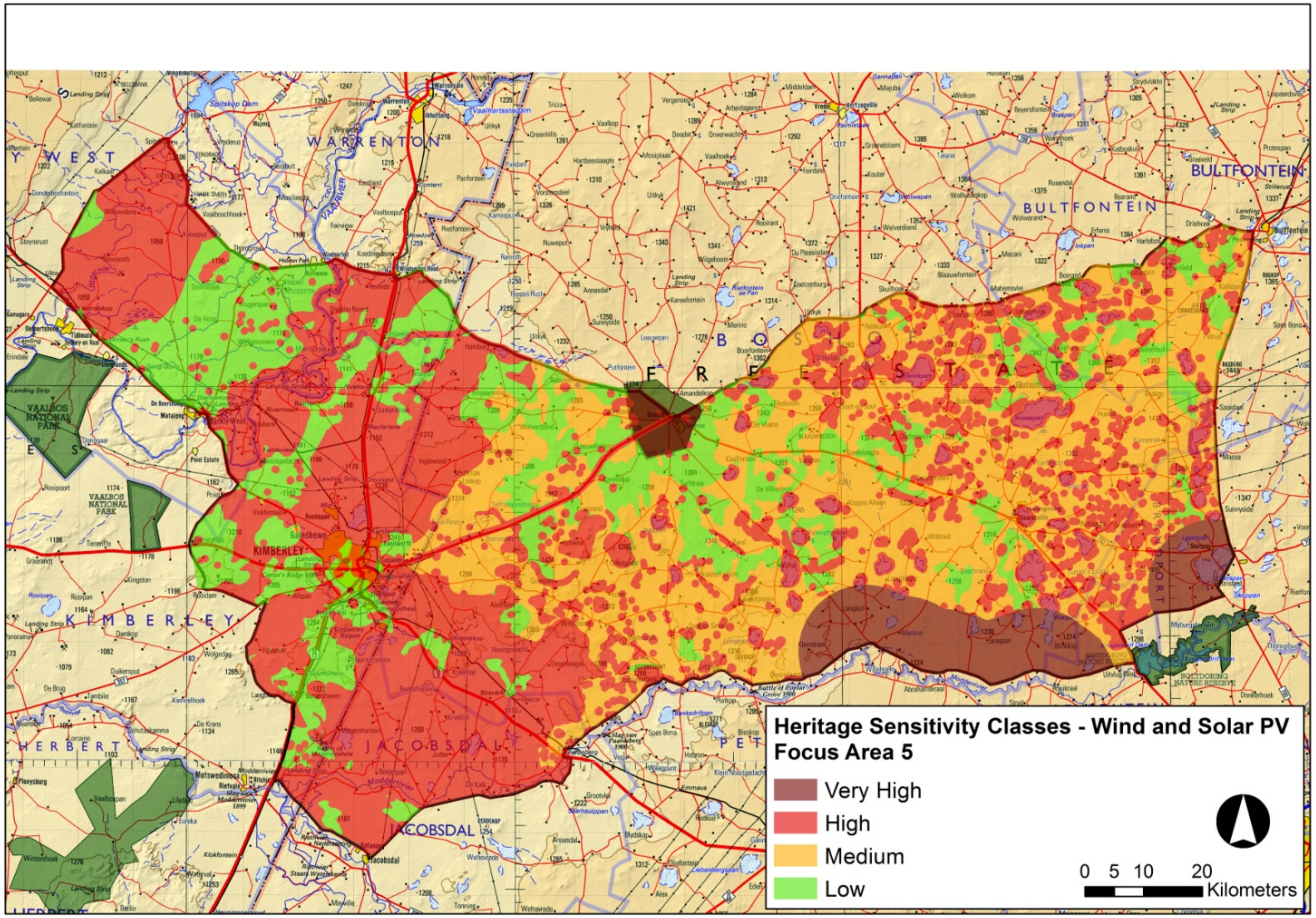


Figure 24 – Combined heritage sensitivity map – Focus Area 5

4.2.6 Vryburg focus area 6

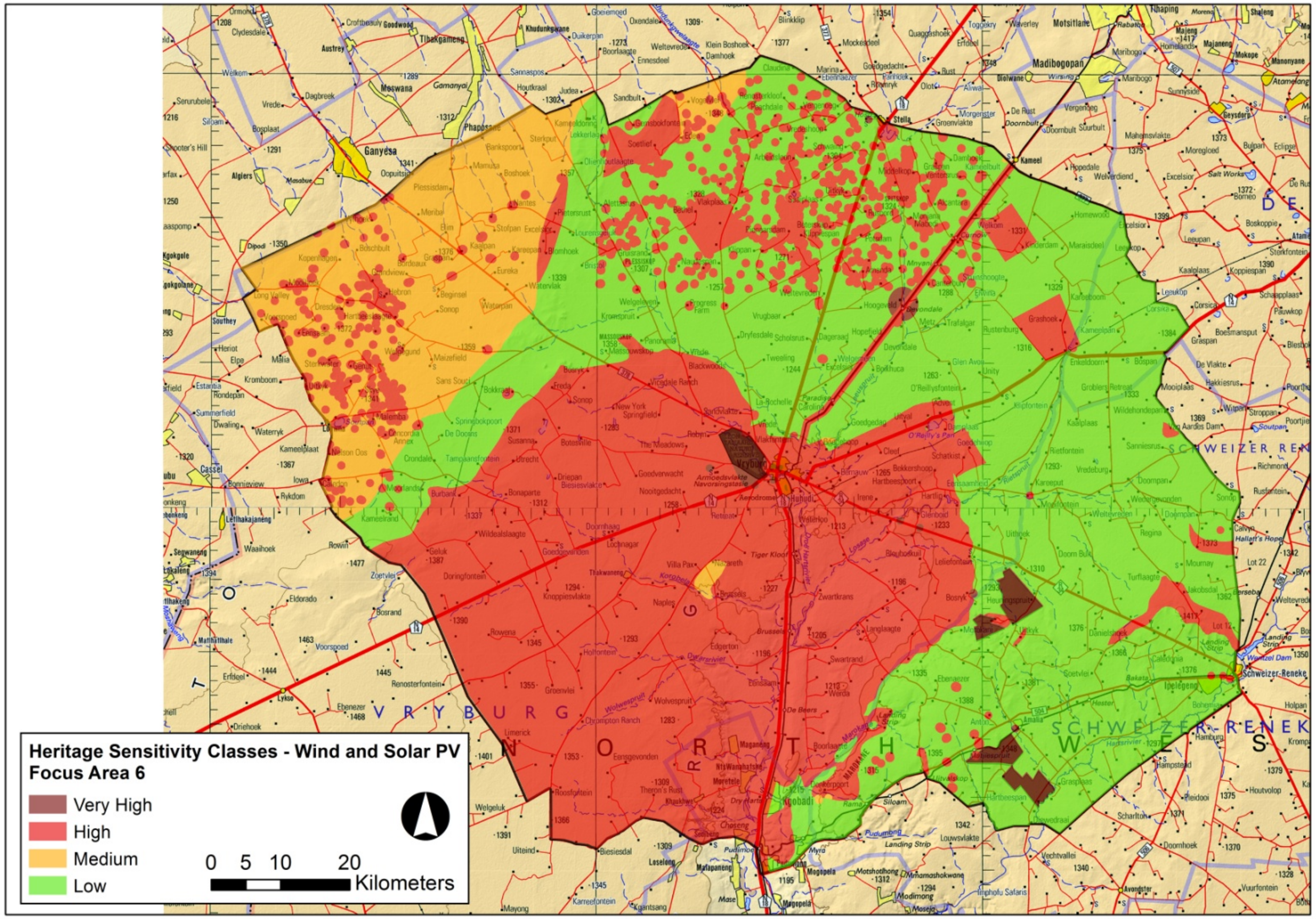


Figure 25 – Combined heritage sensitivity map – Focus Area 6

4.2.7 Upington focus area 7

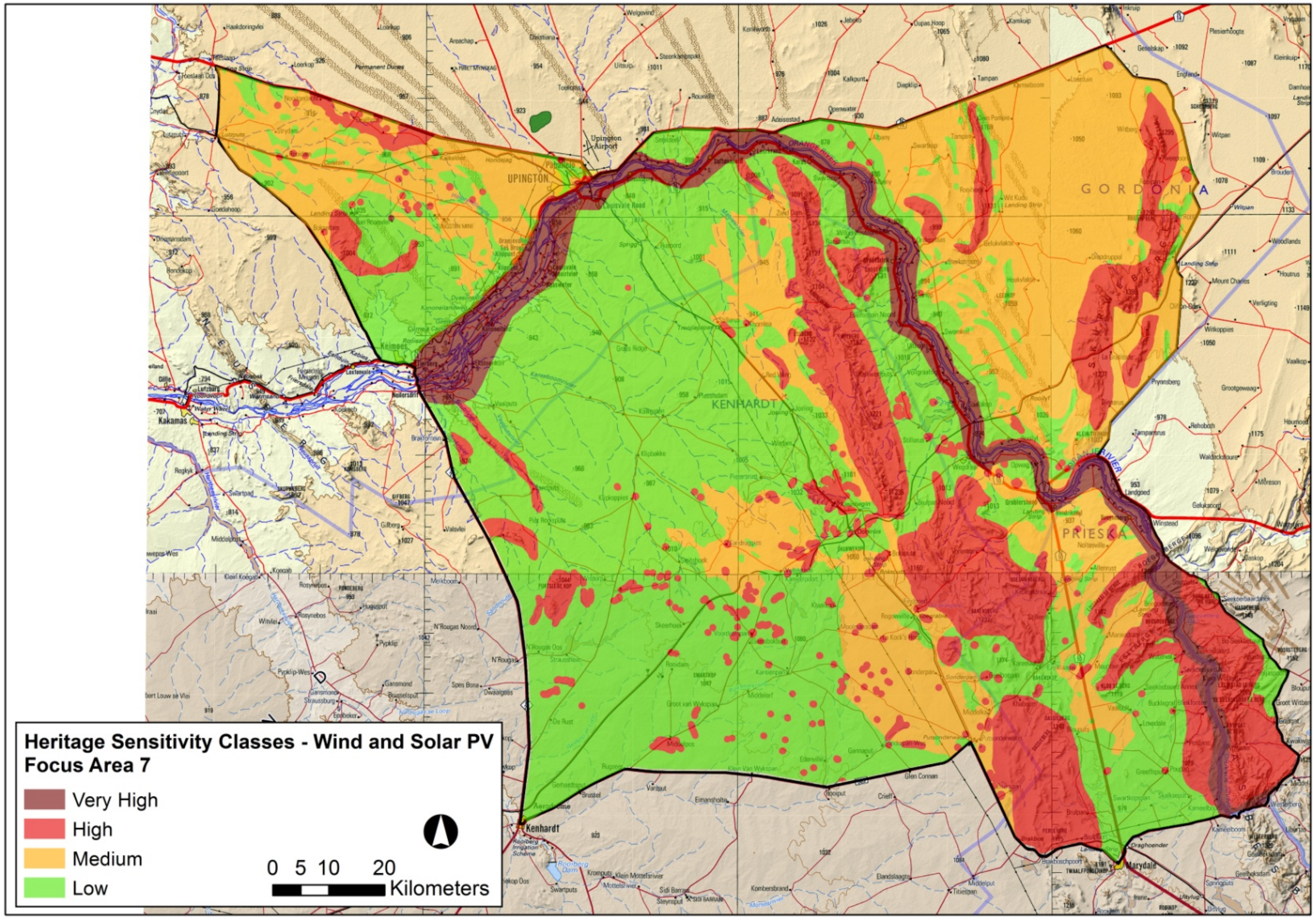


Figure 26 – Combined heritage sensitivity map – Focus Area 7

4.2.8 Springbok focus area 8

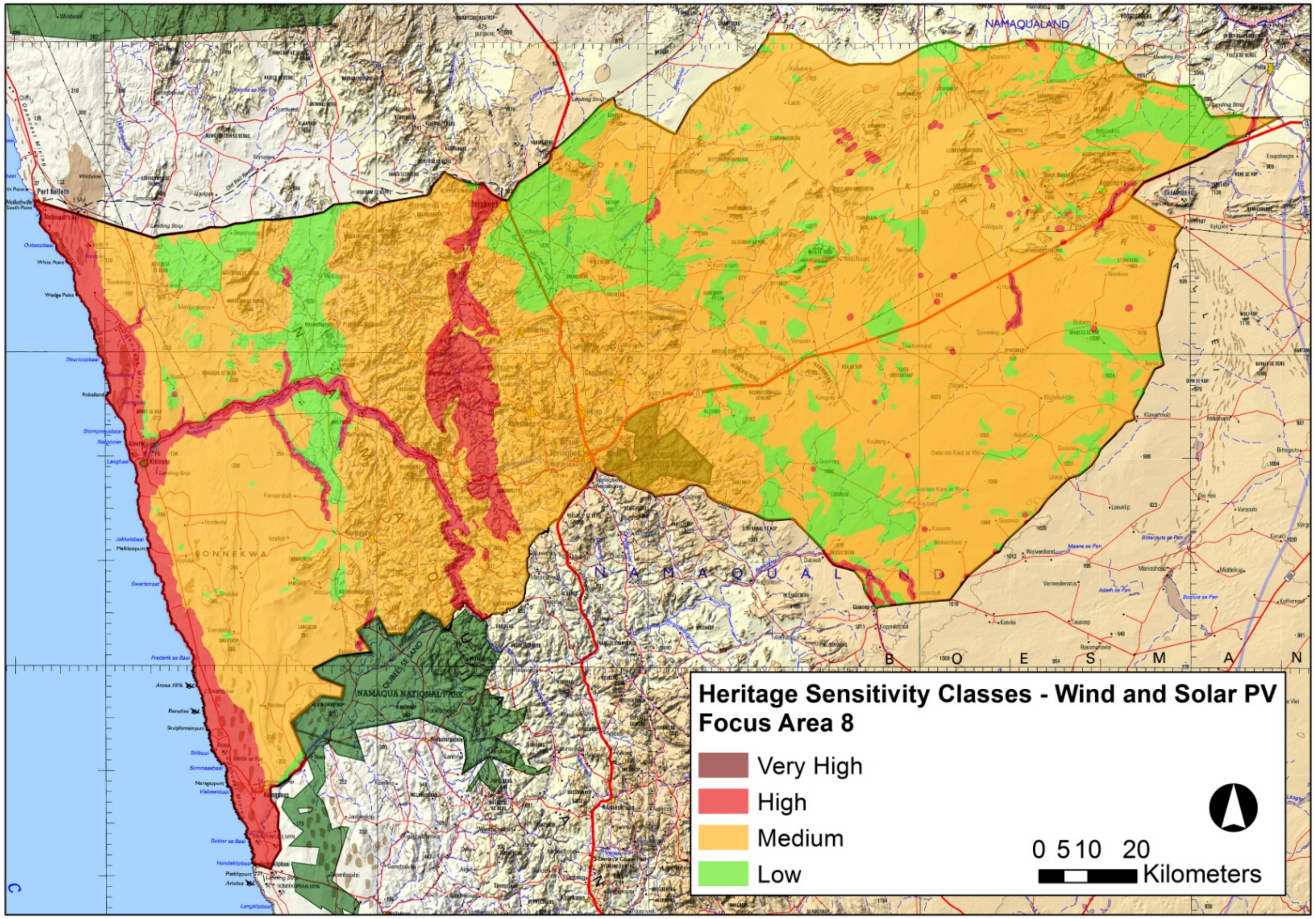


Figure 27 – Combined heritage sensitivity map – Focus Area 8

5 INTERPRETATION AND IMPLEMENTATION OF SENSITIVITY MAPS

Cognisant of the requirements of Section 38 of the NHRA, and the Regulations as promulgated under NEMA, a set of development guidelines were formulated and linked to the sensitivities as identified in this study. Section 5.1 provides a background on the current status quo and requirements for the process to be followed for heritage assessments and the extent of the studies required, while Section 5.2 then proposes specific study extents linked to the relative sensitivities as identified in each of the focus areas.

5.1 Existing Heritage Impact Assessment Requirements: Status Quo

5.1.1 Notification of proposed development

The requirements of the identification of impacts on heritage resources has been set-out under Section 38 of the NHRA with a list of triggers in Section 38(1) providing guidelines on the type of development that will require the developer to contact the responsible heritage resources authority and furnish them with information regarding the proposed project. Following the NHRA, the location, nature and extent of the proposed development needs to be provided. In the Western Cape province this initial interaction occurs via a form known as the "Notification of Intent to Develop" (NID), and its aim is to provide enough relevant information on the location, nature and extent of the proposed development to enable a recommendation on the extent and scope of further studies, if required. In other provinces this notification is commonly carried out through provision of a letter or a Background Information Document (BID).

This notification enables the responsible heritage resources authority to evaluate the possibility that heritage resources may be impacted by a development and whether any impacts would be significant. In the event that the responsible heritage resources authority judges that no significant heritage resources will be impacted, they will inform the developer that no further heritage studies will be required. If however the responsible heritage resources authority judges that significant heritage resources may be impacted, a heritage impact assessment will be requested before any further decisions are made on the proposed development.

The implementation of the responsible heritage resources authorities' requirements will then be enforced by them under Section 38(4) or the Responsible Environmental Authority as part of the provision of Section 38(8) of the NHRA. These Section 38(8) developments refer to developments that require authorisation under other legislation, mainly NEMA and the Minerals and Petroleum Resources Development Act No. 28 of 2002 (MPRDA). Any development requiring authorisation under other legislation will be adjudicated by the relevant national or provincial environmental authority with the heritage resources authority assuming a commenting role. Requirements of the heritage resources authority would be included in their comment and should be written into the environmental authorisation for the development if granted).

5.1.2 Heritage Impact Assessments

The HIA is a document that addresses the impacts of a development on heritage resources, as listed in Section 3.2 of the National Heritage Resources Act as well as under Section 1.2.2 (d) of the present report. The requirements of the responsible heritage resources authority stemming from the notification process will determine the extent of the studies that will be incorporated into the HIA. As no set guidelines for HIAs exist, the minimum standards[115] for Archaeological Impact Assessment (AIA) and Palaeontological Impact Assessment (PIA) have been used as standard in HIA reports.

SAHRA has developed a set of guidelines for minimum standards for the archaeological and palaeontological components of impact assessment reports that set out the extent and detail of the

[115] SAHRA, *Minimum standards for undertaking the archaeological and palaeontological component of heritage impact assessments.* p. 14

information that needs to be contained in an Archaeological Impact Assessment (AIA) [116] or Palaeontological Impact Assessment (PIA). This guideline has in general been implemented as a template for completion of HIAs in the absence of a standard for HIAs and as a result many HIAs are deficient in terms of the range of heritage resources assessed. The general heritage impact assessment (typically referred to as a 'Phase 1' assessment) process as promoted in the NHRA can be simplified as follows:

1. *Under S.38(1), Notification submitted to the responsible heritage resources authority informing them of the location, nature and extent of development;*
2. *Under S.38(2), the responsible heritage resources authority responds with a request for an HIA or with a statement that no further studies are required. If an HIA is required then under S.38(3) they should state what information they require in the HIA;*
3. *An HIA which should identify all heritage resources represented within the study area, any possible impacts from the development and the significance of those impacts should then be submitted. Under S.38(4) the responsible heritage resources authority must then consider the report and issue a decision or comment.*

Further heritage-related studies may then be required. This could include, for example, archaeological and / or palaeontological mitigation which generally involves sampling through excavation or collection (under a permit) at sites that may be lost or impacted. This is traditionally referred to as 'Phase 2'. A 'Phase 3' Heritage Management Plan (for heritage conservation) may be required in rare cases where a heritage site is so important that development will not be allowed or where some or all of the site must be avoided and preserved within the development. Developers may also choose to, or be encouraged to, enhance the value of the sites retained on their properties with appropriate interpretive material or displays.

5.2 Interpretation and implementation of the four tier wind and PV map and approval requirements for each focus area for Heritage resources

As things presently stand, HIAs are at times either unnecessarily larger than required or deficient in terms of their scope. This is because the responsible heritage resources authorities do not always have the staffing capacity to be able to accurately assess project proposals and hence they simply ask for an HIA to be conducted. This leaves a degree of uncertainty as to what really is needed. The Western Cape PHRA (i.e. Heritage Western Cape) has overcome this to some degree through use of their NID form. To determine the approval requirements and scope of HIAs required as a minimum in each of the sensitivity classes, the existing minimum requirements for an HIA need to be considered. These requirements are then reduced to what can be seen as the minimum studies required for approval for each sensitivity class.

The ultimate aim of this study is to provide a concise guideline to the envisaged requirements for approval from the competent authority in each sensitivity rating as identified through this study.

[116] SAHRA, *Minimum standards for undertaking the archaeological and palaeontological component of heritage impact assessments.* p. 15

Table 8 – Interpretation of approval requirements for heritage sensitivity classes in all focus areas

Sensitivity Class	Map	Interpretation	Implementation and additional assessments at project level	Approval requirements (where applicable)
Dark red	*Combined*	*The probability of development being allowed to take place is very low.*	• *Initial contact and submission of notification to the relevant heritage authority indicating extent, nature and location of development as well as and heritage sensitivities identified and the proposed scope of the heritage study.* • *Integrated HIA.*	*Approval at HIA Stage by the responsible heritage resources authority.* *Permits/approval[117] for mitigation[118,119] required under the NHRA.*
	Heritage	*Identified very high heritage sensitivity.*	• *Full heritage specialist assessment, as part of integrated HIA.*	
	Paleontological	*Identified highly significant palaeontological site or rock units.*	• *Full Paleontological specialist assessment (including desktop and field-based study) as part of integrated HIA.*	
Red	*Combined*	*High probability of encountering sensitive areas. Development could be possible through planning and implementation of management requirements of EMP.*	• *Initial contact and submission of notification to the relevant heritage authority indicating extent, nature and location of development as well as and heritage sensitivities identified and the proposed scope of the heritage study. Integrated HIA.*	*Approval at HIA Stage by the responsible heritage resources authority.* *Permits/approval for mitigation[120,121] required under the NHRA.*
	Heritage	*Potential high heritage sensitivity.*	• *Full heritage specialist assessment, as part of integrated HIA.*	
	Paleontological	*Potential for outcrop areas with high palaeontological sensitivity.*	• *Full Paleontological specialist assessment (desktop and field-based study) as part of integrated HIA.*	
Orange	*Combined*	*Medium probability of encountering sensitive areas. Development possible through planning and implementation of management requirements of*	• *Initial contact and submission of notification to the relevant heritage authority indicating extent, nature and location of development as well as and heritage sensitivities identified and the proposed scope of the heritage study. If no sensitivities are found on site heritage*	*Approval at notification stage by the responsible heritage resources authority, if appropriate.* *If further studies required then an*

117 Note that Heritage Western Cape no longer issues permits for mitigation under S.38 but requires approval of a 'work plan' instead.
118 PN298 – Regulations by Heritage Western Cape under Section 25(2)(h) of the NHRA
119 Regulation 548 – National Regulations by under Section 25(2)(h) of the NHRA
120 PN298 – Regulations by Heritage Western Cape under Section 25(2)(h) of the NHRA
121 Regulation 548 – National Regulations by under Section 25(2)(h) of the NHRA

Sensitivity Class	Map	Interpretation	Implementation and additional assessments at project level	Approval requirements (where applicable)
		EMP.	*approval can be based on the notification without requiring HIA.* • *Additional studies may be required but as indicated by the applicable heritage authority.*	*approval at the subsequent HIA stage by the responsible heritage resources authority.* *Permits/approval for mitigation*[122,123] *required under the NHRA.*
	Heritage	*Potential medium heritage sensitivity.*	• *Heritage specialist input to the notification should be based on a field survey.* • *No further specialist assessment as part of HIA required if no significant sensitivities have been identified on site.*	
	Paleontological	*Potential for outcrop area of rock units with medium palaeontological sensitivity.*	• *Paleontological specialist input to notification (desktop assessment).* • *No further palaeontological specialist assessment as part of HIA required if no significant sensitivities have been identified.*	
Green	*Combined*	*No significant heritage issues foreseen.*	• *Initial contact and submission of notification to the responsible heritage resources authority.* • *If no sensitivities are found on site heritage approval can be granted at notification stage.*	*Approval at notification stage as only input required for a heritage assessment by the responsible heritage resources authority.*
	Heritage	*Areas unlikely to have significant heritage sensitivities.*	• *Heritage specialist input to the notification should be based on a field survey.* • *No further heritage assessment required if no significant sensitivities have been identified on site.*	
	Paleontological	*Potential for outcrop area of rock units with low or zero palaeontological sensitivity.*	• *Paleontological specialist input to the notification (Palaeontological comment or reasoned Letter of Exemption from further palaeontological studies).* • *No further palaeontological specialist assessment as part of HIA required if no significant sensitivities have been identified.*	

122 PN298 – Regulations by Heritage Western Cape under Section 25(2)(h) of the NHRA
123 Regulation 548 – National Regulations by under Section 25(2)(h) of the NHRA

6 GENERAL COMMENTS AND DISCUSSION

6.1 Key Impacts and Mitigation

Table 9 summarises the key impacts as envisaged for each of the focus areas of this study, providing a short listing of particularly notable areas where such impacts could be expected and a guideline of the type of mitigation to be implemented in each case. Note that the Overberg and Kimberley focus areas do not have any particular key impacts for palaeontology.

Table 9 – Key impacts and proposed mitigation measures

Focus Area	Key Impacts	Site specific description	Mitigation
1. Overberg	*Heritage* Destruction of heritage sites, degradation of the context of heritage sites and impacts on cultural landscapes	Cultural landscapes include: • Bot River Valley, Bot River settlement and historical railway precinct • Caledon Hot Springs (historical development) • Elim (just on the border of the study area) • Hagedisberg Outspan • Riviersonderend Valley • Buffelsjagrivier Valley, including the Bontebok National Park	Adjust buffers through site specific management and incorporation of viewshed analysis from VIA's.
2. Komsberg	*Heritage* Destruction of heritage sites, degradation of the context of heritage sites and impacts on cultural landscapes	Cultural landscapes • Localised cultural landscapes in the kloofs at the foot of the escarpment (agricultural, historical and pre-colonial) • Matjiesfontein Provincial Heritage Site (historical village) • Karoopoort National Heritage Site	Adjust buffers through site specific management and incorporation of viewshed analysis from VIA's.
	Palaeontology Destruction or disturbance of fossil heritage in the Karoo Supergroup outcrop area or in overlying older alluvial sediments	Extensive outcrop area of the Ecca and Lower Beaufort Groups. Generally unmapped areas of older (Tertiary / Quaternary) alluvial deposits.	Combined desktop and field-based assessment with recommendations for mitigation before or during the construction phase. Possible no-go areas may be defined.

Focus Area	Key Impacts	Site specific description	Mitigation
3. Cookhouse	*Heritage* Destruction of heritage sites, degradation of the context of heritage sites and impacts on cultural landscapes	South African War battle sites Cultural landscapes • Cookhouse and Great Fish River Valley • Small agricultural landscapes in river valleys • Historical settlement of Somerset East, Bedford, Alicedale, Adelaide, Riebeeck Oos (typical historical grid layouts)	Adjust buffers through site specific management and incorporation of viewshed analysis from VIA's.
	Palaeontology Destruction or disturbance of fossil heritage in the Karoo Supergroup outcrop area or in overlying older alluvial sediments	Extensive outcrop area of the Ecca and Lower Beaufort Groups. Generally unmapped areas of older (Tertiary / Quaternary) alluvial deposits.	Combined desktop and field-based assessment with recommendations for mitigation before or during the construction phase. Possible no-go areas may be defined.
4. Stormberg	*Heritage* Destruction of heritage sites, degradation of the context of heritage sites and impacts on cultural landscapes	Cultural landscapes • Mission stations - Nyaba Maria Mission, St Cyprions Mission • Traditional rain making sites – Qamata.	Adjust buffers through site specific management and incorporation of viewshed analysis from VIA's. Localised community consultation to identify acceptable buffers for rainmaking site.
	Palaeontology Destruction or disturbance of fossil heritage in the Karoo Supergroup outcrop area or in overlying older alluvial sediments	Extensive outcrop area of the Upper Beaufort and Stormberg Groups. Generally unmapped areas of older (Tertiary / Quaternary) alluvial deposits.	Combined desktop and field-based assessment with recommendations for mitigation before or during the construction phase. Possible no-go areas may be defined.

Focus Area	Key Impacts	Site specific description	Mitigation
5. Kimberley	*Heritage* Destruction of heritage sites, degradation of the context of heritage sites and impacts on cultural landscapes	• Kimberley town (Victorian settlement and mining landscape) • Wildebeestkuil rock art landscape (prominent landscape feature) • Vaal and Riet River rock art sites (engraved glacial pavements) • Florisbad archaeological and palaeontological site • Kantienkoppie (historic mining and ESA occupation) • Battlefields – Magersfontein.	Adjust buffers through site specific management and incorporation of viewshed analysis from VIA's.
	Palaeontology Destruction or disturbance of fossil heritage in older (Tertiary / Quaternary) alluvial sediments along major river systems (*e.g.* Vaal, Modder)	Mostly unmapped areas of older (Tertiary / Quaternary) alluvial deposits. High palaeontological sensitivities are associated with the Lower Ecca rocks near Kimberley, older alluvial deposits of the Vaal and Modder Rivers, as well as key fossil sites at Florisbad and Erfkroon near Bloemfontein.	Combined desktop and field-based assessment with recommendations for mitigation before or during the construction phase. Possible no-go areas may be defined (*e.g.* known site at Erfkroon on Modder River).
6. Vryburg	*Heritage* Destruction of heritage sites, degradation of the context of heritage sites and impacts on cultural landscapes	Vryburg concentration camp Tigerkloof Institute Devondale Mission Niekerksrus farmstead	Adjust buffers through site specific management and incorporation of viewshed analysis from VIA's.
	Palaeontology Destruction or disturbance of fossil heritage (stromatolites) in Transvaal Supergroup carbonate sediments	Outcrop area of the Transvaal Supergroup	Combined desktop and field-based assessment with recommendations for mitigation before or during the construction phase. Possible no-go areas may be defined.

Focus Area	Key Impacts	Site specific description	Mitigation
7. Upington	*Heritage* Destruction of heritage sites, degradation of the context of heritage sites and impacts on cultural landscapes	Orange River (historical and pre-colonial settlement and associated cultural landscapes)	Adjust proposed buffers where possible through site specific evaluation and incorporate VIA findings in study
8. Springbok	*Heritage* Destruction of heritage sites, degradation of the context of heritage sites and impacts on cultural landscapes	Copper Mining Landscape that includes the Provincial Heritage sites of: • Orbicule Koppie, Concordia • Van der Stel's Coppermine, Carolusberg • Copper smelting chimney at Springbok • Old smoke stack at Okiep • Cornish pump building at Okiep Grootmis historical settlement Coastal belt (extremely high density pre-colonial occupation)	Adjust proposed buffers where possible through site specific evaluation and incorporate VIA findings in study
	Palaeontology Destruction or disturbance of fossil heritage in the West Coast Group	Largely unmapped outcrop area below 100 m amsl along the west coast.	Combined desktop and field-based assessment with recommendations for mitigation before or during the construction phase. Possible no-go areas may be defined

6.2 General comments

Table 10 – Suitability of focus areas in respect of impact on heritage resources

Site	Overall Suitability	Comment
Overberg focus area 1	***Good*** *Most of the focus area is of medium palaeontological sensitivity and heritage sites and cultural landscapes with high sensitivity are localised.*	***Heritage*** *Archaeological sites are localised in the study, area while the cultural landscapes tend to be concentrated around historical settlements which make large areas suitable for RE projects with the implementation of the required studies as listed in Section 5.*
		Palaeontology *More than 80 % of the Overberg focus area has been rated as having a medium palaeontological significance, with only small areas of Palaeozoic and Mesozoic rocks rated as having a high palaeontological sensitivity.*

Site	Overall Suitability	Comment
Komsberg focus area 2	***Good*** *Additional PIAs could shed light on the significant palaeontology of the region. Heritage sites and cultural landscapes with high sensitivity are localised.*	***Heritage*** *Sensitive heritage features such as cultural landscapes and archaeological sites are very localised and can be managed through thorough HIAs as recommended in sensitive areas.*
		Palaeontology *Most of the central and northern regions are of high palaeontological sensitivity due to important Karoo vertebrate fossils.* *Although large areas of the focus area have a high rated palaeontological heritage sensitivity it is still suitable for RE developments with the proviso that PIAs form an essential part of the heritage assessment for the proposed projects.* *Palaeontological field assessment of many areas rated as highly sensitive on the basis of geological maps will probably show that they are unproblematic in practice. Where significant fossils are present at or near surface, mitigation (recording and sampling of fossil material at the pre-construction or construction phase), can usually be effective, once the development footprint has been finalised.*
Cookhouse focus area 3	***Good*** *Palaeontology has an overall high sensitivity, indicating the need for paleontological field work* *Heritage sites and cultural landscape with high sensitivity are localised.*	***Heritage*** *Sensitive heritage features such as cultural landscapes and archaeological sites are very localised with the exception of the Great Fish River valley, however impacts on heritage resources can be managed through thorough HIA's as recommended in sensitive areas.*
		Palaeontology *Most of the central and northern regions are of high palaeontological sensitivity due to important Karoo vertebrate fossils.* *Although large areas of the focus area have a high rated palaeontological heritage sensitivity it is still suitable for RE developments with the proviso that PIAs form an essential part of the heritage assessment for the proposed projects.* *Palaeontological field assessment of many areas rated as highly sensitive on the basis of geological maps will probably show that they are unproblematic in practice. Where significant fossils are present at or near surface, mitigation (recording and sampling of fossil material at the pre-construction or construction phase), can usually be effective, once the development footprint has been finalised.*

Site	Overall Suitability	Comment
Stormberg focus area 4	***Good*** *Palaeontology has an overall high sensitivity, indicating the need for paleontological field work*	***Heritage*** *Sensitive heritage features such as cultural landscapes and archaeological sites are very localised and impacts on heritage resources can be managed through thorough HIA's as recommended in sensitive areas.*

Site	Overall Suitability	Comment
	Heritage sites and cultural landscape with high sensitivity are localised.	***Palaeontology*** *Apart from dolerites, most of the area is of high palaeontological sensitivity due to important Karoo vertebrate fossils.* *Although large areas of the focus area have a high rated palaeontological heritage sensitivity it is still suitable for RE developments with the proviso that PIAs form an essential part of the heritage assessment for the proposed projects.* *Palaeontological field assessment of many areas rated as highly sensitive on the basis of geological maps will probably show that they are unproblematic in practice. Where significant fossils are present at or near surface, mitigation (recording and sampling of fossil material at the pre-construction or construction phase), can usually be effective, once the development footprint has been finalised.*
Kimberley focus area 5	***Good*** *Large parts of the eastern part of the focus area has a medium sensitivity, while the western section of the focus area ranks as having high sensitivity.* *Heritage sites and cultural landscapes with high sensitivity are common in the area, however it is still possible to accommodate RE developments.*	***Heritage*** *The Kimberley focus area has an immensely rich heritage layering spanning the whole cultural sequence from 300 million years ago to the South African War.* ***Palaeontology*** *High palaeontological sensitivities are associated with the Lower Ecca rocks near Kimberley, older alluvial deposits of the Vaal and Modder Rivers, as well as key fossil sites at Florisbad and Erfkroon near Bloemfontein.*
Vryburg focus area 6	***Very good*** *Palaeontological resources have been rated as having a low to high sensitivity.* *Heritage features are localised and cultural landscapes are rare due to the flat topography and vegetation.*	***Heritage*** *The eastern and south-eastern sections of the Vryburg focus area have been rated as having low heritage sensitivity with only small sections referenced as having high significance.* *The Vryburg focus area as a whole has few significant cultural landscapes.* ***Palaeontology*** *Most of the area is of low to medium palaeontological sensitivity. Precambrian stromatolite-bearing rocks in the south-western portion of the area are of high sensitivity.*
Upington focus area 7	***Very good*** *Additional PIA's could shed light on the significant palaeontology of the region.* *Localised and concentrated heritage resources around the Orange River provide ample development opportunities away from these areas of high heritage significance.*	***Heritage*** *The Upington focus area has heritage sensitivity strongly associated with the topography and the Orange River and all its farming settlements. The western and south western sections of the focus area have low heritage sensitivity.* ***Palaeontology*** *Most of the area is of low to medium palaeontological sensitivity, with the exception of small areas of Precambrian sediments in the easternmost portion of the focus area. Older alluvial sediments along the Orange River are of high palaeontological sensitivity.*

Site	*Overall Suitability*	*Comment*
Springbok focus area 8	***Good*** *Medium to low sensitivities regarding palaeontology occur in the central eastern and western sections of the focus area. High sensitivities from a paleontological and heritage perspective have been mapped on the coast as well as the central highlands of the focus area.*	***Heritage*** *The Springbok focus area has shown an overall medium heritage sensitivity (in most cases a function of the palaeontological sensitivity) with localised areas of high sensitivity. The localisation of archaeological resources around coastal areas as well as mountainous zones provide the opportunity for development in low sensitivity areas incorporating acceptable minimum standards as recommended.*
		Palaeontology *Most of the area is of low to medium palaeontological sensitivity. The West Coast zone and Precambrian rocks of the Nama Group west of Springbok are of high palaeontological sensitivity.*

7 CONCLUSIONS AND FURTHER RECOMMENDATIONS

The specialist input for this SEA study has gathered and mapped heritage data on a Scoping level by collating databases, heritage reports, known heritage research and topographical information to develop a set of maps that illustrate known heritage resources as well as possible sensitive areas that could contain heritage resources.

An evaluation of national and international standards for determining criteria for heritage sensitivity and buffer distances has provided a valuable background against which a set of buffers and criteria were developed to assist in creating sensitivity maps for the eight focus areas. The integrated heritage sensitivity maps provide a clear picture of the definite and possible heritage sensitivities in each of the focus areas, which can inform further planning and implementation.

The sensitivity mapping was then linked to minimum requirements for heritage studies needed for the approval of a RE development by the responsible heritage resources authority for each specific focus area.

The body of work has further shown that the impact from wind and PV projects can have significant impacts on the cultural landscape, archaeological, palaeontological and historical resources. The union of all the available data sets and the evaluation of the minimum requirements have indicated the following:

1. The possibility of reducing the extent of the heritage studies to be undertaken as part of the approval process for a RE development does exist;
2. The lack of a National Heritage Survey that systematically covered large swathes of land excludes the possibility of totally discarding the need for any type of heritage assessment as part of the authorisation for projects such as RE developments;
3. The only areas that can be excluded from heritage surveys are those previously subjected to heritage impact assessments where the coverage was appropriate to the newly proposed development and where the absence of significant heritage resources was confirmed;
4. Setting these minimum requirements will require a paradigm shift that does not sit well with heritage practitioners (archaeologists and palaeontologists alike), but the outcomes of the SEA will assist in the fulfilment of the listed heritage requirements for each focus area and lead to a streamlined process.
5. It is envisaged that the minimum requirement for any heritage study situated in an area of low or medium heritage sensitivity should be (1) the submission of a notification containing information on the location, nature and extent of the proposed development backed by (2) a field assessment

as well as (3) a palaeontological statement provided by a qualified palaeontologist to advise on the level of palaeontological assessment, if any, that is necessary (letter of exemption / desktop study / field-based study). Subsequent determination of the extent and scope of further studies, if any, should be made by the responsible heritage resources authority. The responsible heritage resources authority may then approve the development without any further studies or, in cases where further work is recommended, request that the specified additional work be completed before approval.

6. The high and very high heritage sensitivity areas will trigger a full HIA process and will be initiated with the responsible heritage resources authority by the submission of a notification as in the case of the low and medium sensitivity areas. This notification will, however, contain specific recommendations that will need to be implemented as an integrated process of heritage study with the possible inclusion of a variety of specialist studies as part of the assessment depending on the types of sensitivity that was identified in the area of development through the sensitivity mapping.

This study provides guidelines on the minimum requirements for approval of RE facilities by the responsible heritage resources authority in the REDZs once gazetted. These guidelines could enable the rapid roll-out of RE development in the REDZs once gazetted, but will require the buy-in from SAHRA as well as the responsible heritage resources authority for each of the provinces where these focus areas are situated.

8 SPECIALIST SHORT CV

Specialist Short CV

WOUTER FOURIE

Professional Heritage Specialist and Director PGS Heritage

Summary of Experience:
Specialised expertise in Cultural Resource Management and Heritage Impact Assessment, Archaeology, Anthropology, Applicable survey methods, Fieldwork and project management, Geographic Information Systems, including inter alia:

Involvement with various Heritage Impact Assessments, within South Africa, including:
- Archaeological walkdowns for various projects
- Phase 2 Heritage Impact Assessments and EMPs for various projects
- Heritage Impact Assessments for various projects
- Iron Age Mitigation Work for various projects, including archaeological excavations and monitoring

Involvement with various Heritage Impact Assessments, outside South Africa, including:
- Heritage Impact Assessments in Mozambique, Botswana and DRC
- Grave Relocation projects in DRC

Involvement in various grave relocation projects (some of which relocated up to 1000 graves) and grave “rescue” excavations in the various provinces of South Africa

Key Qualifications:
BA [Hons] (Cum laude): Archaeology and Geography
BA: Archaeology, Geography and Anthropology

Professional Affiliation
Professional Archaeologist - Association of Southern African Professional Archaeologists (ASAPA) - Professional Member
Accredited Professional Heritage Specialist – Association of Professional Heritage Practitioners (APHP)
CRM Accreditation (ASAPA):
- Principal Investigator - Grave Relocations
- Field Director – Iron Age
- Field Supervisor – Colonial Period and Stone Age

Accredited with Amafa KZN and Eastern Cape PHRA

Key Work Experience:
2008-current: Director –Professional Grave Solutions (Pty) Ltd t/a PGS Heritage
2007-2008: Project Manager – Matakoma-ARM, Heritage Contracts Unit, University of the Witwatersrand
2005-2007: Director - Professional Grave Solutions (Pty) Ltd
2000-2004: CEO– Matakoma Consultants
1998-2000: Environmental Co-ordinator – Randfontein Estates Limited. Randfontein, Gauteng
1997-1998: Environmental Officer – Department of Minerals and Energy. Johannesburg.

JOHN E. ALMOND

Palaeontologist/ geologist, Managing Member of Natura Viva cc

Key Qualifications:
Honours Degree in Natural Sciences (Zoology), University of Cambridge, UK (1980).
PhD in Earth Sciences (Palaeontology), University of Cambridge, UK (1986).

Membership of Professional Bodies:

- Member of the Palaeontological Society of Southern Africa, Geological Society of South Africa (Western Cape)
  - Accredited Professional Heritage Specialist – Association of Professional Heritage Practitioners (APHP)
  - Accredited with Amafa KZN and Eastern Cape PHRA

Summary of Other Experience:
Post-doctoral Research Fellowships at University of Cambridge, UK and Tübingen University, Germany (Humboldt Research Fellow).
Visiting Scientist at various research institutions in Europe, North America, South Africa and fieldwork experience in all these areas, as well as in North Africa.
Extensive palaeontological field and research experience in South Africa and southern Namibia as Scientific Officer for the Council for Geoscience, RSA (1990-1998)
Reviews of fossil heritage related to new 1: 250 000 geological maps published by the Council for Geoscience (Geological Survey of SA) – e.g. Clanwilliam, Loeriesfontein, Alexander Bay sheets.
Several hundred palaeontological heritage desktop studies and field-based assessments completed over the past few years for projects in Western Cape, Eastern Cape, Northern Cape, Free State, Northwest Province, Mpumulanga, Limpopo and Gauteng.
Former long-standing member of Archaeology, Palaeontology and Meteorites Committee for Heritage Western Cape (HWC). Occasional advisor on palaeontological conservation and management issues for the Palaeontological Society of South Africa (PSSA), HWC and SAHRA.
Contributions to palaeotechnical reports on provincial palaeontological heritage of Western, Northern and Eastern Cape, Limpopo, Gauteng & Free State for SAHRA and HWC.

REVIEWER: JAYSON ORTON

Archaeologist and heritage specialist, Director of ASHA Consulting (Pty) Ltd

Key Qualifications:
MA (Archaeology), University of Cape Town, 2004
D.Phil (Archaeology), University of Oxford, UK, 2013

Professional memberships:
Association of Southern African Professional Archaeologists CRM Section Member No. 233
Professional accreditation:
Principal Investigator: Stone Age, Coastal shell middens, Grave relocation
Field Director:Rock art, Colonial Period
Heritage Western Cape Archaeology, Palaeontology and Meteorites committee member
South African Archaeological Society Council member

Summary of experience:
Numerous heritage impact assessments and specialist archaeological mitigation projects throughout the Western and Northern Cape Provinces since 2004 and for a wide variety of development types. Projects include a large number of wind energy facilities and solar PV facilities.

ASSISTANTS:

Stephany van der Walt - Archaeologist
Makungu Shadrack Maluleke - Masters Candidate - Archaeology
Nokukhanya Sabelo Khumalo – BA(Hons) Archaeology
Jacqueline Jordaan – Masters Candidate - Archaeology
Nomawethu Hlazo – BSc Biochemistry and Archaeology

8.1 Specialist Declaration

I, Wouter Fourie as the appointed independent specialist hereby declare that I:

- act/ed as the independent specialist in this application;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct;
- do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed;
- have and will not have any vested interest in the proposed activity proceeding;
- have disclosed any material information that have or may have the potential to influence the objectivity of any report or decisions base thereon; and
- am aware that a false declaration is an offence in terms of regulation 71 of GN No. R. 543.

Name of company: PGS Heritage

Professional Registration:

Accredited Professional Archaeologist - Association of Southern African Professional Archaeologists (ASAPA) - Member number: 041

Accredited Professional Heritage Specialist – Association of Professional Heritage Practitioners (APHP)

Date: 15 October 2014

STRATEGIC ENVIRONMENTAL ASSESSMENT FOR WIND AND SOLAR PHOTOVOLTAIC ENERGY IN SOUTH AFRICA

Appendix A4

Terrestrial & Aquatic Biodiversity Scoping Assessment Report

Specialists' names:
Andrew Skowno; Simon Todd,
Kate Snaddon & Justine Ewart-Smith
ECOSOL GIS & Freshwater Consulting Group

contents

LIST OF FIGURES

Looking from the Elandsberge towards the Great Escarpment near Sutherland in the Komsberg Focus Area

ABBREVIATIONS AND ACRONYMS

CBA	Critical Biodiversity Area
CESA	Critical Ecological Support Area
CSIR	Council for Scientific and Industrial Research
DAFF	Department of Agriculture, Forestry and Fisheries
DEADP	Department of Environmental Affairs and Development Planning
DEAT	Previous Department of Environmental Affairs and Toursim
DEA	Department of Environmental Affairs
DLA-CDSM	Department of Land Affairs' Chief Directorate: Surveys and Mapping
DWA	Department of Water Affairs
ECPAES	Eastern Cape Protected Area Expansion Strategy
EIS	Ecological Importance and Sensitivity
ESA	Ecological Support Area
FA	Focus Area
GA	General Authorisation, according to Water Act (1998)
NBA	National Biodiversity assessment 2011
NPAES	National Protected Area Expansion Strategy
NFEPA	National freshwater ecosystem priority areas
PA	Protected Area - statutory
PES	Present Ecological State
SA	South Africa
SANBI	South African National Biodiversity Institute
VEG	Vegetation
WAR	Water Allocation Reform
WULA	Water Use Licence Application

1 BACKGROUND

The Department of Environment Affairs (DEA) has appointed the CSIR to undertake a strategic environmental assessment (SEA) which aims to identify geographical areas best suited for the roll-out of wind and solar PV energy projects, referred to as Renewable Energy Development Zones (REDZs). It is envisaged that wind and solar PV development will be incentivised and streamlined in the REDZs. The SEA process also provides a platform for coordination between the various authorities responsible for issuing authorisations, permits or consents and thereby will allow for a more streamlined environmental authorisation process. Phase I of the process, undertaken by the CSIR in 2013 and based on development potential, major constraints and industry inputs, involved the identification of focus areas (Figure 1.1). Phases II and III, the current project, entails the refinement of these focus areas through broad stakeholder consultation as well as specialist assessments. Refinement of the areas includes sensitivity mapping, as well as the possible enlargement, reduction or elimination of the identified focus areas.

As part of Phase III of the process, ECOSOL GIS and Freshwater Consulting Group (FCG) were sub-contracted by the CSIR in March 2014 to undertake the terrestrial and aquatic freshwater biodiversity assessment, focused primarily on interpreting existing information and based on defensible biodiversity planning methodologies, and to make recommendations for the environmental authorisation process in the REDZs.

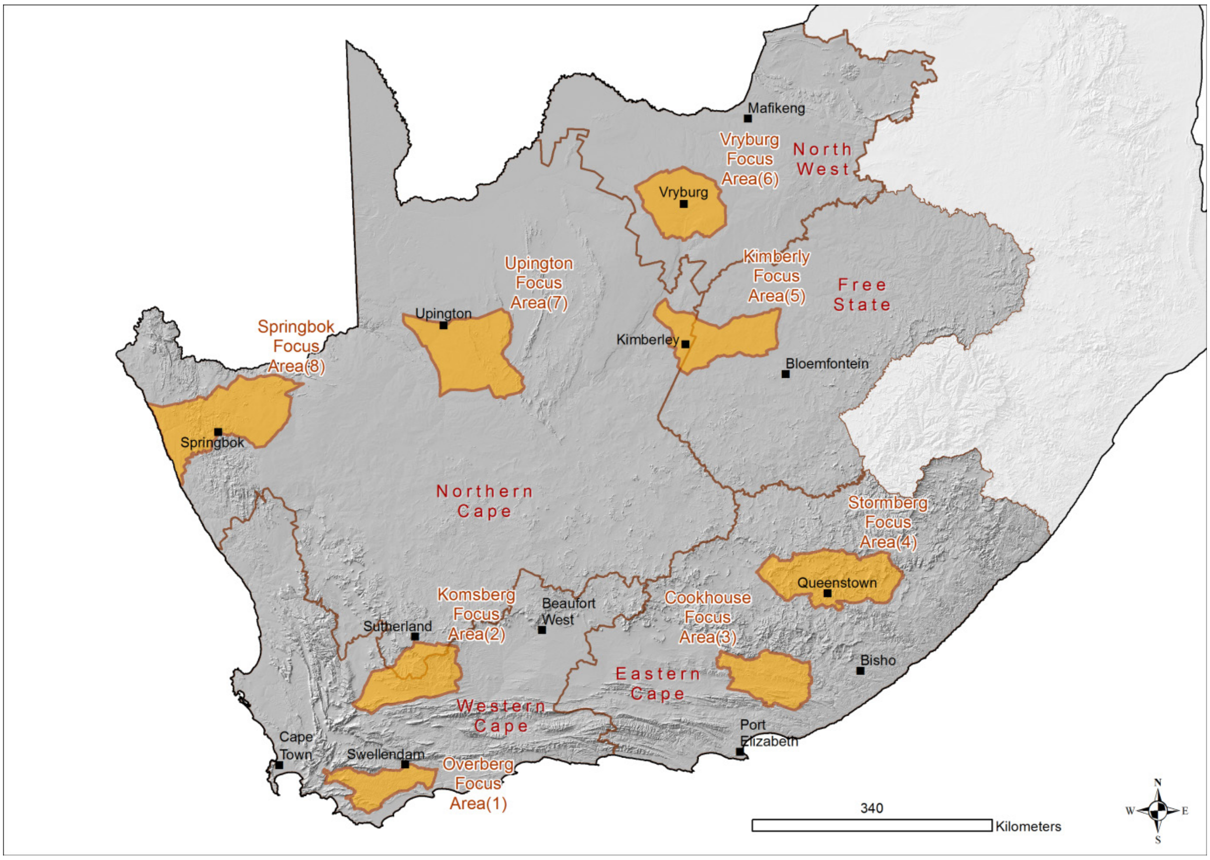


Figure 1.1. Focus Areas for renewable energy project development identified by CSIR.

2 APPROACH AND GENERAL METHODOLOGY

2.1 Approach

A desktop approach was used to assess terrestrial and aquatic biodiversity sensitivity for the eight focus areas (FAs) identified through the SEA process. A spatial database containing relevant national and regional biodiversity layers was provided by the CSIR. This database was supplemented with additional regional layers sourced though expert networks, national species data from the South African National Biodiversity Institute (SANBI), and additional desktop mapping of selected features. Availability, resolution and accuracy of terrestrial biodiversity data was inconsistent across the focus areas. For example, FA 1 (Overberg) has fine-scale Critical Biodiversity Area (CBA) maps and accurate vegetation and land cover information on which to base sensitivity, in other focus areas, such as FA 7 (Upington) there are no fine scale datasets and no CBA maps. Available aquatic biodiversity datasets are national in extent and therefore cover all the focus areas. However, the accuracy of the wetland data varied substantially across the FAs and some remapping / reclassification was required. A full list of data sets utilised can be found in Section 2.2.

- **Sensitivity Analysis**

The data layers relevant to each FA were identified and combined in a simple multi criterion decision making system. The various input layers were scored on a scale of 0 to 10, with 10 representing the highest sensitivity value and 0 the lowest sensitivity value. Different combinations of layers were selected for each FA and then summed to produce an absolute sensitivity score. The resulting absolute sensitivity maps were then assessed on a focus area by focus area basis, and where necessary, the scores of particular features were adjusted and / or the formula combining feature scores was revised (Section 4).

The absolute sensitivity scores were then categorised into Very High, High, Medium and Low sensitivity classes (Section 5).

To convert the absolute sensitivity scores to the required four tier system, cut-offs between the categories were set. Very sensitive biodiversity features which represent an automatic Very High sensitivity classification (such as protected areas, remaining extent of listed critically endangered ecosystems, forests, and aquatic features (plus the buffers applied to these features) all have total scores of over **10**. Areas with no natural habitat remaining are considered Low sensitivity and were usually assigned a score of **0,** exceptions to this are protected areas and certain aquatic feature buffers which were assigned a score of 10 regardless of level of transformation. The cut-off between Medium and High sensitivity was chosen to be half way between Low and Very High sensitivities, with medium sensitivity thus being between 1 and 5.

The final section of the study provides recommendations for the streamlining of the environmental authorisation process in the REDZs. Potential issues and mitigation measures are also discussed for each focus area. In addition to the "per sensitivity category recommendations" the absolute sensitivity analyses can be used in regional screening process.

2.2 Data Sources

Data title	Source and date of publication	Data Description
National Datasets		
NFEPA wetlands and rivers	Nel J.L., Driver A., Strydom W., Maherry A., Petersen C., Roux D.J., Nienaber S., van Deventer H, Smith-Adao LB and Hill L. (2011). Atlas of Freshwater Ecosystem Priority Areas in South Africa: Maps to support sustainable development of water resources. WRC Report No. TT 500/11, Water Research Commission, Pretoria	Wetland and priority river data updated and used at all FAs. Only those ecosystems identified as Natural were used.
NFEPA sub-catchments	Nel J.L., Driver A., Strydom W., Maherry A., Petersen C., Roux D.J., Nienaber S., van Deventer H, Smith-Adao LB and Hill L. (2011). Atlas of Freshwater Ecosystem Priority Areas in South Africa: Maps to support sustainable development of water resources. WRC Report No. TT 500/11, Water Research Commission, Pretoria	Sub-quaternary catchments classified according to the FEPA rivers they contain.
NFEPA groundwater recharge	Nel J.L., Driver A., Strydom W., Maherry A., Petersen C., Roux D.J., Nienaber S., van Deventer H, Smith-Adao LB and Hill L. (2011). Atlas of Freshwater Ecosystem Priority Areas in South Africa: Maps to support sustainable development of water resources. WRC Report No. TT 500/11, Water Research Commission, Pretoria	High groundwater recharge areas are sub-quaternary catchments where groundwater recharge is three times higher than the average for the related primary catchment.
Strategic Water Source Areas	Jeanne Nel, Christine Colvin, David Le Maitre, Janis Smith and Imelda Haines (2013). South Africa's Strategic Water Source Areas. CSIR Report no. CSIR/NRE/ECOS/ER/2013/0031/A	Strategic Water Source Areas are those areas that supply a disproportionately high amount of the country's mean annual runoff, in relation to their surface area
1:50 000 River Lines and River Area	Department of Land Affairs; Chief Directorate: National Geographic Information	River lines are centre lines for all streams and rivers of all orders in South Africa. River areas are polygons inconsistently depicting riparian areas around river channels.
Ramsar sites	RAMSAR Sites Information Services www.ramsar.wetlands.org	19 Wetlands of International Importance in South Africa. None were identified within the 8 focus areas.
Protected Areas	DEA 2013 PA database + SANBI PA database from NBA 2011	Protected Areas - formal, used for all FAs
Listed Threatened Ecosystems of South Africa	Department of Environmental Affairs (2011). National list of ecosystems that are threatened and in need of protection. *Government Gazette* No. 34809, Notice No. 1002, 9 December 2011.	Gazetted list of threatened ecosystems used in all FAs
Land Cover (LC)	SANBI unpublished beta version 2014	Land cover for South Africa, used for all FAs but replaced by Addo CBA map land cover (Skowno and Holness 2012) for western section of FA3. In FA5 and FA2 extensive areas were noted as being incorrectly mapped as transformed due to remote sensing artefacts linked to low vegetation cover. These areas were reclassified as natural and represent a significant

Data title	Source and date of publication	Data Description
		weakness in the sensitivity maps as no ground-truthing of the Land cover has been performed.
South African Vegetation Map	Mucina L. & Rutherford, M.C. (eds) (2006). The Vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria (Note: Namakwa Sand Fynbos vegetation type was refined using unpublished maps provided by Philip Desmet and Nick Helme)	South African National vegetation map used in all FAs for determining vegetation endemism, additional vegetation sensitivity and sensitive biomes.
	Regional Datasets	
Cape Lowland Conservation Project priority patches	Von Hase A., Rouget M., Maze, K and Helme, N.(2003) A Fine-Scale Plan for the Cape Lowlands: technical report. CCU report 2/03, Botanical Society	Additional information on priority lowland Renosterveld patches for Overberg FA 1
Namakwa Biodiversity Sector Plan	Desmet P. & Marsh A. (2009) Namakwa Biodiversity Sector Plan. Conservation International.	CBA map used in the Springbok FA 8 and partially in the Komsberg FA 2.
North West Biodiversity Assessment	Desmet, Skowno & Schaller (2008) Biodiversity Assessment of North West, NWDACE.	CBA map used in the Vryburg FA 6
Addo Mainstreaming Project CBA Map	Skowno, A.L. & Holness, S.D. (2012) Addo Mainstreaming Project - Updated CBA maps & technical report. SANParks.	CBA map used in the Cookhouse FA 3, including detailed land cover data
Western Cape Biodiversity Framework	Kirkwood, D., Pence, G.Q., & von Hase, A. 2010 Western Cape Biodiversity Framework: Critical Biodiversity Areas and Ecological Support Areas of the Western Cape. A C.A.P.E. Land-use planning project. Unpublished Project Report	CBA map used in the Overberg FA1 and Komsberg FA2
Eastern Cape Biodiversity Conservation Plan	Berliner D. & Desmet P. (2007). Eastern Cape Biodiversity Conservation Plan: Technical Report. Department of Water Affairs and Forestry Project No 2005-012,Pretoria.	CBA map used in FA3 (eastern section) and FA 4
STEP thicket degradation map	Cowling, R.M., Lombard, A.T., Rouget, M., Kerley G.I.H., Wolf T., Sims-Castley, R., Knight, A., Vlok, J.H.J., Pierce, S.M., Boshoff, A.F. & Wilson, S.L. 2003. A conservation assessment for the Subtropical Thicket Biome. *Terrestrial Ecology Research Unit Report* No 43. 106 pp. Appendices 80 pp. University of Port Elizabeth, South Africa. (see www.bgis.sanbi.org)	Pristine thicket patches in FA3
SKEP Expert Areas	Updated SKEP expert areas (SKEP 2012)	Taxon specific priority areas identified for SKEP programme used to refine CBA maps in FA 8
Forest patches map 2005	Berliner, D. (2005) Systematic conservation planning for the forest biome of South Africa. DAFF, Pretoria	Forest patches mapped by Berliner 2005 present in FA 1, 3 and 4. (Note: these forest patches are not adequately represented by the SA vegetation map.)
Eastern Cape Protected Areas Expansion Strategy	Skowno, A., Holness, S., Jackelman, J. and P. Desmet (2012) Eastern Cape Protected Area Expansion Strategy, Eastern Cape Parks and Tourism Agency, East London.	High scoring areas in the EPAES analysis were used to supplement the CBA information for FA4
National Protected Areas Expansion Strategy	DEAT (2008) The National Protected Area Expansion Strategy 2008-2012: A framework for Implementation. South African National Biodiversity Institute, National Department of Environmental Affairs and Tourism.	Wilderness Areas were identified based on the NPAES focus areas layer.

Data title	Source and date of publication	Data Description
Digital Elevation Model	NASA Land Processes Distributed Active Archive Center (LP DAAC). ASTER L1B. USGS/Earth Resources Observation and Science (EROS) Center, Sioux Falls, South Dakota. 2001.	ASTER 30m DEM version 2 used for identification of high elevation areas and steep slopes

2.3 Assumptions and Limitations

Limitation	Included in the scope of this study	Excluded from the scope of this study	Assumption
Resource availability	*Only existing, published datasets used with limited desk top verification*	*Field verification of datasets and outcomes, and extensive local expert consultation*	*Reasonable accuracy of data layers used. Field verification will take place on a site by site basis linked to development proposals.*
This is a desktop assessment of biodiversity sensitivity based largely on existing datasets. Some of these existing datasets were refined and/or modified, and a limited amount of new desktop expert mapping of features was undertaken. As such, the primary limitation of the study is the lack of ground truthing and local expert consultation. Due to the large size of the FAs, there is a limit as to the size of features that can be effectively mapped. While the current analyses and maps capture the distribution of sensitive features and habitats at the medium to broad scale, there will always be small or localised features present which are sensitive and can only be mapped with the aid of site visits.			

2.4 Relevant Regulatory Instruments

Instrument	Key objective
International Instrument	
Ramsar Convention (The Convention of Wetlands of International Importance (1971 and amendments)	*Protection and conservation of wetlands, particularly those of importance to waterfowl and waterfowl habitat. South Africa is a signatory to the Ramsar Convention and is thus obliged to promote the conservation of listed wetlands and the 'wise management' of all others.*
National Instrument	
National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004)	*The National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004) provides for listing threatened or protected ecosystems, in one of four categories: critically endangered (CR), endangered (EN), vulnerable (VU) or protected. Activity 12 in Listing Notice 3 (Government Notice R546 of 2010) relates to the clearance of 300 m2 or more of vegetation, within Critical Biodiversity Areas.*
National Environmental Management Act (Act 107 of 1998).	*The National Environmental Management Act of 1998 (NEMA), outlines measures that...."prevent pollution and ecological degradation; promote conservation; and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development."* *Of particular relevance to this assessment is Chapter 1(4r), which states that sensitive, vulnerable, highly dynamic or stressed ecosystems, such as coastal shores, estuaries, wetlands, and similar systems require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure.*
NEMA EIA 2010 regulations (Government Gazette 33306 (June 2010)	*These regulations provide listed activities that require environmental authorisation prior to development because they are identified as having a potentially detrimental effect on natural ecosystems, including freshwater ecosystems. Different sorts of activities are listed as environmental triggers that determine different levels of impact assessment and planning required.*

Instrument	Key objective
	The regulations detail the procedure to be followed for a basic or full environmental impact assessment.
The National Forests Act (Act 84 of 1998)	*The objective of this Act is to monitor and manage the sustainable use of forests. In terms of Section 12 (1) (d) of this Act and GN No. 1012 (promulgated under the National Forests Act), no person may, except under licence:* • Cut, disturb, damage or destroy a protected tree; or • Possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree or any forest product derived from a protected tree.
National Water Act (Act 36, 1998)	*This act provides the legal framework for the effect and sustainable management of water resources. It provides for the protection, use, development, conservation, management and control of water resources as a whole. Water use pertains to the consumption of water and activities that may affect water quality and condition of the resource such as alteration of a watercourse. Water use requires authorisation in terms of a Water use licence (WULA) or General Authorisation (GA), irrespective of the condition of the affected watercourse.*
Conservation of Agricultural Resources Act (CARA, Act 43 of 1983).	*Key aspects include legislation that allows for:* *Section 6: Prescription of control measures relating to the utilisation and protection of vleis, marshes, water sponges and water courses. These measures are described in regulations promulgated in terms of the Act, as follows;* *Regulation 7(1): Subject to the Water Act of 1956 (since amended to the Water Act 36 of 1998), no land user shall utilise the vegetation of a vlei, marsh or water sponge or within the flood area of a water course or within 10 m horizontally outside such flood area in a manner that causes or may cause the deterioration or damage to the natural agricultural resources.* *Regulation 7(3) and (4): Unless written permission is obtained, no land user may drain or cultivate any vlei, marsh or water sponge or cultivate any land within the flood area or 10 m outside this area (unless already under cultivation).*
Provincial Instrument	
Nature and Environmental Conservation Ordinance (Ordinance 19 of 1974; amended in 2000).	*This ordinance is applicable in the Western Cape, Eastern Cape, Northern Cape and parts of the North West Province. This ordinance provides measures to protect the natural flora and fauna, as well as listing nature reserves in these provinces This ordinance was amended in 2000 to become the Nature Conservation Laws Amendment Act. Lists of endangered flora and fauna can be found in this act.*

3 FOCUS AREAS DESCRIPTION

3.1 FA 1 - Overberg

- Terrestrial Environment:

There are 20 distinct vegetation types in the focus area, represented mostly by types from the Fynbos biome with small amounts of Forest and Azonal types. Only 18% of the FA is in a natural state, and among the 20 vegetation types, 8 are listed as Critically Endangered, 3 as Endangered and 3 as Vulnerable. One Critically Endangered ecosystem Central Rûens Shale Renosterveld has over 80% of its national extent within this FA. The area is covered by fine scale biodiversity assessments while critical biodiversity areas maps are also available. Several project-level assessments have been undertaken in this area providing more comprehensive and reliable data than what is available for many of the other Focus Areas.

Due to the high degree of transformation in this FA, intact vegetation occurs as fragments scattered across the FA, usually associated with steep slopes or rocky hills unsuitable for cultivation. As a result of the high levels of transformation the Overberg FA consists of highly contrasting sensitivities, with the majority of the FA (82% of the extent) being low sensitivity transformed areas (old fields and active agricultural areas) and the remaining untransformed areas of very high sensitivity. The fragmentation of this once intact habitat is thought to have resulted in a large extinction debt, with many species doomed to extinction in the future as they occur on patches that are too small to maintain viable populations, or because pollinators and other vital interactions are no longer operational. Places where there are clusters of large intact renosterveld fragments in proximity to one another are seen as being particularly important in negating these effects. These clusters represent areas where there is some possibility to maintain or encourage gene flow between the relatively isolated populations of fauna and flora on the different habitat islands. Activities which contribute to the further fragmentation or disruption of broad-scale ecological processes are seen as highly undesirable in this context.

The plant biodiversity of this Focus Area is exceptional. More than 4660 indigenous species have been recorded within this area. This includes a remarkably high proportion of red-data listed species, including 661 species of high conservation concern (CR, EN, VU) and 357 species of moderate conservation concern (Appendix 1). Many of these species are highly localised and may occur only within a single renosterveld fragment. Diversity at the site scale is also exceptional and as many as 140 species have been recorded from a single 0.1 ha plot, which ranks amongst the highest levels of local diversity recorded at this scale in the country. Combined with the very high threat status of the affected vegetation types, the consequence of these diversity patterns is that each remnant patch should be considered irreplaceable and there is no possibility of providing an offset for development within such areas.

In terms of fauna, there are few free ranging mammals of conservation concern within this Focus Area. While the areas' reptile diversity, at 55 species, is relatively high, there are few species of conservation concern that are likely to be impacted by renewable energy development, especially if the intact remnants are avoided on account of their high botanical sensitivity. At 28 species, the Overberg FA has the highest amphibian diversity of any of the FAs. While this includes a number of listed species, these are mostly water-dependent species which are never found far from water and hence would be inherently protected through the protection of wetland environments. The butterfly Dickson's Strandveld copper *Chrysoritis dicksoni* is listed as Critically Endangered and is known from north of Witsand, but almost certainly does not occur within the FA itself. As most fauna are associated with the intact vegetation remnants, there are no known specific faunal issues that would need to be considered outside of the context of the remnant patches and the maintenance of landscape connectivity for fauna (Appendix 1).

- **Aquatic Environment:**

A network of streams and rivers is spread across the FA, with three major rivers included within the boundaries. The Riviersonderend flows along the northern boundary of the FA, joining with the Breede River, which occupies the eastern portion of the FA. The Sout River is located in the middle of the FA. Most of the FA lies within the Southern Coastal Belt Level 1 Ecoregion (Kleynhans *et al.*, 2005). Two FEPA sub-catchments were identified within the Overberg – the relatively unimpacted Kars River, which is considered a fish sanctuary for the Cape kurper (*Sandelia capensis*) and the mid- to lower reaches of the Breede River further east. In addition, a short section of the Riviersonderend has been classified a fish sanctuary for both the Cape kurper and the Breede River redfin *Pseudobarbus burchelli* cf Breede. The elevated area north and east of Caledon is considered a strategic water source area.

A total of 29 wetland types is found in the Overberg, most of which lie in the East Coast Renosterveld "wetland vegetation group" (*sensu* NFEPA) (Appendix 2). The latter vegetation group includes wetlands of all types – channelled and unchannelled valley bottom wetlands, floodplain wetlands, flats, seeps and depressions. All six of the wetland types are also found within the Southwest Ferricrete Fynbos vegetation group. The most extensive wetland type across all the vegetation groups is the channelled valley bottom wetlands (35% of wetland area), followed by floodplain wetlands (34%). The majority (63%) of all the wetland types are in a moderate condition (class C). Most of the wetlands that are in good to pristine condition (class AB) are seeps, situated at the upper extent of catchments, and so less transformed by the extensive agriculture in this focus area.

Critically Endangered Central Ruens Shale Renosterveld near Napier in the Overberg FA. Large intact fragments such as this are rare and are considered highly sensitive and should not be further disrupted.

3.2 FA 2 - Komsberg

- **Terrestrial Environment:**

There are 15 distinct vegetation types in the focus area, representing the Fynbos, Nama-Karoo, and Succulent-Karoo biomes. Over 96% of the FA is in a natural state and of the 15 vegetation types none are listed as threatened. One vegetation type, Central Mountain Shale Renosterveld is restricted to the FA and another, Koedoesberge-Moordenaars Karoo has over 60% of its extent within the FA. The area is covered by medium to broad scale biodiversity assessments while critical biodiversity areas maps are also available. These are, however, at a broad scale with a focus on the maintenance of biodiversity processes rather than known biodiversity patterns, which are generally poorly known within this FA.

From a terrestrial biodiversity point of view the Komsberg focus area is dominated by medium sensitivity natural areas, high sensitivity natural areas and very high sensitivity areas, with small amounts of low sensitivity transformed areas. The number of plant species recorded for the Komsberg FA is 2656 which is second only to the Overberg FA. In addition, 270 species, or just over 10% of the species present are of conservation concern, which is a very high proportion and illustrates the potential sensitivity of the FA.. Due to the paucity of studies in this area, the number of red-data listed species reported from this Focus Area is likely to be an underestimate and undescribed species will continue to be discovered in this region. This FA presents a large variety of habitats and terrains. The altitudinal range within this Focus Area is more than 1100 m with a similarly large rainfall gradient from around 100 mm in the lowlands of the Tanqua Karoo to more than 500 mm in the mountains of the southwest and northeast. This is relevant to this study as it results in numerous strong climatic gradients across the Focus Area, overlying a wide variety of soil types and landscape forms, and resulting in a large number of different habitats and vegetation forms. At the site scale, the rugged topography of the area generates a large number of micro-habitats at a relatively fine scale including seeps, rock pavements, gravel patches, moist kloofs, cliffs and a variety of slope and aspect combinations. A consequence of this heterogeneity is that there are several different centres of significance across the FA. Recognised areas of endemism include the Great Escarpment and Komsberg area, Elandsberge, the Klein Roggeveld area and parts of the Tanqua Karoo. Although the plains of the Tanqua Karoo in the south west are more homogenous in nature, the skeletal soils have resulted in numerous areas of exposed gravels, calcrete and quartz which are home to numerous habitat specialists and Tanqua endemics such as *Tanquana, Didymaotus* and *Lithops*.

In terms of fauna, there are no listed butterflies or frogs known from the FA, at least three listed mammals and one listed reptile. Although reptile diversity within this FA is very high at 85 species, only the Karoo Padloper *Homopus boulengeri* (NT) is listed as Near Threatened and although five are not currently listed they are abundant species that are not likely to be listed when next revewed. In terms of mammals, there are three listed species which are known to occur in the area; the Black-footed cat *Felis nigripes*, the Honey Badger *Mellivora capensis* and the Riverine Rabbit *Bunolagus monticularis*. Of these the Riverine Rabbit is considered of particular concern as this species is listed as Critically Endangered and it is estimated that there are less than 500 breeding pairs remaining. Potential impact to this species requires specific attention where there is a possibility that development occurs within the habitat of this species. It is known from several sites within the Focus Area, including the Riet River and its tributaries on top of the escarpment and the Groot Rivier in the Tanqua Karoo. In general this species is considered to be associated with the silty floodplain environment of arid drainage lines usually dominated by shrubs such as various species of *Salsola* and *Atriplex vestita*. However, this species is divided into a southern and a northern population and the above association is true only for the northern population. The area near to Touws River falls within the southern population and within this area, this species is less confined to the proximity of drainage lines and may occur anywhere within renosterveld vegetation and has even been recorded from old lands on which some shrub cover has returned.

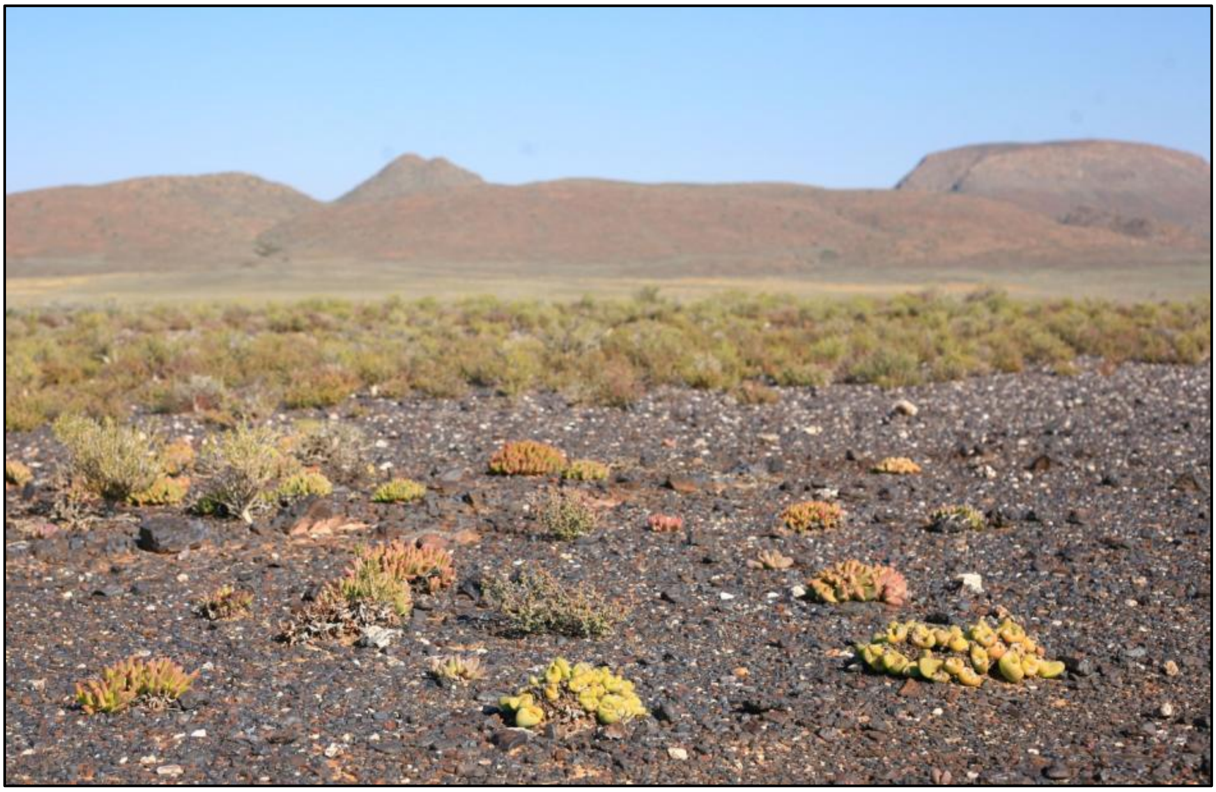
When considering the sensitivity of this Focus Area to development it is important to place the Focus Area in context of the broader landscape and in particular the position of the Focus Area which straddles the Great Escarpment. As such, this area contains important ecological gradients from the low-lying ground in the south to the high-lying areas on top of the escarpment in the north, as well as representing a corridor for dispersal along the Great Escarpment from east to west and vice versa. Development which compromises either gradient is therefore identified as problematic and the high lying parts of the escarpment and plateau are also identified as sensitive features that should be preserved as much as possible as these areas act as climate change refuges and also contain numerous species of conservation concern.

- **Aquatic Environment:**

Ten of the sub-catchments in the Komsberg FA have been classified as FEPAs, due to the relatively good condition of the river reaches, and not as fish sanctuaries. The named FEPA rivers include the Kolkies, Karee, Adamskraal and Doring Rivers in the west of the FA (all largely in the Great Karoo ecoregion), and Beerfontein se Laagte (Great Karoo ecoregion) and the Riet River in the east of the FA (Nama Karoo ecoregion). The Buffels River in the south of the FA has been classified as a Fish Support Area, considered to be important as habitat for *Labeo umbratus* (status is “Least Concern”) but not in good enough condition (this river reach is categorised as Class C: Moderately Modified by NFEPA) to be a Fish Sanctuary. All of the rivers in the FA are ephemeral, and fairly high order (i.e. upper reaches of rivers flowing mainly westwards towards the Tanqua Karoo and southwards towards Touws River).

The majority of wetlands in the Komsberg FA are located within the Karoo Shale Renosterveld (39% of wetland area) and Trans-Escarpment Succulent Karoo (37%) wetland vegetation groups. Channelled valley bottom wetlands and depressions are by far the most extensive wetland types across all vegetation groups. There are very few flats and floodplain wetlands, and the latter are all in poor condition due to intensive agriculture being practiced alongside the lowland rivers in this FA. However, 80% of total wetland area in the FA has been classified as being in good to pristine condition (class AB). Depressions and seeps are significantly under-mapped on the FEPA Wetlands map for the Komsberg FA.

The Komsberg FA consists largely of rugged topography, except for the Sutherland Plateau area and the plains of the Tanqua Karoo in the southwest. Large parts of this FA are remote and inaccessible and as a result are poorly known.



The plains in the west of the Komsberg FA consist largely of the low Tanqua Karoo vegetation type, which may contain locally sensitive features such as gravel patches with Tanqua endemics such as the *Tanquana prismatica* pictured in the foreground.

3.3 FA 3 - Cookhouse

- **Terrestrial Environment:**

There are 16 distinct vegetation types in the focus area, representing the Forest, Fynbos, Nama-Karoo, Savannah and Albany Thicket biomes. Over 86% of the FA is in a natural state, and of the 16 vegetation types none are listed as threatened. Two vegetation types, Albany Broken Veld and Bedford Dry Grassland have 80% or more of their extent within the FA. The area is covered by fine to broad scale biodiversity assessments while critical biodiversity areas maps are also available. From a terrestrial biodiversity point of view the Cookhouse focus area is dominated by medium sensitivity natural areas while still containing significant amounts of high sensitivity natural areas, very high sensitivity areas and low sensitivity transformed areas.

Plant diversity within the Cookhouse FA is fairly high with more than 2500 recorded species and around 121 of these being red-data listed. Although large parts of this focus area can be considered relatively low sensitivity, especially many of the areas mapped as Albany Broken Veld, Bedford Dry Grassland or Great Fish Thicket, there are also some areas which are considered highly sensitive. The rugged or high-lying areas in the southeast, north and northwest of the FA are considered as being particularly sensitive. In the southeast, the mountains around Riebeeck East are considered particularly sensitive. This is a mountainous area with very steep environmental gradients which contains a fine-scale mosaic of different vegetation and habitat types and Savannah, Fynbos, Thicket, Nama Karoo and Forest biome elements all abut or occuring in close proximity to one another. Mistbelt Forest patches may occur along the rivers, south-facing slopes and in sheltered kloofs, with shale and quartzite fynbos on the middle to upper mountain slopes and thicket on the lower slopes and valley bottoms. Although it has not been mapped, the higher-lying ridges are topped with grassland dominated by *Themeda triandra* which can be best decribed as Bhisho Thornveld without the woody element. Species richness and turnover in this area is exceptionally high and a variety of species of conservation concern are common in this area including several *Encephalartos* species as well as a number of protected trees. In a similar manner, the higher lying areas of Camdebo Escarpment Thicket around Somerset East such as around Bruintjieshoogte and the Bedford Dry Grassland of the mountains east of Cookhouse are also considered sensitive as they contain a variety of habitats associated with steep environmental gradients that are not represented elsewhere.

The national vegetation map for many parts of the Cookhouse FA is an oversimplification of the patterns on the ground, which can be ascribed to the coarse mapping scale of the Vegmap and the fine scale variability in vegetation associated with the steep environmental gradients of the area. The topographically diverse hills, valleys and mountains of the area have generated a lot of habitat complexity which are characterised by fine-scale vegetation mosaics that cannot easily be mapped down to broad vegetation types and hence are usually mapped as the dominant form within the matrix. This is however not an adequate level of detail for assessing development impacts and at least within the more heterogenous areas, specialist assessment should include more detailed habitat and plant community mapping.

Vertebrate diversity within the Cookhouse FA is high with at least 74 naturally occurring mammal species present and an additional 20 plus species which are conservation dependent or introduced. Listed mammals include South African Hedgehog, White-tailed Rat, Blue Duiker, Honey Badger and Black-footed Cat. As all of these species are quite widely distributed within the FA, there is a high probability that renewable energy development would impact these species to some degree. These species are however widely distributed outside of the FA and development within the lower sensitivity parts of the FA would not be likely to compromise the overall viability of these species. Listed reptiles include Karoo Padloper (NT), Coppery Grass Lizard (NT) and Albany Sandveld Lizard (NT). Of these, the Albany Sandveld Lizard *Nucras taeniolata* is the most restricted and has only been recorded from 13 QDS, four of which are within the FA. Therefore, as the majority of the range is outside the FA, it is not likely that development within the FA would compromise the overall population of this species. There are no listed butterflies known from the Cookhouse FA.

Vegetation degradation is a major influence within the Cookhouse FA and the thicket vegetation types are particularly vulnerable to overgrazing by livestock. In an intact state these vegetation types are characterised by dense thickets usually dominated by Spekboom *Portulaca afra*. With overgrazing the succulent component may be completely eliminated resulting in an anthropogenic Savannah comprised of the remaining tall woody elements such as *Pappea capensis* and *Boscia oleiodes* with an understorey of karoo shrubs and grasses, especially *Cynodon dactylon*. Due to the change in microclimate at ground level, which accompanies this transition, degraded areas do not easily return to their former state without additional human intervention. As a result of widespread degradation, degraded areas are considered relatively low sensitivity while areas in good condition are less abundant and are considered relatively sensitive. Bush encroachment, especially by *Acacia karoo,* is problematic in large parts of the Bedford Dry Grassland vegetation type.

- Aquatic Environment:

The dominant freshwater ecosystems identified in this area include a network of river systems that drain the area *via* a number of major perennial river systems. These include the Groot Vis and the Klein Vis Rivers which traverse through the Drought Corridor Ecoregion that dominates the focus area, a major tributary of the Groot Vis River, the Koonap River, which drains eastwards across the focus area, and the Boesmans and New Years Rivers, which drain southwards towards the coast. The Koonap, Boesmans and New Years Rivers and some of their tributaries, as well as the ephemeral Brak River in the west of the focus area, are considered FEPAs because of their importance either as fish habitat or their good ecological condition and thus biodiversity value. Indeed, about 55% of the sub-catchments within this focus area are considered river priority areas.

Comparatively few natural wetland ecosystems are located in this area, although it is likely that many of the natural seeps that give rise to the drainage network have not been mapped. Of the wetlands that have been mapped, most are small depressions with some channelled and unchannelled valley bottom wetlands associated with the many rivers through this region.

Part of the Cookhouse FA near to Riebeek East, illustrating the extreme habitat diversity of parts of this FA. The tops of the ridges consist of grassland, while the upper slopes are fynbos, the narrow gorges contain afromontane forest, the lower slopes are thicket and the valley bottom dwarf shrublands of the Nama Karoo. Species of conservation are also abundant within this FA as illustrated by the Cycads in the foreground.

3.4 FA 4 – Stormberg

- **Terrestrial Environment:**

There are 11 distinct vegetation types in the FA, representing the Forest, Nama-Karoo and Grassland biomes. Over 75% of the FA is in a natural state, and of the 11 vegetation types none are listed as threatened. Two vegetation types, Queenstown Thornveld and Tsomo Grassland have over 60% of their extent within the FA. Tsomo Grassland is of potential conservation concern because it has been fragmented by agricultural development and rural development which has transformed an estimated 27% of this vegetation type. However, this is likely to be an underestimate due to shifting cultivation and the abandonment of old cultivated fields. The area is covered by a broad scale biodiversity assessment while critical biodiversity areas maps are also available.

Although the number of plant species recorded from the Stormberg FA is reasonably high at 2060 species, only 50 of these are considered a conservation concern. This suggests that a large proportion of the species known from the Stormberg FA are widespread grassland species likely to be common beyond the boundaries of the site. Some parts of this FA have not been well investigated in the past and it is likely that additional species and species of conservation concern are present. However, given the low starting point, this is not likely to significantly increase the overall sensitivity of the FA. Fire is a key driver of grassland ecosystems and wind energy development poses a risk of disrupting fire related processes within affected areas.

Faunal diversity within the Stormberg FA is comparatively high, with 86 mammals, 63 reptiles, 19 frogs and 182 butterflies recorded. This includes nine mammal species of conservation concern, suggesting that impacts on mammals within this FA is likely to be an issue that warrants attention. Some of these are associated with specialised habitats such as forest patches as in the case of the Giant Golden Mole *Chrysospalax trevelyani* (VU) and Samango Monkey *Cercopithecus mitis* (VU), while others such as the Oribi *Ourebia ourebi* (EN) and White-tailed Rat *Mystromys albicaudatus* (EN) are associated with open grassland. Although the species associated with specialised habitats are more vulnerable to impact, these species also tend to enjoy some level of protection at the habitat level as forests, rivers, wetlands and other specialised habitats may be protected by legislation or are recognised as sensitive. It is likely therefore that the species associated with open grassland are more likely to be impacted by development in this FA and it is species vulnerable to disturbance such as Oribi which are identified as most vulnerable.
There is only one listed reptile known from the area, the Coppery Grass Lizard *Chamaesaura aenea*. This species is however widely distributed beyond the site and it is not likely that development within the FA would compromise the populations of this species. There are two listed butterflies known from the area. The Tsomo River Opal *Chrysoritis lyncurium* is known only from six to ten sites and is thought to be declining as a result of alien plants and overgrazing. Given the restricted distribution of this species it would be susceptible to impact. Pennington's opal *Chrysoritis penningtoni* has a similarly restricted distribution and would also be vulnerable to impact from development within the relatively small distribution area.

- Aquatic Environment:

Freshwater Ecosystems in this focus area include mostly rivers and streams which rise in the Eastern Escarpment Mountains to the north and flow mainly south and eastwards through the Drought Corridor Ecoregion which dominates this FA. While the majority of watercourses along the western margin of the area are ephemeral, flowing mainly through the drier Drought Corridor Ecoregion, those in the east of the FA within the South Eastern Uplands Ecoregion are predominantly perennial or seasonal. Almost all the sub-catchments associated with the Drought Corridor Ecoregion in the west of the FA are rated as river priorities because of their good ecological condition or as important fish sanctuaries. Also, a number of streams along the northern boundary of the area are either considered priority rivers or are upstream of river priorities. A number of sub-catchments associated with perennial streams within the South Eastern Uplands Ecoregion along the eastern margin of the area were also identified as important river systems because they are upstream of priority rivers in terms of biodiversity importance.

A number of channelled and unchannelled valley bottom wetlands of ecological importance were identified in this area, as well as some isolated depression wetlands and seeps. However, relative to the dense system of rivers and streams that drain this region, very few natural wetland ecosystems are found within this area.

Typical vista in the western section of the Stormberg focus area showing commercial rangelands with sub escarpment grassland communities (Photo CSIR).

Communal lands in the Stormberg focus area, showing subsistence cultivation and scattered homesteads typical of the region (Photo CSIR).

3.5 FA 5 – Kimberley

- **Terrestrial Environment:**

There are 11 distinct vegetation types in the FA, representing the Grassland, Nama-Karoo and Savannah biomes. Over 84% of the FA is in a natural state, and of the 11 vegetation types one, Vaal-Vet Sandy Grassland is listed as Endangered, and Bloemfontein Dry Grassland as Vulnerable. The extent of these vegetation types within the FA is however very low and less than 5% of the original extent of each is within the FA. Therefore, the direct impact of development on these vegetation types within the FA is likely to be relatively low. Nevertheless, local impacts on Vaal-Vet Sandy Grassland remain a potential concern. None of the vegetation types present have over 60% of their extent within the FA. The area is not covered by any biodiversity assessment and critical biodiversity areas maps are also not available, although an assessment of the Free State is underway.

This FA has a relatively low plant diversity and 1031 plant species have been recorded in the FA of which only 10 are considered to be of conservation concern. The low diversity can be ascribed to the aridity and relative homogeneity of the area in terms of soils, climate and topography, which limits the variety of vegetation types and plant communities present. The low number of listed species in the FA highlights the wide distribution of most plant species present in this area, which can be ascribed to the relatively homogenous nature of many of the Savannah vegetation types present, which are associated with kalahari sands which are very widely distributed. Some of the listed species such as *Acacia erioloba* and *Boophone disticha* are also widely distributed and very abundant within large parts of their range within and outside the FA. Protected tree species such as *Acacia eioloba*, *Acacia haematoxylon* and Boscia *albitrunca* are common in some areas and DAFF is likely to request offset compensation where large numbers of these species are affected.

Features of greater sensitivity which characterise this FA include the large number of pans within the eastern half of the FA and the dolerite hills, butts and outcrops which are concentrated between Kimberley and Boshof, but which may occur anywhere within the FA. These areas have significantly higher species richness of fauna and flora than the adjacent plains and as a result are considered locally sensitive features. However, as these areas consist of steep or rough terrain, it is unlikely that a large proportion of these areas would be selected for solar energy development and the actual amount of landscape potentially lost from development is likely to be negligible. The areas of dense Camel Thorn (*Acacia erioloba*) to the south and east of Kimberley are also considered sensitive as dense stands of Camel Thorn are uncommon and occur only sporadically across the range of this species and are especially uncommon as far south as Kimberley.

There are several major rivers which run through this FA including the Vaal, Harts and Modder Rivers. The vicinity of these rivers would be considered highly sensitive but intensive agricultural development along the rivers has rendered the majority of these areas of low terrestrial ecological value.

- **Aquatic Environment:**

From a freshwater ecological perspective, depressions are the dominant wetland type within this FA, which are characterised largely as ephemeral pans typical of the Dry Highveld Grassland Vegetation type. Many depressions do however occur within the Eastern Kalahari Bushveld and Upper Nama Karoo vegetation types. Similarly, wetland flats are present in these areas, also largely as ephemeral systems with less topographically defined margins compared with depressions. Valley Bottom wetlands, particularly unchannelled systems are also characteristic of this area and largely represent wide, ephemeral watercourses, many with ill-defined riparian corridors. Although seemingly unimportant from an ecological perspective, during wet seasons, these ephemeral systems support aquatic fauna for short periods of their life cycle that are wholly dependent on water and can pass extended dry periods in some state of diapause. From a biodiversity perspective, ephemeral watercourses such as those typical of the Kimberley FA play important roles as ecological corridors through harsh and often barren surrounding areas.

Despite the dominance of ephemeral freshwater ecosystems in this FA, the Vaal River is a major perennial river that traverses the FA to the north east. Although this system is modified, it is considered a system with High Ecological Importance and Sensitivity within this area. Two other perennial tributaries of the Vaal that fall within the Kimberley FA include the Harts River in the far north-western corner and the Leeu River with confluences with the Vaal River from the east. Three ephemeral tributaries of the Hart River are classified as river FEPAs because they have a high or moderate ecological importance and sensitivity. The sub-catchment of the Leeu River is regarded as a FEPA because of its good ecological condition and high ecological importance and sensitivity. The sub-catchment to the east of this Leeu River FEPA is also prioritised as a FEPA because it occurs upstream of the Leeu River. Further south, the perennial Modder River, a tributary of the Riet River, lies immediately south of the FA in the east, but passes through the FA in its far south-western corner. This system is highly modified with a low ecological importance and sensitivity rating, and is therefore not classified as a FEPA.

Kimberley Thornveld about 30 km northwest of Kimberley. The tree layer in this area is a mix of *Acacia tortillis* and *Acacia erioloba* of moderate density and would be considered moderate to high semsitivity dependent on the density of the protected *Acacia erioloba*.

The eastern half of the Kimberley FA is dominated by Western Free State Clay Grassland as seen in the foreground, with occasional rocky outcrops and hills consisting of Vaalbos Rocky Shrubland, which are considered sensitive but are not usually suitable for solar energy development in any case.

3.6 FA 6 – Vryburg

- **Terrestrial Environment:**

There are 8 distinct vegetation types in the FA, representing the Grassland and Savannah biomes. The area is covered by a medium scale biodiversity assessment while critical biodiversity areas maps are not available. Over 76% of the FA is in a natural state and of the 8 vegetation types, one Western Highveld Sandy Grassland is listed as Critically Endangered while Mafikeng Bushveld and Schweizer-Reneke Bushveld are listed as Vulnerable. One of the vegetation types present, Stella Bushveld, has over 80% of its extent within the FA. While Mafikeng and Schweizer-Reneke Bushveld are listed as Vulnerable, Stella Bushveld is not currently listed, but at least 33% of this vegetation type has been lost to transformation, which suggests that this vegetation type is vulnerable to cumulative impacts especially from habitat loss and fragmentation.

The primary source of concern in this FA is the remnant patches of Listed Ecosystems. In particular the remnant patches of Western Highveld Sandy Grassland are of highest concern as this vegetation type is classified as Critically Endangered and any further loss of this vegetation type should be avoided. Both Mafikeng Bushveld and Schweizer-Reneke Bushveld are classified as Vulnerable and should also be avoided as much as possible. The Stella Bushveld vegetation type is near-endemic to the FA and parts of this vegetation type occur on deep Kalahari sands with a high density of the protected tree *Acacia erioloba*. Although this species is widespread and is not currently threatened, development within areas of high density is not encouraged by the authorities due to the protected status of this tree and the significance of areas of high density . In addition, parts of the Stella Bushveld vegetation type have experienced a high degree of transformation and local-level impacts on habitat fragmentation may be a concern. In terms of intact vegetation, those areas of Ghaap Plateau Vaalbosveld are likely to be least sensitive and most suitable for development.

The Vryburg FA has a low plant diversity with 766 recorded species of which only 10 are listed. As such, direct impacts on plant diversity are likely to be relatively low and the primary source of potential impact in this FA would be through habitat loss and an impact on broad-scale ecological processes. None of the 50 reptile species recorded from the Vryburg FA are listed and the low overall reptile diversity can be ascribed to the general lack of specialised reptile habitats within this area such as rocky outcrops. Similarly, the diversity of butterflies (42), mammals (47) and amphibians (15) is also comparatively low. Three listed mammal species are known from the area, the South African Hedgehog *Atelerix frontalis* (NT), Brown Hyaena *Hyaena brunnea* (NT) and Pangolin *Manis temminckii* (VU). These species are likely to be associated with the intact remnants and development within transformed areas would be likely to generate little impact on such species. The only listed amphibian is the Giant Bullfrog *Pyxicephalus adspersus* (NT) which is associated with pans and is occasional within the FA.

- **Aquatic Environment:**

Numerous depressional wetlands, typically grassland pans, characterise the majority of the Vryburg FA from a freshwater perspective. The highest density of depressions occur on the Ghaap Plateau in the west of the FA and within the Southern Kalahari and Highveld Ecoregions in the north of the FA. Despite the high number of wetlands mapped within this region as part of the NFEPA project, a comparison with the SPOT imagery for the area suggests that wetlands within this area are poorly represented. Indeed, large mosaics of seeps and pans appear to characterise the central parts of the area. It is also evident that a number of unchannelled and channelled valley bottom wetlands may be under-represented along the eastern margin of the area. Besides wetlands, the FA is characterised by a system of ephemeral watercourses that flow southwards into the Harts River, a tributary of the Vaal River.

Parts of the Vryburg FA such as the Ghaap Plateau Vaalbosveld near Vryburg, (left) are not considered highly sensitive, while some areas, such as the Stella Bushveld (right) with large numbers of protected *Acacia erioloba* are less suitable for development.

3.7 FA 7 – Upington

- **Terrestrial Environment:**

There are 11 distinct vegetation types in the FA, representing the Savannah and Nama-Karoo biomes. Over 98% of the FA is in a natural state, and of the 11 vegetation types none are listed as threatened. None of the vegetation types present have over 60% of their extent within the FA, indicating that all the vegetation types present are extensive vegetation types which have a large proportion of their extent outside of the FA. The area is not covered by any biodiversity assessment and critical biodiversity areas maps are also not available.

From a terrestrial biodiversity point of view the Upington FA is dominated by medium sensitivity natural areas, with a limited extent of very high sensitivity areas and very little low sensitivity transformed areas. In terms vegetation types, the areas of Bushmanland Arid Grassland are considered relatively low sensitivity on account of the extensive nature and low levels of plant species richness and endemism characteristic of this vegetation type. Vegetation types and habitats that are considered higher sensitivity include Lower Gariep Broken Veld which occupies the rocky hills, ridges and outcrops of the FA. Although the areas classified as Lower Gariep Broken Veld within Mucina & Rutherford (2006) are relatively limited, in practice this unit has been underestimated and the rocky hills are far more extensive than suggested by the Vegmap as most smaller rocky hills and outcrops have not been mapped. In addition, there are also fairly extensive areas present which consist of low hills with quartz or gravel substrate and which frequently harbour species of conservation concern such as *Lithops spp*, *Anacampceros spp*. or *Dinteranthus spp*. Although the Gordonia Duneveld has not been mapped as sensitive, parts of this vegetation type cannot be developed without a high impact due to the presence of dunes which would need to be levelled for most types of renewable energy development. This represents a functionally irreversible impact and is considered highly undesirable. Disturbance within the dune systems also poses the danger that large amounts of sand are mobilised which is undesirable as the sand is likely to smother other vegetation and potentially propagate further mobilisation. The protected species *Acacia erioloba* and *Acacia haematoxalon* are also often abundant in the dune systems and extensive development within such areas is not encouraged by the provincial conservation authorities.

Nearly 800 plant species have been recorded from the Upington FA, which suggests that plant diversity within this area is relatively low. This includes 16 species of conservation concern including some of the characteristic species of the area such as *Acacia erioloba*, *Aloe dichotoma* and *Hoodia gordonii*. There are some areas within the FA, particularly between Kenhardt and Keimoes where large and dense populations of *Aloe dichotoma* are present and these areas should be considered high sensitivity. As some of these populations occur on the open plains, they are not easily mapped and may not have been captured by the sensitivity map presented here. The populations on the open plains are considered especially significant because dense aloe aggregations on open plains are very unusual. Protected tree species such as *Acacia eioloba*, *Acacia haematoxylon* and Boscia *albitrunca* are common in some areas and DAFF is likely to request offset compensation where large numbers of these species are affected.

Although there are some listed mammals which occur within the FA, including Pangolin, Littledale's Whistling Rat, South African Hedgehog and Honey Badger none of these are highly restricted and the FA occupies a small proportion of the distribution of these species. There are no listed reptiles or amphibians recorded from the FA and there is only one listed butterfly that has been recorded, Linda's hairtail *Anthene lindae*. This species is not well known and has been recorded from only two QDS and occurs along the eastern margin of the FA towards Olifantshoek within the Olifantshoek Plains Thornveld vegetation type but may well occur more widely.

- **Aquatic Environment:**

The aquatic environment of the Upington FA is dominated by the perennial Orange River (Nama Karoo Ecoregion), flowing east to west across the area. The river ranges from a moderately modified (PES = C) system in the east of the FA to largely modified (PES = D) at its western boundary, indicating a deterioration in ecological state due to intensive farming along the banks of the river, and surrounds. All other streams and rivers in the FA are ephemeral. All of the sub-catchments centred around the Orange River are Fish Support Areas. There are two FEPA sub-catchments in the west of the FA around unnamed rivers, one around the Olienhout River in the middle of the FA, and one containing the Matjies River in the north. A further six FEPA sub-catchments are located in the south of the FA. None of the FEPAs are important as fish sanctuaries.

Example of an ephemeral stream in the Upington Focus Area – the surrounding vegetation is dominated by *Acacia mellifera* (Photo taken by Retief Grobler).

The wetlands in the Upington FA are under-mapped, especially the ephemeral depressions, seeps and valley bottom wetlands scattered across the area. These arid drainage lines and depressions are difficult to delineate and are often missed at the desktop mapping level. Furthermore, these systems are poorly understood, and their sensitivity and importance underestimated. Some of them have been mapped inconsistently in places by the National Vegetation Map, as Bushmanland Vloere. These are pans and ancient alluvial plains, with sparse vegetation and a highly ephemeral hydrological regime.

The majority of mapped wetlands are floodplain wetlands associated with the Orange River. Most of these wetlands are moderately modified, due to agricultural activities in the floodplain. The remainder of the wetland area is located in natural landscapes, and are thus in good to pristine condition (with the exclusion of the floodplain wetlands, 84% of wetland area in the FA is in good to pristine condition).

Parts of the Upington FA consist of parallel dune systems, which are considered sensitive as they cannot be developed without levelling the dunes and they contain numerous protected species such as *Boscia albitrunca*, *Acacia erioloba* and Acacia *haematoxylon* all of which can be seen in the distance.

An area mapped as Bushmanland Arid Grassland east of the R27 south of Keimoes. Although the plains are not considered highly sensitive, populations of protected species such as the *Aloe dichotoma* in the middle ground may be present and should not be disturbed. The hills in the background consist of Lower Gariep Broken Veld which is considered a sensitive vegetation type. The photograph also illustrates the poor resolution of the national vegetation map, as this area is clearly does not consist of Bushmanland Arid Grassland which is associated with more sandy soils than those present here.

3.8 FA 8 – Springbok

- **Terrestrial Environment:**

There are 29 distinct vegetation types in the FA, representing the Succulent-Karoo, Nama-Karoo, Desert and Fynbos biomes. The high number of vegetation types present within the FA relates to the high edaphic diversity of the Namaqualand region of the FA and the gradient from winter to summer rainfall across the FA. Over 99% of the FA is in a natural state, and of the 29 vegetation types, none are listed as threatened. Two of the vegetation types present, Namaqualand Shale Shrubland and Namaqualand Salt Pans have over 80% of their extent within the FA, and three Bushmanland Inselberg Shrubland, Riethuis-Wallekraal Quartz Vygieveld and Southern Richtersveld Inselberg Shrubland have over 60% of their extent within the FA. The area is covered by a medium scale biodiversity assessment with Critical Biodiversity Areas. However, it is important to note that the detail within the Biodiversity Sector Plan of Desmet & Marsh (2009) is not homogenous and some areas are dealt with in detail due to fine-scale conservation planning within limited parts of the FA, while some areas are covered only at a very broad scale, depending on the detail of the existing information that was available at the time the assessment was conducted. From a terrestrial biodiversity point of view the Springbok FA is dominated by medium sensitivity natural areas, with significant amounts of very high sensitivity areas and high sensitivity natural areas, and little low sensitivity transformed areas.

This is a very heterogeneous FA and as a result it is difficult to generalise patterns across the FA. Vegetation types which are considered high sensitivity and generally unsuitable for development include Namaqualand Sand Fynbos, Aggeneys Gravel Vygieveld and Bushmanland Inselberg Shrubland which are characterised by the presence of a high proportion of listed and endemic species. Apart from these areas, there are a number of other areas which are considered to have exceptional or unique plant biodiversity, which are captured through the SKEP expert maps for the area. Plant diversity within the Springbok FA is exceptionally high considering the low rainfall that the majority of the FA receives. A total of 1760 plant species have been recorded from the FA of which nearly 200 are red-data listed and an even larger proportion are likely to be endemic to the FA. In this regard it is also important to place the Springbok FA in context of the Succulent Karoo Biome which is a globally recognised biodiversity hotspot and is one of the few arid biodiversity hotspots. The spring flower displays are world-renowned and attract large amounts of tourists to the area each spring. Although the eastern part of the FA falls within the summer rainfall region, some of the vegetation types which occur in this area such as Bushmanland Inselberg Shrubland and Aggeneys Gravel Vygieveld are considered to be part of the Succulent Karoo Biome and contain a large number of succulent species as well as species of conservation concern. There are also a lot of other specific areas of known significance for plant diversity and endemism within the FA. These are largely captured by the SKEP expert maps for the FA, which is included as part of the sensitivity map for the FA. It is also important to note that geophytes and annuals form a large proportion of the flora of the winter-rainfall parts of the FA and specialist surveys conducted within the FA need to take cognisance of the season presence of many species.

In terms of fauna, the diversity of reptiles within this FA is very high at 85 species, but this includes only 2 listed species the Large-scaled Girdled Lizard (NT) and Lomi's Blind Legless Skink (NT). Both these species are restricted to sandy soils along the coastline within areas that have been affected by diamond mining and further fragmentation of these habitats is clearly undesirable. Amphibian diversity is very low at only 9 species, but this includes two listed species, the Desert Rain Frog and Namaqua Stream Frog. Terrestrial mammal diversity at 42 species is comparatively low but this includes 6 listed species which is remarkably high given the low overall total and reflects the presence of several rare locally-endemic species. Listed species include Namaqua Dune Mole-rat, De Winton's Golden Mole, Grant's Golden Mole, Brown Hyaena, Honey Badger and Dassie Rat. Species of particular concern within the FA include De Winton's Golden Mole *Cryptochloris wintoni* (CR), Grant's Golden Mole *Eremitalpa granti* (VU) and Desert Rain Frog *Breviceps macrops*, all of which are restricted to sandy soils associated with the coastal strip, which has been significantly impacted by open cast diamond mining. There are two listed butterflies known from the FA, Trimen's opal and Lyndsey's Opal both of which are listed as Vulnerable.

At a broad level, the sensitivity of the FA is generally higher within the winter rainfall parts of the site towards the west and lower in the arid summer rainfall eastern section. The quartz plains and inselbergs towards the north east of the FA around Aggeneys are however also pointed out as being highly sensitive and represent outliers of succulent vegetation within the summer rainfall region.

- Aquatic Environment:

All of the rivers in the Springbok FA are ephemeral, and showing only small to moderate modification (PES = B or C). The Buffels River is the largest system, flowing east to west and meeting the Atlantic Ocean at Kleinsee. There are seven FEPA sub-catchments in the FA – the Kwaganap River and an unnamed tributary of the Buffels River in the north-east of the FA, and the Komaggas, Wildeperdehoek se Brak, Buffels and Stry Rivers in the centre. These have been designated FEPAs on the basis of the good condition of the river reaches, and not due to the location of fish sanctuaries within them.
The wetlands are poorly mapped in the Springbok FA. There is a diversity of wetland types (20 in total), with 67% of wetland area being considered in a good to pristine condition. The greatest wetland area is occupied by flats, classified in the National Vegetation Map as Namaqualand Salt Pans. Two particular extensive examples are located south of the Buffels River. Some flats and depressions near the coast have been heavily impacted by mining activities, but similar wetland types located in the remainder of the FA are in good condition. Channelled valley bottom wetlands along the Buffels River are also in good condition, classified on the National Vegetation Map as Namaqualand Riviere.

The coastal plain within the Springbok FA has been heavily impacted by mining activities as illustrated here near Kleinsee. Ideally, development should occur within the disturbed areas and further disruption of the landscape along the coastline should be limited.

Aggeneys Gravel Vygieveld and Bushmanland Inselberg Shrubland, pictured here near Aggeneys are sensitive vegetation types within the eastern part of the Springbok FA that should be avoided as much as possible.

4 ABSOLUTE SENSITIVITY MAPPING

4.1 Identification of Absolute Sensitivity Criteria.

4.1.1 Scoring System and Integration of Terrestrial and Aquatic Sensitivities

The data layers relevant to each FA were identified and combined in a simple GIS based multi criterion prioritisation system. The various input layers were standardised by scoring them on a scale of 0 to 10, with 10 representing the highest sensitivity value and 0 the lowest sensitivity value. Different combinations of layers were selected for each FA and then summed to produce an absolute sensitivity score (4.1.2). The resulting absolute sensitivity maps were then assessed on a focus area by focus area basis, and where necessary, the scores of particular features were adjusted and / or the formula combining feature scores was revised (4.1.3).

4.1.2 Input layers used in the analysis (refer to section 2.2 for full references)

Layer	Description and Preparation	Focus Areas
Aquatic Buffers	The NFEPA wetland layer and river layer formed the basis of the aquatic ecosystem sensitivity layer. The 1:500 000 NFEPA river layer (polyline format) was supplemented with the 1:50 000 scale River Area layer (polygon format) from CD-NGI prior to buffering process. The wetland layer required editing of both features and TYPE attribute (described in Appendix 3). Buffers were determined for wetland and river features based on combination of Type, Ecosystem Status, and Importance (see Appendix 3 for details).	All FAs
Land Cover (SANBI 2013)	The SANBI land cover 2013 was found to over-estimate transformation in arid sections of FA2 and FA5 (probably due to a remote sensing error which classifies natural bare ground as transformed), this was corrected manually. In the western portion of FA3 the land cover from the Addo Mainstreaming Project (Skowno & Holness 2012) was used as it was judged to be more accurate than the SANBI layer. The land cover classes were reclassified into Natural and Transformed categories, Degraded classes were considered Natural for this study as the degradation status is not verified or widely accepted.	All FAs
Protected Areas (DEA 2013 & SANBI 2011)	The DEA protected area database[1] was compared to the SANBI protected area database (NBA 2011) and discrepancies were resolved. Protected areas were added to the DEA layer based on the SANBI layer in FA8 and FA6. In other FAs the DEA layer proved comprehensive.	All FAs
SA Vegetation Map Biomes (Mucina and Rutherford 2006)	All vegetation types falling into the forest and azonal biomes were selected as being particularly sensitive.	All FAs
Forest Patches (Berliner 2005)	In the FA1, FA3 and FA4 all forest patches in the National Forests Coverage (Berliner 2005) were included	FA1, FA3 and FA4
Terrestrial Threatened Ecosystems (DEA 2011)	In this study area all the nationally listed threatened ecosystems are aligned with SA vegetation types. This allowed us to add an attribute [THREAT] denoting the threat status of each vegetation to the SA vegetation layer.	FA1, FA5, FA6 and FA7
Vegetation Endemism (Mucina and Rutherford	The vegetation types that intersected the FAs were selected and unioned with the modified land cover layer. This allowed for the calculation of percentage transformation of each vegetation type throughout its national extent and within the FAs. The proportion of the vegetation type falling within a FA was also	FA1, FA2, FA3, FA6 & FA7

[1] Department of Environment Affairs - Protected Area Database 2013 - Pers Com

Layer	Description and Preparation	Focus Areas
2006)	calculated as a percentage and termed "regional endemism". This was categorised as follows, and added to the vegetation layer as an attribute [VEGEND]; >95% endemic to the focus area = Endemic, >80% of habitat type falls within the focus area = Near Endemic. These steps allowed for the identification of vegetation types that need additional protection within the focus areas (Appendix 4).	
Additional Vegetation Sensitivity (Mucina and Rutherford 2006)	Vegetation types judged to be particularly sensitive to disturbance were categorised as Very High or High Sensitivity [ADDVEG]. The SA vegetation map was used as basis for this with the exception of Namakwa Sand Fynbos for which an updated fine-scale vegetation map was used (Philip Desmet & Nick Helme, pers comm). In the FA7 some additional patches of Lower Gariep Broken Veld were mapped by Simon Todd. FA2:Central Mountain Shale Renosterveld, Roggeveld Shale Rensoterveld, Matjiesfontein Shale Renosterveld, Matjiesfontein Quartzite Fynbos. FA7: Lower Gariep Broken Veld, Lower Gariep Alluvial Vegetation FA8: Aggeneys Gravel Vygieveld, Arid Estuarine Salt Marshes, Bushmanland Inselberg Shrubland, Namaqualand Sand Fynbos, Namaqualand Seashore Vegetation, Anenous Plateau Shrubland, Kosiesberg Succulent Shrubland, Namaqualand Coastal Duneveld, Namaqualand Klipkoppe Shrubland, Namaqualand Riviere, Namaqualand Salt Pans, Oograbies Plains Sandy Grassland, Richtersveld Coastal Duneveld, Richtersveld Sandy Coastal Scorpionstailveld, Riethuis-Wallekraal Quartz Vygieveld, Southern Richtersveld Inselberg Shrubland, Southern Richtersveld Scorpionstailveld.	FA2, FA7 and FA8
Critical Biodiversity Area (Kirkwood *et al.*, 2011, Skowno & Holness 2012, Berliner & Desmet 2007, Desmet *et al.*, 2008).	FA 1,2,3,4,6 and 8 are covered by CBA maps based on systematic biodiversity assessments. These CBA maps use a range of classes, the more recent being Ecological Support Areas (ESA) and Critical Biodiversity Areas (CBA). For FA1, FA2, FA8 and the western part of FA3 the CBA map available required no modification. For FA4 and the eastern portion of FA3 the Eastern Cape Biodiversity Conservation Plan CBA map required reclassification as follows: CBA1 = CBA, CBA2=ESA, CBA3 not utilised. For FA6 the Northwest Biodiversity Assessment aquatic CBA class, which represented priority quaternary catchments, were not utilised as they covered 90% of the FA.	FA1, FA2, FA3, FA4, FA6 and FA8
SKEP Expert Derived Priority Areas (SKEP 2012)	In FA8 and FA 2 the updated SKEP expert areas (high priority, botanically sensitive areas), supplemented by expert mapping by Nick Helme were included. These areas were used to supplement the boundaries of the CBA features.	FA8 and FA2
Priority areas from EPAES (Skowno *et al.*, 2012)	In the Stormberg FA, the Eastern Cape Protected Areas Expansion Strategy value grid was used to supplement the CBA layer [CBA], this includes climate change resilience and species level information that were not found in the 2008 CBA map.	FA4
Thicket in pristine state (Cowling *et al.*, 2003)	In the Cookhouse FA, the pristine thicket, as mapped for the STEP project, was categorised as High sensitivity [Thicket]	FA3
Renosterveld clusters (von Hase *et al.*, 2004)	Priority Renosterveld clusters from the Cape Lowlands Conservation Plan were used to identify natural vegetation with additional sensitivity. Transformed areas within these clusters were also identified as having slightly elevated sensitivity due to proximity to high priority natural vegetation.	FA1
Riverine Rabbit Habitat (C.Bragg pers com)	The Groot river in FA 2 was buffered by 1000m as it is a known Riverine Rabbit area.	FA2
NPAES priority areas	Priority expansion areas outside of protected areas represent corridors of connectivity to supplement the CBA and ESA network in this region	FA2

Layer	Description and Preparation	Focus Areas
(DEAT 2008)		
Extra Features Derived from DEM (ASTER DEM)	A DEM (ASTER 30m DEM) was used to identify Very high elevation areas (>1600m), High elevation areas (100-1600), areas with steep slopes (>10°) and the Sutherland plateau.	FA2
Extra Mapped Features	Mesic hill tops and associated altitudinal gradient with high vegetation type turnover were categorised as Very High or High Sensitivity	FA3
Extra Mapped Features	Dolerite hills and one known large camel thorn thicket in the western portion of FA5 were mapped off aerial photographs and categorised as high sensitivity.	FA5

4.1.3 Scoring System Applied to Input Data Layers

Site	Description of feature/criteria	Attribute	Scoring
OVERBERG 1	Land Cover 2013	LC4 (sc_LC4)	Transformed areas: **0** Natural areas: **1**
	Aquatic features and associated buffers	AQBUFF (sc_AQBUFF)	All wetland and river features and the buffers applied: **10** (see Appendix 3 for buffering methodology)
	Protected Areas	PA (sc_PA)	All formal protected area categories: **10**
	Forest Patches	FOREST (sc_FOREST)	All DAFF forest patches: **10**
	Terrestrial Listed Threatened Ecosystems	THREAT (sc_THREAT)	Critically endangered: **10** Endangered vegetation types : **8** Vulnerable vegetation types : **6** **Modifier: If sc_LC4 =0 then score: 0**
	Western Cape Biodiversity Framework	CBA (sc_CBA)	CBA areas : **7** ESA areas : **2** **Modifier: If sc_LC4 =0 then score: 0**
	Biomes	BIOME (sc_ADDVEG)	Biome = Forest: **8** Biome = Azonal: **6** **Modifier: If sc_LC4 =0 then score: 0**
	Regional Endemism	VEGEND (sc_ADDVEG)	One regionally near-endemic vegetation type (Central Ruens Shale Renosterveld): **4** **Modifier: If sc_LC4 =0 then score: 0**
	Cape Lowlands Priority Renosterveld Clusters	EXTRA (sc_EXTRA)	Priority lowland Renosterveld cluster map was used to identify medium sensitivity natural areas around priority patches of natural: **2** **Modifier: If sc_LC4 =0 then score: 1**
	Total Score = sc_PA+ sc_AQBUFF+ sc_THREAT+ sc_LC4+sc_CBA+ sc_EXTRA+ sc_FOREST		
KOMSBERG 2[2]	Land Cover 2013	LC4 (sc_LC4)	Transformed areas: **0** Natural areas: **1**

[2] For FA2 more restrictive modifiers were used to prevent double scoring across the CBA, EXTRA and ADDVEG attributes. This was necessary due to high degree of overlap between these features.

Site	Description of feature/criteria	Attribute	Scoring
	Aquatic features and associated buffers	AQBUFF (sc_AQBUFF)	All wetland and river features and the buffers applied: **10** (see Appendix 3 for buffering methodology)
	Protected Areas	PA (sc_PA)	All formal protected area categories**: 10**
	SKEP Expert Derived Priority Areas	SKEP (sc_EXTRA)	Priority areas were scored: **7** **Modifier: If sc_ =0 then score: 0**
	Riverine Rabbit Habitat	EXTRA (sc_EXTRA)	Riverine Rabbit habitat along the Groot river: **10** **Modifier: If sc_ =0 then score: 0**
	Extra Features Derived from DEM	EXTRA (sc_EXTRA)	Very high elevation areas (>1600m)**: 10** **Modifier: If sc_ =0 then score: 0** High elevation areas (100-1600m): **7** Steep slopes (>10°): **7** **Modifier: If sc_ =0 OR sc_EXTRA>7 then score: 0** Sutherland plateau: **5** **Modifier: If sc_ =0 OR sc_EXTRA>5 then score: 0**
	NPAES priority areas	EXTRA (sc_EXTRA)	NPAES focus areas: **5** **Modifier: If sc_ =0 OR sc_EXTRA>5 then score: 0**
	Additional Sensitive Vegetation	ADDVEG (sc_ADDVEG)	Central Mountain Shale Renosterveld, Roggeveld Shale Rensoterveld, Matjiesfontein Shale Renosterveld, Matjiesfontein Quartzite Fynbos were scored as: **6** **Modifier: If sc_ =0 OR sc_EXTRA >6 then score: 0**
	Regional Endemism	VEGEND (sc_ADDVEG)	One regionally endemic vegetation type (Central Mountain Shale Renosterveld): **6** **Modifier: If sc_LC4 =0 OR sc_EXTRA > 6 then score: 0**
	Western Cape Biodiversity Framework	CBA (sc_CBA)	CBA areas **: 7** **Modifier: If sc_ =0 OR sc_EXTRA >5 then score: 0** ESA areas **: 2** **Modifier: If sc_ =0 OR sc_EXTRA >2 then score: 0**
	Namakwa Biodiversity Sector Plan	CBA (sc_CBA)	CBA areas **: 7** **Modifier: If sc_ =0 OR sc_EXTRA >5 then score: 0** ESA areas **: 2** **Modifier: If sc_ =0 OR sc_EXTRA >2 then score: 0**
	Total score = sc_LC4+ sc_PA+ sc_AQBUFF+ +ADDVEG+sc_EXPERT+ sc_CBA		
COOKHOUSE 3	Land Cover 2013	LC4 (sc_LC4)	Transformed areas**: 0** Natural areas: **1**
	Aquatic features and associated buffers	AQBUFF (sc_AQBUFF)	All wetland and river features and the buffers applied: **10** (see Appendix 3 for buffering methodology)
	Protected Areas	PA (sc_PA)	All formal protected area categories**: 10**
	Forest Patches	FOREST (sc_FOREST)	All DAFF forest patches: **10**
	Eastern Cape Biodiversity Conservation Plan	CBA (sc_CBA)	CBA areas **: 7** ESA areas **: 2** **Modifier: If sc_LC4 =0 then score: 0**

Site	Description of feature/criteria	Attribute	Scoring
	Addo Mainstreaming Project - CBA map	CBA (sc_CBA)	CBA areas : **7** ESA areas : **2** **Modifier: If sc_LC4 =0 then score: 0**
	Biomes	BIOME (sc_ADDVEG)	Biome = Forest: **8** Biome = Azonal: **6** **Modifier: If sc_LC4 =0 then score: 0**
	Regional Endemism	VEGEND (sc_ADDVEG)	Two regionally near-endemic vegetation types (Albany Broken Veld & Bedford Dry Grassland): **4** **Modifier: If sc_LC4 =0 OR sc_ADDVEG>4 then score: 0**
	Expert Features	EXPERT (sc_EXPERT)	Sensitive vegetation was mapped by Simon Todd for this project - Mesic areas with very high habitat diversity and species richness: **7** Mesic areas with high habitat diversity and species richness: **5** **Modifier: If sc_LC4 =0 then score: 0**
	Pristine Thicket	THICKET (sc_THICKET)	Patches of pristine Albany thicket were extracted from STEP database: **6** **Modifier: If sc_LC4 =0 then score: 0**
	Total Score = sc_LC4+ sc_PA+ sc_AQBUFF+ sc_ADDVEG+ sc_CBA+ sc_EXTRA+ sc_FOREST+ sc_THICKET		
STORMBERG 4	Land Cover 2013	LC4 (sc_LC4)	Transformed areas**: 0** Natural areas: **1**
	Aquatic features and associated buffers	AQBUFF (sc_AQBUFF)	All wetland and river features and the buffers applied: **10** (see Appendix 3 for buffering methodology)
	Protected Areas	PA (sc_PA)	All formal protected area categories**: 10**
	Forest Patches	FOREST (sc_FOREST)	All DAFF forest patches: **10**
	Biomes	BIOME (sc_ADDVEG)	Biome = Forest: **8** Biome = Azonal: **6** **Modifier: If sc_LC4 =0 then score: 0**
	Eastern Cape Protected Area Expansion Strategy	EPAES (sc_CBA)	EPAES value raster used to supplement CBA layer as they are the outcomes of an optimized biodiversity assessment similar to the ECBCP. Values > 40 = Very high: **7** values >25 but <40 = High: **4** **Modifier: If sc_LC4 =0 OR sc_CBA>4 then score: 0**
	Total Score = sc_LC4+ sc_PA+ sc_AQBUFF+ sc_ADDVEG+ sc_+ sc_CBA+ sc_FOREST		
KIMBERLEY 5	Land Cover 2013	LC4 (sc_LC4)	Transformed areas**: 0** Natural areas: **1**
	Aquatic features and associated buffers	AQBUFF (sc_AQBUFF)	All wetland and river features and the buffers applied: **10** (see Appendix 3 for buffering methodology)
	Protected Areas	PA (sc_PA)	All formal protected area categories**: 10**

Site	Description of feature/criteria	Attribute	Scoring
	Terrestrial Listed Threatened Ecosystems	THREAT (sc_THREAT)	Endangered vegetation types : **8** Vulnerable vegetation types : **6** **Modifier: If sc_LC4 =0 then score: 0**
	Biomes	BIOME (sc_ADDVEG)	Biome = Azonal: **6** **Modifier: If sc_LC4 =0 then score: 0**
	Expert Features	EXPERT (sc_EXPERT)	Sensitive areas were mapped off aerial photographs by Simon Todd for this project. Dolerite hills & koppies & large camel thorn forest: **6** **Modifier: If sc_LC4 =0 then score: 0**
	Total Score = sc_LC4+sc_PA+ sc_AQBUFF+ sc_ADDVEG+ sc_THREAT+ sc_EXTRA		
VRYBURG 6	Land Cover 2013	LC4 (sc_LC4)	Transformed areas: **0** Natural areas: **1**
	Aquatic features and associated buffers	AQBUFF (sc_AQBUFF)	All wetland and river features and the buffers applied: **10** (see Appendix 3 for buffering methodology)
	Protected Areas	PA (sc_PA)	All formal protected area categories: **10**
	Terrestrial Listed Threatened Ecosystems	THREAT (sc_THREAT)	Critically Endangered vegetation types: **10** Endangered vegetation types : **8** Vulnerable vegetation types : **6** **Modifier: If sc_LC4 =0 then score: 0**
	Biomes	BIOME (sc_ADDVEG)	Biome = Azonal: **6** **Modifier: If sc_LC4 =0 then score: 0**
	Regional Endemism	VEGEND (sc_ADDVEG)	One regionally near-endemic vegetation type (Stella Bushveld): **4** **Modifier: If sc_LC4 =0 OR sc_ADDVEG>4 then score: 0**
	North West Biodiversity Assessment	CBA (sc_CBA)	CBA areas : **7** ESA areas : **2** **Modifier: If sc_LC4 =0 then score: 0**
	Total Score = sc_PA+ sc_AQBUFF+ sc_ADDVEG+ sc_+ sc_EXTRA		
UPINGTON 7	Land Cover 2013	LC4 (sc_LC4)	Transformed areas: **0** Natural areas: **1**
	Aquatic features and associated buffers	AQBUFF (sc_AQBUFF)	All wetland and river features and the buffers applied: **10** (see Appendix 3 for buffering methodology)
	Protected Areas	PA (sc_PA)	All formal protected area categories: **10**
	Terrestrial Listed Threatened Ecosystems	THREAT (sc_THREAT)	Endangered vegetation types : **8** **Modifier: If sc_LC4 =0 then score: 0**
	Biomes	BIOME (sc_ADDVEG)	Biome = Azonal: **6** **Modifier: If sc_LC4 =0 then score: 0**

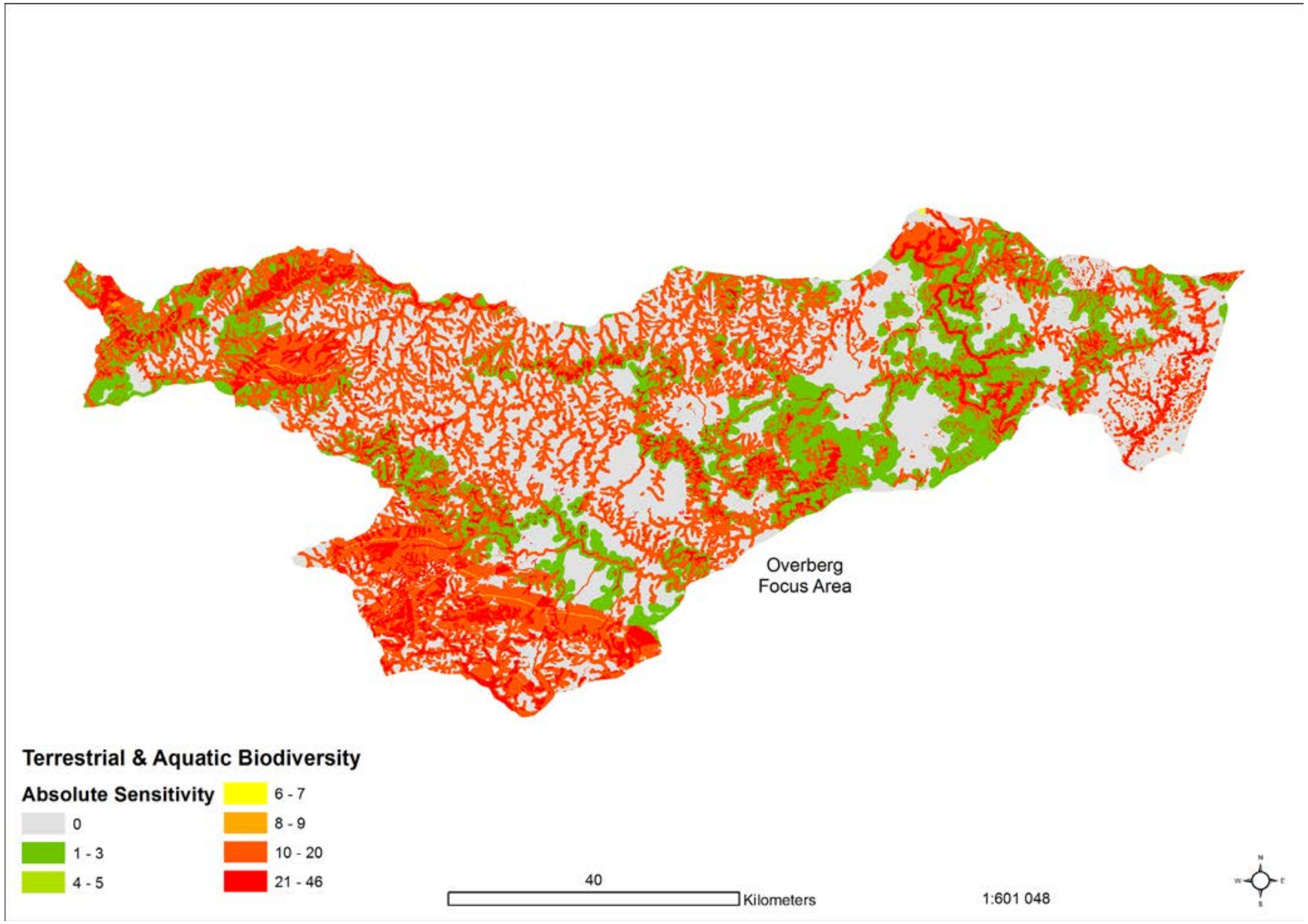
Site	Description of feature/criteria	Attribute	Scoring
	Expert Features	EXPERT (sc_EXTRA)	Additional portions of Lower Gariep Broken Veld mapped for this project off aerial photographs by Simon Todd: **6** **Modifier: If sc_LC4 =0 then score: 0**
	Additional Sensitive Vegetation	ADDVEG (sc_ADDVEG)	Based on very high sensitivity to disturbance, Lower Gariep Broken Veld and Lower Gariep Alluvial Vegetation: **7** **Modifier: If sc_LC4 =0 then score: 0**
	Total Score = sc_LC4+ sc_PA+ sc_AQBUFF+ + sc_THREAT+ sc_ADDVEG+ sc_EXPERT		
SPRINGBOK 8	Land Cover 2013	LC4 (sc_LC4)	Transformed areas**: 0** Natural areas: **1**
	Aquatic features and associated buffers	AQBUFF (sc_AQBUFF)	All wetland and river features and the buffers applied: **10** (see Appendix 3 for buffering methodology)
	Protected Areas	PA (sc_PA)	All formal protected area categories**: 10**
	Biomes	BIOME (sc_ADDVEG)	Biome = Azonal: **6** **Modifier: If sc_LC4 =0 then score: 0**
	Additional Sensitive vegetation	ADDVEG (sc_ADDVEG)	Aggeneys Gravel Vygieveld, Arid Estuarine Salt Marshes, Bushmanland Inselberg Shrubland, Namaqualand Sand Fynbos[3], Namaqualand Seashore Vegetation: **6** Anenous Plateau Shrubland, Kosiesberg Succulent Shrubland, Namaqualand Coastal Duneveld, Namaqualand Klipkoppe Shrubland, Namaqualand Riviere, Namaqualand Salt Pans, Oograbies Plains Sandy Grassland, Richtersveld Coastal Duneveld, Richtersveld Sandy Coastal Scorpionstailveld, Riethuis-Wallekraal Quartz Vygieveld, Southern Richtersveld Inselberg Shrubland, Southern Richtersveld Scorpionstailveld: **4** **Modifier: If sc_LC4 =0 OR sc_ADDVEG>4 then score: 0**
	Regional Endemism	VEGEND (sc_ADDVEG)	One regionally near-endemic vegetation type (Namaqualand Salt Pans & Namaqualand Shale Shrubland): **4** **Modifier: If sc_LC4 =0 OR sc_ADDVEG>4 then score: 0**
	Namakwa Biodiversity Sector Plan	CBA (sc_CBA)	CBA areas : **7** ESA areas : **2** **Modifier: If sc_LC4 =0 then score: 0**
	SKEP expert priority areas	SKEP (sc_CBA)	SKEP priority areas were used to refine and supplement the CBA layers as there was high degree of overlap between the layers, they were scored: 7[4] **Modifier: If sc_LC4 =0 then score: 0**
	Total Score = sc_LC4+ sc_PA+ sc_AQBUFF + sc_ADDVEG+ sc_CBA		

[3] Note an unpublished fine scale maps of Namakwa Sand Fynbos was used in conjunction with the SA veg map to identify this habitat (Source: Nick Helme and Philip Desmet - Expert Mapping for various mining companies).
[4] Note the SKEP expert areas showed very high overlap with CBA areas in FA8, to avoid double counting the SKEP areas were used to refine and expand CBA areas.

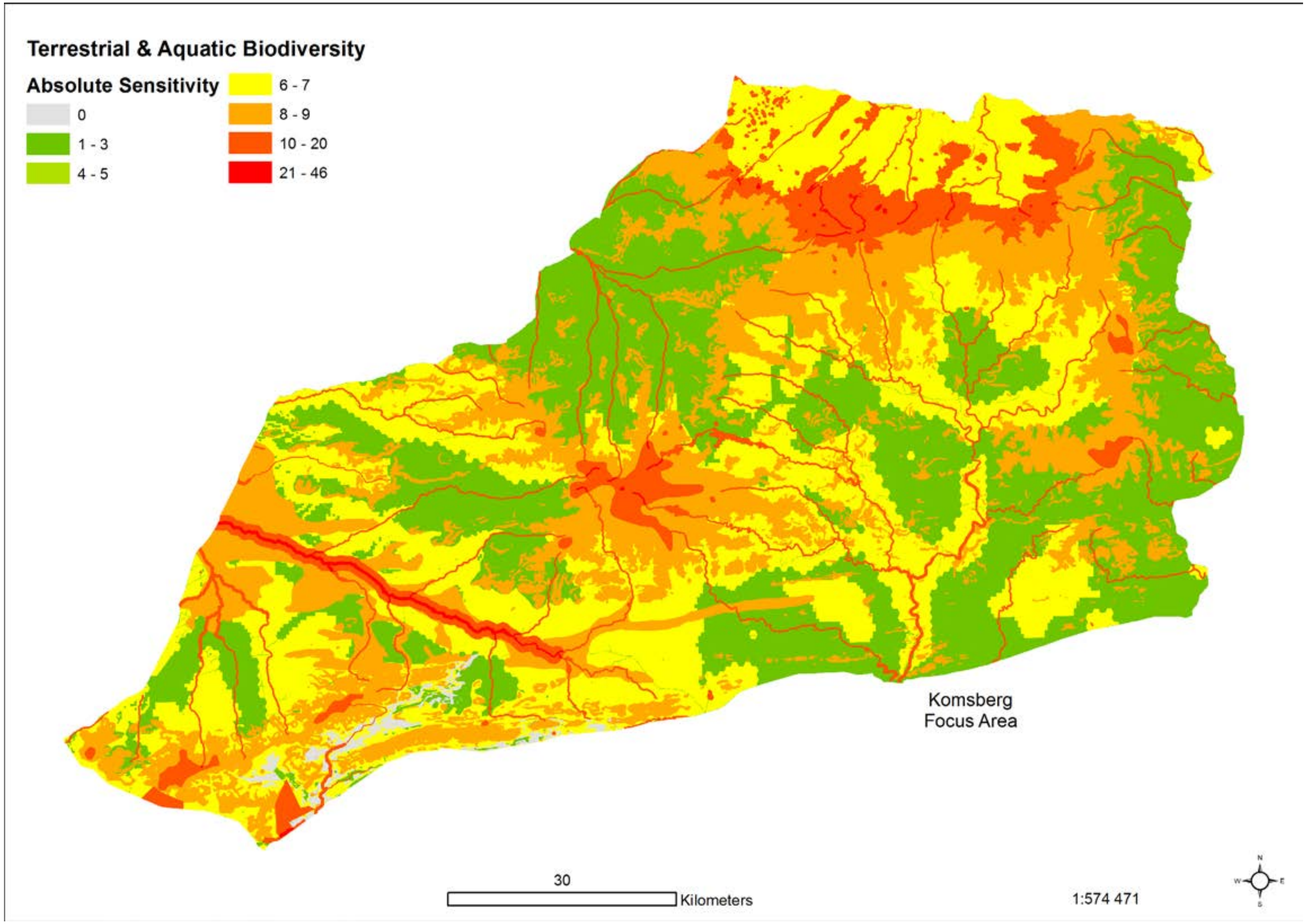
4.2 Absolute Sensitivity Maps

Basic maps showing absolute sensitivity of terrestrial and aquatic biodiversity features based on rapid desktop analysis.

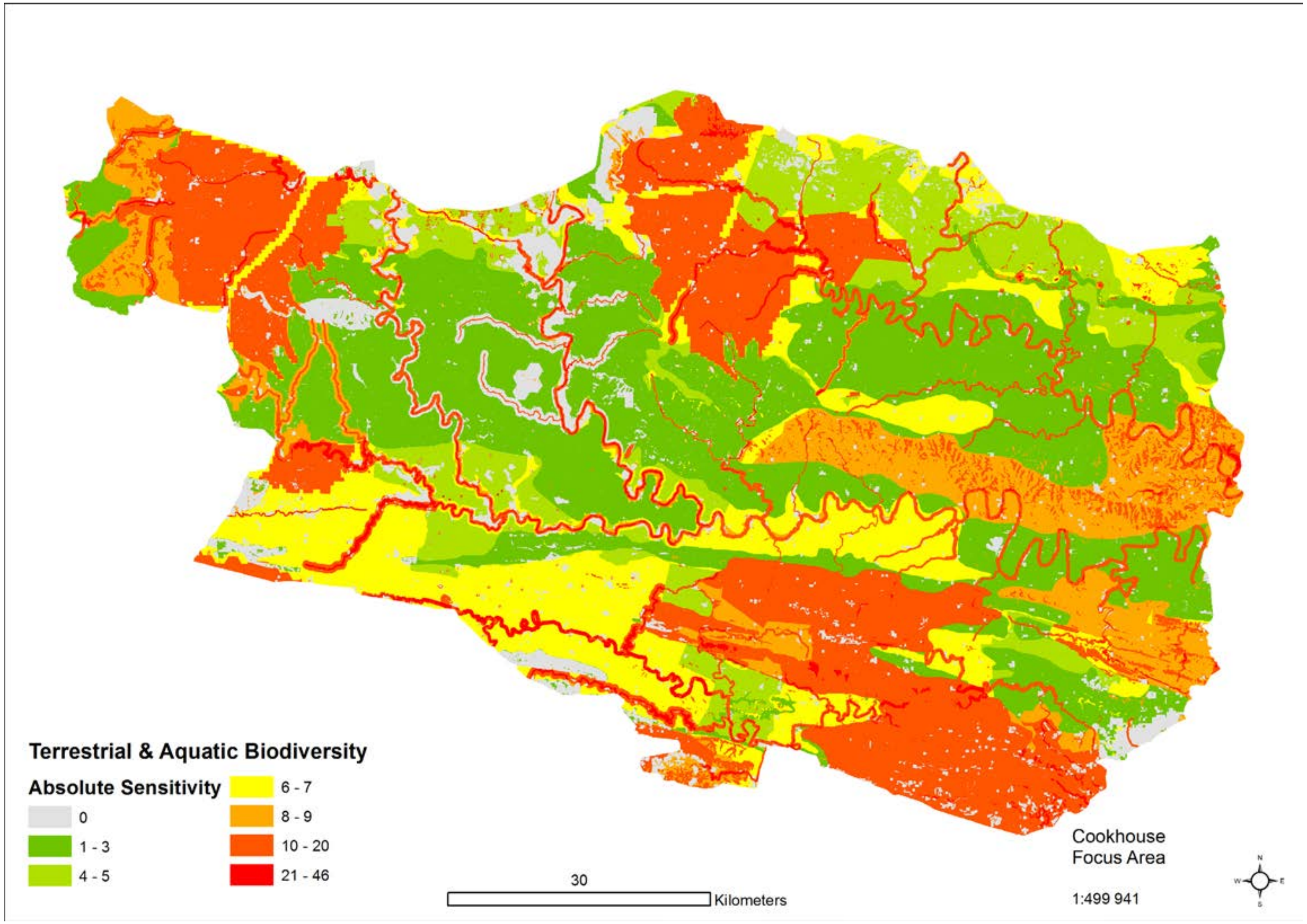
4.2.1 FA 1- Overberg



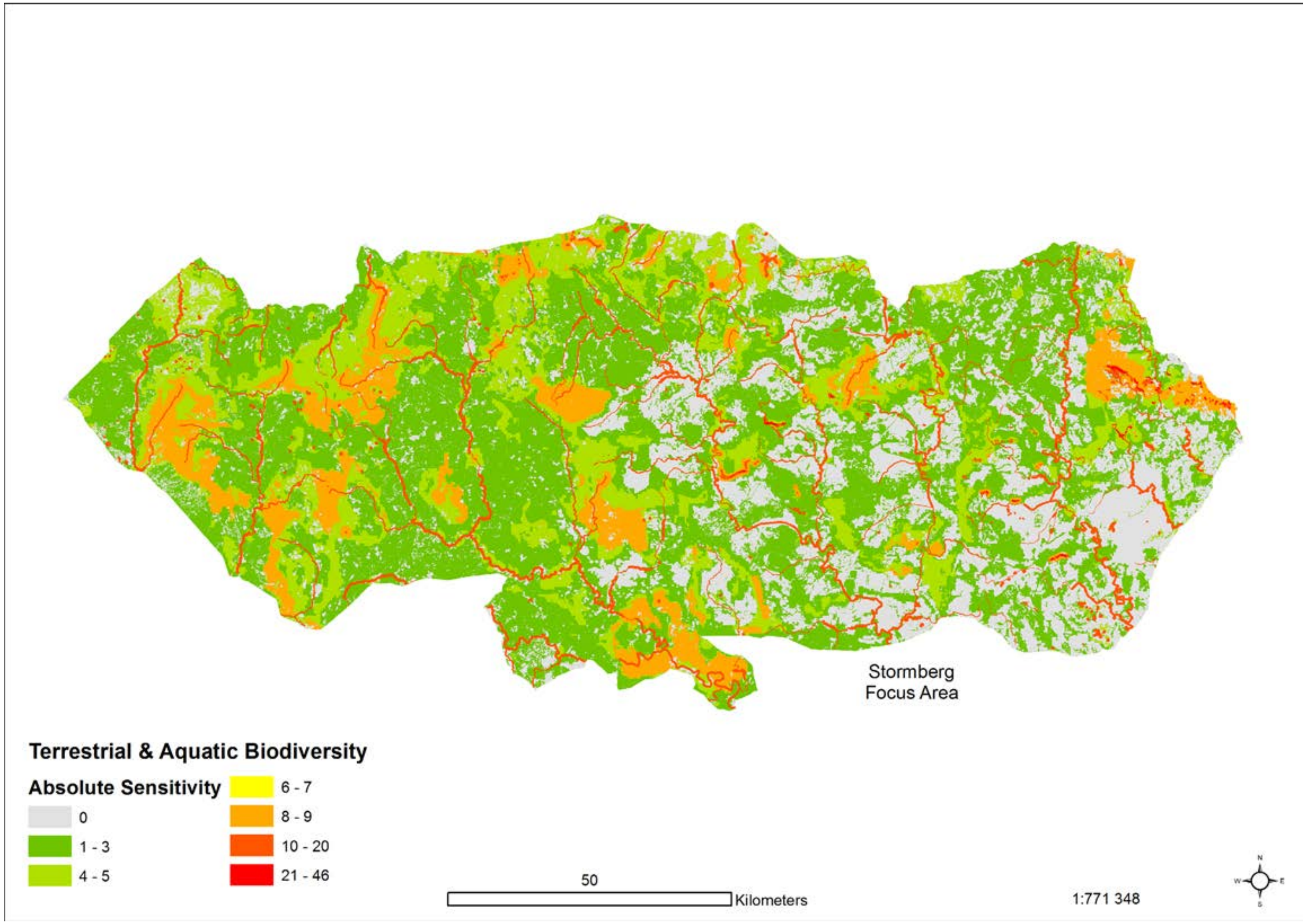
4.2.2 FA 2 - Komsberg



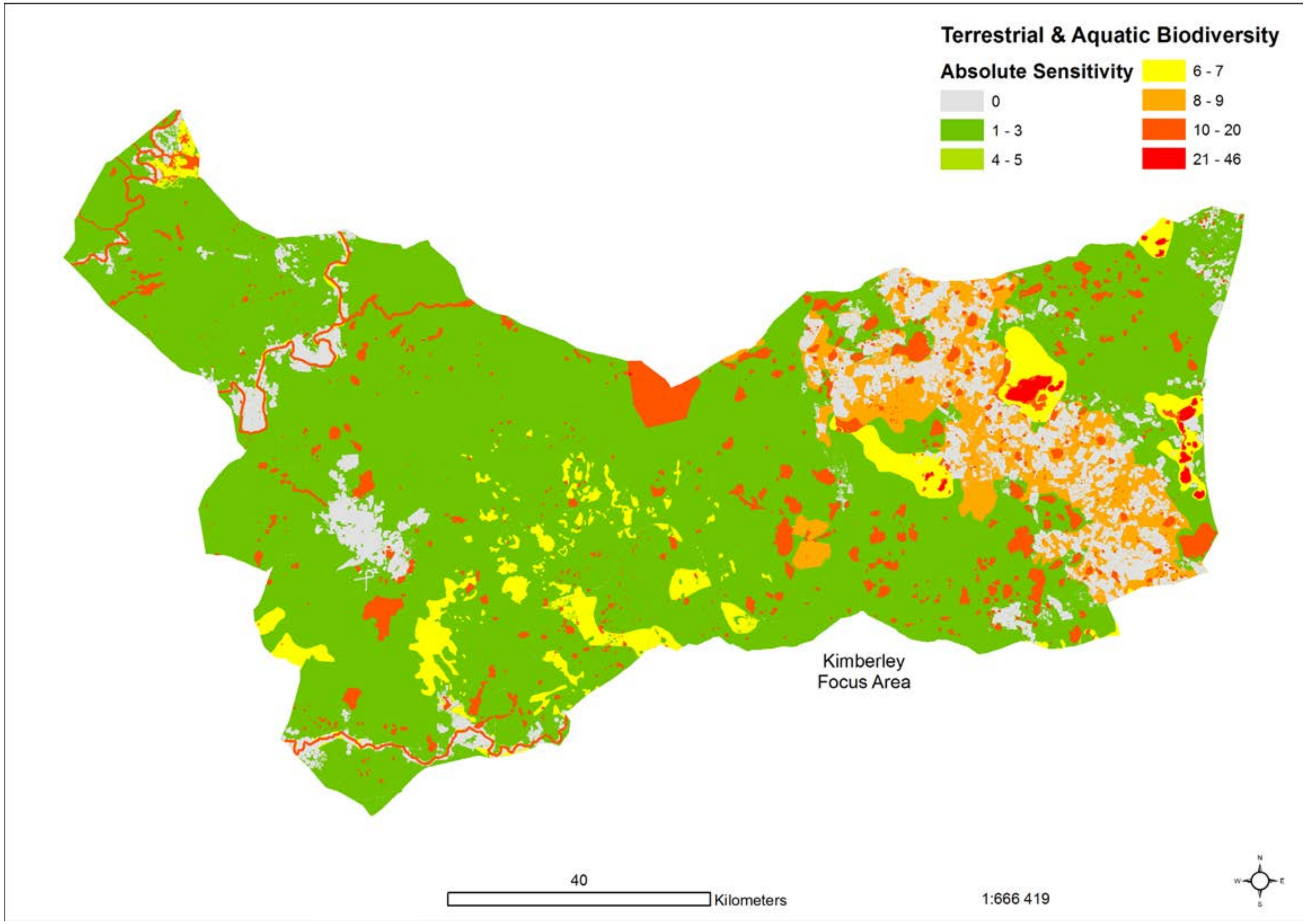
4.2.3 FA 3 - Cookhouse



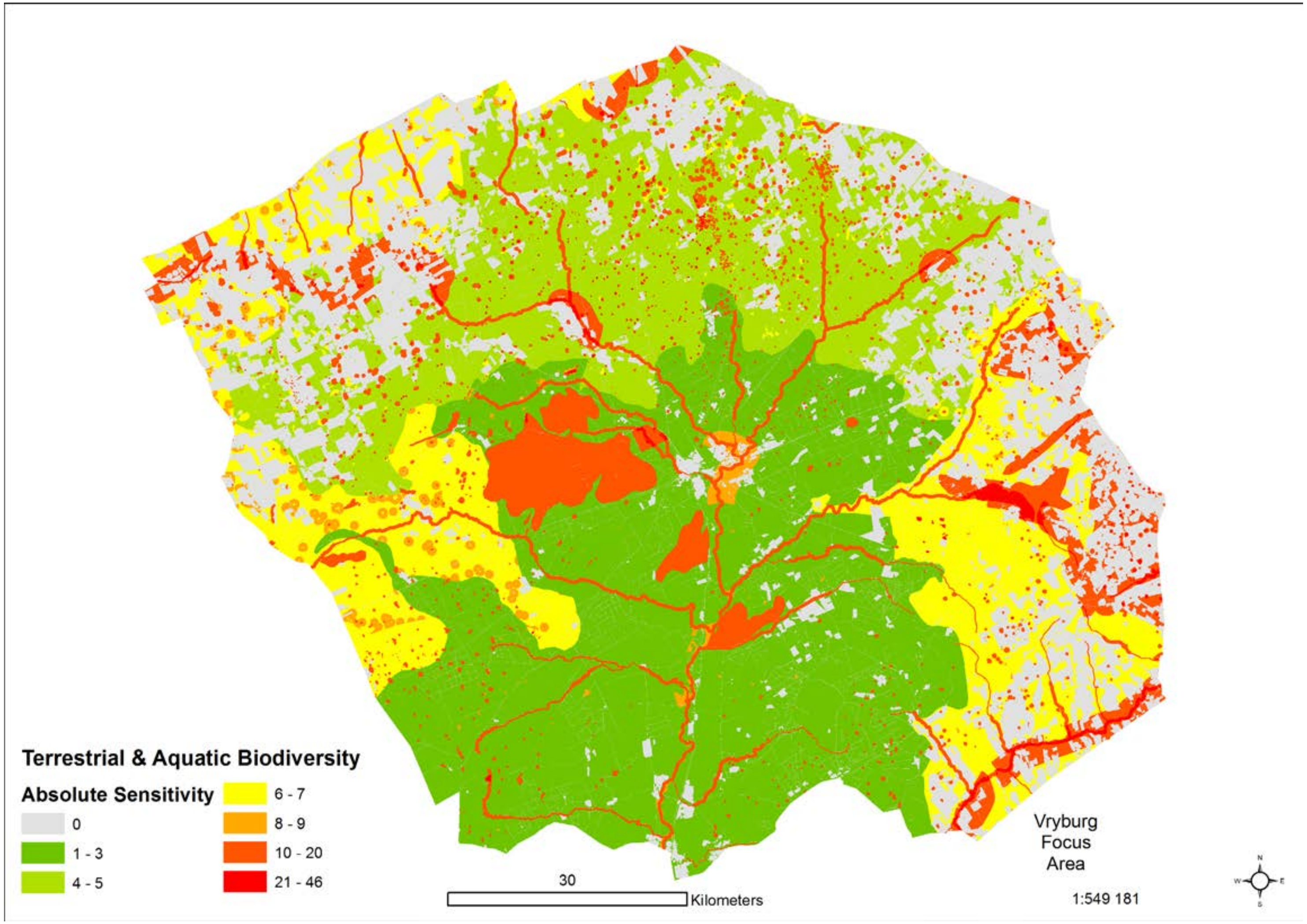
4.2.4 FA 4 - Stormberg



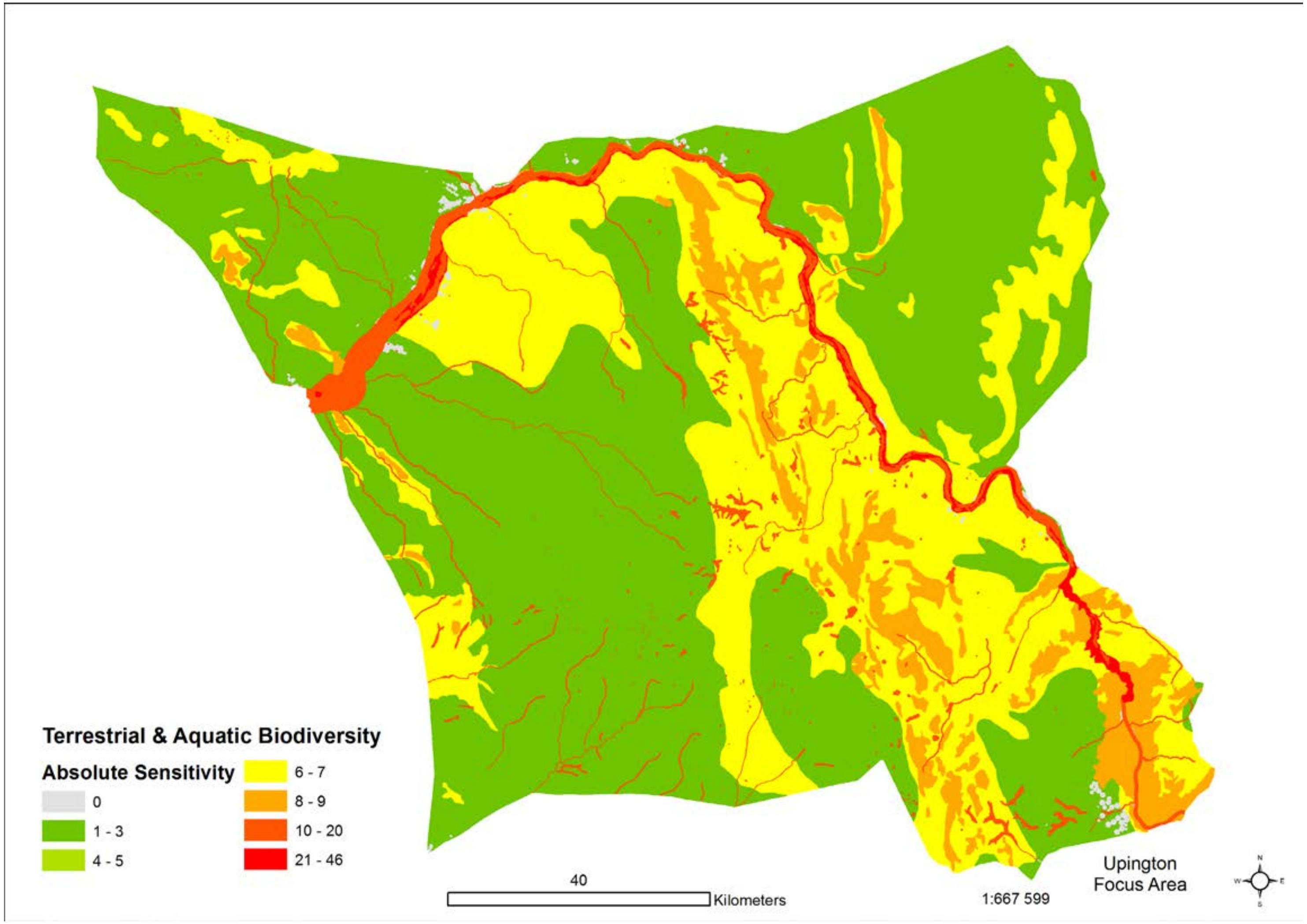
4.2.5 FA 5 - Kimberley



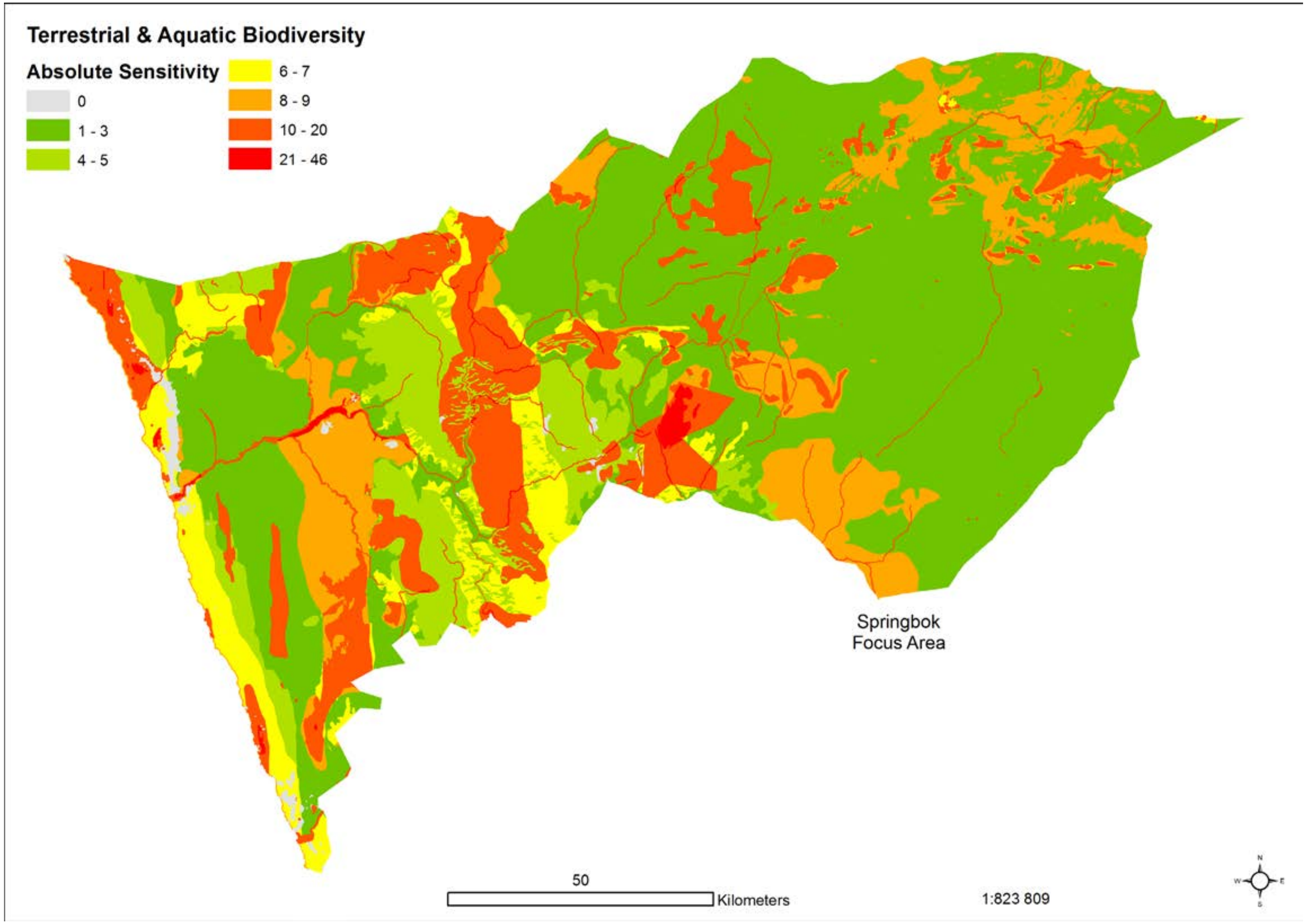
4.2.6 FA 6 - Vryburg



4.2.7 FA 7 - Upington



4.2.8 FA 8 – Springbok



5 COMPARATIVE SENSITIVITY MAPPING

The comparative sensitivity mapping follows a four tier sensitivity classes approach with

- Dark red: very high sensitivity,
- Red: high sensitivity,
- Orange: medium sensitivity and
- Green: lowest sensitivity.

To convert the absolute sensitivity scores to the required four tier system, cut-offs between the categories need to be chosen. Very sensitive biodiversity features which represent an automatic Very High sensitivity classification (such as protected areas, remaining extent of listed critically endangered ecosystems, forests, and aquatic features (plus the buffers applied to these features)) all have total scores of over 10. Areas with no natural habitat remaining are considered Low sensitivity and were usually assigned a score of 0, exceptions to this are protected areas and certain aquatic feature buffers which were assigned a score of 10 regardless of level of transformation. The cut-off between Medium and High sensitivity was chosen to be half way between Low and Very High sensitivities, with medium sensitivity thus being between 1 and 5.

Very high sensitivity areas (very high sensitivity): Total Score ≥10

High sensitivity areas: Total Score of 6 to 9

Medium sensitivity areas: Total Score of 1 to 5

Low sensitivity areas: Total Score of 0

5.1 Very High Sensitivity Zones

All mapped wetlands and rivers and their associated buffers are considered to be very high sensitivity zones and most likely to be unsuited for development. The rivers and streams delineated by the 1:50 000 River Lines and a buffer of 32 m on either side of the river, or of the wetland associated with the river or stream, are very high sensitivity zones. The 1:50 000 River Lines map is not always accurate and thus must be ground-truthed for all applications. The formal protected area network is considered as very high sensitivity areas as are the remaining natural extent of listed critically endangered ecosystems and forest patches.

5.2 Mapping Limitations & Assumptions

In this section we discuss some of the major assumptions and limitations associated with the mapping and the appropriate interpretation and use of the sensitivity maps. These apply to both the absolute and comparative maps.

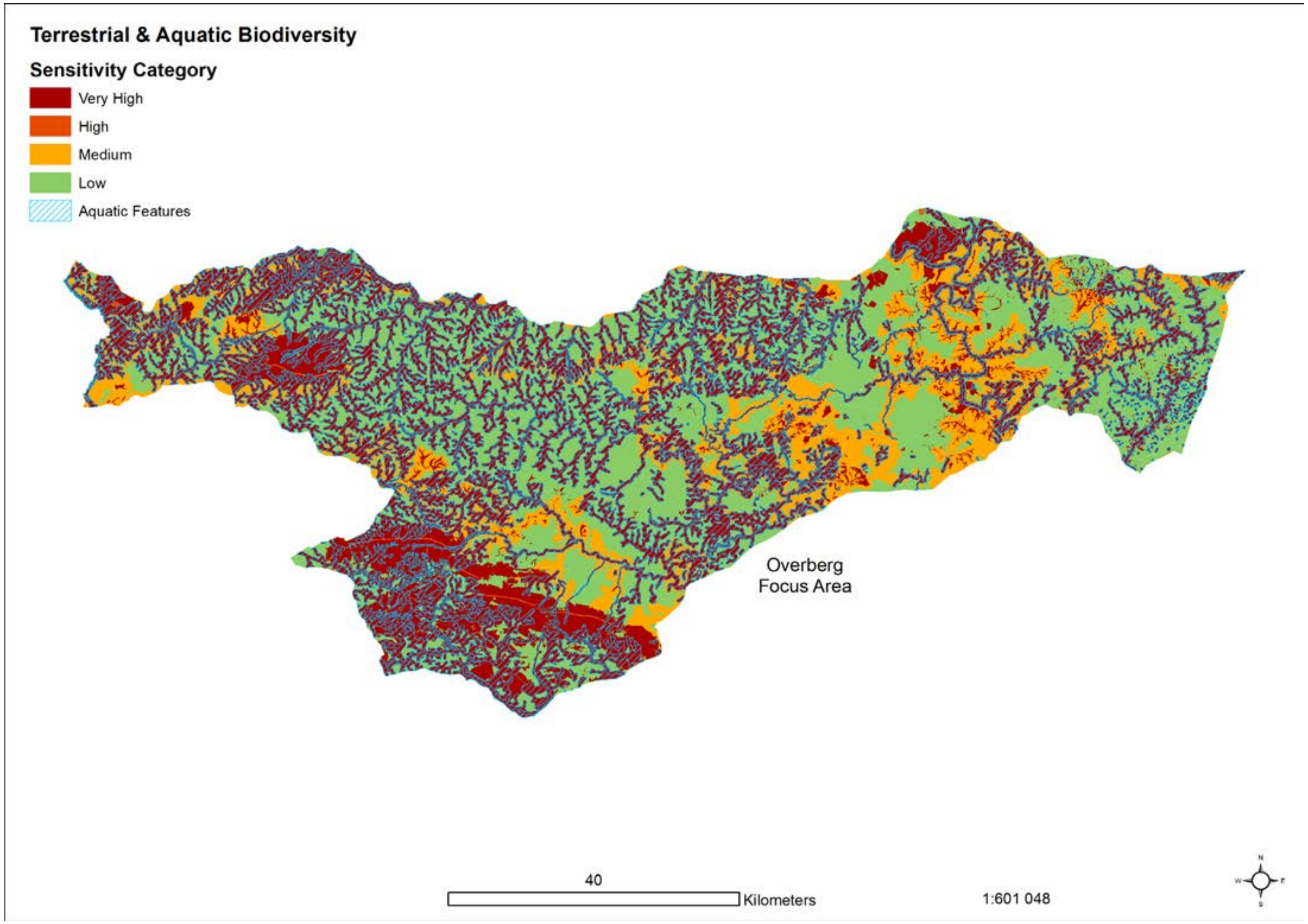
- For the more arid focus areas such as Kimberley and the Komsberg, the performance of the national land cover map proved to be particularly poor as it was not able to differentiate bare ground from cultivated or transformed ground. This was especially a problem because in arid systems, such areas of bare ground are commonly associated with pans and drainage systems, which are considered to be areas of above average sensitivity, not low sensitivity as predicted by the landcover. For these focus areas, the landcover was only used in those parts of the site where it was deemed to be acceptably accurate or where classification errors were deemed to be low. The implications of this are however, that at least within these focus areas, the landcover should not be considered a reliable method for identifying transformed or low sensitivity areas and alternative approaches should be used for screening studies.
- For many of the Focus Areas, this project relied heavily on existing data for the identification of ecosystems that are differentially sensitive to development. The use of SPOT imagery for all 8 focus areas indicated that the input data for wetlands, in particular, is inadequate for the accurate

determination of wetlands and other sensitive freshwater ecosystems at this scale. This is particularly so for the more arid focus areas of Springbok, Upington, Kimberley and Komsberg. Whilst many artificial wetlands are represented within the NFEPA data layer (these are not represented on the sensitivity maps, which only include natural wetlands), it is evident that natural wetlands within these focus areas are poorly represented. Therefore, the presence of such features within sites will need to be verified during the specialist assessment process.

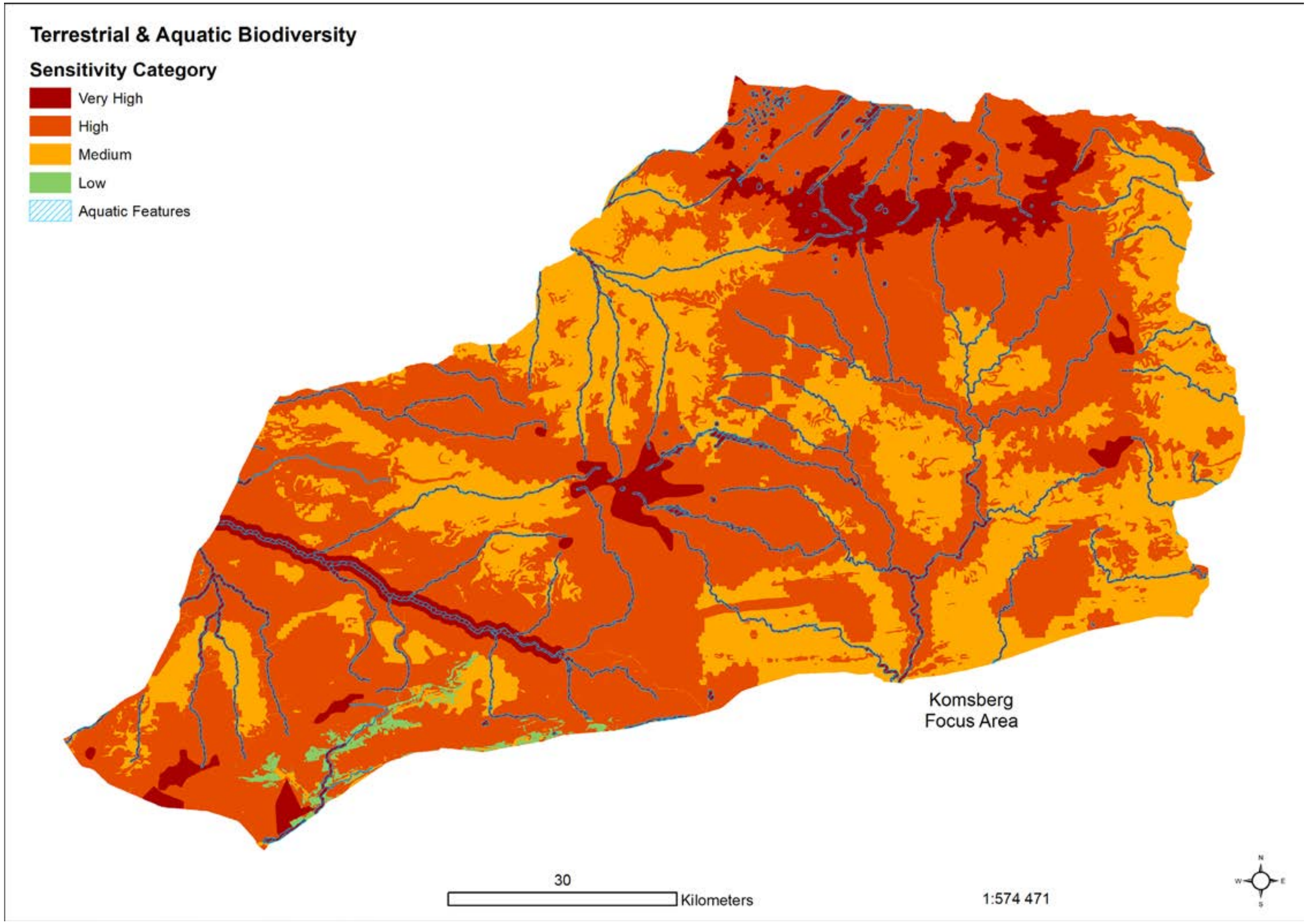
- The available information used to derive the sensitivity maps is at a relatively coarse scale. As such, the sensitivity maps are best used to guide development at scales of approximately 1:10 000 and at finer scales, there are likely to be locally sensitive features present. The presence of such features does not invalidate or compromise the value of the SEA and the current study, but simply implies that some level of specialist input is required to identify and map such features so that they can be avoided at a local level by the development footprint if necessary.
- With the exception of the Overberg FA, it is likely that ecologically sensitive freshwater ecosystems which have not been mapped within this study are present. The presence of potentially sensitive wetland features which have not been mapped therefore needs to be evaluated through specialist input as above.

5.3 Four Tier Sensitivity maps

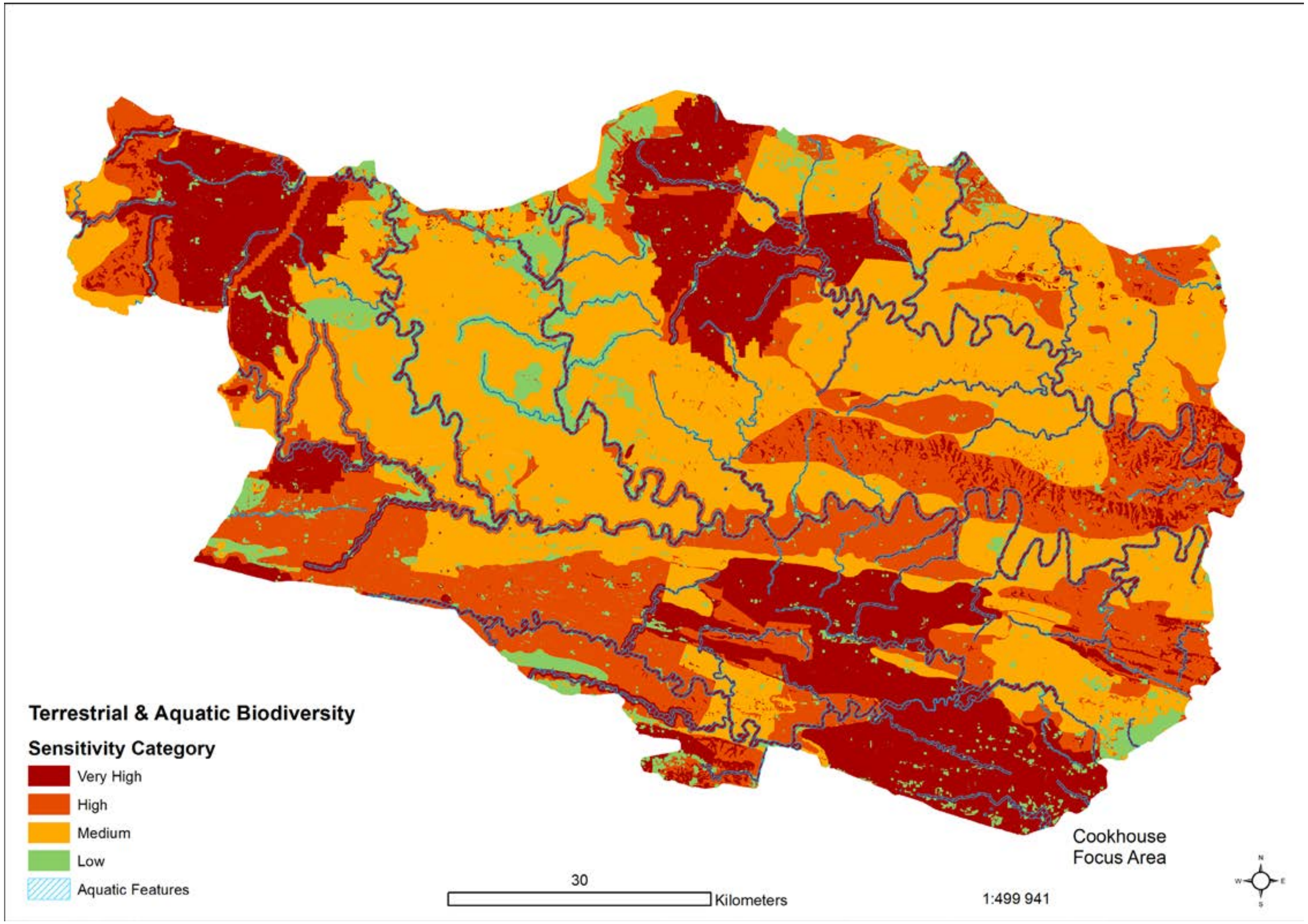
5.3.1 FA 1 - Overberg



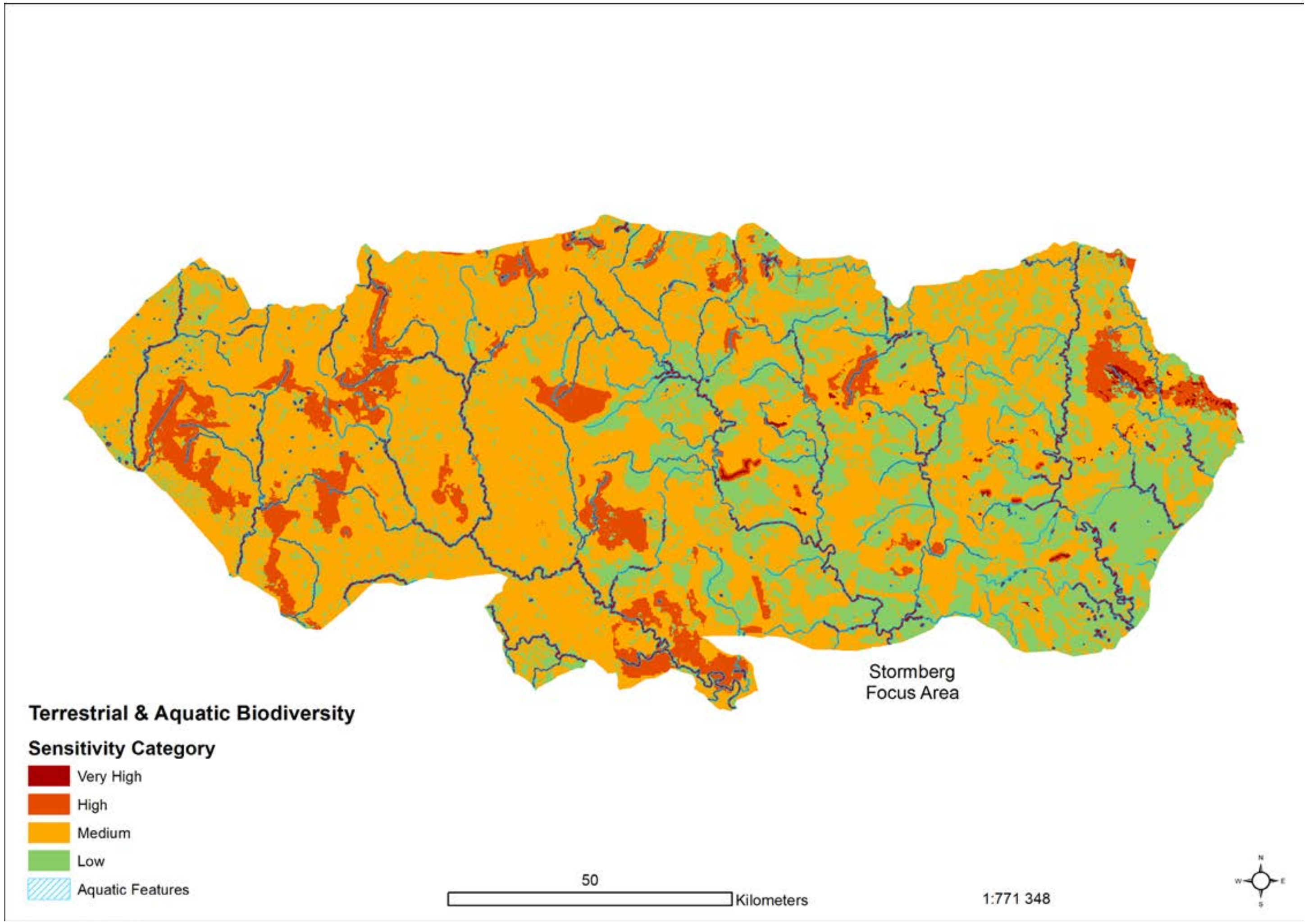
5.3.2 FA 2 - Komsberg



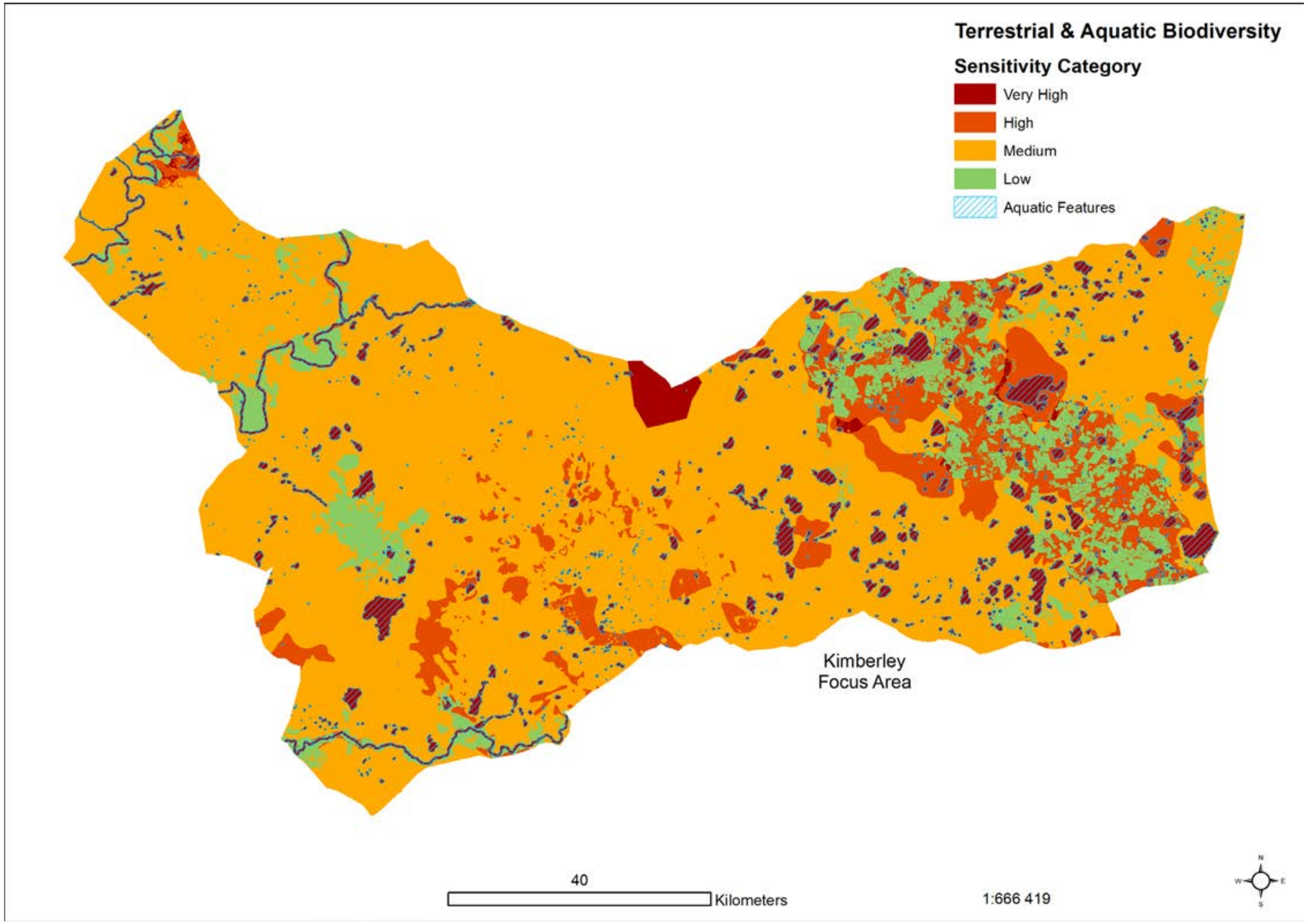
5.3.3 FA 3 - Cookhouse



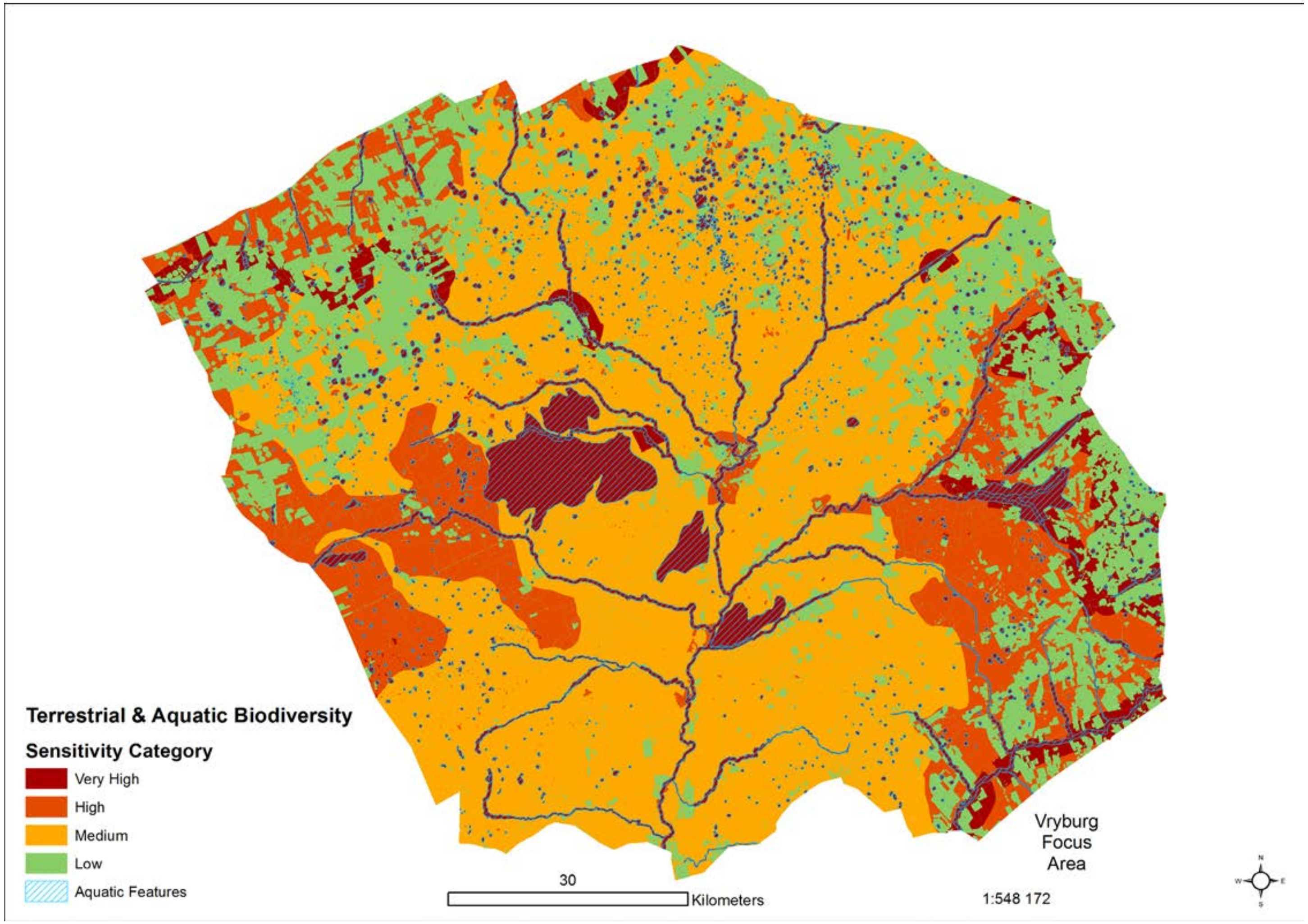
5.3.4 FA 4 - Stormberg



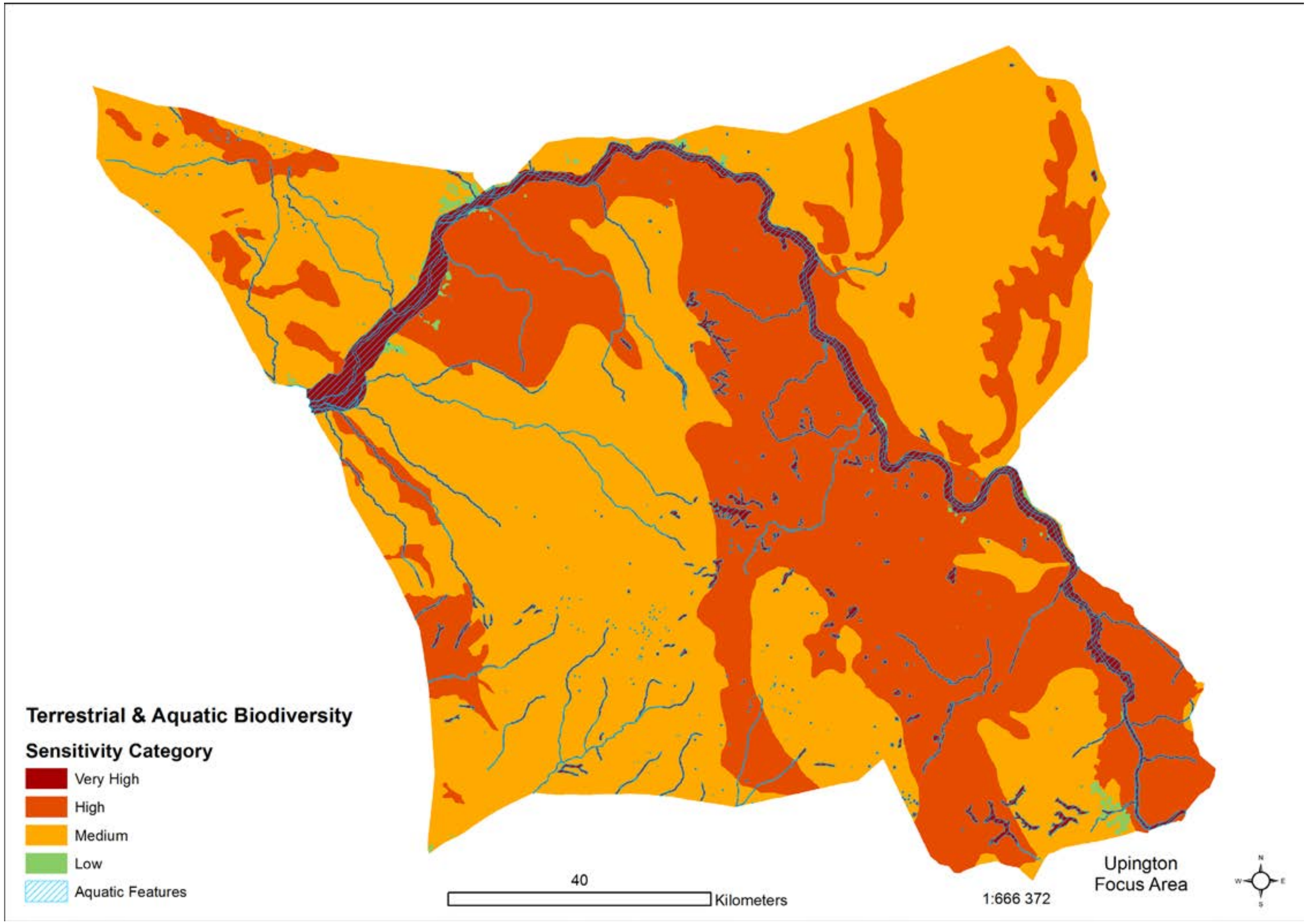
5.3.5 FA 5 - Kimberley



5.3.6 FA 6 - Vryburg



5.3.7 FA 7 - Upington



5.3.8 FA 8 - Springbok

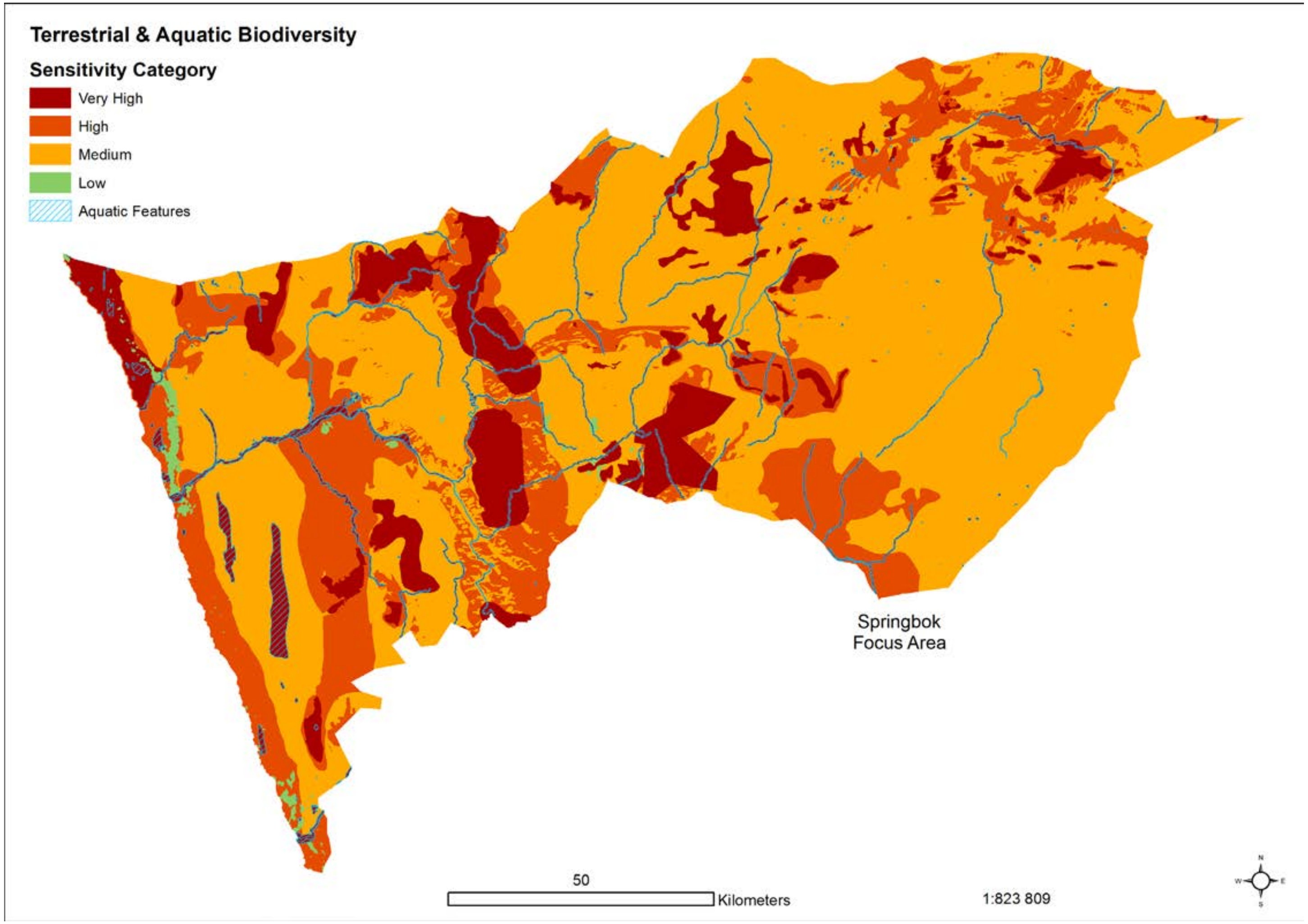


Table showing percentage extent per sensitivity category for each focus area

Sensitivity	FA1	FA2	FA3	FA4	FA5	FA6	FA7	FA8
Very high sensitivity	50%	11%	29%	6%	8%	12%	6%	14%
High	0%	59%	25%	9%	12%	16%	38%	23%
Medium	17%	30%	39%	62%	71%	49%	56%	62%
Low	33%	1%	7%	23%	10%	23%	0%	1%

6 INTERPRETATION AND IMPLEMENTATION OF SENSITIVITY MAPS

6.1 Implementation for Terrestrial Ecosystems

Although the purpose of the SEA is to streamline the development process within the REDZ, in part through reducing the legal and process obstacles to development, the sensitivity maps produced here provide developers with a powerful tool that can be used in development planning to facilitate a similar outcome. Even without the associated reductions in the EIA requirements, the sensitivity maps allow developers to anticipate the likely costs and risks associated with development within a certain area. A developer may accept the high risk and cost associated with obtaining authorisation for development within high sensitivity areas if they perceive that the resource availability or other economic drivers is sufficiently high to justify this risk. By the same token, the maps indicate those areas where development is likely to be able to proceed with minimal risk and where authorisation is likely to be obtained at lowest cost and in the shortest amount of time.

In terms of the implementation of the sensitivity maps, it is not possible to define every situation or associated impact. Consequently, the recommendations associated with each tier of the sensitivity maps need to be generic and applicable to all FAs. However, this poses a risk of becoming too generalised to the point that the recommendations are no longer useful or cannot be implemented. In addition, such guidelines pose the risk of being inefficient as they may require studies that are not applicable to many situations. Therefore, in order to avoid these problems and maintain an adaptive framework for the assessment of impacts, we define and associate three tiers of specialist study with the different tiers of the sensitivity maps. In this manner, the nature of the specialist studies are defined by the features of the affected environment and the content by the specialist and the level of detail by the minimum requirements defined here for such studies.

The recommended requirements for ecological specialist studies within the different tiers of the sensitivity maps are detailed below. At the highest level, these correspond to the current best-practice guidelines for specialist studies within EIAs as outlined within Brownlie (2005) and De Villiers *et al.* (2005). Subsequent levels are less onerous with the aim of minimising cost to the developer and risk to the environment. It is also important to note that it is incumbent upon the specialist, upon an initial site visit to recommend, where warranted, a higher level of study where potential impacts justify such study. These recommendations are thus considered the minimum requirements for specialist studies within each tier of sensitivity but do not preclude or limit the possibility that a higher level of detail may be required. The three tiers are described in general terms below and detailed thereafter.

Level 1 Specialist Study

This is the highest level of specialist study and is reserved for any development within proclaimed Critically Endangered Ecosystems, development exceeding 1 ha within Very High Sensitivity Areas and 5 ha within High Sensitivity Areas as mapped here. This is calculated on a cumulative basis as per the current NEMBA regulations. As such, this level of study would be triggered when 1 or more phases of a development result in a cumulative loss of more than 1 or 5 ha of habitat as may be the case or where the different elements of the development affect multiple small areas of Very High or High Sensitivity habitat which together amount to more than 1 or 5 ha as per the sensitivity level. This level of study is analogous to the current level of detail required under the EIA process for specialist studies and is also likely to require specific focussed examination of the high sensitivity issues present. In order to meet the recommendations, site visits with detailed field assessment and associated sensitivity mapping is required.

Level 2 Specialist Study

This is likely to be the most commonly required level of specialist study where developers have managed to avoid High and Very High Sensitivity areas and where the development is concentrated within natural vegetation with no known highly sensitive features. The purpose of this level of Specialist Study is to ensure that there are no locally sensitive features present that should be avoided and to ensure that there are no significant populations of species of conservation concern present within the development footprint, or that the development does not lie within an area that is required for the maintenance of important ecological processes which may be disrupted by the development. This level of study is roughly equivalent to a Basic Assessment in detail. Details on the presence of listed and protected species on-site is likely to be required to meet provincial permitting requirements. Targeted site visit and field assessment is required for generation of sensitivity maps, but the requirements would be less onerous than that for a Level 1 Specialist Study.

Level 3 Specialist Study

This is the lowest level of specialist study and would be required where neither of the higher level studies have been triggered. In most instances, this would correspond to development within transformed areas, where the risk of significant ecological impact is very low. In such cases, a desktop review of the available information is likely to be sufficient, with a site visit being optional and at the discretion of the specialist where it may be necessary to demonstrate or verify the low sensitivity of the affected area. A statement letter from the specialist addressing the issues raised below should be sufficient to obtain authorisation.

Specialist Study Minimum Requirements:

The minimum requirements associated with each level of specialist study is detailed below. It is important to note that the scope of the specialist study is dictated by the features within the development footprint and the specific features associated with each of the FAs as detailed in Section 7. As such, the specialist studies are intended to be more focussed on the actual issues associated with the FA and are not intended to characterise those features of the FA which are not relevant to either the nature of the impacts of the development or the features within the development footprint.

Level 1 Specialist Study - Minimum Requirements:

1. Provide a general overview of the affected area in terms of connectivity, corridors, and ecological processes and viability of the affected area.
2. In terms of biodiversity pattern, identify or describe:
   2.1 Community and ecosystem level:
      a. The main vegetation types, their aerial extent and interaction with neighbouring types, soils or topography.
      b. Critical Biodiversity Areas, Ecological Support Areas, NFEPA Priority Catchments or NPAES Focus Areas within the site.
      c. The types of plant communities or fine-scale habitats that occur within and in the vicinity of the site. (This must be derived and mapped by the specialist in the field as this level of detail is not usually available) It is not adequate to reproduce the existing national vegetation map, CBA maps or similar broad-scale product.
      d. Threatened or vulnerable ecosystems (Listed Ecosystems as well as locally important habitat types which may occur below the vegetation type level)
      e. The types of faunal communities present and any faunal species, areas or habitats present which may be particularly important for fauna.

2.2 Species level

a. Red Data Book species of fauna and flora and their distribution within the site.
b. The viability of and estimated population size of the RDB species that are present
c. The likelihood of other RDB species, or species of conservation concern, occurring in the vicinity (include degree of confidence).

2.3 Other pattern issues

a. Any significant landscape features or rare or important vegetation/faunal associations such as seasonal wet lands, alluvium, seeps, quartz patches or salt marshes in the vicinity.
b. The extent of alien plant cover at the site, and whether the infestation is the result of prior soil disturbance such as ploughing or other land use.
c. The condition of the site in terms of current or previous land uses.

3. In terms of biodiversity process, identify or describe:
   a. The key ecological "drivers" of ecosystems on the site and in the vicinity, such as fire, soils, topography etc..
   b. Any spatial component of an ecological process that may occur at the site or in its vicinity (i.e. corridors such as watercourses, upland-lowland gradients, migration routes, coastal linkages or inland-trending dunes, and vegetation boundaries such as edaphic interfaces, upland-lowland interfaces or biome boundaries).
   c. Any possible changes in key processes e.g. increased fire frequency or drainage/artificial recharge of aquatic systems.
   d. The condition and functioning of rivers and wet lands (if present) in terms of: possible changes to the channel, flow regime (surface and groundwater) and naturally-occurring riparian vegetation.
4. Would the site or neighbouring properties potentially contribute to meeting regional conservation targets for both biodiversity pattern and ecological processes? In other words, is the affected area within an ecosystem that is poorly conserved and for which there are limited alternatives available for conservation in order to reach the conservation target.
5. Should development within the site take place, what are the likely constraints and opportunities for mitigation or avoidance of impacts in relation to the future land use and management possibilities within the facility? (For example if a facility will be fenced, then this will significantly impact the ability of the development to implement measures to mitigate a decline in landscape connectivity for fauna).
6. What is the significance of the potential impact of the proposed project, alternatives and related activities - with and without mitigation - on biodiversity pattern and process (including spatial components of ecological processes) at the site, landscape and regional scales? In this regard it is especially important to consider the presence of similar developments in the area and Cumulative Impacts at the landscape and regional scales.
7. If is likely that the development will generate significant impact on species or habitats of conservation concern, is a conservation offset a viable option to compensate for the assessed impact? This requires consideration of whether or not there is similar habitat available to be used as an offset and whether or not there is an existing threat to this habitat.
8. Generate, based on the detailed plant community or habitat map produced in 2c, a sensitivity map of the site at the appropriate scale illustrating the sensitive areas in relation to:
   - The area that would be impacted by the proposed development;
   - The location of vegetation, habitat and spatial components of ecological processes that should not be developed or otherwise transformed; and
   - Areas, including the site and surrounds that must remain intact as corridors or ecological "stepping stones" to maintain ecosystem functioning, including fires in fire-prone systems.
9. Recommend actions that should be taken to prevent or, if prevention is not feasible, to mitigate impacts and restore disturbed vegetation or ecological processes. Indicate how preventative and

remedial actions will be scheduled to ensure long-term protection, management and restoration of affected ecosystems and biodiversity.

10. Indicate limitations and assumptions, particularly in relation to seasonality and the manner in which the timing and intensity of sampling is likely to have impacted the ability to detect species of conservation concern or other significant features that may be present.
11. Indicate how the developer has taken biodiversity considerations into account in terms of changes to the layout of the facility and the extent to which these changes are likely to be effective in avoiding or mitigating the potential negative effects of the development on the sensitive receptors.
12. Any further monitoring or studies that should take place subsequent to the Specialist Study in order to address any limitations of the existing study or in order to address any issues which may require a greater level of detail than possible during a standard Specialist Study. This might include additional surveys to ascertain the distribution of certain plant species of conservation concern or to better evaluate the presence of fauna of particular concern such as the Riverine Rabbit.
13. All relevant legislation, permits and standards that would apply to the development should be identified.

Level 2 Specialist Study - Minimum Requirements:

1. In terms of biodiversity pattern and process, identify or describe, based on a desktop-level study:
    a. The main vegetation types, their aerial extent and interaction with neighbouring types, soils or topography.
    b. Critical Biodiversity Areas, Ecological Support Areas, NFEPA Priority Catchments or NPAES Focus Areas within the site.
    c. Threatened or vulnerable ecosystems
    d. The types of faunal communities present and any faunal species, areas or habitats present which may be particularly important for fauna.
    e. Listed and threatened fauna and flora known from the area according to the available spatial databases such as the SANBI SIBIS database and the ADU's Virtual Museum. (http://sibis.sanbi.org/ and http://*vmus.**adu**.org.za/*)
2. Based on the results of a site visit and field assessment:
    a. Generate, a sensitivity map of the site at the appropriate scale illustrating the sensitive areas in relation to:
        - The area that would be impacted by the proposed development;
        - The location of vegetation, habitat and spatial components of ecological processes that are considered sensitive or should not be impacted or otherwise avoided.
    b. Identify or describe
        - Any significant landscape features or rare or important vegetation/faunal associations such as seasonal wet lands, alluvium, seeps, quartz patches or salt marshes within or near the development footprint.
        - The observed or likely presence of flora and fauna of conservation concern in or near the development footprint.
3. Recommend actions that should be taken to prevent or, if prevention is not feasible, to mitigate impacts and restore disturbed vegetation or ecological processes. Indicate how preventative and remedial actions will be scheduled to ensure long-term protection, management and restoration of affected ecosystems and biodiversity.
4. Indicate limitations and assumptions, particularly in relation to seasonality and the manner in which the timing and intensity of sampling is likely to have impacted the ability to detect species of conservation concern or other significant features that may be present.
5. Indicate how the developer has taken biodiversity considerations into account in terms of changes to the layout of the facility and the extent to which these changes are likely to be effective in avoiding or mitigating the potential negative effects of the development on the sensitive receptors.

6. Any further monitoring or studies that should take place subsequent to the Specialist Study in order to address any limitations of the existing study or in order to address any issues which may require a greater level of detail than possible during a standard Specialist Study.
7. All relevant legislation, permits and standards that would apply to the development should be identified.

Level 3 Specialist Study - Minimum Requirements:

Provide a specialist statement letter which addresses or includes the following:

1. The transformation status of the vegetation within the affected area.
2. Where there is doubt as to the status of the vegetation, (for example CBA or landcover maps may indicate that certain transformed areas are intact), photographs or other supporting evidence can be included.
3. The likely presence of any fauna of conservation concern within the site and a statement regarding the likely impact of the development on such species.
4. The likelihood that any broad-scale ecological processes might be disrupted by the development.
5. Any limitations or provisions associated with a statement of negligible impact.
6. Whether or not any specific avoidance or mitigation measures should be implemented.

6.2 Implementation for Aquatic Ecosystems

6.2.1 Impact Assessment

All mapped aquatic features and the buffers applied to them are considered to be Very High sensitivity areas. There is a high likelihood of aquatic features, particularly wetlands, being present in the Focus Areas that are not currently mapped. Any aquatic feature encountered during desktop assessments or field verification of mapped areas are also considered to be Very High sensitivity areas, and a buffer must be applied according to the criteria provided in Appendix 3.

In terms of NEMA, an application for wind or solar facilities within these areas should trigger a Level 1 specialist assessment, described above in Section 6.1 and Appendix 5. Environmental authorisation of applications should be accompanied by stringent ecological requirements to prevent degradation of ecological condition of any freshwater resource and to strive towards rehabilitation of these ecosystems.
Considering the low confidence associated with the available maps of freshwater ecosystems, especially wetlands, all applications for wind or solar PV facilities in all areas, regardless of the level of sensitivity will require at least a desktop verification of the presence of aquatic features. This must be done by a suitably qualified aquatic specialist. The level of specialist input following the detection of wetlands through the desktop process will depend on the layout and proposed operation of any wind or solar PV facility. In other words, should a proposed facility encroach into any aquatic feature or aquatic buffer detected through the desktop process, then a Level 1 specialist assessment (see Section 6.1 and Appendix 5) would be triggered. However, should wetlands be detected but avoided through adjustment to any given layout of wind and solar PV facility, then the need for a detailed freshwater assessment may be avoided.

6.2.2 Water Use

The National Water Act (NWA) regulates 11 water uses that require registration and/or authorisation, and is thus applicable to wind and solar facilities. Section 21 of the NWA defines water use as:

a. taking water from a water resource;
b. storing water;
c. impeding or diverting the flow of water in a watercourse;
d. engaging in a stream flow reduction activity contemplated in section 36;

e. engaging in a controlled activity identified as such in section 37(1)[5] or declared under section 38(1);
f. discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit;
g. disposing of waste in a manner which may detrimentally impact on a water resource;
h. disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process;
i. altering the bed, banks, course or characteristics of a watercourse;
j. removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people; and
k. using water for recreational purposes.

Section 21 (a) and (b) thus apply to **consumptive** use of ground- or surface water (which includes both rivers and wetlands), while the remaining sub-sections refer to **non-consumptive** water uses. All of these uses may impact on the integrity and function of water resources and the overall quality of the resource and therefore must be registered and/or authorised as a water use by the DWA or competent authority (such as a Catchment Management Agency).

- **Registration of a water use** only comes into effect after abstraction of more than 50 m^3/day of surface water, or more than 10 m^3/day of groundwater. Water requirements for the operation of wind and solar PV facilities are minimal, with the most significant activity being the regular washing of solar panels. Construction activities will require water for short-term use, but this is also unlikely to trigger a water use registration. If water use does not exceed these minima, then neither registration nor authorisation are required[6]. Further, in many instances water requirements will be met by municipal supply rather than transferring an existing lawful use, or activating a new water use.
- **Authorisation of a new water use** depends on the type of user, the impact of the water use on the resource (i.e. how it will affect water quality, the environment and other users) and its benefits to society, and the location of the water use. For instance, the **National Water Resource Strategy** defines power generation as a water use of **strategic importance** because it is vital to the economy and livelihoods of all South Africans. In terms of Section 6 of the NWA, strategic users are given high priority in water allocations as well as a high level of assurance of continued supply even during times of drought.

- Both consumptive and non-consumptive water uses require a **water use licence application** (WULA), unless the water use falls within the conditions and limits of a **general authorisation** (GA). The full WULA process is lengthy and detailed, requiring the determination of the "Reserve" for the relevant catchment (see Figure 6.1 for map showing status of Reserve Determination)Figure 6.1. A GA is less detailed, but still requires input from an aquatic specialist (see Appendix 5).
- A GA permits the use of water without requiring the full WULA process in a specific area, or according to a set of conditions or limits. DWA or a Catchment Management Agency can also generally authorise specific groups of people in a catchment, so that they can make productive use of certain water resources, without having to apply for a licence. Individuals, groups or organisations who are using water under a GA must still register their water use if it exceeds the limits for registration. Each GA specifies the area of applicability of, and exclusions from the GA (see for map of catchments excluded from the GAs).
    - o GA 399 (26th March 2004) specifies the limits of abstraction of surface and groundwater (Section 21 (a)), storage of water (Section 21 (a)) and the discharge of waste or water

[5] The reference to power generation in section 37(1) applies only to hydro-electric power generation.

[6] The following quantities of water were projected for a 75MW PV project in Klerksdorp : Construction phase: total use of 450 m^3 during a construction phase of 8 months (roughly 2 m^3/day); Operation phase (20 year life of the facility): 2 100 m^3 per year, or **5.75 m^3/day**.

containing waste into a water resource (Section 21 (f), (g) and (h)). However, it does not apply to wetlands, and, in terms of surface water, it excludes a number of catchments that fall within the eight FAs (Figure 6.1), while in terms of groundwater abstraction, it sets the limits of abstraction for all catchments under which the GA will apply (Figure 6.1). The full WULA process would apply for water abstraction and storage quantities/locations that are not covered by the GA.

- GA 1199 (18th December 2009) provides guidance regarding impeding and diverting the flow in a watercourse (Section 21 (c)), or altering the bed and banks of a watercourse (Section 21 (i)), and is thus applicable to encroachment of a built footprint into an aquatic feature or its buffer, and the construction or widening of river or wetland crossings, which are likely to be required for some wind and solar PV facilities. This GA replaces the need for the full WULA process. The following conditions must be met:
  - The impeding of flow does not impact detrimentally on the water resource or on any other persons water use, property or land;
  - The natural migration patterns of aquatic biota and the sustainable ecological function of the system are not interfered with;
  - The volume of flow is not reduced except for natural evaporation losses;
  - The water quality is not detrimentally affected;
  - All reasonable measures are taken to ensure:
    - The stability of the watercourse is not detrimentally affected;
    - Scouring, erosion or sedimentation of the watercourse is prevented;
    - Rehabilitation of the watercourse including riparian and instream habitat is undertaken after any alteration of the bed, banks, course or characteristics of the watercourse.
- GA 1199 does not apply to any activities occurring within 500 m of a wetland or in a few quaternary catchments specified in the GA (see Figure 6.1), thus triggering a full WULA. However, if the impact is located outside of the buffer recommended by this SEA but within 500 m of the wetland, DWA will consider reasons provided by a qualified aquatic specialist as to why the proposed activity will not impact on affected wetlands. DWA may then waive the full WULA process in favour of authorisation under GA 1199.

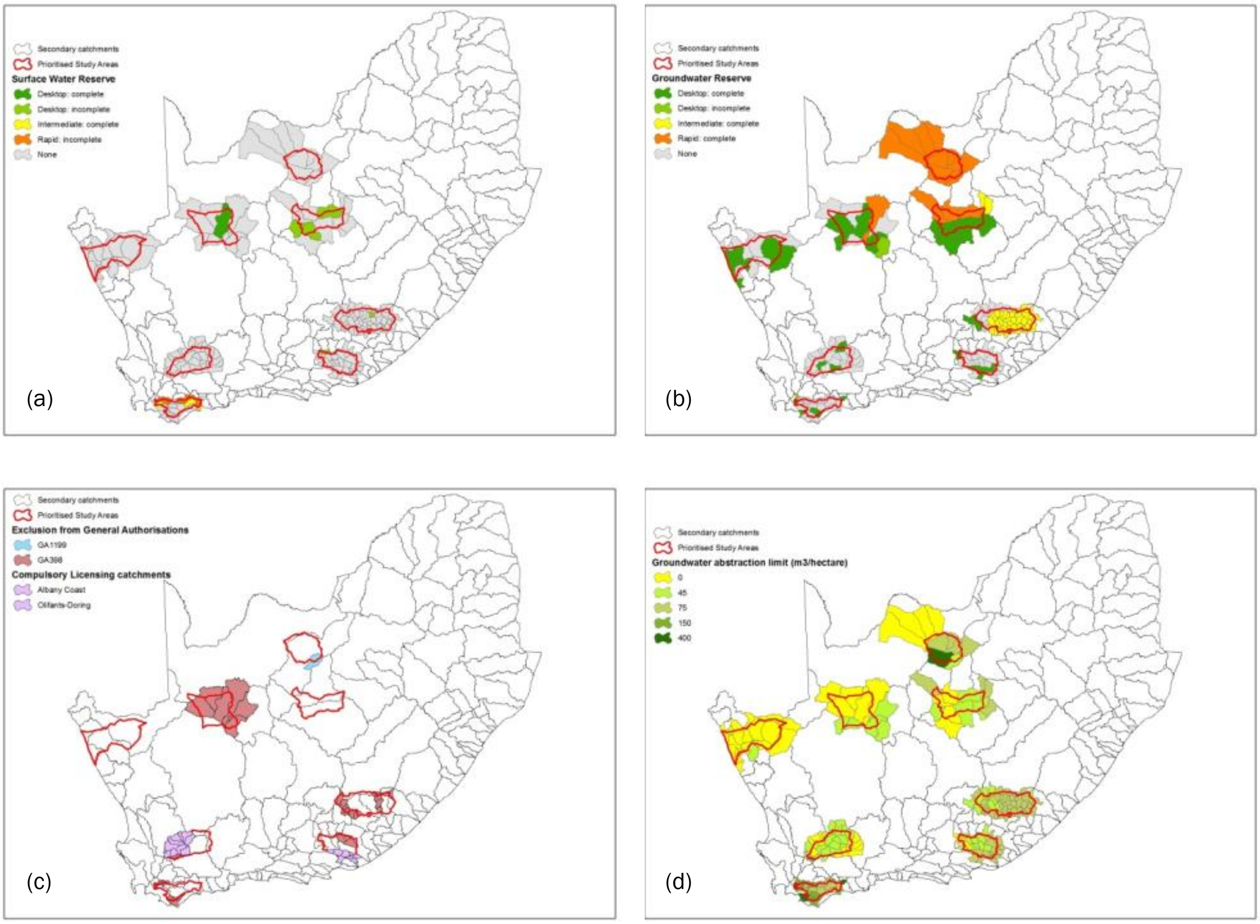
- In addition to the above, certain water-stressed catchments[7] have been identified for **compulsory licensing** (see Figure 6.1). This is a process through which all water uses in a particular catchment are reviewed, and water is re-allocated according to certain priorities, needs and requirements, in line with the national Water Allocation Reform (WAR) process. Authorising water uses in water stressed catchments therefore requires a detailed process. Nevertheless, strategic water uses (see above) receive priority during this process. Compulsory licensing currently applies only to three consumptive uses – water abstraction (Section 21 (a)), water storage (Section 21 (b)) and stream flow reduction activities (Section 21 (d)). Of relevance to this project, the Albany Coast catchments in the Cookhouse FA, and the Olifants-Doring catchments in the Komsberg FA are compulsory licensing catchments and any consumptive use of water in these areas would be subject to the detailed procedures associated with compulsory licensing (Figure 6.1).

6.2.3 Integrated Authorisation

The DWA in the Western Cape and the provincial Department of Environmental Affairs and Development Planning (DEADP) have recently discussed a special operating procedure, whereby the environmental and water use authorisation processes can occur in parallel, with an agreed timeframe. It is envisaged that this procedure will streamline the authorisation processes and approval for development required by these departments. Considering that development is frequently delayed by a backlog for the issuing of water licences, it is strongly recommended that this procedure be considered for all wind and solar PV facilities, and that integrated authorisation be pursued in the other affected provinces.

[7] Catchments where water uses have been over-allocated.

Figure 6.1 : Maps showing quaternary catchments (a) with status of surface water reserve determination, (b) with status of groundwater reserve determination, (c) that are excluded from General Authorisations discussed in the text or



that are compulsory licensing catchments, and (d) with maximum groundwater abstraction rates that qualify for GA 398.

7 GENERAL COMMENTS AND DISCUSSION

7.1 Impact Source & Nature

From both an aquatic and terrestrial environment perspective the major source of impacts from the construction and operation of renewable energy facilities results directly or indirectly from habitat loss and transformation. Other significant sources of impact include changes in surface hydrology, noise from turbines or other operating infrastructure, and disturbance due to human presence and activities. Although there are some important differences in the nature of the impacts associated with wind and solar energy developments, it is generally not necessary to distinguish between them in terms of the sensitivity maps presented here, as these differences are site- and situation-specific and will be drawn out by the specialist studies associated with each development application. A general discussion of the impacts associated with renewable energy development is provided below.

At a broad level, the major difference between wind and solar energy facilities is that solar developments are geographically concentrated, while wind energy developments are diffuse on account of the constraints on turbine spacing. As a result of these differences, solar energy developments generate a high local impact, but are relatively limited in extent, while wind energy developments generate a lower-level impact over a greater area. A constraint on solar development, is that the development area must be relatively flat and as a result, solar developments are usually located on open plains and flat ground. The quality of the wind resource is a key element for wind energy facilities, which as a result are often located in mountainous areas; it is usually desirable to have the turbines located along ridgelines and other exposed locations. As a result of these differences, the parts of the landscape affected by wind and solar energy development are often different and this also generates differences in the nature of impacts between the two in terms of which types of ecosystems, fauna and flora are most affected.

In terms of water use, the main impacts associated with both wind and solar facilities are non-consumptive, i.e. where there is a disturbance to the bed and banks or flow regime of a watercourse, or where development encroaches into wetlands and their buffers. Very little water is required for both the construction and operational phases of these facilities, however, almost every application will require road or pipeline crossings over streams and/or wetlands.

Solar Energy Facilities:

Depending on the nature of the substrate as well as the construction engineers, the footprint of PV facilities may or may not be cleared prior to construction. It is obviously preferable not to clear the vegetation, but this is not always possible where there is significant woody biomass present. Cleared areas generate a significantly greater alien invasion risk, changes in surface hydrology and a greater risk of erosion. For instance, levelling and grading of areas to remove steep slopes and undulations in the landscape is often associated with the placement of the PV arrays, and such topographic alteration and intrusion of the development footprint across the myriad minor drainage channels in some areas would alter the natural surface hydrology. Furthermore, extensive hardening of surfaces associated with solar PV facilities would result in significant increases in stormwater runoff and concentration of surface flow patterns. Infrastructural development such as cables and roads across watercourse would lead to the interruption of flows.

During the operational phase, a large amount of plant biomass poses a fire risk and a danger to the facility and hence must be managed. Manual clearing methods such as mowing are preferred and together with the shading caused by the panels, will ultimately cause a shift in vegetation community structure and diversity within the facility.

Based on preliminary observations from existing facilities, it is likely that rodent abundance, especially gerbils will increase within PV facilities, while smaller carnivores such as mongoose are also apparently able to persist in these areas. Solar energy facilities are usually fenced-off with security fencing that prevents most middle to larger-sized mammals from entering the facility. As such, these animals must move around the facility in order to pass by. Given the relatively limited extent of most facilities, this is generally not a significant problem for most fauna except where there are other obstacles to movement which prevent fauna from moving past the facility. While it clear that PV facilities may be able retain a significant proportion of the pre-construction biodiversity, the resulting ecosystem is fairly isolated from the surrounding landscape and will be largely anthropogenic in nature.

Construction phase on a PV plant that was sterilised prior to construction due to the rough ground and presence of tall woody biomass. As can be seen from the image, this has generated a large local impact within the facility and at this point no natural vegetation remained.

Operating PV facility in the Free State where it was not necessary to clear the vegetation during construction and the grass layer is still intact. Mowing of the grass along the front of the of panels is also evident and is conducted to reduce fire risk as well as prevent shading.

Boundary security fence of a PV facility, illustrating the fine mesh fencing which prevents most fauna from entering the facility and the electrified strands, which are on the inside, which is very important in reducing potential fauna impacts. It is also important to note that the fence is not buried and it is likely that some fauna will dig under the fence in time.

Wind Energy Facilities:

A major impact associated with wind energy facilities are the access roads which are required between the turbines; for a 100MW facility, access roads usually amount to about 40-60 km depending on the nature of the landscape and the size of the turbines. This footprint is usually an order of magnitude greater than that required for the turbines themselves. Due to the mountainous terrain associated with many wind energy facilities, these roads must traverse some steep slopes where the risk of erosion is high. Although the width of access roads required during operation are usually listed as around 6 m, during construction, these are usually much wider and may exceed 12 m in width. In the context of some of the undisturbed environments where the WEFs are located, this constitutes a significant disturbance and can generate a significant amount of habitat loss. It is also highly likely that these roads will cross over hillslope seeps, thus altering the diffuse surface flow of water in these areas and leading to concentrated flow and subsequent erosion.

In terms of the turbines themselves, there is significant disturbance required to establish the foundations and may include blasting with explosives. Within undisturbed environments, this is likely to create an avenue for alien plant invasion. Many of the impacts potentially associated with wind turbines are not well known, especially with regards to fauna. It is likely that many fauna will be deterred by the presence of turbines due to their movement or noise. The noise generated may impact some species' ability to communicate or find mates or to detect prey or avoid predators. Although the noise generated by turbines drops off relatively quickly with distance to fairly low levels, within rural landscapes the level of natural background noise is often low and the presence of turbines may significantly increase background noise for many species. This effectively amounts to habitat degradation for such species as they must spend more time finding food or being vigilant to avoid predators. In the long-term it is likely that many fauna will become habituated to the presence and noise generated by wind turbines. It would be highly beneficial if some faunal monitoring within wind energy facilities took place in order to better gauge and understand these effects.

Overall, it can be seen that wind energy facilities are able to maintain a more natural landscape than PV facilities and the main sources of impact are habitat alteration and loss, primarily from access roads, and habitat degradation which may result from noise, alien plant invasion, erosion or human presence.

An access road built along a ridgeline specifically to establish a wind measuring mast within an area that was previously undisturbed and inaccessible.

A newly established 132kV in/out power line as is typically required for both wind and solar energy developments. If constructed in a sensitive manner, the impact of such lines can be kept to a fairly low level as illustrated here and consists of a temporary construction track and some disturbance around the foundations of the pylons. In most instances it is not necessary to establish a corridor of cleared vegetation for the power line.

7.2 Focus Area Specific Mitigation and Effects

Site	Key Impacts	Site specific description	Possible effects	Mitigation
FA 1-Overberg	Transformation and loss of highly endangered lowland renosterveld vegetation types High potential impact on listed plant species Further fragmentation of an already highly impacted ecosystem Fragmentation of complex, high density drainage system across the whole FA Transformation and loss of a high diversity of listed wetland types	There are 14 listed ecosystems present within this FA and the further loss and fragmentation of the remaining habitat is considered highly undesirable. Over 70% of 29 wetland types, and 73% of the river types are Critically Endangered. In general, impacts to Critically Endangered ecosystems cannot be effectively mitigated and avoidance is the best option. More than 4500 indigenous plant species have been recorded within this FA including more than 1000 red-data species. Any development within intact vegetation remnants is therefore highly likely to impact listed plant species.	Further loss and fragmentation of vegetation types listed under the National List of Threatened Ecosystems. Loss of biodiversity Local or global extinction of localised or RDB-Listed plant species. Further transformation, loss or fragmentation of listed river and wetland types	Any impact to an ecosystem listed as Critically Endangered should trigger a Level 1 Specialist Study. Any encroachment into an aquatic feature or its buffer should trigger a Level 1 Specialist study. Avoid impact to intact lowland vegetation types. Development in close proximity to priority renosterveld clusters should be minimised in order to retain the connectivity or potential for the restoration of connectivity of the landscape. Special attention to be paid to the cumulative impact to river and wetland network.
FA 2 - Komsberg	High potential impact on species and habitats of conservation concern Impact on Riverine Rabbit *Bunolagus monticularis* Increased fragmentation and disruption of landscape and hydrological connectivity	The distribution of plant species of conservation concern within this FA is not well known. 22% of wetland types are Critically Endangered or Endangered, however less than 1% of the river types are listed. The Critically Endangered Riverine Rabbit is confirmed to occur within the FA, both on the escarpment as well as on the plains of the Tanqua Karoo and the renosterveld vegetation towards Touws Rivier. The site lies on the Great Escarpment which is considered to be an important corridor for the dispersal of fauna and flora. Transformation and the presence of renewable energy facilities may disrupt the connectivity of the landscape and impair the ability of fauna and flora to move about the landscape or respond to environmental change.	Impact on plant species of conservation concern. Impact on rare or specialised habitats. Direct and indirect impact on the Riverine Rabbit may occur due to habitat loss, disturbance or noise generated by wind turbines. Habitat fragmentation and reduced ability of fauna and flora to disperse or respond to environmental change. Transformation, loss or fragmentation of rivers and wetlands	Specific attention to the presence of plant species of conservation concern with field sampling at the appropriate time of year to detect such species. Sensitivity mapping to take specific cognisance of species and habitats of conservation concern such as quartz patches and other specialised habitats. Any encroachment into an aquatic feature or its buffer should trigger a Level 1 Specialist study. Specific attention to be paid to the possible presence of the Riverine Rabbit and a habitat evaluation for this species should be conducted with a follow-up survey if suitable habitat is found. The EWT Riverine Rabbit Project should be consulted where an impact on this species is a possibility. Specific attention to be paid to the possible cumulative impact of development along the escarpment.

Site	Key Impacts	Site specific description	Possible effects	Mitigation
FA 3 - Cookhouse	High potential impact on species and habitats of conservation concern Habitat fragmentation and loss of climate change buffering ability Transformation and loss of listed wetland and river types	This FA has high species richness as well as very steep environmental gradients that are likely to be important for environmental change buffering and which may be vulnerable to disruption. 68% of wetland types and 20% of river types are Critically Endangered or Endangered. Presence of plant species of conservation concern including cycads which are vulnerable to illegal harvesting from the wild. Presence of a variety of potentially sensitive vegetation types such as dense thicket, high altitude grassland, Afromontane Forest and fynbos vegetation types.	Direct impact on biodiversity. Illegal collection of wild cycad plants leading to reductions or extinction of local populations. Reduced ability of fauna and flora to disperse or respond to environmental change. Transformation, loss or fragmentation of rivers and wetlands	Specialist assessments to pay specific attention to the presence of species of conservation concern with surveys conducted at the appropriate time of year to detect the presence of SCC. Specific attention to be paid to impacts on sensitive vegetation and habitat types such as forest patches, high elevation grasslands or other specialised plant communities. Any encroachment into an aquatic feature or its buffer should trigger a Level 1 Specialist study. Specific attention to be paid to the potential disruption of the steep ecological gradients which characterise the FA.
FA 4 - Stormberg	Potential impact on species and habitats of conservation concern. Impacts on ecosystem process - fire. Transformation and loss of listed wetland and river types	There are a number of listed mammals within the FA that have been identified as potentially vulnerable to negative impacts associated with renewable energy development. This includes the Oribi which is vulnerable to human-induced disturbance and is listed as Endangered. 85% of wetland types and 22% of river types are Critically Endangered or Endangered. There are also two range-restricted butterfly species present, the Tsomo River Opal *Chrysoritis lyncurium* and Pennington's opal *Chrysoritis penningtoni* which would be vulnerable to impact from habitat loss within their narrow distribution. Wind farm development, especially the presence of wind farm access roads may act as fire breaks and impact the natural spread of fire.	Negative impact on the local Oribi population. Habitat loss may negatively impact the Tsomo River Opal and Pennington's Opal. Changes to the fire frequency may have negative consequences on vegetation composition and ecological processes. Transformation, loss or fragmentation of rivers and wetlands.	Any encroachment into an aquatic feature or its buffer should trigger a Level 1 Specialist study. Specific attention to be paid to the possible presence of Oribi within the distribution range of this species. Potential impacts on Tsomo River Opal and Pennington's Opal should be considered in or near the known distribution of these species. Possible impacts on fire frequency and spread should receive specific attention and a fire management plan may be required.

Site	Key Impacts	Site specific description	Possible effects	Mitigation
FA 5 - Kimberley	Impact on listed vegetation types Impact on locally significant habitats Impact on protected tree species Transformation and loss of listed seasonal and ephemeral river types Transformation and loss of ephemeral wetlands	The Vaal-Vet Sandy Grassland vegetation type within the east of the FA is listed as Endangered and further loss of intact remnants of this vegetation unit are undesirable. There are some habitats within the FA that are considered higher sensitivity, including rocky outcrops, Camel Thorn Forests and Highveld Salt Pans. There are some parts of the FA which have a high abundance of protected tree species such as *Acacia erioloba* or *Boscia albitrunca*. Species such as *A.erioloba* are also ecologically significant in their own right due to the variety of species associated with large tree specimens. Less than 5% of wetland types are Critically Endangered or Endangered but 95% of river types are listed.	Further fragmentation and loss of currently intact areas of Vaal-Vet Sandy Grassland. Impact on locally sensitive habitats or plant communities.. Loss of individuals of protected tree species Transformation, loss or fragmentation of rivers and wetlands.	Any encroachment into an aquatic feature or its buffer should trigger a Level 1 Specialist study. Where development takes place within the Vaal-Vet Sandy Grassland vegetation type, specific attention should be paid to the implementation of avoidance measures to minimise further loss of this vegetation unit. Specific attention should be paid to the possible presence of Camel Thorn Forests or other similar sensitive plant communities, especially in the Kimberley area.
FA 6 --Vryburg	Impact on listed vegetation types Impact on protected tree species Transformation and loss of listed ephemeral river types Transformation and loss of ephemeral wetlands	There are several listed vegetation types within this FA including Western Highveld Sandy Grassland, Schweizer-Reneke Bushveld and Mafikeng Bushveld. There are some parts of the FA which have a high abundance of protected tree species such as *Acacia erioloba*. Species such as *A.erioloba* are also ecologically significant in their own right due to the variety of species associated with large tree specimens. 16% of wetland types and 87% of river types are Critically Endangered or Endangered.	Further fragmentation and loss of currently intact areas of listed vegetation types. Loss of individuals of protected tree species. Loss of ecologically significant habitats and plant communities. Transformation, loss or fragmentation of rivers and wetlands.	Any encroachment into an aquatic feature or its buffer should trigger a Level 1 Specialist study. Avoidance measures should be implemented with regards to development within Western Highveld Sandy Grassland, which is classified as Critically Endangered. Specific attention should be paid to the further loss and fragmentation of listed vegetation types, and the implementation of mitigation and avoidance measures to reduce impact on these vegetation types. Sensitivity mapping should take account of the presence of protected tree species and sensitive plant communities with a high abundance of such species.

Site	Key Impacts	Site specific description	Possible effects	Mitigation
FA 7 - Upington	Impact on sensitive habitats such as rocky hills or parallel dune ecosystems. Impact on protected tree species	The rocky hills contain significantly greater diversity of both fauna and flora than the adjacent plains. The dunes are a sensitive environment that is not very tolerant of disturbance and most kinds of renewable energy development will require that the dunes are levelled, which is considered an irreversible impact. There are some parts of the FA which have a high abundance of protected tree species such as *Acacia erioloba*, *A.haematoxalon*, *Boscia albitrunca*, *B.foetida*. Species such as *A.erioloba* are also ecologically significant in their own right due to the variety of species associated with large tree specimens. Populations *of Aloe dichotoma* may be impacted where development coincides with dense populations of this species, such as but not limited to, the area between Kenhardt and Keimoes. No listed wetland types and only 15% of river types are Endangered. However, knowledge and mapping of wetland systems in this FA is poor, and due to the ephemeral nature of most of these systems, it is highly likely that wetland presence is more extensive (especially of depressional wetlands or pans) and that these wetland types should be listed as Endangered.	Direct impact on biodiversity within sensitive habitats such as rocky hills or dunes. Loss of ecologically significant plant communities. Loss of individuals of protected tree species. Transformation, loss or fragmentation of rivers and wetlands.	Development within the rocky hills should proceed with caution and specialist studies should pay specific attention to the presence of listed fauna and flora within these habitats. Where development impinges on the dune systems, specific attention needs to be paid to the evaluation of alternatives and where no alternatives exist, options for mitigating or reducing impact to dune systems should be examined. Site-scale sensitivity mapping should take note of the distribution and abundance of protected tree species. Any encroachment into an aquatic feature or its buffer should trigger a Level 1 Specialist study. Specific attention should be paid to ensuring that development impacts on dense populations of *Aloe dichotoma* are avoided as much as possible. This can be through including populations as features to avoid during sensitivity mapping, or through changes to the layout or location of development footprint areas to avoid impact to these areas.

Site	Key Impacts	Site specific description	Possible effects	Mitigation
FA 8 - Springbok	Impact on rare or restricted habitats such as quartz patches or vegetation types such as Aggeneys Gravel Vygieveld, Sand Fynbos or other restricted types. Impact on faunal species of conservation concern Loss or fragmentation of ephemeral rivers and wetlands.	There are a range of habitats and vegetation types within the FA which are considered rare or which contain an abundance of endemic species or species of conservation concern. Some vegetation types are restricted to specialised substrates which are very limited in extent and hence impacts on these habitats cannot be effectively mitigated through any avenue except avoidance. Development within these areas should be restricted as much as possible. It is not possible to map all of these fine-scale patterns and their presence must be evaluated through site visits. Less than 3% of wetland types and less than 4% of river types are Critically Endangered or Endangered. However, knowledge and mapping of wetland systems in this FA is poor, and due to the ephemeral nature of most of these systems, it is highly likely that wetland presence is more extensive (especially of depressional wetlands or pans) and that these wetland types should be listed as Endangered. There are several range-restricted fauna species present in the FA associated with sandy soils along the coastline. These are already impacted by mining activities and are vulnerable to further habitat loss and fragmentation. It is also important to note that this includes the subterranean species De Winton's Golden Mole and Grant's Golden Mole which use vibration to detect their prey and may therefore be vulnerable to noise pollution from wind turbines and any noise or vibrations transferred from the turbines to the soil.	Habitat loss and impact on sensitive vegetation and habitat types. Loss of species of conservation concern from development footprints. Reduced ability to meet conservation targets for unprotected vegetation types. Transformation, loss or fragmentation of rivers and wetlands. Habitat fragmentation and loss of red-listed fauna associated with the coastline.	Specific attention must be paid to the presence sensitive habitat types and plant species of conservation concern within the development footprint. These can only be effectively evaluated through site visits during the appropriate season. Any encroachment into an aquatic feature or its buffer should trigger a Level 1 Specialist study. Specialist studies for development along the coastline should take specific cognisance of the presence of fauna of conservation concern in these areas and the potential impact of development on habitat fragmentation for such species.

7.3 General comments

Site	Overall Suitability	Sensitivity Map Integrity	Comment
FA 1 - Overberg	Intact remnants are invariably very highly sensitive but constitute a small proportion of the FA. Development potential within transformed areas that are outside of aquatic features and their buffers, which constitute the larger proportion of this Focus Area, is very high. Development must avoid the high number of listed wetland and river types.	The terrestrial sensitivity mapping for this focus area is based principally on a fine-scale land cover and detailed vegetation maps. The critical biodiversity areas are defensible and largely represent tracts of remaining intact natural habitat. The extensive low sensitivity areas are situated in agricultural landscapes with limited biodiversity value. The map is therefore considered among the most reliable of those in the study and it is unlikely that any additional information would materially affect the results.	This Focus Area consists of highly contrasting sensitivity. Although development within intact vegetation is highly undesirable, such areas represent a small proportion of the landscape. The majority of the Focus Area consists of transformed areas with a high development potential.
FA 2 – Komsberg	Overall, development potential of this Focus Area should be considered to be low. It has exceptional levels of plant species richness and abundance and has been very poorly investigated to date. Development within this FA is highly likely to generate a suite of ecological impacts including direct impacts on biodiversity, erosion, alien plant invasion and habitat fragmentation.	The existing broad-scale vegetation, aquatic and critical biodiversity areas maps for the FA are not considered highly reliable as large parts of the FA have not been well investigated in the past and the existing biodiversity information for the area is very patchy. As a result, expert input and in-project experience were used to derive a map of areas considered important within the FA, which was used in conjunction with the existing information to derive the final sensitivity map for the FA. The map is considered to be reasonably reliable in capturing known areas of high sensitivity, but as large parts of the FA have not been well investigated in the past, there may be additional areas of higher sensitivity present which have not yet been documented.	There are few areas within this Focus Area which can be considered highly suitable for development. The areas on the escarpment are within an area of high species richness and endemism while large parts of the FA are very steep and mountainous where the risk of erosion and other secondary impacts such as sedimentation of receiving freshwater ecosystems is high. There are already a relatively large number of approved wind farm developments in this FA and cumulative impacts will increasingly become a significant concern.
FA 3 - Cookhouse	Development potential of this Focus Area is moderate to low. Although there are some extensive areas where the potential for impact is fairly low, there are also some mountainous areas present which have very high biodiversity and which are largely unsuitable for development.	This focus area is reasonably well mapped from a terrestrial biodiversity point of view and with additional expert input, the sensitivity map is considered fairly reliable. However, the wetlands have been poorly mapped. It is thus likely that additional aquatic feature information may alter the sensitivity map presented here. However, from a terrestrial point of view, there are no areas present in the FA that are likely to be considered highly sensitive, which have not already been captured.	There are extensive parts of this FA which are characterised by exceptional biodiversity, both in terms of species richness as well as habitat diversity. This diversity is not adequately captured by existing data sources such as the national vegetation map. Due to the topography of the FA, there are many areas with a high density of small streams and the potential for erosion and sedimentation of receiving freshwater ecosystems would be high if development could not avoid

Site	Overall Suitability	Sensitivity Map Integrity	Comment
			the dense network of drainage lines which characterise this area.
FA 4 - Stormberg	Overall, the development potential of the Stormberg Focus Area is moderate to high. There are however a number of listed fauna present and a high percentage of listed wetland types which may be impacted. Parts of this FA have not been well investigated in the past, with the result that the sensitivity of parts of the FA may have been underestimated.	Although the available biodiversity information for this area is relatively poor, the data suggests that, with the exception of the aquatic features and buffers, the overall sensitivity of the FA is likely to remain relatively low, regardless of the availability of new information. In addition, there are parts of the site which are very steep and would be considered sensitive, but have not been mapped as such in the current assessment as the threat to these areas from renewable energy is low as wind turbines cannot be placed on steep slopes. Therefore, at a broad level, the sensitivity map is considered to adequately represent the sensitivity of the FA.	Development within the more transformed parts of the FA in the east appears to be particularly promising. In addition, overgrazing, hunting and other disturbance sources within the communal rangelands of the FA are likely to have had a substantive impact on faunal diversity and development within such areas is likely to generate significantly less impact than development within better condition sites.
FA 5 – Kimberley	Overall, this appears to be a highly favourable area for renewable energy development. Development must avoid the high percentage of listed river types.	The sensitivity map for this FA is considered highly reliable. Although there may be locally sensitive features present, which have not been mapped here, the broad-scale sensitivity map is highly reliable as the ecological patterns within the FA are generally very clear-cut. To the east, there are sensitive vegetation types which should be avoided, but there are extensive transformed areas within the same area that represent low sensitivity areas favourable for development. Within the remainder of the FA, there are some pans, rocky ridges, Camel Thorn Forests and drainage lines which are locally sensitive features, but the majority of the remaining areas are likely to prove suitable for development.	This focus area is fairly homogenous and most plant species are widely distributed Savannah species, with the result that local impacts on plant species are not likely to be of broader significance. There may be some features present which are considered locally sensitive such as the rocky hills, *Acacia erioloba* forests and pans, but these do not occupy a significant proportion of the FA. Ill-defined drainage networks characterise this area and therefore it is unlikely that any development footprint could completely avoid many of the minor drainage lines. It is therefore imperative that stormwater management be considered for development to minimise water quality and quantity impacts.
FA 6 - Vryburg	Although there are several listed vegetation types within this FA, there is also a large extent of potentially suitable areas for development, within the transformed areas, as well as within the less sensitive vegetation types. The vegetation types in the east and in the west are listed but the vegetation in the central part of the	Due to the presence of large amounts of transformation within the FA, the sensitivity map for these areas is generally considered highly reliable. The FA is however located on a large drainage basin which forms the head of the Droë Harts River. Allied to the low slope of large parts of the FA, this has resulted in the development of expansive drainage networks characterised by the presence of large numbers of pans, especially in the east of the FA. Many of the drainage areas as well as the pans have not been	This is an area of contrasting development potential with the presence of several listed vegetation types as well as an extensive area of transformed habitat with high development potential. Due to the flat landscape, there are a relatively large number of aquatic features such as pans and wetlands present and these would need to be identified and avoided at the site scale. Large mosaics of grassland seeps and pans were

Site	Overall Suitability	Sensitivity Map Integrity	Comment
	site is generally less sensitive and there are extensive tracts of lower sensitivity vegetation present in these areas which are in principle suitable for development. Development must avoid the high percentage of listed river types.	properly mapped and it is likely that that there are many sensitive wetlands that are as yet unmapped. Development within these areas would therefore need to proceed with caution and with the input of freshwater experts. Within the central parts of the FA, there are extensive areas with few sensitive features present that would need to be avoided.	identified from aerial imagery, particularly within the Gaap Plateau Ecoregion (Kleynhans *et al.* 2005). Also, valley bottom wetlands along the eastern margin of the site have not been mapped. The central and southern parts of the FA are likely to represent the best opportunities for development, especially within the Ghaap Plateau Vaalbosveld vegetation type.
FA 7 - Upington	Overall development potential of this Focus Area should be considered moderate to high. The presence of dune systems in the northeast of the FA is a limiting factor as is the presence of relatively extensive tracts of Lower Gariep Broken Veld associated with rocky hills to the south of the Gariep. The areas mapped as Bushmanland Arid Grassland are generally considered most suitable for development as they contain few species of conservation concern or other impediments to development.	From a terrestrial point of view, the sensitivity map for this FA is considered highly reliable as the vegetation patterns in this FA are relatively consistent and well understood. Apart from the area along the Gariep, transformation has had a negligible impact on this FA to date. Although there are extensive areas mapped as high sensitivity, this is precautionary across large parts of the FA especially within the dune systems and the presence and sensitivity of features present needs to be evaluated by experts on-site. Probably the only significant feature which may not have been well mapped are some of the *Aloe dichotoma* forests prevalent to the east of the R27 between Keimoes and Kenhardt. There are also some areas towards the eastern margin of the FA where there may be high densities of *Boscia albitrunca*, which is a protected tree species. Wetlands have been poorly mapped in this FA, and thus may add significantly to the very high sensitivity areas.	Within the Focus Area, there is a fairly large extent of dune systems and rocky hills which are considered of high potential sensitivity, but with avoidance, the remaining areas are largely suitable for development with little potential for significant impact on biodiversity. The presence of sensitive features as listed above should be evaluated at the site scale. Numerous ephemeral wetlands and streams are scattered throughout the Focus Area, many of which are not mapped, and these must be avoided. These systems are particularly sensitive to changes in hydrology. It is recommended that aerial photography or SPOT imagery be consulted for any applications within this area.
FA 8 - Springbok	The development potential of this Focus Area is very mixed. Those parts of the FA which fall within the Succulent Karoo Biome should all be considered potentially sensitive as the abundance of rare, endemic and specialised species in this area is very high. There are however fairly extensive areas present to the east which are potentially suitable for development. At a broad level, those areas which fall with the	This area is generally fairly well known and the availability of reliable vegetation information is considered relatively high. As a result, the sensitivity map is considered highly reliable at the appropriate mapping scale., from a terrestrial point of view However, especially within the west of the FA, terrestrial biodiversity is consistently high and at a site scale, there is always the possibility that sensitive features are present. Therefore, specialist input is considered a prerequisite for development in this FA. With the exception of the inselbergs and quartz fields, the eastern portion of the FA represents the generally least sensitive part of the FA where the risk of encountering sensitive features is largely	This focus area lies partly within a recognised global biodiversity hotspot and renewable energy development within the Succulent Karoo section of the FA needs to take cognisance of this constraint and place development within this context. Due to the high biodiversity within the western part of the FA, there are relatively large extents present in this area which are considered unfavourable for development. Wind energy development pressure on the coastal plain is likely to be high and cumulative impacts on these ecosystems will need to be carefully considered. Although there are some sensitive features present in the eastern half of the

Site	Overall Suitability	Sensitivity Map Integrity	Comment
	Bushmanland Arid Grassland vegetation type are singled out as being generally lowest sensitivity and most favourable for development.	very low. Wetlands have been poorly mapped in this FA, and thus may add significantly to the very high sensitivity areas.	FA, these are relatively well defined and of limited extent with the result that these areas represent the best opportunities for development with the least likely biodiversity constraints. Numerous ephemeral wetlands and streams are scattered throughout the Focus Area, many of which are not mapped, and these should be avoided. These systems are particularly sensitive to changes in hydrology. It is recommended that aerial photography or SPOT imagery be consulted for any applications within this area.

8 CONCLUSIONS AND FURTHER RECOMMENDATIONS

In terms of meeting the goals of the SEA, this study has produced three primary products which will significantly contribute to the streamlining of development within the REDZ:

- Firstly and perhaps most importantly the absolute sensitivity maps produced here will enable developers to adequately assess the risks of development within the different parts of the REDZ. As such, this will significantly contribute to streamlining the development process because developers can choose sites which do not have any known obstacles to development. Within such areas, the costs of the ecological assessment will be lower and it is less likely that significant issues or appeals will hold up the approval process. In addition, the underlying features which are most important in causing the ecological sensitivity of a particular area can be interrogated and related to the nature of the development to further assess development risk. Development within higher sensitivity areas is not precluded, but the requirements in terms of specialist studies are higher and it is likely that more costly mitigation and avoidance measures would need to be implemented.
- Secondly, the three tiers of specialist assessment associated with the different sensitivity categories makes the requirements for specialist studies within the different areas explicit and are more efficient than the current system because the level of detail required is matched to the sensitivity of the affected area. In addition, the sensitivity maps identify the reasons for the underlying sensitivity of an area and so the issues that need to be evaluated within the specialist study are elucidated and the studies themselves are thereby streamlined as it is not necessary to include extraneous detail.
- Thirdly, the SEA does not exonerate developers from reducing their impacts on the environment to an acceptable level and the specific recommendations highlight those issues which need to addressed within each FA by the specialist studies to ensure that the impacts associated with development can be properly mitigated and avoided.

A potential development obstacle that has not been dealt with in the SEA are provincial and national permitting requirements. These can represent major obstacles to development and it can sometimes take up to a year or more to obtain vegetation clearing permits, permits to destroy protected tree species, or a WULA or GA for water use. For vegetation, the current process is very inefficient because DEA requires that bids under the REIPP bid process have already obtained permits or a letter from the relevant authorities stating that they will receive permits. However, the various authorities are very reluctant to issue such letters and obtaining permits is also costly for developers as they must pay for a walk-down of the development footprint even though the development has not been selected as a preferred bidder and may never be built.

This issue can only be resolved by the DEA and the relevant permitting authorities through the development of a more integrated authorisation process and while this is outside of the scope of this study, this issue is highlighted as a significant potential constraint to the effective implementation of this SEA.

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10 APPENDIX 1. SPECIES RICHNESS AND CONSERVATION STATUS SUMMARIES PER FOCUS AREA

Table A1. Number of plant species per focus area with threat status.

Status	Overberg	Komsberg	Springbok	Cookhouse	Stormberg	Kimberley	Upington	Vryburg
LC	3521	2331	1716	2396	1992	1014	774	763
DDT	122	55	44	23	18	6	5	3
DDD	31	23	15	7	5	1	3	0
Declining	20	4	3	17	13	3	4	5
Rare	154	97	81	21	12	1	1	0
Critically Rare	5	3	4	2	2	0	0	0
NT	129	32	19	19	5	4	5	3
Thr*	18	6	8	1	0	0	0	0
VU	336	73	50	33	9	0	3	2
EN	245	24	15	15	3	1	0	0
CR	80	8	2	6	1	0	0	0
Grand Total	**4661**	**2656**	**1957**	**2540**	**2060**	**1031**	**795**	**776**

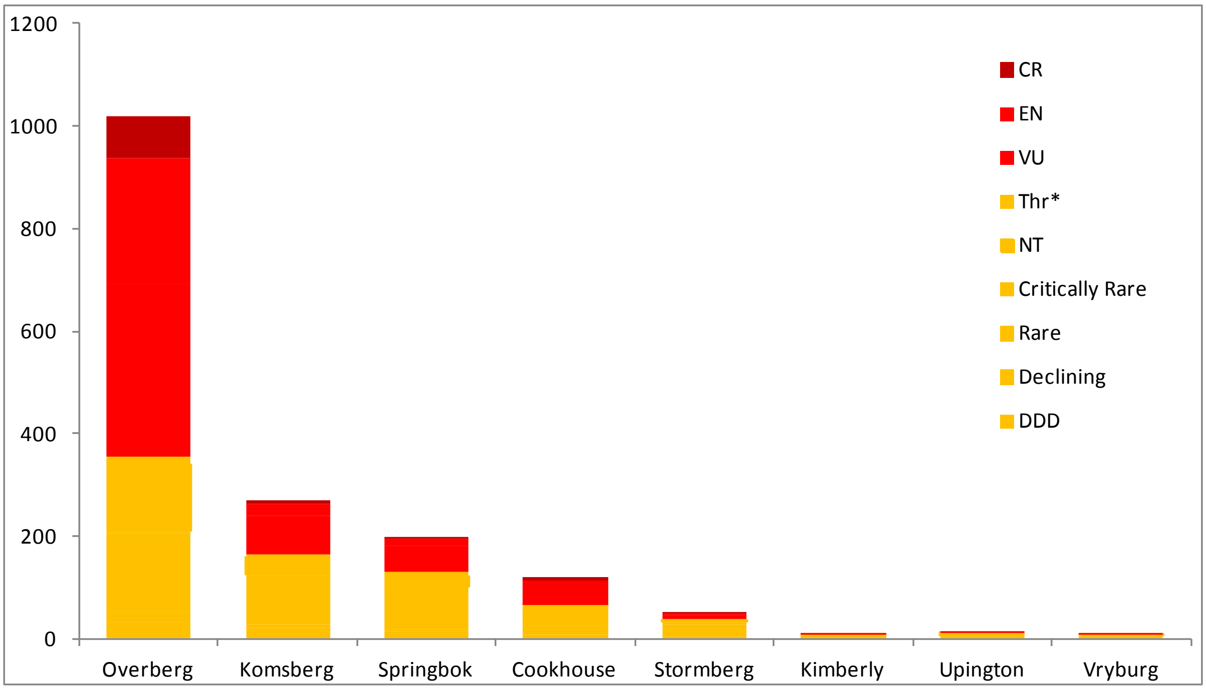

Figure 1. Number of threatened plant species per focus area

Table A2. Number of threatened animals species (per taxon)

Mammals	Overberg	Komsberg	Springbok	Cookhouse	Stormberg	Kimberley	Upington	Vryburg
Critically Endangered	0	0	1	0	0	0	0	0
Endangered	0	0	0	1	2	0	0	0
Vulnerable	2	0	1	3	3	1	1	1
Near Threatened	2	1	4	5	4	4	3	2
Data Deficient	6	7	3	7	13	0	5	4
Least Concern	47	58	33	58	64	42	44	40
Not Evaluated	0	0	0	0	0	0	0	0
Not Listed	0	0	0	0	0	0	0	0
Total	**57**	**66**	**42**	**74**	**86**	**47**	**53**	**47**
Reptiles	Overberg	Komsberg	Springbok	Cookhouse	Stormberg	Kimberley	Upington	Vryburg
Critically Endangered	0	0	0	0	0	0	0	0
Endangered	0	0	0	0	0	0	0	0
Vulnerable	2	0	0	0	0	0	0	0
Near Threatened	1	1	2	3	1	0	0	0
Data Deficient	0	0	0	0	0	0	0	0
Least Concern	51	79	73	64	57	54	65	49
Not Evaluated	0	0	0	0	0	0	0	0
Not Listed	1	5	10	3	5	2	4	1
Total	**55**	**85**	**85**	**70**	**63**	**56**	**69**	**50**
Amphibians	Overberg	Komsberg	Springbok	Cookhouse	Stormberg	Kimberley	Upington	Vryburg
Critically Endangered	1	0	0	0	0	0	0	0
Endangered	2	0	0	0	0	0	0	0
Vulnerable	1	0	2	0	0	0	0	0
Near Threatened	2	0	0	1	1	1	0	1
Data Deficient	1	1	0	0	0	0	0	0
Least Concern	21	11	7	20	18	14	12	14
Not Evaluated	0	0	0	0	0	0	0	0
Not Listed	0	0	0	0	0	0	0	0
Total	**28**	**12**	**9**	**21**	**19**	**15**	**12**	**15**
Butterflies	Overberg	Komsberg	Springbok	Cookhouse	Stormberg	Kimberley	Upington	Vryburg
Critically Endangered	1	0	0	0	0	0	0	0
Endangered	1	0	0	0	0	0	0	0
Vulnerable	1	0	2	0	2	0	1	0
Near Threatened	2	0	0	0	0	0	0	0
Data Deficient	1	1	0	1	2	0	0	0
Least Concern	119	130	73	190	175	90	68	40
Not Evaluated	0	0	1	0	0	0	1	1
Not Listed	6	2	2	1	3	3	6	1
Total	**131**	**133**	**78**	**192**	**182**	**93**	**76**	**42**

11 APPENDIX 2: EXTENT IN HECTARES OF WETLAND TYPES AND WETLAND CONDITION IN EACH FOCUS AREA.

		Condition			
OVERBERG		High	Moderate	Low	Totals
Wetland vegetation group	Wetland type (level 4)				
East Coast Shale Renosterveld	*Channelled valley-bottom wetland*	0.25	4534.79	5042.20	9577.24
	Depression		1.29	499.27	500.57
	Flat		828.89	1019.80	1848.69
	Floodplain wetland		5119.46	1758.27	6877.73
	Seep	8.68	2727.83	2531.15	5267.66
	Unchannelled valley-bottom wetland	0.53	4.17	31.94	36.64
East Coast Silcrete Renosterveld	*Channelled valley-bottom wetland*			0.07	0.07
	Depression			48.25	48.25
	Flat			10.37	10.37
	Seep			0.53	0.53
South Coast Sand Fynbos	*Channelled valley-bottom wetland*		21.81		21.81
	Depression		2.70	13.49	16.19
	Flat		13.96		13.96
	Unchannelled valley-bottom wetland			44.16	44.16
Southern Silcrete Fynbos	*Channelled valley-bottom wetland*		14.10		14.10
	Flat	4.67	0.86	0.56	6.09
	Seep	322.56			322.56
Southwest Ferricrete Fynbos	*Channelled valley-bottom wetland*		756.53	95.27	851.80
	Depression		159.46		159.46
	Flat		246.39	19.26	265.65
	Floodplain wetland		3807.96		3807.96
	Seep		761.78	84.35	846.13
	Unchannelled valley-bottom wetland		2.23	0.90	3.13
Southwest Sandstone Fynbos	*Channelled valley-bottom wetland*	3.75	520.10	199.99	723.85
	Flat	39.71	111.95	2.90	154.56
	Seep	13.95	340.44	28.75	383.15
	Unchannelled valley-bottom wetland		0.09		0.09
Southwest Shale Fynbos	*Channelled valley-bottom wetland*			0.01	0.01
	Seep	14.82	45.67		60.50
Totals		**408.93**	**20022.47**	**11431.49**	**31862.89**

		Condition			
KOMSBERG		High	Moderate	Low	Totals
Wetland vegetation group	Wetland type (level 4)				
Karoo Shale Renosterveld	*Channelled valley bottom wetland*	172.10	56.30	11.73	240.12
	Depression	155.33	73.31		228.64
	Flat	8.21	4.31	0.98	13.50
	Seep	73.32	2.98		76.30
	Unchannelled valley-bottom wetland	5.37	23.43	2.48	31.28
Lower Nama Karoo	*Depression*	0.95			0.95
	Unchannelled valley-bottom wetland	0.24			0.24
Rainshadow Valley Karoo (Skv)	*Channelled valley bottom wetland*	231.53	34.65	28.05	294.24
	Depression	2.80	22.46	2.39	27.65
	Flat		1.49		1.49
	Unchannelled valley-bottom wetland	3.90	5.23	2.76	11.88
Trans-Escarpment Succulent Karoo (Skt)	*Channelled valley bottom wetland*	537.60			537.60
	Depression	15.49			15.49
	Seep		6.47		6.47
	Unchannelled valley-bottom wetland	2.88			2.88
Western Fynbos-Renosterveld Shale Renosterveld	*Channelled valley bottom wetland*	10.19	3.10	1.17	14.46
	Floodplain wetland			19.65	19.65
	Seep		2.00		2.00
	Unchannelled valley-bottom wetland		1.44		1.44
Totals		**1219.91**	**237.17**	**69.21**	**1526.29**

		Condition			
COOKHOUSE		High	Moderate	Low	Totals
Wetland vegetation group	Wetland type (level 4)				
Albany Thicket Valley	*Channelled valley-bottom wetland*		0.98		0.98
	Depression	9.79			9.79
	Unchannelled valley bottom wetland		39.10		39.10
Eastern Fynbos-Renosterveld Quartzite Fynbos	*Depression*	1.08			1.08
	Flat	0.65			0.65
Lower Nama Karoo	*Channelled valley-bottom wetland*		2.08	35.95	38.03
	Depression	5.33			5.33
Sub-Escarpment Grassland Group 9	*Channelled valley-bottom wetland*			0.09	0.09
	Depression	26.31			26.31
	Flat	1.59			1.59
	Seep			1.40	1.40
	Unchannelled valley-bottom wetland			2.48	2.48
Sub-Escarpment Savannah	*Depression*	11.39			11.39
	Unchannelled valley-bottom wetland			0.29	0.29
Totals		**56.14**	**42.15**	**40.21**	**138.50**

		Condition			
STORMBERG		**High**	**Moderate**	**Low**	**Totals**
Wetland vegetation group	**Wetland type (level 4)**				
Drakensberg Grassland Group 2	*Channelled valley bottom wetland*	169.33			169.33
	Depression	42.50	0.48	15.63	58.60
	Seep	3.17	3.77		6.93
	Unchannelled valley bottom wetland	7.74			7.74
Drakensberg Grassland Group 3	*Channelled valley bottom wetland*	28.23			28.23
Dry Highveld Grassland Group 1	*Channelled valley bottom wetland*	10.02	7.59		17.60
	Seep	6.14	1.26		7.40
	Unchannelled valley bottom wetland	18.34			18.34
Sub-Escarpment Grassland Group 5	*Channelled valley bottom wetland*		46.77		46.77
	Depression	5.39	7.49	1.07	13.95
	Flat	2.02	3.43		5.45
	Seep	7.35	3.82		11.17
Sub-Escarpment Grassland Group 7	*Channelled valley bottom wetland*	55.39	41.43	44.30	141.11
	Depression	8.08	89.68	39.08	136.84
	Flat	6.04		3.27	9.31
	Seep	55.50	8.66	35.54	99.69
	Unchannelled valley bottom wetland	22.34	61.55	8.91	92.79
Sub-Escarpment Grassland Group 8	*Channelled valley bottom wetland*	32.46	31.49	6.97	70.91
	Depression	24.68	4.83		29.52
	Flat	0.42	2.31		2.74
	Seep	1.27	4.55	33.40	39.23
	Unchannelled valley bottom wetland	25.05	7.97	0.69	33.71
Upper Nama Karoo	*Channelled valley bottom wetland*	51.99		57.66	109.66
	Depression	4.42			4.42
	Flat	4.20		11.09	15.29
	Seep	2.66			2.66
	Unchannelled valley bottom wetland	16.26		30.83	47.09
Totals		**610.98**	**327.09**	**288.42**	**1226.49**

		Condition			
KIMBERLEY		**High**	**Moderate**	**Low**	**Totals**
Wetland vegetation group	**Wetland type (level 4)**				
Dry Highveld Grassland Group 3	*Channelled valley-bottom wetland*	115.91	20.62		136.53
	Depression	21609.44	2195.18	1893.39	25698.01
	Flat	43.03	58.47	2.57	104.06
	Floodplain wetland			0.03	0.03
	Seep	91.65	10.00	25.72	127.38
	Unchannelled valley-bottom wetland	497.12	56.58	7.46	561.16
Eastern Kalahari Bushveld Group 3	*Channelled valley-bottom wetland*	455.62	452.34	0.02	907.98
	Depression	6577.55	644.53	789.17	8011.25
	Flat	261.16	573.09	18.16	852.40
	Floodplain wetland		4.53		4.53

	Seep	401.29	6.97	5.65	413.91
	Unchannelled valley-bottom wetland	520.15	289.38	23.18	832.71
Eastern Kalahari Bushveld Group 5	*Channelled valley-bottom wetland*	81.28			81.28
	Depression	83.68	6.03		89.71
	Seep	192.86		6.03	198.88
	Unchannelled valley-bottom wetland	139.01	19.33		158.34
Upper Nama Karoo	*Channelled valley-bottom wetland*	1648.34			1648.34
	Depression	1371.20	11.96		1383.16
	Flat	13.53			13.53
	Seep	4.83			4.83
	Unchannelled valley-bottom wetland	134.45	5.16	0.01	139.62
Totals		**34242.09**	**4354.17**	**2771.38**	**41367.65**

		Condition			
VRYBURG		**High**	**Moderate**	**Low**	**Totals**
Wetland vegetation group	**Wetland type (level 4)**				
Dry Highveld Grassland Group 5	*Depression*	88.61	130.16	75.07	293.84
	Flat	1.09	19.22	27.08	47.40
	Seep	23.85	17.92	27.50	69.27
	Unchannelled valley-bottom wetland	7.79	3909.28		3917.07
Eastern Kalahari Bushveld Group 1	*Channelled valley-bottom wetland*		42.19	32.66	74.86
	Depression	268.86	40.63	162.07	471.56
	Flat	70.79	38.01	29.64	138.45
	Seep	88.63	226.15	75.24	390.02
	Unchannelled valley-bottom wetland	47.73	586.02	20.30	654.05
Eastern Kalahari Bushveld Group 2	*Channelled valley-bottom wetland*	18.98	18.34	4.08	41.40
	Depression	942.35	558.95	444.41	1945.71
	Flat	287.29	329.06	214.02	830.37
	Seep	384.38	333.77	286.78	1004.93
	Unchannelled valley-bottom wetland	309.27	196.25	44.90	550.42
Eastern Kalahari Bushveld Group 3	*Seep*	1.98			1.98
Eastern Kalahari Bushveld Group 5	*Channelled valley-bottom wetland*	2.83	3.22	0.00	6.05
	Depression	875.28	79.88	36.35	991.52
	Flat	24779.50	31.16	12.58	24823.24
	Seep	258.55	3.81		262.36
	Unchannelled valley-bottom wetland	106.48	53.59	1.35	161.43
Totals		**28564.25**	**6617.64**	**1494.04**	**36675.93**

		Condition			
UPINGTON		**High**	**Moderate**	**Low**	**Totals**
Wetland vegetation group	**Wetland type (level 4)**				
Eastern Kalahari Bushveld Group 6	*Depression*	66.30			66.30
Kalahari Duneveld	*Channelled valley-bottom wetland*	32.99		15.74	48.73
	Depression	104.62		3.59	108.20
	Flat	34.82			34.82
	Seep	16.14		2.38	18.53
	Unchannelled valley-bottom wetland	12.37	20.43		32.80
Nama Karoo Bushmanland	*Channelled valley-bottom wetland*	1299.14	603.95	11.68	1914.76
	Depression	986.29	54.23	2.20	1042.72
	Flat	350.25	1.04	3.10	354.39
	Seep	1800.28	3.30		1803.58
	Unchannelled valley-bottom wetland	773.44	329.02	29.99	1132.44
Totals		**5476.64**	**1011.96**	**68.67**	**6557.27**

		Condition			
SPRINGBOK		**High**	**Moderate**	**Low**	**Totals**
Wetland vegetation group	**Wetland type (level 4)**				
Estuarine	*Estuary*			93.09	93.09
Nama Karoo Bushmanland	*Channelled valley-bottom wetland*	54.21			54.21
	Depression	480.50	9.96		490.46
	Flat	3.43			3.43
	Seep	4.74			4.74
	Unchannelled valley-bottom wetland	6.15			6.15
Namaqualand Hardeveld (Skn)	*Channelled valley-bottom wetland*	449.95			449.95
	Depression		52.71		52.71
	Flat	3.47	15.93	1.22	20.62
	Seep	4.28	2.67	2.28	9.22
	Unchannelled valley-bottom wetland	6.84	11.02		17.86
Namaqualand Sandveld (Sks)	*Channelled valley-bottom wetland*	135.42	2931.17		3066.59
	Depression	373.62	314.73		688.36
	Estuary		66.73		66.73
	Flat	8188.57	380.37		8568.95
	Seep	17.02	687.75		704.77
	Unchannelled valley-bottom wetland	67.92	103.17	12.32	183.41
Northwest Sand Fynbos	*Unchannelled valley-bottom wetland*	10.97			10.97
Richtersveld (Skr)	*Depression*	2.97			2.97
Totals		**9810.07**	**4576.22**	**108.91**	**14495.20**

12 APPENDIX 3: METHODS FOR MAPPING OF FRESHWATER ECOSYSTEMS, CRITERIA USED FOR THE SCORING OF BIODIVERSITY AND FUNCTIONAL VALUE OF FRESHWATER ECOSYSTEMS, AND RULES FOR THE DETERMINATION OF BUFFER WIDTHS.

Methods for mapping of freshwater ecosystems

The NFEPA wetlands and rivers layers were used as the basis for the development of maps of the freshwater ecosystems for each focus area. The FEPA rivers layer was not edited, as it is a good representation of the important river systems of South Africa. However, it was discovered that the FEPA wetlands layer was inadequate for use for this SEA due to the significant under-mapping of isolated wetlands, such as depressions, seeps and flats. Within the resource provisions of the project (see Section 2.3), the FEPA wetlands layer was thus edited as follows:

1. Polygons misidentified as natural wetlands were deleted;
2. Wetland polygons that were mapped as the same wetland system (i.e. WETUNITID is the same) but which have been split into slivers/multiple polygons (generally as a result of landform modelling), were merged;
3. Fringes around dams mapped as natural wetlands that were misidentified as wetlands were deleted, especially if wetland condition was modelled as "Z2"[8].
4. Artificial aquatic features (e.g. dams, wastewater treatment ponds) that have erroneously been mapped as natural wetlands were deleted.
5. "Valleyhead seeps" were edited to current appropriate terminology (valleyhead seeps are no longer a wetland type, as determined by the National Classification System for Wetlands (Ollis *et al.*, 2013)).
6. Azonal vegetation types mapped in the National Vegetation Map (Mucina and Rutherford, 2006) were added to the wetlands map. These included the following azonal types in the following Focus Areas:
    a. Cookhouse: Cape Inland Salt Pans; Southern Karoo Riviere;
    b. Kimberley: Highveld Salt Pans; Southern Kalahari Salt Pans;
    c. Komsberg: Bushmandland Vloere;
    d. Overberg: Cap Inland Salt Pans; Cape Lowland Freshwater Wetlands;
    e. Springbok: Arid Estuarine Salt Marsh; Bushmanland Vloere, Namaqualand Salt Pans, Namaqualand Riviere;
    f. Stormberg: None;
    g. Upington: Bushmanland Vloere, Southern Kalahari Salt Pans;
    h. Vryburg: Southern Kalahari Salt Pans.
7. "River Areas" mapped by the Department of Land Affairs' Chief Directorate: Surveys and Mapping (DLA-CDSM), were added to the wetlands map, where relevant.

The NFEPA wetland typing (Level 4 – National Classification System for Wetlands (Ollis *et al.,* 2013)) and condition was edited for a subset of wetlands within each FA, within the resource constraints of this project. NFEPA wetland condition was generally found to be accurate across all focus areas, but typing was approximately less than 50% accurate (this was not quantified). The edited wetlands layers were reviewed by Nancy Job, independent freshwater ecologist, and further edited according to the review comments.

[8] This condition category is described in Nel *et al.* (2011) as "where the majority of the wetland is classified as "artificial".

The 1:50 000 River Lines data from DLA-CDSM was added to the absolute sensitivity map, in order to represent all streams and rivers. These rivers were not scored or buffered.

Criteria for scoring biodiversity and functional value

The criteria used for scoring biodiversity and functional value are provided in Table 12.1 and Table 12.2. The data were extracted unedited from the FEPA Wetlands and Rivers maps. The score assigned to each wetland and river reach was categorised as high, moderate or low, depending on the maximum score reached **within each focus area**, and not across all focus areas. Thus, each focus area contains wetlands in all three categories.

Table 12.1 Criteria used for scoring biodiversity and functional value of wetlands, using data from the NFEPA project of Nel *et al.* (2011).

Criteria	Mapped unit	Scores:				Maximum score possible for criterion
		3	2	1	0	
Biodiversity value						
Wetland condition	Polygon	AB (or High)	C (or Medium)	DEF (or Low); Z1		3
Threatened fish species – riverine[9] wetlands within sub-catchments, regardless of condition	Sub-catchments	Status = 2	Status = 1		Status = 0	3
Threatened frog species - wetlands within 500 m of record, regardless of condition	Points	Yes	No	No	No	3
Threatened water-bird species - wetlands within 500 m of record, regardless of condition	Points	Yes	No	No	No	3
Crane species - wetland lies in sub-catchment, regardless of condition	Sub-catchments	Yes	No	No	No	3
Important Bird Areas – wetlands within polygon	Polygons	-	Yes	No	No	2
River FEPA - majority of wetland lies in sub-catchment, regardless of condition	Sub-catchments	River FEPA	Fish Support Area or Fish Corridor	Phase 2 FEPA or Upstream Management Area	None	3
Expert identified wetlands	Polygons	Code = 2 or 3[10]	No	No	No	3
Functional value						
Strategic water source areas[11]	Polygon	Code = 3	Code = 2	Code = 1		3
High groundwater recharge – wetlands located within high recharge sub-catchments	Sub-catchments	Ratio [12]>500	Ratio = 300 - 500	Ratio = 101 - 300	Ratio ≤ 100	3

[9] Floodplain and valley bottom wetlands.
[10] These wetlands were identified as being important by experts, either with (code = 2) or without (code = 3) documentation.
[11] This map uses the Water Resources of South Africa data (WR2005) for Mean Annual Runoff at a quaternary catchment scale, which was then disaggregated to a 1 x 1 minute grid resolution using published rainfall-runoff relationships for South Africa.
[12] Ratio of 100 means recharge within sub-catchment is the same as for the primary catchment, so ratio of 500 means recharge is 5 times higher than for the primary catchment, so disproportionately large contribution.

Table 12.2 Criteria used for scoring biodiversity and functional value of rivers, using data from the NFEPA project of Nel *et al.* (2011).

Criteria	Mapped unit	Scores:				Maximum score possible for criterion
		3	2	1	0	
Biodiversity value						
River condition	Line	AB, B	C	DEF, Z		3
Threatened fish species sanctuaries – river reach within sub-catchments, but only AB and C condition	Sub-catchments	Status = 2	Status = 1		Status = 0	3
River FEPA – river reach lies within FEPA sub-catchments	Sub-catchments	River FEPA	Fish Support Area or Fish Corridor	Phase 2 FEPA or Upstream Management Area	None	3
Important Bird Areas – river reaches within polygon	Polygons	-	Yes	No	No	2
Functional value						
Strategic water source areas[13]	Polygon	Code = 3	Code = 2	Code = 1		3
High groundwater recharge – river reach located within high recharge sub-catchments	Sub-catchments	Ratio >500	Ratio = 300 - 500	Ratio = 101 - 300	Ratio ≤ 100	3

The maximum scores obtained in each Focus Area were as follows:

Focus area	Wetlands	Rivers
Cookhouse	11	9
Kimberley	6	6
Komsberg	7	6
Overberg	18	10
Springbok	7	8
Stormberg	10	8
Upington	6	6
Vryburg	7	6

Rules used for determining buffer width for wetlands and rivers.

Buffers around each wetland and river reach were determined for each FA based on a set of buffering rules. The rules refer to the biodiversity/functional value score category (high, medium or low), wetland type (Level 4 – NCSW) or river type, and threat status (from the list of nationally threatened ecosystems (Nel & Driver, 2012)).

[13] This map uses the Water Resources of South Africa data (WR2005) for Mean Annual Runoff at a quaternary catchment scale, which was then disaggregated to a 1 x 1 minute grid resolution using published rainfall-runoff relationships for South Africa.

Table 12.3 Buffering rules for wetlands. CR = critically endangered, EN = endangered, VU = vulnerable; LT = least threatened.

Wetland type:	Threat status and Importance score category:								
	CR, EN HIGH SCORE	CR, EN MODERATE SCORE	CR, EN LOW SCORE	VU HIGH SCORE	VU MODERATE SCORE	VU LOW SCORE	LT HIGH SCORE	LT MODERATE SCORE	LT LOW SCORE
Estuaries	500	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Channelled valley bottom wetlands	200	200	200	200	100	100	200	100	100
Unchannelled valley bottom wetlands	200	200	200	200	100	100	200	100	100
Floodplain wetlands	200	200	200	200	100	100	200	100	100
Depressions	100	100	100	100	100	50	100	50	50
Flats	100	100	100	100	100	50	100	50	50
Seeps	200	200	200	200	200	100	200	100	100

NOTE: Buffer size was halved if the total size of the wetland was less than 1 hectare.

Table 12.4 Buffering rules for rivers. CR = critically endangered, EN = endangered, VU = vulnerable; LT = least threatened.

River type:	Threat status and Importance score category:								
	CR, EN HIGH SCORE	CR, EN MODERATE SCORE	CR, EN LOW SCORE	VU HIGH SCORE	VU MODERATE SCORE	VU LOW SCORE	LT HIGH SCORE	LT MODERATE SCORE	LT LOW SCORE
Free-flowing rivers	200	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Mountain	100	100	100	100	100	50	100	50	50
Upper foothill	100	100	100	100	100	50	100	50	50
Lower foothill	200	200	200	200	200	50	100	50	50
Lowland river	200	200	200	200	200	100	200	100	100

NOTE: Buffer size was augmented by 20 m for all ephemeral systems.

13 APPENDIX 4: SUMMARY OF VEGETATION TYPE PER FOCUS AREA, INCLUDING LISTED THREATENED ECOSYSTEM STATUS, "REGIONAL ENDEMISM".

Overberg	FA ha Natural	FA ha Transformed	FA ha Total	FA % Remaining	SA ha Natural	SA ha Transformed	SA ha Total	SA % Remaining	Proportion of national extent within FA	Regional Endemism	NEMBA	BIOME
Agulhas Limestone Fynbos	5	21	26	19%	25179	4274	29453	85%	0.1%	L END	VU	Fynbos Biome
Agulhas Sand Fynbos	1090	1116	2205	49%	9739	13323	23062	42%	9.6%	L END	EN	Fynbos Biome
Albertinia Sand Fynbos	48	1392	1439	3%	47348	23475	70823	67%	2.0%	L END	VU	Fynbos Biome
Cape Inland Salt Pans	687	400	1088	63%	7775	687	8462	92%	13.7%	L END	0	Azonal Vegetation
Cape Lowland Alluvial Vegetation	1745	5281	7027	25%	14437	21411	35848	40%	19.6%	L END	CR	Azonal Vegetation
Cape Lowland Freshwater Wetlands	369	136	505	73%	6614	581	7196	92%	7.0%	L END	0	Azonal Vegetation
Central Ruens Shale Renosterveld	6484	166551	173035	4%	18815	182361	201176	9%	86.0%	H END	CR	Fynbos Biome
Eastern Ruens Shale Renosterveld	19196	142992	162188	12%	49271	227839	277109	18%	58.5%	L END	CR	Fynbos Biome
Elim Ferricrete Fynbos	6288	20686	26974	23%	20723	45835	66558	31%	40.5%	L END	CR	Fynbos Biome
Greyton Shale Fynbos	6132	7388	13519	45%	14009	12888	26897	52%	50.3%	L END	EN	Fynbos Biome
Kogelberg Sandstone Fynbos	5	82	87	6%	78305	13220	91525	86%	0.1%	L END	CR	Fynbos Biome
North Sonderend Sandstone Fynbos	523	343	866	60%	50152	1173	51325	98%	1.7%	L END	0	Fynbos Biome
Overberg Sandstone Fynbos	37227	8493	45720	81%	103590	13355	116945	89%	39.1%	L END	CR	Fynbos Biome
Potberg Ferricrete Fynbos		41	41	0%	2672	1377	4049	66%	1.0%	L END	EN	Fynbos Biome
Ruens Silcrete Renosterveld	1712	7358	9070	19%	3787	17202	20989	18%	43.2%	L END	CR	Fynbos Biome
South Sonderend Sandstone Fynbos	420	491	911	46%	35671	2408	38079	94%	2.4%	L END	0	Fynbos Biome
Southern Afrotemperate Forest	21		21	100%	68332	11647	79979	85%	0.0%	L END	0	Forests
Swellendam Silcrete Fynbos	3173	2141	5314	60%	40020	46834	86854	46%	6.1%	L END	VU	Fynbos Biome
Western Coastal Shale Band Vegetation	1192	126	1318	90%	12871	597	13468	96%	9.8%	L END	0	Fynbos Biome
Western Ruens Shale Renosterveld	6177	68786	74963	8%	15885	103149	119034	13%	63.0%	M END	CR	Fynbos Biome
Total	**92494**	**433822**	**526316**	**18%**								

Komsberg	FA ha Natural	FA ha Transformed	FA ha Total	FA % Remaining	SA ha Natural	SA ha Transformed	SA ha Total	SA % Remaining	Proportion of national extent within FA	Regional Endemism	NEMBA	BIOME
Bushmanland Vloere	23		23	100%	458928	11766	470694	98%	0.8%	L END	0	Azonal Vegetation
Central Mountain Shale Renosterveld	121826	1460	123286	99%	123372	276	123648	100%	99.7%	VH END	0	Fynbos Biome
Gamka Karoo	133167	1456	134623	99%	2025878	6620	2032498	100%	6.6%	L END	0	Nama-Karoo Biome
Koedoesberge-Moordenaars Karoo	281482	8715	290197	97%	470479	972	471451	100%	61.6%	M END	0	Succulent Karoo Biome
Matjiesfontein Quartzite Fynbos	33684	1016	34700	97%	125180	1644	126824	99%	27.4%	L END	0	Fynbos Biome
Matjiesfontein Shale Renosterveld	38885	6148	45033	86%	187613	24979	212592	88%	21.2%	L END	0	Fynbos Biome
Roggeveld Karoo	12820		12820	100%	564754	798	565552	100%	0.0%	L END	0	Succulent Karoo Biome
Roggeveld Shale Renosterveld	69874	114	69988	100%	291370	320	291690	100%	4.4%	L END	0	Succulent Karoo Biome
Southern Karoo Riviere	956	112	1068	89%	455282	74638	529919	86%	3.6%	L END	0	Azonal Vegetation
Swartruggens Quartzite Fynbos	0	0	1	61%	162945	1673	164618	99%	0.0%	L END	0	Fynbos Biome
Swartruggens Quartzite Karoo	0	2	3	8%	55904	34	55938	100%	0.0%	L END	0	Succulent Karoo Biome
Tanqua Escarpment Shrubland	30771		30771	100%	132132	0	132132	100%	23.3%	L END	0	Succulent Karoo Biome
Tanqua Karoo	72953	9337	82290	89%	695544	3284	698828	100%	11.8%	L END	0	Succulent Karoo Biome
Tanqua Wash Riviere	50008	9755	59763	84%	207678	5331	213009	97%	28.1%	L END	0	Azonal Vegetation
Western Little Karoo	26	1	27	98%	404224	15909	420133	96%	0.0%	L END	0	Succulent Karoo Biome
Total	**846476**	**38117**	**884593**	**96%**								

Cookhouse	FA ha Natural	FA ha Transformed	FA ha Total	FA % Remaining	SA ha Natural	SA ha Transformed	SA ha Total	SA % Remaining	Proportion of national extent within FA	Regional Endemism	NEMBA	BIOME
Albany Broken Veld	123293	9016	132308	93%	155559	9230	164789	94%	80.3%	H END	0	Nama-Karoo Biome
Bedford Dry Grassland	157439	9432	166871	94%	192360	12730	205091	94%	81.4%	H END	0	Grassland Biome
Bhisho Thornveld	27282	4084	31366	87%	483404	317177	800581	60%	3.9%	L END	0	Savannah Biome
Camdebo Escarpment Thicket	17065	891	17956	95%	193410	4203	197613	98%	9.1%	L END	0	Albany Thicket Biome
Cape Inland Salt Pans	75	0	75	99%	7775	687	8462	92%	13.7%	L END	0	Azonal Vegetation
Eastern Cape Escarpment Thicket	3651	1251	4902	74%	119364	9827	129191	92%	3.8%	L END	0	Albany Thicket Biome
Eastern Lower Karoo	1148	11	1160	99%	815279	16829	832108	98%	0.1%	L END	0	Nama-Karoo Biome
Great Fish Noorsveld	28960	1346	30305	96%	61820	5571	67391	92%	45.0%	L END	0	Albany Thicket Biome
Great Fish Thicket	194530	54002	248531	78%	627750	48578	676328	93%	36.7%	L END	0	Albany Thicket Biome
Kowie Thicket	35769	9339	45109	79%	187512	37364	224876	83%	20.1%	L END	0	Albany Thicket Biome
Southern Karoo Riviere	9744	8004	17748	55%	455282	74638	529919	86%	3.6%	L END	0	Azonal Vegetation
Southern Mistbelt Forest	627	10	637	98%	94752	15259	110011	86%	2.3%	L END	0	Forests
Sundays Noorsveld	63	595	658	10%	117869	9247	127116	93%	0.5%	L END	0	Albany Thicket Biome
Sundays Thicket	2543	1446	3989	64%	469357	54204	523560	90%	0.8%	L END	0	Albany Thicket Biome
Suurberg Quartzite Fynbos	27202	980	28182	97%	86040	2504	88544	97%	31.8%	L END	0	Fynbos Biome
Suurberg Shale Fynbos	6394	429	6822	94%	49790	1708	51498	97%	13.2%	L END	0	Fynbos Biome
Total	**635784**	**100835**	**736620**	**86%**								

Stormberg	FA ha Natural	FA ha Transformed	FA ha Total	FA % Remaining	SA ha Natural	SA ha Transformed	SA ha Total	SA % Remaining	Proportion of national extent within FA	Regional Endemism	NEMBA	BIOME
Aliwal North Dry Grassland	114	61	175	65%	606375	109761	716136	85%	0.0%	L END	0	Grassland Biome
Drakensberg Foothill Moist Grassland	127216	26857	154072	83%	932522	356680	1289202	72%	12.0%	L END	0	Grassland Biome
Eastern Upper Karoo	45724	9429	55153	83%	4849390	132746	4982136	97%	1.1%	L END	0	Nama-Karoo Biome
Freshwater Lakes	29		29	100%	13638	2193	15831	86%	0.2%	L END	0	Waterbodies
Karoo Escarpment Grassland	79072	5430	84502	94%	815309	22515	837824	97%	10.1%	L END	0	Grassland Biome
Queenstown Thornveld	198941	53446	252387	79%	280100	80527	360627	78%	70.0%	M END	0	Grassland Biome
Southern Drakensberg Highland Grassland	38481	3098	41578	93%	584930	62811	647741	90%	6.4%	L END	0	Grassland Biome
Southern Mistbelt Forest	1665	228	1894	88%	94752	15259	110011	86%	2.3%	L END	0	Forests
Stormberg Plateau Grassland	27130	6711	33841	80%	250947	45489	296436	85%	11.4%	L END	0	Grassland Biome
Tarkastad Montane Shrubland	186822	6199	193021	97%	413708	10267	423975	98%	45.5%	L END	0	Grassland Biome
Tsomo Grassland	196324	191171	387495	51%	349632	264059	613691	57%	63.1%	M END	0	Grassland Biome
Total	**901519**	**302630**	**1204149**	**75%**								

Kimberley	FA ha Natural	FA ha Transformed	FA ha Total	FA % Remaining	SA ha Natural	SA ha Transformed	SA ha Total	SA % Remaining	Proportion of national extent within FA	Regional Endemism	NEMBA	BIOME
Bloemfontein Dry Grassland	247	404	651	38%	296292	195413	491705	60%	0.1%	L END	VU	Grassland Biome
Highveld Alluvial Vegetation	2097	988	3085	68%	342291	123399	465690	74%	5.8%	L END	0	Azonal Vegetation
Highveld Salt Pans	24824	1082	25906	96%	112310	3782	116091	97%	22.3%	L END	0	Azonal Vegetation
Kimberley Thornveld	372498	45765	418263	89%	1540339	410910	1951249	79%	21.6%	L END	0	Savannah Biome
Northern Upper Karoo	50025	8796	58821	85%	4042499	140413	4182912	97%	1.6%	L END	0	Nama-Karoo Biome
Schmidtsdrif Thornveld	41012	5982	46994	87%	438430	64845	503275	87%	9.3%	L END	0	Savannah Biome
Southern Kalahari Salt Pans	218	0	218	100%	86895	1373	88268	98%	1.2%	L END	0	Azonal Vegetation
Upper Gariep Alluvial Vegetation	654	1483	2137	31%	132972	45557	178529	74%	1.2%	L END	0	Azonal Vegetation
Vaalbos Rocky Shrubland	21131	1456	22587	94%	143329	1808	145137	99%	15.6%	L END	0	Savannah Biome
Vaal-Vet Sandy Grassland	61365	52205	113570	54%	801941	1472367	2274308	35%	5.0%	L END	EN	Grassland Biome
Western Free State Clay Grassland	225921	38656	264577	85%	550544	116506	667050	83%	39.7%	L END	0	Grassland Biome
Total	**799991**	**156818**	**956809**	**84%**								

Vryburg	FA ha Natural	FA ha Transformed	FA ha Total	FA % Remaining	SA ha Natural	SA ha Transformed	SA ha Total	SA % Remaining	Proportion of national extent within FA	Regional Endemism	NEMBA	BIOME
Ghaap Plateau Vaalbosveld	324370	19644	344014	94%	1513551	28871	1542422	98%	22.3%	L END	0	Savannah Biome
Highveld Alluvial Vegetation	19064	5053	24117	79%	342291	123399	465690	74%	5.8%	L END	0	Azonal Vegetation
Kimberley Thornveld	2171	658	2829	77%	1540339	410910	1951249	79%	21.6%	L END	0	Savannah Biome
Mafikeng Bushveld	86432	41900	128333	67%	968742	470166	1438908	67%	8.9%	L END	VU	Savannah Biome
Schweizer-Reneke Bushveld	64312	36472	100784	64%	115538	87189	202727	57%	49.7%	L END	VU	Savannah Biome
Southern Kalahari Salt Pans	734	3	737	100%	86895	1373	88268	98%	1.2%	L END	0	Azonal Vegetation
Stella Bushveld	194192	95901	290094	67%	209444	112310	321754	65%	90.2%	H END	0	Savannah Biome
Western Highveld Sandy Grassland	8094	21428	29522	27%	171781	686344	858126	20%	3.4%	L END	CR	Grassland Biome
Total	**699370**	**221059**	**920430**	**76%**								

Upington	FA ha Natural	FA ha Transformed	FA ha Total	FA % Remaining	SA ha Natural	SA ha Transformed	SA ha Total	SA % Remaining	Proportion of national extent within FA	Regional Endemism	NEMBA	BIOME
Bushmanland Arid Grassland	695010	3522	698532	99%	4539916	7979	4547894	100%	26.4%	L END	0	Nama-Karoo Biome
Bushmanland Vloere	3433	2	3435	100%	458928	11766	470694	98%	0.8%	L END	0	Azonal Vegetation
Gordonia Duneveld	262580	551	263131	100%	3676128	1063	3677191	100%	7.2%	L END	0	Savannah Biome
Gordonia Plains Shrubland	154		154	100%	788327	32	788359	100%	0.0%	L END	0	Savannah Biome
Kalahari Karroid Shrubland	146809	1205	148014	99%	826181	2205	828386	100%	17.9%	L END	0	Nama-Karoo Biome
Koranna-Langeberg Mountain Bushveld	12254		12254	100%	162075	20	162095	100%	7.6%	L END	0	Savannah Biome
Lower Gariep Alluvial Vegetation	20339	16553	36892	55%	46177	28979	75156	61%	49.1%	L END	0	Azonal Vegetation
Lower Gariep Broken Veld	93998	150	94148	100%	452254	1559	453813	100%	20.7%	L END	0	Nama-Karoo Biome
Northern Upper Karoo	9430		9430	100%	4042499	140413	4182912	97%	1.6%	L END	0	Nama-Karoo Biome
Olifantshoek Plains Thornveld	17249		17249	100%	847219	2439	849657	100%	2.0%	L END	0	Savannah Biome
Southern Kalahari Salt Pans	64		64	100%	86895	1373	88268	98%	1.2%	L END	0	Azonal Vegetation
Total	**1261318**	**21983**	**1283301**	**98%**								

Springbok	FA ha Natural	FA ha Transformed	FA ha Total	FA % Remaining	SA ha Natural	SA ha Transformed	SA ha Total	SA % Remaining	Pro nat extent within FA	Regional Endemism	NEMBA	BIOME
Aggeneys Gravel Vygieveld	3196		3196	100%	6224	0	6224	100%	51.4%	L END	0	Succulent Karoo Biome
Anenous Plateau Shrubland	12371		12371	100%	23429	0	23429	100%	52.8%	L END	0	Succulent Karoo Biome
Arid Estuarine Salt Marshes	151	4	154	98%	4808	859	5668	85%	2.7%	L END	0	Azonal Vegetation
Bushmanland Arid Grassland	501483		501483	100%	4539916	7979	4547894	100%	26.4%	L END	0	Nama-Karoo Biome
Bushmanland Inselberg Shrubland	45295		45295	100%	63750	0	63750	100%	71.0%	M END	0	Succulent Karoo Biome
Bushmanland Sandy Grassland	88238		88238	100%	228272	29	228300	100%	38.7%	L END	0	Nama-Karoo Biome
Bushmanland Vloere	80		80	100%	458928	11766	470694	98%	0.8%	L END	0	Azonal Vegetation
Eastern Gariep Plains Desert	32416		32416	100%	157546	254	157800	100%	20.5%	L END	0	Desert Biome
Eastern Gariep Rocky Desert	32679		32679	100%	256678	175	256853	100%	12.7%	L END	0	Desert Biome
Eenriet Plains Succulent Shrubland	5550		5550	100%	26075	0	26075	100%	21.3%	L END	0	Succulent Karoo Biome
Kosiesberg Succulent Shrubland	35		35	100%	61216	0	61216	100%	0.1%	L END	0	Succulent Karoo Biome
Namaqualand Arid Grassland	6989		6989	100%	69962	436	70398	99%	9.9%	L END	0	Succulent Karoo Biome
Namaqualand Blomveld	103588	346	103934	100%	372363	8548	380911	98%	27.3%	L END	0	Succulent Karoo Biome
Namaqualand Coastal Duneveld	52310	6195	58505	89%	90606	7740	98346	92%	59.5%	L END	0	Succulent Karoo Biome
Namaqualand Heuweltjieveld	71666	720	72386	99%	251320	2267	253587	99%	28.5%	L END	0	Succulent Karoo Biome
Namaqualand Klipkoppe Shrubland	223356	1339	224694	99%	1065363	28256	1093619	97%	20.5%	L END	0	Succulent Karoo Biome
Namaqualand Riviere	2951	6	2957	100%	71033	14433	85466	83%	3.5%	L END	0	Azonal Vegetation
Namaqualand Salt Pans	8577	0	8577	100%	9337	616	9952	94%	86.2%	H END	0	Azonal Vegetation
Namaqualand Sand Fynbos	15934		15934	100%	91644	2291	93936	98%	17.0%	L END	0	Fynbos Biome
Namaqualand Seashore Vegetation	3129	194	3323	94%	6303	451	6755	93%	49.2%	L END	0	Azonal Vegetation
Namaqualand Shale Shrubland	55802	87	55889	100%	66739	87	66826	100%	83.6%	H END	0	Succulent Karoo Biome
Namaqualand Strandveld	150155	760	150915	99%	359249	32394	391643	92%	38.5%	L END	0	Succulent Karoo Biome
Oograbies Plains Sandy Grassland	2062		2062	100%	12329	0	12329	100%	16.7%	L END	0	Succulent Karoo Biome
Platbakkies Succulent Shrubland	38474		38474	100%	97793	0	97793	100%	39.3%	L END	0	Succulent Karoo Biome
Richtersveld Coastal Duneveld	14205	945	15149	94%	39075	9255	48330	81%	18.8%	L END	0	Fynbos Biome
Richtersveld Sandy Coastal Scorpionstailveld	9108	77	9185	99%	37575	94	37669	100%	40.2%	L END	0	Succulent Karoo Biome
Riethuis-Wallekraal Quartz Vygieveld	2		2	100%	13253	0	13253	100%	69.3%	M END	0	Succulent Karoo Biome

Southern Richtersveld Inselberg Shrubland	22389		22389	100%	72138	0	72138	100%	61.2%	M END	0	Succulent Karoo Biome
Southern Richtersveld Scorpionstailveld	8302		8302	100%	36557	0	36557	100%	11.5%	L END	0	Succulent Karoo Biome
Total	**1510494**	**10671**	**1521165**	**99%**								

14 APPENDIX 5: REQUIREMENTS FOR BIODIVERSITY SPECIALIST STUDIES WITHIN THE DIFFERENT SENSITIVITY CLASSES

In this Appendix, the recommended requirements for ecological specialist studies within the different tiers of the sensitivity maps are detailed. At the highest level, these correspond to the current best-practice guidelines for specialist studies within EIAs as outlined within Brownlie (2005) and De Villiers *et al.* (2005). Subsequent levels are less onerous with the aim of minimising cost to the developer and risk to the environment. It is also important to note that it is incumbent upon the specialist, upon an initial site visit to recommend, where warranted, a higher level of study where potential impacts justify such study. These recommendations are thus considered the minimum requirements for specialist studies within each tier of sensitivity but do not preclude or limit the possibility that a higher level of detail may be required. In particular, should any aquatic features be encountered during a Level 2 or 3 Specialist Study, this will trigger a Level 1 Study, at least for the freshwater ecosystems located on the site.

<u>Level 1 Specialist Study</u>

This is the highest level of specialist study and is reserved for development exceeding 1 ha within Very High Sensitivity Areas and 5 ha within High Sensitivity Areas, or for developments encroaching into an aquatic feature and/or the buffer applied to the feature. Loss of terrestrial habitat is calculated on a cumulative basis as per the current NEMBA regulations. As such, this level of study would be triggered when 1 or more phases of a development result in a cumulative loss of more than 1 or 5 ha of habitat as may be the case or where the different elements of the development affect multiple small areas of Very High or High Sensitivity habitat which together amount to more than 1 or 5 ha as per the sensitivity level.

<u>Level 2 Specialist Study</u>

This is likely to be the most commonly required level of specialist study where developers have managed to avoid High and Very High Sensitivity areas and where the development is concentrated within natural vegetation with no known highly sensitive features. The purpose of this level of Specialist Study is to ensure that there are no locally sensitive features present that should be avoided and to ensure that there are no significant populations of species of conservation present within the development footprint, or that the development does not lie within an area that is required for important ecological processes which may be disrupted by the development. A suitably qualified freshwater specialist is required to examine aerial or satellite imagery in order to determine whether aquatic features are present. If so, a Level 1 Specialist Study is triggered, at least for the aquatic features. A suitable buffer must be applied to the aquatic feature, according to the rules in Appendix 3.

<u>Level 3 Specialist Study</u>

This is the lowest level of specialist study and would be required where neither of the higher level studies have been triggered. In most instances, this would correspond to development within transformed areas, where the risk of significant ecological impact is very low. In such cases, a desktop or screening level assessment is likely to be sufficient, with a site visit being optional and at the discretion of the specialist where it may be necessary to demonstrate or verify the low sensitivity of the affected area. A suitably qualified freshwater specialist is required to examine aerial or satellite imagery in order to determine whether aquatic features are present. If so, a Level 1 Specialist Study is triggered, at least for the aquatic features. A suitable buffer must be applied to the aquatic feature, according to the rules in Appendix 3.

<u>Level 1 Specialist Study - Minimum Requirements:</u>

1. Provide a general overview of the affected area in terms of connectivity, corridors, wetland clusters, and ecological processes and viability of the affected area.
2. In terms of biodiversity pattern, identify or describe:

2.1 Community and ecosystem level:
   a. The main vegetation types, their aerial extent and interaction with neighbouring types, soils or topography.
   b. Critical Biodiversity Areas, Ecological Support Areas, NFEPA Priority Catchments, all rivers (down to 1:50 000 scale), all wetlands and all estuaries, or NPAES Focus Areas within the site.
   c. The types of plant communities or fine-scale habitats, wetlands, rivers and estuaries that occur within and in the vicinity of the site. (This must be derived and mapped by the specialist in the field as this level of detail is not usually available) It is not adequate to reproduce the existing national vegetation map, CBA maps, NFEPA maps or similar broad-scale product.
   d. Threatened or vulnerable ecosystems (Listed Ecosystems as well as locally important habitat types which may occur below the vegetation type level).
   e. The types of faunal communities present and any faunal species, areas or habitats present which may be particularly important for fauna.

2.2 Species level
   a. Red Data Book species of fauna and flora and their distribution within the site.
   b. The viability of and estimated population size of the RDB species that are present
   c. The likelihood of other RDB species, or species of conservation concern, occurring in the vicinity (include degree of confidence).
   d. FEPA Fish Sanctuaries, and Fish Support Areas.
   e. Important Bird Areas.

2.3 Other pattern issues
   a. Any significant landscape features or rare or important vegetation/faunal associations such as seasonal wetlands, alluvium, quartz patches or salt marshes in the vicinity.
   b. The extent of alien plant cover at the site, and whether the infestation is the result of prior soil disturbance such as ploughing or other land use.
   c. The condition of the site in terms of current or previous land uses.

3. In terms of biodiversity process, identify or describe:
   a. The key ecological "drivers" of ecosystems on the site and in the vicinity, such as fire, soils, topography, hydrology etc..
   b. Any spatial component of an ecological process that may occur at the site or in its vicinity (i.e. corridors such as rivers and river/wetland associations, upland-lowland gradients, migration routes, coastal linkages or inland-trending dunes, and vegetation boundaries such as edaphic interfaces, upland-lowland interfaces or biome boundaries).
   c. Any possible changes in key processes e.g. increased fire frequency or drainage/artificial recharge of aquatic ecosystems.
   d. The condition and functioning of rivers and wetlands (if present) in terms of: possible changes to the geomorphology, flow regime (surface and groundwater) and naturally-occurring riparian vegetation.
4. Would the site or neighbouring properties potentially contribute to meeting regional conservation targets for both biodiversity pattern and ecological processes? (In other words, is the affected area within an ecosystem that is poorly conserved and for which there are limited alternatives available for conservation in order to reach the conservation target)
5. Should development within the site take place, what are the likely constraints and opportunities for mitigation or avoidance of impacts in relation to the future land-use and management possibilities within the facility? (For example if a facility will be fenced, then this will significantly impact the ability of the development to implement measures to mitigate a decline in landscape connectivity for fauna)
6. What is the significance of the potential impact of the proposed project, alternatives and related activities - with and without mitigation - on biodiversity pattern and process (including spatial components of ecological processes) at the site, landscape and regional scales? In this regard it is especially important to consider Cumulative Impacts at the landscape and regional scales.

7. Generate, based on the detailed plant community or habitat map produced in 2c, a sensitivity map of the site at the appropriate scale illustrating the sensitive areas in relation to:
    - The area that would be impacted by the proposed development;
    - The location of vegetation, habitat and spatial components of ecological processes that should not be developed or otherwise transformed;
    - The location of all aquatic features and the buffers recommended by this SEA; and
    - Areas, including the site and surrounds that must remain intact as corridors or ecological "stepping stones" to maintain ecosystem functioning, including fires in fire-prone systems.
8. Recommend actions that should be taken to prevent or, if prevention is not feasible, to mitigate impacts and restore disturbed vegetation, aquatic features and their buffers, or ecological processes. I ndicate how preventative and remedial actions will be scheduled to ensure long-term protection, management and restoration of affected ecosystems and biodiversity.
9. Indicate limitations and assumptions, particularly in relation to seasonality and the manner in which the timing and intensity of sampling is likely to have impacted the ability to detect species of conservation concern, seasonal/ephemeral aquatic ecosystems or other significant features that may be present.
10. Indicate how the developer has taken biodiversity considerations into account in terms of changes to the layout of the facility and the extent to which these changes are likely to be effective in avoiding or mitigating the potential negative effects of the development on the sensitive receptors.
11. Any further monitoring or studies that should take place subsequent to the Specialist Study in order to address any limitations of the existing study or in order to address any issues which may require a greater level of detail than possible during the Specialist Study. This might include additional surveys to ascertain the distribution of certain plant species of conservation concern or to better evaluate the presence of fauna of particular concern such as the Riverine Rabbit.
12. All relevant legislation, permits and standards that would apply to the development should be identified. In particular, the following information must be provided by an aquatic specialist in order to meet the requirements for registration and/or authorisation of water use.

Table 14.1 List of information to be supplied by aquatic specialist for completing a WULA or GA.

PES	Describe within context of the immediate catchment and ecosystem, the historic (reference) as well as current state (PES) of the affected river reach or wetland with regards to the following characteristics: • Flow and sediment regimes • Water quality • Riparian and In stream Habitat • Morphology (physical structure) • Vegetation • Biota
EIS	Describe the ecological importance and sensitivity (EIS) of the ecosystem
Other sensitive aquatic systems	List and map any other sensitive aquatic systems in close proximity of the project site - sensitive environments include wetlands, nature reserves, protected areas, important bird areas, etc.
Impact prediction and assessment	Provide a prediction and assessment of the likely environmental and social impacts or effects associated with the water use/s and for the different project phases, and how this will affect the PES and functionality of the ecosystem for the different project phases of the project. Focus should be on: • The ecosystem and its characteristics; • Other water users; and • On the broader public and landscape. Assess the potential impacts with regard to their nature, extent, magnitude, duration, probability and significance – each impact must be described in terms of source of impact, pathway (propagation of impact) and receptor (target that experience the impact). Provide a brief description of the methodologies employed to undertake impact prediction and assessment as well as a motivation for these.
Risk assessment	Provide an assessment of the risks associated with water use/s and related activities.
Mitigation and management measures	Provide mitigation measures to prevent, reduce, remediate or compensate the pre-determined impacts; also provide emergency responses.
Changes to the ecosystem	Assess to what extent the impacts after mitigation will bring about changes in respect of the PES (and recommended ecological category, if this information is available at the stage of study) and functionality of the watercourse.
Monitoring and compliance	Provide a detailed monitoring programme and describe the auditing, compliance and reporting mechanisms to ensure execution of the mitigation measures and for informing DWA of incidents – ensure that these measures are appropriate in relation to the impacts, mitigation measures, status of the ecosystem, etc.

<u>Level 2 Specialist Study - Minimum Requirements:</u>

1. In terms of biodiversity pattern and process, identify or describe, based on a desktop-level study (satellite or aerial imagery must be used by a suitably qualified aquatic specialist for determining the presence of aquatic features):
    a. The main vegetation types, their aerial extent and interaction with neighbouring types, soils or topography.
    b. Critical Biodiversity Areas, Ecological Support Areas, NFEPA Priority Catchments, all rivers (down to 1:50 000 scale), all wetlands and all estuaries (NOTE: all natural rivers, wetlands, waterbodies or estuaries are Very High Sensitivity areas, thus triggering a Level 1 Specialist Study for the aquatic features), or NPAES Focus Areas within the site.
    c. Threatened or vulnerable ecosystems
    d. The types of faunal communities present and any faunal species, areas or habitats present which may be particularly important for fauna.

   e. Listed and threatened fauna and flora known from the area according to the available spatial databases such as the SANBI SIBIS database and the ADU's Virtual Museum. (http://sibis.sanbi.org/ and http://*vmus.**adu**.org.za/*)
2. Based on the results of a site visit and field assessment:
   a. Generate, a sensitivity map of the site at the appropriate scale illustrating the sensitive areas in relation to:
      - The area that would be impacted by the proposed development;
      - The location of vegetation, habitat and spatial components of ecological processes that are considered sensitive or should not be impacted or otherwise avoided.
   b. Identify or describe
      - Any significant landscape features or rare or important vegetation/faunal associations such as seasonal wet lands, alluvium, seeps, quartz patches or salt marshes within or near the development footprint.
      - The observed or likely presence of flora and fauna of conservation concern in or near the development footprint.
3. Recommend actions that should be taken to prevent or, if prevention is not feasible, to mitigate impacts and restore disturbed vegetation or ecological processes. Indicate how preventative and remedial actions will be scheduled to ensure long-term protection, management and restoration of affected ecosystems and biodiversity.
4. Indicate limitations and assumptions, particularly in relation to seasonality and the manner in which the timing and intensity of sampling is likely to have impacted the ability to detect species of conservation concern or other significant features that may be present.
5. Indicate how the developer has taken biodiversity considerations into account in terms of changes to the layout of the facility and the extent to which these changes are likely to be effective in avoiding or mitigating the potential negative effects of the development on the sensitive receptors.
6. Any further monitoring or studies that should take place subsequent to the Specialist Study in order to address any limitations of the existing study or in order to address any issues which may require a greater level of detail than possible during a standard Specialist Study.
7. All relevant legislation, permits and standards that would apply to the development should be identified.

Level 3 Specialist Study - Minimum Requirements:

Provide a specialist statement letter which addresses or includes the following:

1. The transformation status of the vegetation within the affected area.
2. Where there is doubt as to the status of the vegetation, (for example CBA or landcover maps may indicate that certain transformed areas are intact), photographs or other supporting evidence can be included.
3. A statement confirming the absence of rivers (down to 1:50 000 scale), wetlands and estuaries (NOTE: all natural rivers, wetlands, waterbodies or estuaries are Very High Sensitivity areas, thus triggering a Level 1 Specialist Study for the aquatic features), as determined by a suitably qualified aquatic specialist at a desktop level, using satellite or aerial imagery.
4. The likely presence of any fauna of conservation concern within the site and a statement regarding the likely impact of the development on such species.
5. The likelihood that any broad-scale ecological processes might be disrupted by the development.
6. Any limitations or provisions associated with a statement of negligible impact.
7. Whether or not any specific avoidance or mitigation measures should be implemented.

15 SPECIALIST SHORT CV

Specialist Short CV

Include a short version of your curriculum vitae in this section (max 3 pages).

SIMON TODD

Profession: Ecological Consultant (ECOSOL GIS & Simon Todd Consulting)
SACNASP registered as a Professional Natural Scientist, (Ecology) No. 400425/11.

- Specialisation: Plant & Animal Ecology
- Years of Experience: 15 Years

Skills & Primary Competencies

- Research & description of ecological patterns & processes in Nama Karoo, Succulent Karoo, Thicket, Arid Grassland, Fynbos and Savannah Ecosystems.
- Ecological Impacts of land use on biodiversity
- Vegetation surveys & degradation assessment & mapping
- Long-term vegetation monitoring
- Faunal surveys & assessment.
- GIS & remote sensing
- Conducted a large number of fauna and flora specialist assessments distributed widely across South Africa, including a large number of wind energy facilities. Projects have ranged in extent from <50 ha to more then 50 000 ha.
- Involved in all phases of wind energy development, from ecological prefeasibility studies to pre-construction walk-through.
- Widely-recognized ecology specialist. Published numerous peer-reviewed scientific publications based on various ecological studies across the country. Past chairman of the Arid Zone Ecology Forum and current executive committee member.
- Extensive experience in the field and exceptional level of technical expertise, particularly with regards to GIS capabilities which is essential with regards to producing high-quality sensitivity maps for use in the design of final project layouts.
- Strong research background which has proved invaluable when working on several ecologically sensitive and potentially controversial sites containing some of the most threatened fauna in South Africa.
- Published numerous research reports as well as two book chapters and a large number of papers in leading scientific journals dealing primarily with human impacts on the vegetation and ecology of the arid and semi-arid parts of South Africa.
- Maintain several long-term vegetation monitoring projects distributed across Namaqualand and the karoo.
- Guest lecturer at two universities and have also served as an external examiner.

Tertiary Education:

- 1992-1994 – BSc (Botany & Zoology), University of Cape Town
- 1995 – BSc Hons, Cum Laude (Zoology) University of Natal
- 1996-1997- MSc, Cum Laude (Conservation Biology) University of Cape Town

Employment History

1997 – 1999 – Research Scientist (Contract) – South African National Biodiversity Institute. 2000-2004 – Specialist Scientist (Contract) - South African National Biodiversity Institute. 2004-2007 – Senior Scientist (Contract) – Plant Conservation Unit, Department of Botany, University of Cape Town. 2007 Present – Senior Scientist (Associate) – Plant Conservation Unit, Department of Botany, University of Cape Town. 2007-Present – Independent Ecological Consultant and Sole Proprietor of Simon Todd Consulting.

ANDREW SKOWNO

Profession: Ecological Consultant (ECOSOL GIS)
SACNASP registered as a Professional Natural Scientist, (Ecology) No. 400085/13.

- Specialisation: Plant Ecology & Systematic Biodiversity Planning
- Years of Experience: 14 Years

Skills & Primary Competencies

- Professional ecologist and conservation planner with over 14 years experience in the biodiversity sector. Key performance areas include use of Geographic Information Systems (GIS) in biodiversity & ecology assessments, systematic conservation planning, protected areas management and landscape ecology.
- Extensive experience in using GIS data to produce high quality maps for wide range of applications including systematic planning reports and posters, scientific publications, popular press articles, municipal tourism reports, reserve management plans and adventure tourism destinations and events. As ecologist I have a wide range of applied research experience on topics including endangered species population viability assessments, vegetation mapping, management of fires and herbivores, and subtropical thicket restoration research.
- Land cover mapping specialist with 13 years experience in remote sensing analysis and interpretation of aerial photos and satellite imagery.
- Extensive project management, research and specialist consulting experience in applied biodiversity and ecology

Tertiary Education:

- Master of Science (Botany) 2000;
- Bachelor of Science - Honours (Botany) 1996;
- Bachelor of Science (Botany and Zoology) 1995.

Employment History
National Botanical Institute (SANBI), 2000 - Cedar Population Viability Analysis, Ecologist and GIS analyst; National Botanical Institute (SANBI), 2001-2003 Conservation Farming Project, Ecologist and GIS analyst; Wilderness Foundation, 2003-2008 Baviaanskloof Mega-Reserve Project, Ecologist and Conservation Planner; Consultant/Owner ECOSOL GIS, 2008 - Present, Ecologist and Conservation Planner.

KATE SNADDON **(Freshwater Consulting Group)**

Profession: Freshwater Ecological Consultant
SACNASP registered as a Professional Natural Scientist, (Ecology) No. 400225/06.

- Specialisation: Freshwater Ecology
- Years of Experience: 19 Years

Skills & Primary Competencies
Kate has 19 years of experience in the field of freshwater ecology (both as a researcher and consultant) and general environmental consulting. Her specialist skills lie in the areas of:

- freshwater macroinvertebrate collection and identification;
- SASS5 biomonitoring;
- wetland mapping and delineation;
- conservation planning for the aquatic environment;
- management and implementation of ecological monitoring and research programmes;
- assessment of impacts of anthropogenic interference in freshwater ecosystems, and
- urban river and wetland rehabilitation.
- Kate has worked extensively in the City of Cape Town and the Western Cape. She has published over 70 specialist freshwater ecological consultancy reports, 3 Water Research Commission reports, 2 chapters in international books, and 8 scientific papers.

Tertiary Education:

- B.Sc., Majoring in Zoology (with Distinction), University of Cape Town, 1989
- B.Sc. (Hons), Zoology (with Distinction),.University of Cape Town, 1990
- M.Sc, Zoology (with Distinction), University of Cape Town, 1998

Employment History

March 2003 – present Freshwater Ecological Consultant, The Freshwater Consulting Group, Cape Town; July 2000 - October 2002 Sustainable Business Solutions team, PricewaterhouseCoopers, London, UK; March 1995 - March2000, part-time basis Freelance ecological consultant, Cape Town ; January 1996 - January 2000Research Officer on Water Research Commission Project; February 1991 - August 1992 Research Assistant, Freshwater Research Unit, University of Cape Town.

JUSTINE EWART-SMITH **(Freshwater Consulting Group)**

Profession: Freshwater Ecological Consultant

- Specialisation: Freshwater Ecology
- Years of Experience: 18 Years

Skills & Primary Competencies

Fourteen years' experience, both nationally and internationally in various aspects of aquatic ecology, including specialist input into:Research on the ecology of periphyton, largely benthic algae in Western Cape River systems but also abroad, particularly that of the Peruvian Andes; aquatic macroinvertebrate and hydraulic biotope components of Ecological Reserve Determinations for riverine systems; Ecological input into the development of the National Water Resource Classification system for South Africa; management and development of a database for the collation of biomonitoring data on a national scale (Rivers Database); Rehabilitation of riverine systems and assessment pre- and post-construction; Biological assessment and monitoring of water quality and the ecological integrity of rivers and wetlands for Environmental Impact Assessments (EIAs) and situation assessments; Conservation of aquatic ecosystems; Development of a wetland classification system for the National Wetland Inventory; Use of Geographic Information Systems (GIS) for relevant spatial data analyses; Viability of various development options for water resources. My involvement ranges from research and specialist ecological input to overall project co-ordination and management. My regional experience includes: South Africa, Lesotho, Kenya, Peru and the United Arab Emirates

Tertiary Education:

PhD from the University of Cape Town (UCT) in Zoology (Freshwater Ecology)	2012
MSc from the University of Cape Town (UCT) in Zoology (Marine Ecology)	1998
BSc (Hons) in Zoology from UCT (with distinction).	1994
BSc UCT Zoology and Environmental & Geographical Science (with distinction)	1993

Employment History

Present : Co-director and researcher with the Freshwater Research Centre. 2009 – present: Member and Aquatic Ecosystem Consultant, Freshwater Consulting Group. 2007 - 2009 Scientific Officer in the Freshwater Research Unit, UCT researching periphyton dynamics in rivers, Member and Aquatic Ecosystem Consultant, Freshwater Consulting Group. 2002 to 2008: Member and Aquatic Ecosystem Consultant, Freshwater Consulting Group. Occasional Lecturer (community ecology of freshwater ecosystems), University of Cape Town. 1998 to 2002: Aquatic Ecosystem Consultant, Southern Waters Ecological Research and Consulting. 1994 to 1998: Researcher, Marine Biology Research Institute, UCT. 1993 to 1994:Research Assistant, Marine Biology Research Institute, UCT.

15.1 Specialist Declaration

I, ..Andrew Skowno...., as the appointed independent specialist hereby declare that I:

- act/ed as the independent specialist in this application;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct;
- do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed;
- have and will not have any vested interest in the proposed activity proceeding;
- have disclosed any material information that have or may have the potential to influence the objectivity of any report or decisions base thereon; and
- am aware that a false declaration is an offence in terms of regulation 71 of GN No. R. 543.

Signature of the specialist: ... .

Name of company: ECOSOL GIS

Professional Registration (incl number): ...Pr.Sci.Nat 400085/13...........

Date: ...29 July 2014...........

15.2 Specialist Declaration

I, ..Kate Snaddon...., as the appointed independent specialist hereby declare that I:

- act/ed as the independent specialist in this application;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct;
- do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed;
- have and will not have any vested interest in the proposed activity proceeding;
- have disclosed any material information that have or may have the potential to influence the objectivity of any report or decisions base thereon; and
- am aware that a false declaration is an offence in terms of regulation 71 of GN No. R. 543.

Signature of the specialist: ....Snaddon.

Name of company: Freshwater Consulting Group

Professional Registration (incl number): ...Pr.Sci.Nat 400225/06............

Date: ...29 July 2014............

STRATEGIC ENVIRONMENTAL ASSESSMENT FOR WIND AND SOLAR PHOTOVOLTAIC ENERGY IN SOUTH AFRICA

Appendix A5

Birds Scoping Assessment Report

Specialist name:
AVISENSE Consulting

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ABBREVIATIONS AND ACRONYMS

ADU	Animal Demography Unit, University of Cape Town
BLSA	BirdLife South Africa
CAR	Coordinated Avifaunal Roadcount (ADU Citizen Science project)
CSIR	Council for Scientific and Industrial Research
CWAC	Coordinated Waterbird Counts (ADU Citizen Science project)
DEA	Department of Environmental Affairs
DEM	Digital Elevation Model
DOE	Department of Energy
EIA	Environmental Impact Assessment
EWT	Endangered Wildlife Trust
FA	Focus Area
IBA	Important Bird Area
PV	Photovoltaic
RE	Renewable Energy
REIPPP	Renewable Energy Independent Power Procurement Program
REDZ	Renewable Energy Development Zone
SABAP	Southern African Bird Atlas Project
SEA	Strategic Environmental Assessment
WEF	Wind Energy Facility

1 INTRODUCTION

1.1 Background

The South African government has recently begun exploring the production of renewable energy (RE) by private companies as a means to rapidly grow the country's capacity to generate electricity. To this end, the national Department of Energy (DoE) has established the Renewable Energy Independent Power Producer Procurement Program (REIPPP) for processing applications to build and operate RE plants, which requires that all bidders for selection by REIPPP submit their projects for full Environmental Impact Assessment (EIA) before they can be granted an Environmental Authorisation (EA) by the Department of Environmental Affairs (DEA). DEA has since received over 500 development applications, mainly for wind and solar photovoltaic (PV) plants, and has identified inefficiencies in their EIA process which are significantly slowing the roll-out of RE projects. In order to address these inefficiencies, DEA has opted to conduct a Strategic Environmental Assessment (SEA) for wind and solar PV development in South Africa, with a view to identifying Renewable Energy Development Zones (REDZs) in which environmental impacts are relatively low and/or at least partially pre-assessed, and where there are legitimate grounds for accelerating the authorisation of development applications.

The Council for Scientific and Industrial Research (CSIR) was selected by DEA to conduct this SEA, which began with a broad-scale assessment of environmental sensitivities to RE development across the country that identified eight development Focus Areas (FAs) (Fig. 1). The second stage of the SEA involves the scoping-level assessment of RE development sensitivities within each FA, to identify those areas of lowest sensitivity, where development applications can be fast-tracked without compromising the environmental sustainability of the RE industry. *AVISENSE* Consulting was contracted by the CSIR to do the avifaunal component of this second stage of the SEA.

1.2 Birds and Wind farms

Wind farming offers a renewable means to generate much-needed electricity, but must be practiced responsibly in order to achieve environmental sustainability (Drewitt & Langston 2006, 2008, Kuvlevsky *et al.* 2007). One potential downside of populating landscapes with wind turbines is the effect that these structures have on the surrounding bird life. Documented impacts have included (i) disturbance of resident (and possibly breeding) birds by the construction of the wind farm and/or the appearance and sound of the operating plant, which may result in displacement of populations and/or depress feeding rates and breeding success at local nests, (ii) habitat loss to the construction footprint of the wind farm, and even broader scale displacement of resident populations or preferred flight-lines from turbine-occupied areas, and (iii) injury or mortality of birds flying through or resident within the development area, in collisions with turbine blades or associated power lines, or in electrocutions on live power infrastructure (Drewitt & Langston 2006, Lehman *et al.* 2007, Jenkins *et al.* 2010, 2012a).

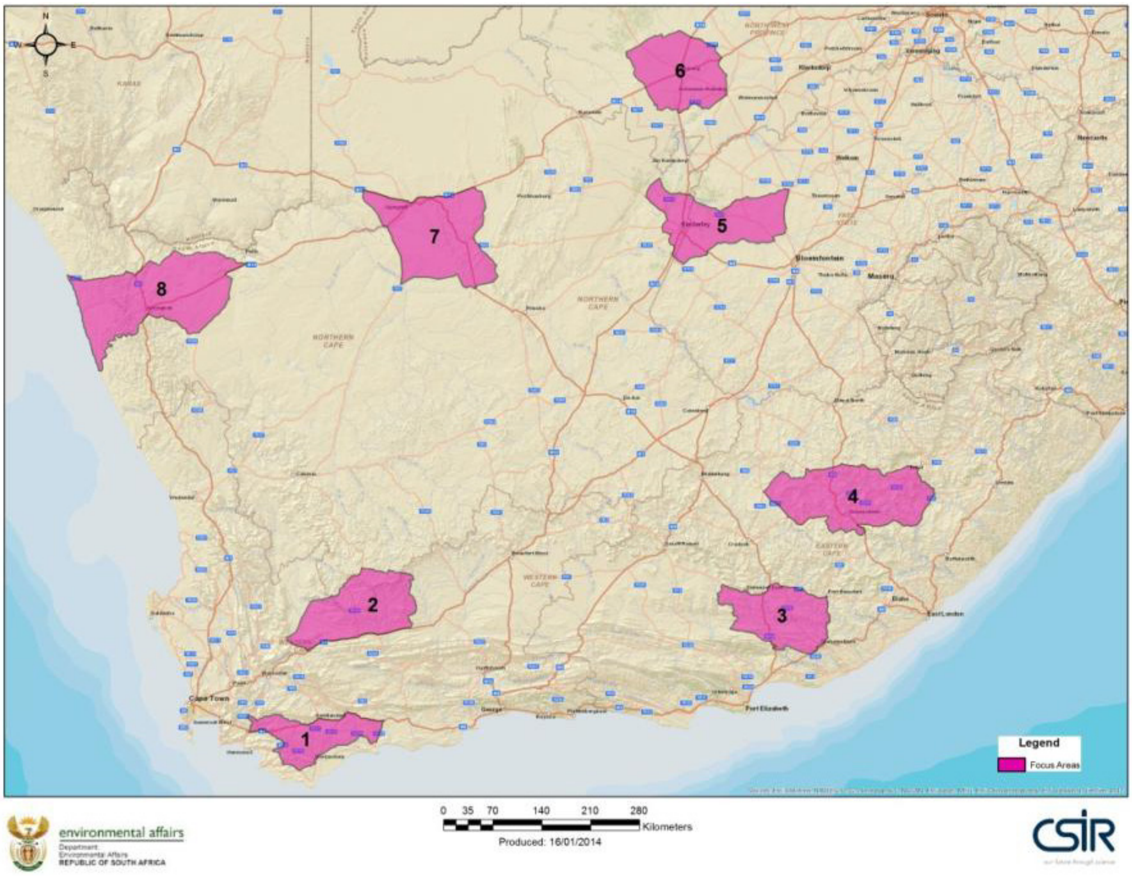

Figure 1: The eight Focus Areas (FAs) identified in the first stage of the SEA study.

While the nature and severity of wind farm impacts can be highly site- and taxon-specific, they are simultaneously very difficult to predict (Drewitt & Langston 2006, Smallwood *et al.* 2009, Ferrer *et al.* 2012). Poorly sited wind farms, or just one or two badly-placed turbines within a much bigger array, can have a significant detrimental effect on birds at the population level, and even threaten the regional, national or global conservation status of particularly impact susceptible species (Carrete *et al.* 2009). Hence, while wind energy development may offer an environmentally preferable alternative to many other sources of power generation, it is essential that the interface between a proposed wind farm and the avifauna of its receiving environment is well understood before the project goes to construction.

Predicting the impacts of wind farms on birds

Multiple factors influence the number of birds killed in collisions at wind energy facilities. These can be classified into three broad groupings: (i) avian variables, (ii) location variables, and (iii) facility-related variables. Although only one study has so far shown a direct relationship between the abundance of birds in an area and the number of collisions (Everaert 2003), it would seem logical to assume that the more birds there are flying through an array of turbines, the higher the chances of a collision occurring. The nature of the birds present in the area is also very important as some species are more vulnerable to collision with turbines than others, and feature disproportionately frequently in collision surveys (Drewitt & Langston 2006, 2008, de Lucas *et al.* 2012). Species-specific variation in behaviour, from general levels of activity to particular foraging or commuting strategies, also affect susceptibility to collision (Barrios & Rodríguez 2004, Smallwood *et al.* 2009). There may also be seasonal and temporal differences in behaviour, for example breeding males engaging in aerial displaying may be particularly at risk.

Predicting which species are most susceptible to wind farm impacts

Collision-prone birds are generally either (i) large species and/or species with high ratios of body weight to wing surface area (wing loading), which confers low manoeuvrability (e.g. cranes, bustards, vultures, waterfowl), (ii) species which fly at high speeds (raptors, gamebirds, aerial insectivores), (iii) species which are distracted in flight - predators or species with aerial displays (many raptors, aerial insectivores, some open country passerines), (iv) species which habitually fly in low light conditions, and (v) species with narrow fields of forward binocular vision (Drewitt & Langston 2006, 2008, Jenkins *et al.* 2010, Noguera *et al.* 2010, Herera-Alsina *et al.* 2013). These traits confer high levels of *susceptibility*, which may be compounded by high levels of *exposure* to man-made obstacles such as wind farms and associated overhead power lines (Jenkins *et al.* 2010). Exposure is greatest in (i) very aerial species, (ii) species inclined to make regular and/or long distance movements (migrants, any species with widely separated resource areas - food, water, roost and nest sites), (iii) species that regularly fly in flocks (increasing the chances of incurring multiple fatalities in a single collision incident).

Soaring species may be particularly prone to colliding with wind turbines where they are placed along ridges to exploit the same updrafts favoured by such birds - vultures, storks, cranes, and most raptors - for cross-country flying (Erickson *et al.* 2001, Kerlinger & Dowdell 2003, Drewitt & Langston 2006, 2008, Jenkins *et al.* 2010, Noguera *et al.* 2010). Large soaring birds – for example, many raptors and storks - depend heavily on external sources of energy for sustainable flight (Pennycuick 1989). In terrestrial situations, this generally requires that they locate and exploit pockets or waves of rising air, either in the form of bubbles of vertically rising, differentially heated air – thermal soaring - or in the form of wind forced up over rises in the landscape, creating waves of rising turbulence – slope soaring. Certain species are morphologically specialized for flying in open landscapes with high relief and strong prevailing winds, and are particularly dependent on slope-soaring opportunities for efficient aerial foraging and travel. South African examples might include Cape Vulture *Gyps coprotheres*, Verreaux's Eagle *Aquila verreauxii*, Jackal Buzzard *Buteo rufofuscus*, Peregrine Falcon *Falco peregrinus*, Lanner Falcon *Falco biarmicus* and Black Stork *Ciconia nigra* and, to a lesser extent, most other open-country raptors. Such species are potentially threatened by wind energy developments where turbines are situated to exploit the wind shear created by hills and ridge-lines. In these situations, birds and industry are competing for the same wind resource, and the risk that slope soaring birds will collide with the turbine blades, or else be prevented from using foraging habitat critical for their survival, is greatly increased.

1.3 Birds and Solar PV farms

The environmental impacts of solar PV developments globally have not been well-researched (Tsoutsos *et al.* 2005, Gunerhan *et al.* 2009, Lovich & Ennen 2011, Turney & Fthenakis 2011), and the impacts of these plants on birds are poorly understood (RSPB 2011, DeVault *et al.* 2014). Solar PV facilities cover large areas (about 2-5 ha per MW) and in many cases require the complete removal of vegetation from the inclusive footprint of the installed plant (Lovich & Ennen 2011, DeVault *et al.* 2014). It is this tendency to destroy, degrade, fragment or otherwise displace birds from large areas of natural habitat that stimulates most concern about the implications for avifauna of large-scale solar PV development (Lovich & Ennen 2011, RSPB 2011, Smit 2012), particularly in relation to species with restricted ranges and very specific habitat requirements. Recent findings at facilities in North America suggest that collision mortality impacts may be underestimated at solar PV plants, with collision trauma with the PV panels – perhaps associated with polarised light pollution and/or with waterbirds mistaking large arrays of PV panels as waterbodies (Horváth *et al.* 2009, Lovich & Ennen 2011) – a significant impact factor at one well-studied site (Kagan *et al.* 2014). Other possible impacts of solar PV farms include noise and disturbance generated by construction and maintenance activities, collision and electrocution mortality associated with newly installed power infrastructure (Bevanger 1994, 1998, Lehman *et al.* 2007, Jenkins *et al.* 2010, 2011, Dwyer *et al.* 2014), the attraction of novel species to an area by the artificial provision of otherwise scarce resources – for example perches, nest sites and shade (DeVault *et al.* 2014), and chemical pollution, mostly associated with measures taken to keep the PV panels clean, such as the use of dust suppressants (Lovich & Ennen 2011).

1.4 Birds and associated infrastructure

Infrastructure commonly associated with renewable energy facilities may also have detrimental effects on birds. The construction and maintenance of substations, power lines, servitudes and roadways causes both temporary and permanent habitat destruction and disturbance, and overhead power lines pose a collision and possibly an electrocution threat to certain species (Van Rooyen 2004, Lehman *et al.* 2007, Jenkins *et al.* 2010). Some habitat destruction and alteration inevitably takes place during the construction of power lines, substations and associated roadways. Also, power line service roads or servitudes have to be cleared of excess vegetation at regular intervals in order to allow access to the line for maintenance, and to prevent vegetation from intruding into the legally prescribed clearance gaps between the ground and the conductors. These activities have an impact on birds breeding, foraging and roosting in or in close proximity to the power line corridor, and retention of cleared servitudes can have the effect of altering bird community structure along the length of any given power line (e.g. King & Byers 2002). Power line collision risk affects a particular suite of susceptible species, mainly comprising large, heavy birds (such as bustards, cranes and large raptors), and smaller, fast-flying birds (such as gamebirds, waterfowl and small raptors - Bevanger 1994, 1998, Janss 2000, Anderson 2001, van Rooyen 2004a, Drewitt & Langston 2008, Jenkins *et al.* 2010), while electrocution risk is strongly influenced by the voltage and design of the power lines erected (generally occurring on lower voltage infrastructure where air gaps are relatively small), and mainly affects larger, perching species, such as vultures, eagles and storks, easily capable of spanning the spaces between energised components (Lehman *et al.* 2007).

2 APPROACH

2.1 Understanding impacts

Clearly, the earlier bird impacts are considered in the schedule of an RE project, the less the risk to both the environment and the developer. Ideally, avian issues should be addressed at the screening or site-selection phase of the process, with strategic reference to broad scale maps of avian sensitivity to wind/solar farm impacts (e.g. Bright *et al.* 2008, Retief *et al.* 2012, this study). Failing this, active collection of data describing the avifauna of a selected site should be completed before proposed projects are authorised, and the results of such monitoring should inform the findings of the avian component of the resulting report (Jenkins *et al.* 2012a).

The level of project-specific knowledge required to support a legitimate RE development application in South Africa is presently informed by two best practice guideline documents compiled by BirdLife South Africa (BLSA) and the Endangered Wildlife Trust (EWT) (Jenkins *et al.* 2012a, Smit 2012, although note that the latter document is currently in review). Because there is (a) some uncertainty around the southern African bird species likely to be susceptible to the negative impacts of wind and solar energy development (Retief *et al.* 2012), (b) generally only limited knowledge of the current distributions of those species thought most likely to be susceptible, and (c) very little understanding of the patterns of bird movements (on any scale) likely to profoundly influence impact susceptibility, the pre-authorisation bird survey and monitoring requirements for proposed new renewable energy projects in this country are necessarily time-, labour- and cost-intensive.

The main object of the present study is to examine and map avian impact sensitivity within eight, large, pre-selected FAs, and to look for areas within each FA where these sensitivities are low enough to allow some abbreviation or streamlining of the baseline monitoring requirements. Because resources were limited, the study was based predominantly on a desk-top integration and interpretation of existing data, with limited opportunity to collect dedicated on-site information. Unfortunately, this prescribed approach rather overestimated the quality of the available data, and hence limited the possibility of reducing the duration and scope of baseline fieldwork required to inform individual development applications within the majority of the FAs.

Note that this constraint did not apply to the Springbok FA, where time spent gathering new, dedicated field information permitted greater confidence in risk prediction, and the opportunity to relax development application requirements.

2.2 Methods

In accumulating and collating as much desk-top data for each of the FAs as possible, the aim of the study was to address three primary questions:

(i) What species occur on site, and which of these should be prioritised to form the basis of the sensitivity mapping process?
(ii) Where are the key areas in each FA for the relevant suite of priority species?
(iii) What protective measures are required to insulate these key areas and their birds from the negative impacts of renewable energy development?

Using Citizen Science data
Southern African Bird Atlas Project 2 (SABAP2) data for each FA was used to assess the total known or predicted avifauna in each case, and a short-list of priority species for each FA was derived from this, based substantially on BLSA's assessment of the ±100 species most likely to be negatively affected by wind energy development (Retief *et al.* 2012, as revised in terms of the most recent national - Taylor In press - and global - http://www.iucnredlist.org/search - assessments of threat status). These are generally rare and/or threatened birds, or restricted-range endemics, that may also be collision-prone and/or sensitive to disturbance or displacement. In some instances it was necessary to refer to SABAP1 information (Harrison et al. 1997) where SABAP2 coverage was very poor. Each short-list of priority species per FA informed all further investigations. Note that this level of exclusivity was adopted to address the challenge of rapidly making multiple, landscape-scale decisions about the suitability of widespread industrial development. The selection of priority species in each FA had the effect of simplifying each scoping-level assessment, and assumed that the suite of species used served as an adequate surrogate for the entire species compliment present. This approach is not necessarily applicable at the project level, and a variety of species not directly considered in the mapping exercises presented here may become relevant to project-specific priorities and decisions made within each FA.

In addition to the SABAP data, other citizen science databases – Coordinated Avifaunal Roadcount (CAR) and Coordinated Waterbirds Count (CWAC) - were also used in this study, although it quickly became clear that none of these databases served the purposes of the project that well. The SABAP2 coverage was generally limited, the CAR data are distributed linearly along the fringes of the road network (which is suitable for calculating density estimates for target species but generally disallows the identification of specific areas that may be more or less important for a given species at the FA scale), and the CWAC data only cover a small fraction of the wetlands present in any FA. As a result, in the absence of any better information, the three sets of data were used and integrated as judiciously as possible, to estimate where key species were most likely to occur. For example, atlas data were used in terms of simple presence/absence distributions (rather than using "Reporting Rate" as a more nuanced index of relative abundance) to partially counteract biases in observer coverage. Also, atlas data were aggregated for suites of priority species with common, broad habitat requirements (e.g. large terrestrial species, large savanna raptors) to estimate the location and extent of key areas for these guilds, perhaps with CAR data overlaid to confirm the general whereabouts of such areas, and a single, inclusive polygon with a common sensitivity rating was used to represent this combination of data in the final mapping exercise. CWAC data were also used to identify important wetlands in each FA, gauged simply in terms of the average aggregate count, the total species count, and the relative presence of red-listed or priority species. In effect, this meant that most CWAC sites were mapped as sensitive, with only a small minority of sites (those which support demonstrably lower numbers of waterbirds), were excluded.

Other sources of data
Wherever possible, information from a variety of sources on the specific location of nest or roost sites, other important resource areas (e.g. wetlands, vulture restaurants), movement patterns (from tracking

studies) or simple sightings of the priority species in each FA, was used to supplement or even supplant the "Citizen Science" data. Such sources included taxon-specific databases (detailing the results of nest or roost surveys or tracking studies) curated by conservation agencies and NGOs, information contained in the published literature or in unpublished baseline monitoring and EIA reports completed for renewable energy (and other) development proposals within each of the FAs, and information solicited directly from professional or amateur ornithologists or birders (see Section 2.3 Data Sources for details).

Predicting distributions
In addition to using data describing known distributions of priority species, some habitat mapping layers were used as cues for predicting distributions in remote areas where such bird data were lacking. For example, a wetland layer was used to locate waterbodies above an arbitrary threshold size (*ca* 200 m x 100 m or 20 000 m^2), on the grounds that (all other factors being equal) larger wetlands are likely to support a greater diversity and biomass of waterbirds than smaller ones (Froneman *et al.* 2001), and a digital elevation model (DEM) was used to plot the distribution of cliffs (areas with slopes >75º) across each FA, in order to predict the distributions of threatened, impact-sensitive, cliff-nesting birds (e.g. Verreaux's Eagle). The latter approach had the added benefit of highlighting most of the major ridgelines in each FA for special attention. Such areas of high relief are known to attract slope-soaring birds, and are commonly associated with increased collision risk for these species (Barrios & Rodriguez 2004, Fielding *et al.* 2006, Smallwood *et al.* 2009, Tapia *et al.* 2009, Miller *et al.* 2013).

All South Africa's Important Bird Areas (except the Overberg which is extremely large and is dominated by highly modified farmland), the major river courses in each FA (given that these generally serve as flyways for many bird species), the coastline (an important flyway for coastal and other species), all proclaimed Protected Areas, and all power transmission lines (given that the pylons supporting these lines are regularly used as nest sites by large, threatened raptors – e.g. Anderson & Hohne 2007, Jenkins *et al.* 2013) were also isolated as impact sensitive areas.

Given the large development footprints of RE plants, and especially of solar PV projects, it may also be appropriate to approach strategic development planning in terms of impacts on important avian habitats, and the taxa or assemblages that these habitats support. Of particular relevance in this context would be potential incursions of RE development into scarce habitats that support threatened, range-restricted endemic birds. Wherever possible, attempts were made in this study to allow for such sensitivities. In practice, however, this was made difficult by the coarse spatial resolution of the available bird data, and insufficient knowledge of the habitat affinities of most such species to link their distributions to finer scale vegetation and land-use mapping.

Site visits
Fieldwork was conducted in only one of the eight FAs (Springbok), presenting an opportunity to demonstrate what can be achieved with sufficient resources to undertake short field surveys. Ten days were spent in the Springbok FA (May 13-22, 2014), and good coverage of the area (Fig. 2) was achieved in that time. Three primary objectives were targeted, developed in terms of the existing information for the area, and an initial assessment of the priority species most likely to influence the outcomes of our sensitivity maps. The DEM-developed map of cliff distribution, together with 1:50 000 and 1:250 000 topographic maps for the area, were used to identify the most significant cliff-lines in the FA, likely to hold breeding pairs of Verreaux's Eagle, as well as pairs of other cliff-nesting birds (e.g. Jackal Buzzard, Peregrine Falcon, Black Stork - Malan 2009).

Using all the known Verreaux's Eagle nest sites in the FA (n = 10, acquired from various sources – see Sections 1.2 and 3.1 below), an idea of typical inter-nest spacing and habitat preferences within the local population was developed, which was then used to guide searches for new sites. All cliffs visited were surveyed for eagles and eagle nest structures using binoculars and a 20-60x spotting scope (Malan 2009). The search was not exhaustive and some occupied sites may have been overlooked, while others (with nests but no birds) may have been considered occupied but weren't. In many instances it was possible to confirm occupation and active breeding by locating incubating birds in nests (the timing of the survey coincided with the early breeding season for this species). Similar surveys were conducted of the Eskom transmission power lines within the FA, looking for Martial Eagle *Polemaetus bellicosus* pairs and nest structures (e.g. Jenkins *et al.* 2013c).

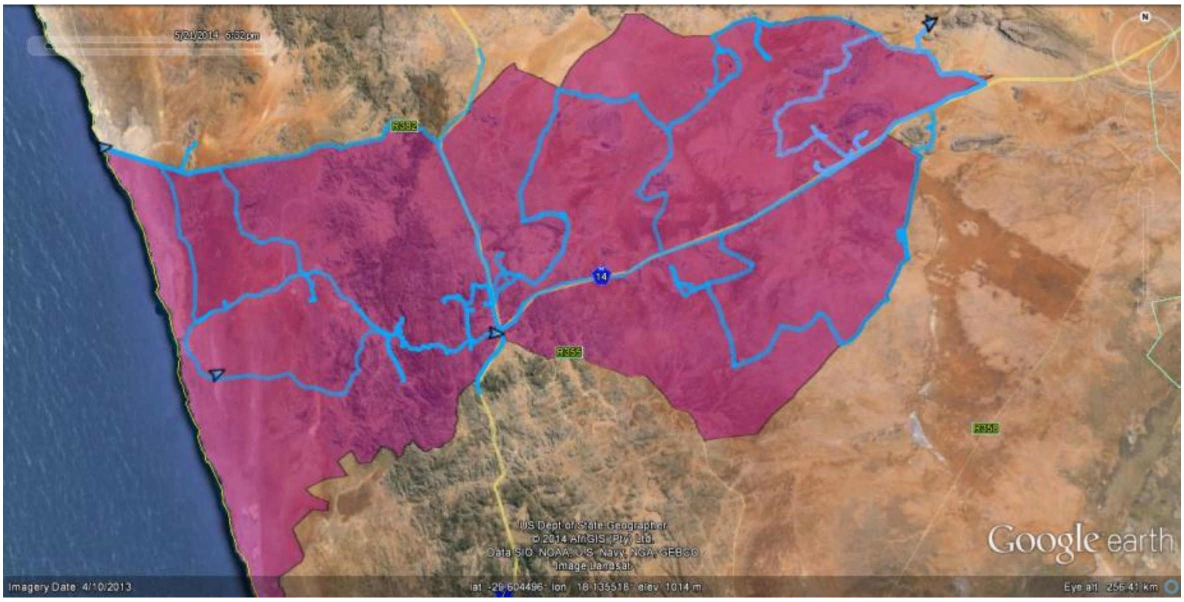

Figure 2: Coverage achieved (roads driven) in the Springbok FA during a 10-day field survey.

The third focus of the field visit was to confirm the presence of the threatened Red Lark *Certhilauda burra* within the Springbok FA, and to collect contemporary information describing its distribution and habitat affinities to inform the sensitivity mapping for this area. Eleven locations spread across the previously described range of Red Lark in the area (Dean *et al.* 1991, Harrison *et al.* 1997) were sampled by conducting 2x 20 min walked surveys at each, and recording the number of individual larks observed on each occasion. These data, together with incidental sightings of the species made during the site visit, SABAP2 information, and sightings recorded in recent RE EIAs in the area (Bio3 2013, Pretorius 2014), contributed to an estimation of the most critical areas of the FA for Red Larks.

Buffers and the principles of mapping

Once all the various sources of point, raster and shape information had been accumulated and mapped for each FA, appropriate buffer distances were allocated. As far as possible these were based on published information on foraging ranges, sensitivity to disturbance or susceptibility to collision, but often requiring the use of conservative estimates based on experience. The general approach was to err on the side of protective caution when making these estimations, and when determining the levels of sensitivity to allocate in each instance. In some instances, the buffer distances imposed have exceeded those routinely applied by bird specialists in assessing and mitigating impacts of individual RE developments at the EIA level. This is because the intention is to strategically guide development away from sensitive areas and to avoid impacts, rather than to mitigate impacts where project-level planning decisions have (in many cases) already been made.

The default position adopted in the execution of this project was that in the absence of sufficient reliable data to show particularly low sensitivity in any given area, the existing constraints on development (i.e. the requirements of the two sets of best practice guidelines) should continue to apply. These are relatively well-defined for wind energy projects (Jenkins *et al.* 2012), and much less so for solar PV (Smit 2012), and both guidelines documents are currently in revision. Both documents should have been updated and improved by the time the development guidelines stemming from this study are actually applied.

2.3 Data Sources

Data title	Source and date of publication	Data Description
Southern African Bird Atlas (SABAP) 2	Animal Demography Unit, University of Cape Town; ongoing atlas project started in 2007. http://sabap2.adu.org.za/,	Citizen science data set which collates bird distribution records collected by the public according to a specific field protocol, and at a 5' x 5' grid (pentad) resolution. Second project of this kind in southern Africa, established to supplement and compliment SABAP1, published in 1997 (Harrison *et al.* 1997). Typically, these data are expressed as reporting rates per pentad, with the number of bird lists (atlas cards) submitted for the pentad which include at least one sighting of any given species expressed as a percentage of the total number of cards submitted for that pentad. Because the SABAP2 coverage for the eight FAs at the time of this analysis was generally poor, we used these data to reflect simple presence/absence of selected species only.
Coordinated Waterbird Counts (CWAC)	Animal Demography Unit, University of Cape Town; ongoing wetland survey project started in 1992 (Taylor *et al.* 1999). http://cwac.adu.org.za/	Citizen science data detailing the diversity and abundance of wetland bird species present at a sample of waterbodies spread across South Africa. Each registered wetland is generally counted twice annually – once in mid-summer and once in mid-winter.
Coordinated avifaunal roadcounts (CAR)	Animal Demography Unit, University of Cape Town; ongoing road transect project started in 1993 (Young *et al.* 2003). http://car.adu.org.za	Citizen science data detailing the diversity and relative abundance of selected large terrestrial species (cranes, bustards, korhaans, storks, Secretarybird) and some raptors, counted along a suite of selected, driven routes within each of 17 precincts spread across South Africa.
Wetland Specialist Strategic Environmental Assessment, Wetland specific; (WSSEA_Wetlands).	Preliminary spatial data from the DEA/CSIR National Wind and Solar PV Freshwater Strategic Environmental Assessment, Prepared by Kate Snaddon and Justine Ewart-Smith from Freshwater Consulting Services.	Freshwater Consulting Services was sub-contracted by the CSIR to conduct scoping level assessments of the various freshwater systems that fall within the various FAs. *AVISENSE* Consulting discussed their requirements regarding the identification of specific freshwater systems specific to various avian aspects, Freshwater Consulting Services agreed to share the initial results of the respective mapping exercises for each of the FAs. This database excludes river systems, but includes various other relevant freshwater systems that fall within the extent of each of the respective FAs.
South African Protected Areas Database (SAPAD)	Department of Environmental Affairs. South African Protected Areas Database, 2014.	The Department of Environmental affairs curates a database containing spatial data on all the various formally protected areas throughout South Africa. Most of these areas are classified as areas set aside for biodiversity and nature conservation.
Eskom Network	Eskom, 2013.	Spatial information on both the Eskom transmission and distribution networks.

Data title	Source and date of publication	Data Description
Remaining Threatened Ecosystems	A product of SANBI (South African National Biodiversity Institute), prepared for the SEA 2013	Spatial information collated in terms of the Biodiversity Act (Act 10 of 2004), detailing the distributions of all threatened and protected ecosystems throughout South Africa. All listed ecosystems are classified according to four categories: Critically Endangered, Endangered, Vulnerable, and Protected. Data were used to identify areas where threatened of protected ecosystems, that could support important or impact sensitive bird species, overlap with any of the FAs.
National Freshwater Ecosystem Priority Areas (NFEPA), Rivers (classes 1-3),	National Freshwater Ecosystem Priority Areas. CSIR, 2007	The National Freshwater Ecosystems Priority Areas project is the product of a collaboration between the CSIR, the SANBI, the Department of Water Affairs (DWA), the Water Research Commission (WRC), WWF South Africa, South African National Parks (SANParks), the South African Institute for Aquatic Biodiversity (SAIAB) and DEA. Freshwater systems were categorised based on various criteria with the aim of identifying valuable freshwater conservation areas. The results of this study were used to identify important river systems within or bordering each FA that could support important bird populations or important avian flyways.
Stellenbosch University Digital Elevation Model (SUDEM)	Stellenbosch University, INNOVUS Technology Transfer; Stellenbosch University Digital Elevation Model (SUDEM)	Stellenbosch University has developed a high resolution digital elevation model of the entire South African terrain. This was used to identify all slopes in each FA with a gradient >75°. These features were considered steep enough to support pairs of cliff-nesting birds, and/or to be used by slope-soaring birds, many of which are susceptible to collision with wind turbines.
BirdLife South Africa, Important Bird Areas (IBA)	BirdLife International & BirdLife South Africa, Important Bird Areas, 2009. http://www.birdlife.org.za/conservation/important-bird-areas	The BLSA IBA Programme identifies and conserves areas or sites that are considered critical to the long-term survival of globally threatened or range-restricted bird species. Five such IBA's overlap or partially overlap with the RE FAs: Soetdoring Nature Reserve (SA049), Dronfield Farm (SA031), Kamfers Dam (SA032), Benfontein Game Farm (SA033), and Haramoep & Black Mountain Mine Nature Reserve (SA035). *Note that given the large size and relatively modified nature of the* Overberg Wheatbelt (SA115), *this IBA was excluded from in the sensitivity mapping for the Overberg FA.*
Lesser Kestrel and Amur Falcon Roost data	Provided by the CSIR through BirdLife South Africa and the Endangered Wildlife Trust. https://www.ewt.org.za/BOP/migratingkestrel.html	The Migrating Kestrel Programme coordinates the annual census of Lesser Kestrel *Falco naumanni* and Amur Falcon *Falco amurenis* roosts across South Africa. In this way, these two highly migratory species are closely monitored and various steps are taken to ensure effective conservation. GPS coordinates of roost locations within FAs were buffered accordingly. This database is managed by the Endangered Wildlife Trust under their Birds of Prey Programme.

Data title	Source and date of publication	Data Description
Cape Vulture Roost and Colony Data	Provided by the CSIR through BirdLife South Africa and the Endangered Wildlife Trust	The Sasol Vulture Monitoring Project is part of the EWT's Birds of Prey Programme, and has been ongoing since 1988. Populations, nesting colonies and roosts of the globally threatened, endemic Cape Vulture are monitored across South Africa. Colonies are coded and prioritised on the basis of the number of nests located within each. GPS coordinates of key roost and colony sites within or close to each FA were buffered accordingly..
CapeNature Cape Vulture ringing, tagging, counting and re-sightings database	Kevin Shaw, Ornithologist, CapeNature	The products of a long-term monitoring and marking study conducted by CapeNature at the Potberg Cape Vulture colony in the De Hoop Nature Reserve (Shaw & Scott 2003). Includes re-sightings of colour-ringed and patagial-tagged birds, used to substantiate the 20-40 km buffer imposed on this critical colony. Unpublished data curated by CapeNature.
CapeNature Blue Crane ringing, counting and sightings database	Kevin Shaw, Ornithologist, CapeNature	The products of a long-term monitoring and marking study conducted by CapeNature in the Overberg wheatbelt. Includes the locations of nest sites, car-based "routes" counted from the road, and re-sightings of colour-ringed birds. Unpublished data curated by CapeNature.
Verreaux's Eagle nest sites, Western Cape	Lucia Rodrigues, Western Cape Black Eagle Project	Unpublished locations of Verreaux's Eagle nest sites, mostly in the Western and Northern Cape Provinces, found and monitored annually by a team of amateur eagle enthusiasts.
Peregrine Falcon nest sites	Andrew Jenkins, Research Associate, FitzPatrick Institute, UCT	Unpublished locations of Peregrine Falcon nest sites, mostly in the Western Cape, found and monitored opportunistically.
Sensitive sites in the Overberg	Odette Curtis, Overberg Lowlands Conservation Trust	Unpublished locations of Black Harrier and Martial Eagle nest sites in the Overberg, and of an important wetland area for Blue Cranes, found and monitored opportunistically.
Raptor nest sites, Overberg	Andrew Jenkins, Avisense Consulting, NCC Environmental Services and BioTherm Energy	Raptor nest sites in the Caledon area, found and monitored in 2011-2013 as part of the baseline/pre-construction monitoring at the proposed Klipheuwel Wind Energy projects (Jenkins *et al.* 2012c).
African Fish-Eagle nests, Overberg	Adam Welz, Walter Neser and Andrew Jenkins, Research Associate, FitzPatrick Institute, UCT,	Unpublished locations of African Fish-Eagle nests sites in the Breede River catchment area, found and monitored as part of a research initiative carried out from 2005-2008.
Black Harrier nests, Overberg	Rob Simmons, Odette Curtis and Andrew Jenkins, Research Associates, FitzPatrick Institute, UCT	Largely unpublished locations of Black Harrier nests sites in the Overberg, found and monitored as part of a long-term research initiative, ongoing since 1999 (Curtis *et al.* 2004, Jenkins *et al.* 2012).
Suurplaats WEF monitoring data	Andrew Jenkins, Avisense Consulting, NCC Environmental Services and Moyeng Energy	Raptor nest sites found in the Komsberg FA as part of the baseline/pre-construction monitoring work done for the proposed Suurplaats Wind Energy Facility in 2012.

Data title	Source and date of publication	Data Description
Martial Eagle nest sites on Eskom 400 kV transmission lines in the Karoo	Andrew Jenkins, Research Associate, FitzPatrick Institute, UCT,	Martial Eagle nest sites on 400 kV transmission pylons in the southern Karoo, found and monitored over the period 2002-2008 as part of the Eskom Electric Eagle Project (Jenkins *et al.* 2013c).
Martial Eagle nest sites on Eskom 132 kV transmission lines in the Karoo	Koos de Goede	Unpublished Martial Eagle nest sites on 132 kV transmission pylons in the southern Karoo, found and monitored over the period 1994-2013 as part of an ongoing long-term monitoring effort.
Lanner Falcon nest sites, Eastern Cape (Grahamstown)	Alan Stephenson	Lanner Falcon nest sites in the Grahamstown area, found and monitored from 1997-2000 as part of an unpublished MSc thesis (Stephenson 2001).
Lanner Falcon nest sites, Eastern Cape (Bedford)	Andrew Jenkins, Avisense Consulting, NCC Environmental Services and Windlab,	Lanner Falcon nest sites in the Bedford area, found and monitored in 2011-2012 as part of the baseline/pre-construction monitoring at the proposed Amakahla Emoyeni and Msenge Emoyeni Wind Energy projects (Jenkins *et al.* 2012b, 2013a).
Cape Vulture colony and roost sites in the Eastern Cape	André Boshoff, Nelson Mandela Metropolitan University, Port Elizabeth	Supplementary information on the location and status of Cape Vulture colony and roost sites in the Eastern Cape, and data used to substantiate 20-40 km buffers, extracted from published papers: Boshoff *et al.* 2009a, b, 2011.
Cape Vulture sightings and roost site locations, Eastern Cape	Kate Webster, Eastern Cape Raptor Rehabilitation Centre	Unpublished locations of sightings of Cape Vulture in and around the Stormberg region, with information on mortalities and the location of restaurants and new roost cliffs.
Vulture Restaurant inventory	Kerri Wolter, Vulpro	Unpublished revision of the vulture restaurants inventory, initially compiled by Dr Steven Piper of the EWT's Vulture Study Group.
Probable Cape Vulture roost site, near Sterkstroom, Eastern Cape	Ian Whyte	Extracted from expert report on the avifauna of the proposed Stormberg Renewable Energy Facility development area (Whyte 2013).
Rudd's Lark and Yellow-breasted Pipit information from the Penhoek area, Eastern Cape	Jon Smallie, Wildskies Ecological Consulting	Historical and anecdotal information on the occurrence of Rudd's Lark and Yellow-breasted Pipit on the northern fringes of the Stormberg FA, extracted from the scoping report for the proposed Stormberg Renewable Energy Facility (Smallie 2013, Whyte 2013).
Verreaux's Eagle nest site, Molteno	Jon Smallie, Wildskies Ecological Consulting	Unpublished Verreaux's Eagle nest site location found during the baseline/pre-construction monitoring work at the Dorper Wind Energy Facility.
Information on the numbers of flamingos using the Kamfers Dam wetland outside Kimberley, and possibly also using the Langleg Pan just to the north	Mark Anderson, BirdLife South Africa	Background information on the significance of Kamfers Dam as a breeding site for Lesser Flamingos; influenced buffer selection for this and other wetlands in the Kimberley FA. Extracted from Anderson & Anderson 2010, and supplemented by personal communications.
Lesser Flamingo flight tracks around Kimberley	Graham McCulloch, Trinity College, Dublin	Satellite tracking locations and tracks for a small sample of Lesser Flamingos in relation to the Kamfers Dam wetland. Unpublished data, supplementing information published in McCulloch *et al.* 2003.

Data title	Source and date of publication	Data Description
Information on the location of large raptor nest sites on the Grootvlei-Kimberley 132 kV power line	Mark Anderson, BirdLife South Africa	Background information on the whereabouts of White-backed Vulture and Martial Eagle nest sites on power lines in the Kimberley FA, which influenced the location, nature and extent of buffers imposed in this area. Extracted from Anderson & Hohne 2007.
African Fish-Eagle nests - Kimberley	Mark Anderson, BirdLife South Africa	Unpublished locations of African Fish-Eagle nests sites in the Vaal River catchment area, found and monitored as part of a research initiative carried out from about 2006-2008.
White-backed Vulture nest site locations, Kimberley	Campbell Murn, Hawk Conservancy Trust	Unpublished recent census data for White-backed Vultures in the Kimberley FA, derived from ongoing monitoring of this population. Update on the information contained in Murn *et al.* 2007, Murn & Anderson 2008.
Raptor nest sites in the Northern Cape	Ronelle Visagie, Birds of Prey Programme, EWT	Unpublished large raptor (mostly vulture and eagle spp.) nest site locations from across the Northern Cape Province.
Raptor nest sites in the Northern Cape	Abrie Maritz, Birds of Prey Programme, EWT	Unpublished large raptor (mostly vulture and eagle spp.) nest site locations from across the Northern Cape Province, including sites where nestlings were ringed.
Raptor nest sites in the Springbok area	Mossie Mostert, Springbok	Unpublished large raptor (mostly eagle spp.) nest site locations from the Springbok area.
African Fish-Eagle nest site, Upington	Dr Riaan de Klerk, Upington	African Fish-Eagle nest site location near Upington. Pers. comm.
Verreaux's Eagle nest sites in the Groblershoop area	Andrew Jenkins, Avisense Consulting, Aurecon and HydroSA,	Verreaux's Eagle nest site locations found during avian impact work associated with the Boegoeberg Hydropower project (Jenkins & du Plessis 2013).
Black Harrier nesting areas near Kleinzee	Rob Simmons, Research Associate, FitzPatrick Institute, UCT,	Unpublished locations of Black Harriers nesting areas along the Buffelsrivier east of Kleinzee.
Red Lark sightings near Aggenys	Bio3	General locations of Red Lark sightings made as part of the baseline monitoring work at the proposed Kangnas Wind Energy Facility. Extracted from Bio3 2013.
Red Lark sightings near Aggenys	Matt Pretorius, EWT	General locations of Red Lark sightings made as part of the EIA for the proposed Dabenoris Solar PV Facility. Extracted from Pretorius 2014.
Red Lark sightings near Aggenys	Richard Dean *et al.*, FitzPatrick Institute	General locations of Red Lark sightings, extracted from Dean *et al.* 1991.

2.4 Assumptions and limitations

Limitation	Included in the scope of this study	Excluded from the scope of this study	Assumption
Poor quality of existing data describing bird distribution and abundance – SABAP2, CWAC, CAR, other databases, solicited unpublished data. For most of the FAs, the data available were few, scattered, and old. This applied particularly to data describing smaller, more cryptic species.	All of SABAP2, even though observer effort was generally very thin and patchy, and often concentrated around urban centres (Fig. 3). Most of CWAC and some CAR data, even though both probably reflect the distributions of observers at least as much as those of birds. Most unpublished data, especially those derived from formal research projects where efforts had been made to achieve representative coverage.	SABAP1 data were generally excluded on the basis of age (now >20 years old). Some of the unpublished data were excluded because they were too old (generally observations made pre-1995 were not used).	That by integrating as much reliable and recent data into our process as possible, our assessments of the distributions of key species would approximate reality. That sensitivity mapping based substantially on data for large, charismatic species caters adequately for smaller, cryptic species.
Almost no information available to describe bird movement patterns within any of the FAs. These are key to understanding and mitigating collision risk	Very limited tracking data for small numbers of vultures and flamingos.	-	Distributional data and knowledge of resource requirements are sufficient to predict possible fly-ways between key areas.
Limited time available in project schedule to accumulate all the available data, so many potential sources of information remained untapped.	As much information as possible.	As little of the received information as possible.	The data accumulated and mapped are sufficient for purpose.
Not all sightings were made by reliable observers – problems with identification or interpretation of behaviour could bias data received.	All data received from reliable sources.	All data received from unreliable sources.	All the data used were accurate.
Limited resources available for field surveys to inform this study.	-	-	The desk-top approach used here is adequate for the purpose of the SEA.

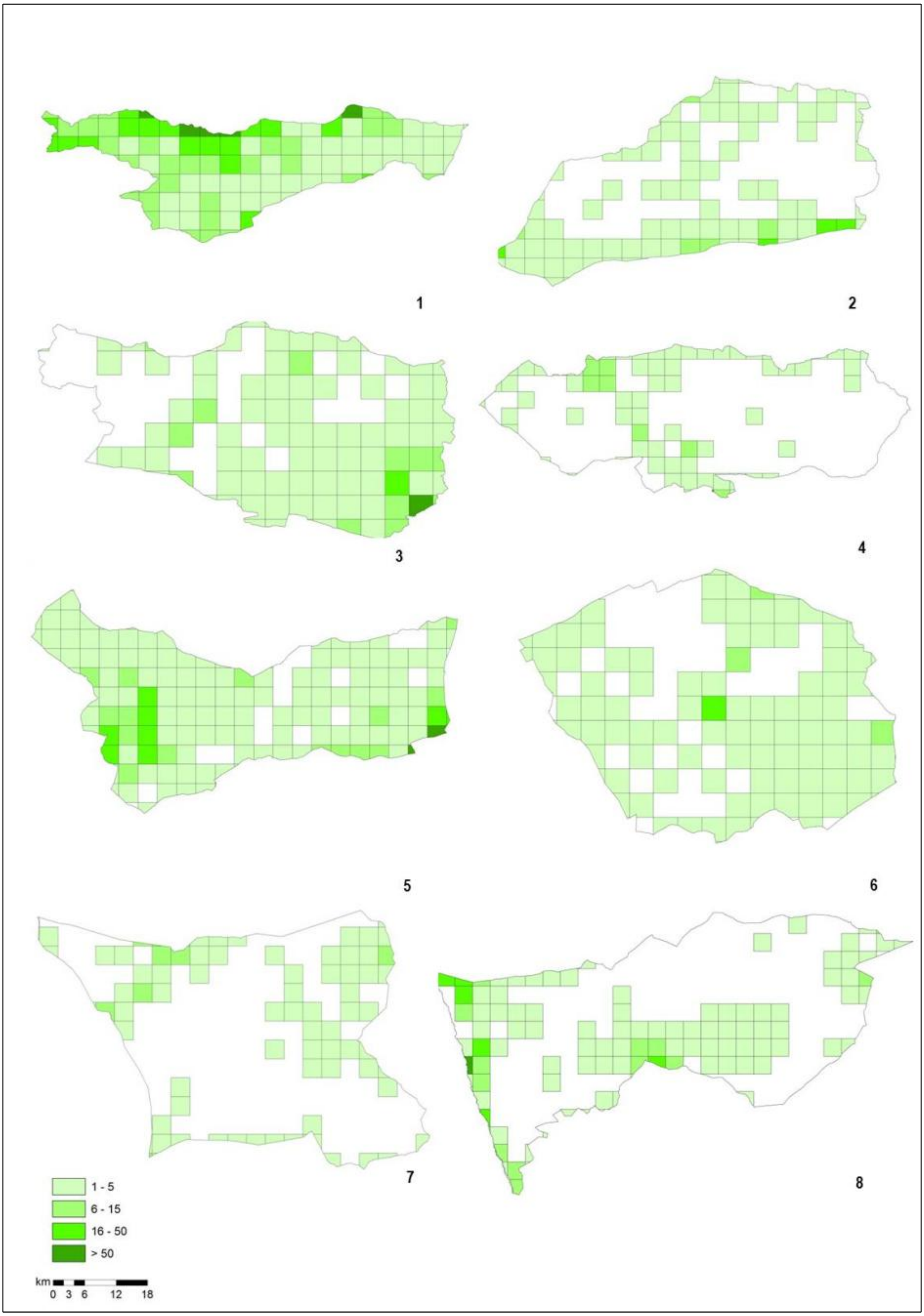

Figure 3: Levels of SABAP2 coverage (atlas cards per pentad) for each of the eight Focus Areas (1 = Overberg, 2 = Komsberg, 3 = Cookhouse, 4 = Stormberg, 5 = Kimberley, 6 = Vryburg, 7 = Upington and 8 = Springbok).

2.5 Relevant Regulatory Instruments

Instrument	Key objective
International Instrument	
Ramsar Convention (The Convention of Wetlands of International Importance (1971 and amendments)	Protection and conservation of wetlands, particularly those of importance to waterfowl and waterfowl habitat.
Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)	Aims to conserve terrestrial, marine and avian migratory species throughout their range.
The Agreement on the Conservation of African-Eurasian Migratory Waterbirds, or African-Eurasian Waterbird Agreement (AEWA)	Intergovernmental treaty dedicated to the conservation of migratory waterbirds and their habitats across Africa, Europe, the Middle East, Central Asia, Greenland and the Canadian Archipelago.
National Instrument	
National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004)	The National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004) provides for listing threatened or protected ecosystems, in one of four categories: critically endangered (CR), endangered (EN), vulnerable (VU) or protected. Activity 12 in Listing Notice 3 (Government Notice R546 of 2010) relates to the clearance of 300 m^2 or more of vegetation,
National Environmental Management: Protected Areas Act, 2003. (Act 57 of 2003)	To provide for the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes; for the establishment of a national register of all national, provincial and local protected areas; for the management of those areas in accordance with national norms and standards; for intergovernmental co-operation and public consultation in matters concerning protected areas; and for matters in connection therewith.
National Environmental Management Act,1998 (Act 107 of 1998)	Promote conservation; and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development;
Environment Conservation Act, 1989 (Act 73 of 1989)	To provide for the effective protection and controlled utilization of the environment and for matters incidental thereto.
Marine Living Resources Act, 1998 (Act 18 of 1998)	To provide for the conservation of the marine ecosystem, the long-term sustainable utilisation of marine living resources and the orderly access to exploitation, utilisation and protection of certain marine living resources; and for these purposes to provide for the exercise of control over marine living resources in a fair and equitable manner to the benefit of all the citizens of South Africa; and to provide for matters connected therewith.

Instrument	Key objective
National Water Act, 1998 (Act 36 of 1998),	Part 3, The Reserve: The ecological reserve relates to the water required to protect the aquatic ecosystems of the water resource.
Provincial Instrument	
Western Cape Nature Conservation Board Act, 1998 (Act 15 of 1998)	To provide for the establishment, powers, functions and funding of the Western Cape Nature Conservation Board and the establishment, funding a control of a Western Cape Nature Conservation Fund, and to provide for matters incidental thereto. The object of the board shall be, (a) promote and ensure nature conservation and related matter in the Province.
Western Cape Nature Conservation Laws Amendment Act, 2000. (Act 3 of 2000)	To provide for the amendment of various laws on nature conservation in order to transfer the administration of the provisions of those laws to the Western Cape Nature Conservation Board; to amend the Western Cape Nature Conservation Board Act, 1998 to provide for a new definition of Department and the deletion of a definition; to provide for an increase in the number of members of the Board; to provide for additional powers of the Board; to amend the provisions regarding the appointment and secondment of persons to the Board; and to provide for matters incidental thereto.
Northern Cape Nature Conservation Act, 2009 (Act 10 of 2009).	To provide for the sustainable utilization of wild animals, aquatic biota and plants: to provide for the implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora; to provide for offences and penalties for contravention of the Act: to provide for the issuing of permits and other authorisations: and provide for the matter connected therewith.
Bophuthatswana Nature Conservation Act, 1973 (Act 3 of 1973; still in force)	To provide for the protection of game and fish, the conservation of flora and fauna and the destruction of vermin in Bophuthatswana
Free State Nature Conservation Ordinance, 1969 (Act 8 of 1969)	To provide for the conservation of fauna and flora and the hunting of animals causing damage and for matters incidental thereto
Ciskei Nature Conservation, 1987 (Act 10 of 1987, still in force)	To consolidate and amend the laws relating to the conservation, management and protection of fauna, flora, fish and the habitats generally, to provide for the establishment and management of nature reserves, hiking trails, water catchment areas and a coastal conservation area, to provide for matter relating to the sea and the seashore and the provide for the incidental matters.

3 FOCUS AREAS DESCRIPTION

Site	Brief description
Overberg Focus Area 1	This FA (5 263 km^2) falls within the Fynbos Biome (Mucina & Rutherford 2006), and largely comprises a wide scattering of vestigial fragments of threatened Renosterveld and lowland Fynbos vegetation, set in a matrix of cereal croplands, fallow lands and pastures. The seasonal life of these highly modified areas simulates open grassland, and attracts some significant birdlife, most importantly the red-listed endemic Blue Crane *Anthropoides paradiseus*, but including some endemic passerines such the red-listed Agulhas Long-billed Lark *Certhilauda brevirostris*. The numerous farm dams in the area support healthy wetland bird communities, particularly during or after wet winters when water levels are highest. Remnants of uncultivated land still support healthy numbers and diversities of locally indigenous birds, supplemented by a limited suite of woodland species associated with alien tree infestations. The FA is closely bordered by the Eastern False Bay Mountains IBA, the Botriviervlei and Kleinmond Estuary IBA, and the De Hoop Nature Reserve IBA, and almost completely encompasses the Overberg Wheatbelt IBA (SA115) (Barnes 1998). The latter area supports >20% of the global population of the Blue Crane (Allan 1993, McCann *et al.* 2007) as well as a significant proportion of the world's Black Harriers *Circus maurus* (Curtis *et al.* 2004), while the Potberg Cape Vulture colony, located just to the south of the FA in the De Hoop Nature Reserve, is the only remaining breeding colony of this Endangered endemic species in the Province, and one of very few colonies that is actually growing, rather than in rapid decline (Shaw & Scott 2003). Also, there used to be a Lesser Kestrel *Falco naumanni* roost site just outside the town of Swellendam, but this has not been used or monitored in recent years. At least 187 bird species are considered likely to occur with some regularity within the broader impact zone of the proposed FA, including 17 red-listed species, and four species which are both endemic and red-listed (Table 1, Barnes 1998, 2000, Taylor In press). We identified a short-list of 19 threatened and/or impact susceptible priority species to inform the sensitivity mapping for this FA (Table 1). Blue Crane, Cape Vulture and Black Harrier were the most influential species in shaping these maps. *Note that the FA-specific sensitivity ratings given in Tables 1-8 are based on a qualitative integration of local status and behaviour with known or anticipated proneness to collision and/or disturbance.*
Komsberg Focus Area 2	This FA (8 846 km^2) spans the junction of the Fynbos and Succulent Karoo biomes (Mucina & Rutherford 2006). Unmodified habitats are dominated by Renosterveld and Karoo vegetation, the terrain is generally rocky, and the topography varies from undulating to mountainous, spanning a wide altitudinal range. The site is not located close to any currently registered national Important Bird Areas (Barnes 1998,). More than 210 bird species could possibly occur on the site, including at least 16 red-listed species, and five red-listed endemics (Ludwig's Bustard *Neotis ludwigii*, Blue Crane, Black Harrier, Sclater's Lark *Spizocorys sclateri*, and African Rock Pipit *Anthus crenatus*. The cliffs of the Roggeveld escarpment which bisects the eastern and western portions of the FA are generally small and broken, but still support breeding pairs of Verreaux's Eagle, as well as other cliff-nesting species including Jackal Buzzard, Booted Eagle *Aquila pennatus*, Cape Eagle-Owl *Bubo capensis,* and Peregrine Falcon, while the power lines on the plains below the escarpment support breeding pairs of Martial Eagle (Jenkins *et al.* 2013c). Greater Flamingo *Phoenicopterus ruber* and a moderate diversity of other wetland species occasionally aggregate at some of the larger wetlands in the area, while the open rangelands hold high densities of Karoo Korhaan

Site	Brief description
	Eupodotis vigorsii. We identified a short-list of 19 threatened and/or impact susceptible priority species to inform the sensitivity mapping for this FA (Table 2). Verreaux's Eagle and Martial Eagle were the most influential species in shaping these maps.
Cookhouse Focus Area 3	This FA (7 366 km^2) falls within the Albany Thicket Biome, at the interface between the Albany Thicket and the Sub-escarpment Grassland Bioregions (Mucina & Rutherford 2006). The area features open, hilly grassland, grading into wooded and succulent-rich thicket vegetation along the drainage lines and forest patches along the base of the escarpment. It is bordered by the Winterberge, the Bloemfonteinberge and the Groot-Bruintjieshoogte mountains to the north, crossed by a series of smaller mountains extending to the north-east of Grahamstown, and traversed by the Great and Little Fish Rivers, and the Koonap River, which form deeply incised valleys through the central plains. The FA is not located close to any recognised national Important Bird Areas, but because it features a wide variety of habitats, it supports a relatively diverse avifauna. At least 283 bird species could occur with some regularity within the FA, including at least 19 red-listed species, and six species – Ludwig's Bustard, Blue Crane, Cape Vulture, Black Harrier, Melodious Lark *Mirafra cheniana* and African Rock Pipit – which are both endemic and red-listed (Barnes 1998, 2000). Cape Vulture occurs in the area as a seasonal visitor, with non-breeding birds being drawn down from higher lying areas to the north-east to feed on stock losses (Boshoff *et al.* 2009a & b). Cape Vulture numbers have decreased sharply in the Eastern Cape in recent decades (Boshoff *et al.* 2009a & b, 2011), at least partly because of high mortality rates caused by collisions with overhead lines. Most of the birds which visit the Cookhouse FA probably forage out from summer roosts at Tarkastad, or at Aggieskloof, about 20 km to the north-east of Bedford. Large terrestrial birds such as Blue Crane, Denham's Bustard *Neotis denhami*, Southern Black Korhaan *Afrotis afra* and White-bellied Korhaan *Eupodotis senegalansis* are relatively plentiful in the area (Young *et al.* 2003), while a range of locally resident or visiting raptors (including Black Harrier, Martial Eagle, African Crowned Eagle *Stephanoaetus coronatus*, Secretarybird *Sagittarius serpentarius*, Lesser Kestrel, Amur Falcon *Falco amurenis* and Lanner Falcon) also make a significant component of the local avifauna. Former Lesser Kestrel roost sites at Pearston and Somerset East have not been active in recent years. We identified a short-list of 19 threatened and/or impact susceptible priority species to inform the sensitivity mapping for this FA (Table 3). Cape Vulture, Martial and African Crowned Eagles, and a suite of large terrestrial birds were the most influential species in shaping these maps.
Stormberg Focus Area 4	This FA (12 041 km^2) falls within the Grassland Biome, at the interface between the Dry Highveld Grassland, Sub-Escarpment Grassland and the Drakensberg Grassland Bioregions (Mucina & Rutherford 2006). The natural vegetation of the study area comprises various forms of high-altitude grassland above and along the escarpment and its outlying ridges, and moist, low altitude grassland and thornveld on the plains below to the south. The area is not located close to any recognised national Important Bird Areas, but because it falls at the interface between the Karoo and Grassland Biomes/Bioregions it supports a relatively diverse avifauna. Over 280 bird species could occur in the area, including at least 27 red-listed species, of which nine are regional endemics (Table 4). The terrain is undulating to mountainous, with many sharp ridgelines and exposed rock faces, and there are at least four large dams situated in the south-east sector of the FA. Montane and Highveld grassland species characterize the local avifauna. While neither has

Site	Brief description
	been adequately confirmed recently, both Rudd's Lark *Heteromirafra ruddi* and Yellow-breasted Pipit *Anthus chloris* are thought to occur in the Penhoek area of the escarpment (Smallie 2013, Whyte 2013), while Blue Crane, Denham's Bustard and Blue Korhaan *Eupodotis caerulescens* occur on the open plateau grasslands, and Grey-crowned Cranes *Balearica regulorum* closer to the more significant wetlands. An Amur Falcon roost site at Dordrecht holds around 2500 birds each summer. The abundant cliffs support breeding pairs of Verreaux's Eagle (and probably several other species of cliff-nesting raptors), and no fewer than eight Cape Vulture colonies or regularly used roost sites occur either within or adjacent to the FA, mostly concentrated in the east of the site. The presence of these Cape Vulture sites poses a significant challenge to the advisability of wind energy development in this FA, given the current status of this species both nationally and regionally (Boshoff *et al.* 2009a & b), and the strong likelihood that it will be susceptible to turbine collision related mortality (e.g. Carrete *et al.* 2012, De Lucas *et al.* 2012, Martinéz-Abrain *et al.* 2012). A recent modelling study has shown that power line mortalities alone are likely to result in the localised extinction of this species over much of the western half of the Eastern Cape Province in the next 20-30 years (Boshoff *et al.* 2011), hence it is critical that the advent of wind energy development in the area does not add a significant additional source of anthropogenic mortality. We identified a short-list of 19 threatened and/or impact susceptible priority species to inform the sensitivity mapping for this FA (Table 4). Cape Vulture, Verreaux's Eagle and a suite of large terrestrial birds were the most influential species in shaping these maps.
Kimberley Focus Area 5	This FA (9 568 km^2) falls at the junction of the Savanna, Grassland and Karoo Biomes (Mucina & Rutherford 2006), and includes significant tracts of all three types of vegetation, distributed over fairly flat, open terrain. The area supports up to 378 species of birds, including 31 red-listed species, of which five are regional endemics. It is located adjacent to the Soetdoring Nature Reserve IBA (SA049), and includes the Dronfield Farm (SA031), Kamfers Dam (SA032) and Benfontein Game Farm (SA033) IBAs. The dry, Highveld grasslands extending to the east of Kimberley and into the Free State feature a myriad of wetlands of varying sizes and degrees of seasonal permanence, while the large pans close to Kimberley itself (particularly Kamfers Dam but also possibly Langleg Pan – M. Anderson pers. comm.) support 10 000s of flamingos, and have hosted significant numbers of breeding Lesser Flamingos *Phoeniconaias minor* (Anderson & Anderson 2010). These birds typically travel to and from the pans areas on a roughly north-east/south-west axis, probably targeting rain-filled pans in the central Free State or the southern Kalahari, or else travelling all the way to Makgadikgadi in Botswana (McCulloch *et al.* 2003).The savanna habitat, which represents the southern extent of the Kalahari, supports significant numbers of White-backed Vultures *Gyps africanus*, with breeding pairs distributed in several loose colonies which are monitored regularly (Murn *et al.* 2007, Murn & Anderson 2008). The savanna also holds Martial and Tawny Eagles *Aquila rapax*, Secretarybird and Lappet-faced Vulture *Aegypius tracheliotus*. The Karoo plains to the south, as well as the open grasslands around Kimberley and to the east, also support a healthy and diverse community of large terrestrial birds (including Grey-crowned Crane, Kori Bustard *Ardeotis kori* and Blue Korhaan). The entire area is traversed by a number of Eskom transmission lines, which are used by both White-backed Vulture and Martial Eagle (Anderson & Hohne 2007, de Swaardt 2013), there are at least four Lesser Kestrel roost sites dispersed across the FA, which hold about 1000-4500 birds every summer, and a healthy population of African Fish-Eagles *Haliaeetus vocifer* nests along the Vaal River which runs across the eastern edge of the FA.

Site	Brief description
	We identified a short-list of 24 threatened and/or impact susceptible priority species to inform the sensitivity mapping for this FA (Table 5). White-backed Vulture, Lesser Flamingo and Lesser Kestrel were the most influential species in shaping these maps.
Vryburg Focus Area 6	This FA (9 204 km^2) falls within the Savanna Biome, and is dominated by the Eastern Kalahari Bushveld Bioregion (Mucina & Rutherford 2006). Open savanna or bushveld vegetation covers the majority of the FA, which features very little topographic relief. The north-western section includes a number of salt pans that form a unique feature in the open landscape. The FA does not include any Important Bird Areas (IBA), but is located about 30 km north-east of Barberspan, an acknowledged and registered RAMSAR site since 1975, and one of the few wetlands in the area that contains water throughout the year, attracting large numbers of wetland and water-dependant bird species. The FA supports up to 337 bird species, of which 23 are red-listed species, and two are red-listed endemics (Melodious Lark and Short-clawed Lark *Certhilauda chuana*). The avifauna of this area is poorly known and virtually undocumented. Levels of rural and agricultural development appear to be high, but in areas where the open savanna is at least partially intact, and especially where sizable trees still remain, large savanna raptor species such as Tawny Eagle, Lappet-faced Vulture, White-backed Vulture, and even Bateleur *Terathopius ecaudatus* may still be present. Otherwise, the open plains are likely to hold numbers of threatened large terrestrial birds (e.g. Secretarybird, Blue Crane and Kori Bustard, the town of Stella is a summer roost site for >3000 Lesser Kestrels, and the wetlands areas are likely to attract both Greater and Lesser Flamingos and a variety of other waterbirds (particularly in wet years). We identified a short-list of 18 threatened and/or impact susceptible priority species to inform the sensitivity mapping for this FA (Table 6). A suite of large savanna raptors, Lesser Kestrel and Greater Flamingo were the most influential species in shaping the sensitivity maps for this area.
Upington Focus Area 7	The Upington FA (12 833km^2) straddles the boundary between the Nama Karoo and Savanna Biomes, and comprises the Bushmanland and Kalahari Duneveld Bioregions (Mucina & Rutherford 2006). The area south of the Orange River is covered mainly by arid grassland, while the area north of the river features a mixture of shrubland and duneveld vegetation (Mucina & Rutherford 2006). The FA is not located close to any registered national Important Bird Areas, but the Orange River flows through a significant portion of the area, acting as an important flyway for birds generally, and supporting significant numbers of waterbirds. In addition to the already well developed vegetation structure on the banks of the river, quite large stands of alien invasive trees, particularly in the Upington area, support a variety of bird species, including nesting African Fish-Eagles. The FA includes two significant ranges of mountains - the Boegoeberge and the Skurweberge, which probably hold numbers of cliff-nesting species including Verreaux's Eagle, Booted Eagle and Black Stork, while well-treed drainage lines in the north of the FA probably support nest sites of large savanna raptors – Martial Eagle, Tawny Eagle and White-backed and Lappet-faced Vulture. Both Verreaux's Eagle and Martial Eagle also nest in man-made power pylons and communications masts in the vicinity of Upington. Over 275 bird species could occur within this FA, including 23 red-listed species and four red-listed endemics. We identified a short-list of 20 threatened and/or impact susceptible priority species to inform the sensitivity mapping for this FA (Table 7). Verreaux's Eagle, a suite of large savanna raptors and a suite of large terrestrial birds were the most influential species in shaping the sensitivity maps for this area.

Site	Brief description
Springbok Focus Area 8	This FA (15 214 km^2) spans the Succulent and Nama Karoo Biomes, and includes (from east to west) strips of the Bushmanland, Namaqualand Hardeveld and Namaqualand Sandveld Bioregions (Mucina & Rutherford 2006). The area supports up to 281 species of birds, including at least 27 red-listed species, of which six are regional endemics, and includes the Haramoep & Black Mountain Mine Nature Reserve IBA (SA035). The eastern part of the FA features the grassy plains of Bushmanland, which support a suite of endemic larks which proliferate in the area after good, autumn rainfall (Dean 2005). Vegetated, red sand dunes, which more or less coincide with the ancient course of the Koa River, form the core of the global distribution of the Red Lark (Dean *et al.* 1991), while sheer-sided inselbergs dotted around the plains support communities of cliff-nesting raptors, including pairs of Verreaux's Eagle, Booted Eagle, Lanner Falcon and possibly Booted Eagle and Cape Eagle Owl, and the open grasslands hold good numbers of large terrestrial birds (Ludwig's Bustard, Kori Bustard, Secretarybird), and breeding pairs of Martial Eagles using the Eskom transmission pylons. The central part of the FA comprises the steep hills around Springbok, dotted with exposed, granite rock-faces which support a high density of Verreaux's Eagle pairs, as well as similarly high densities of Jackal Buzzard and possibly Cape Eagle-Owl and Peregrine Falcon. The western part of the FA includes the coastal plain, with a localised Damara Tern *Sterna balaenarum* breeding site just north of Port Nolloth as well as including a portion of the range of Barlow's Lark *Calendulauda barlowi*, good numbers of Cape Cormorant *Phalacrocorax capensis* active along the rocky shore, large influxes of Ludwig's Bustard after winter rain, flamingos aggregating at coastal salt pans, Black Harriers present and breeding erratically in the Buffelsrivier floodplain, and Martial Eagles nesting in the transmission structures traversing the foot of the escarpment. We identified a short-list of 22 threatened and/or impact susceptible priority species to inform the sensitivity mapping for this FA (Table 8). Verreaux's (about 40 nesting pairs) and Martial Eagles (at least 10-12 nesting pairs), Red Lark and possibly Ludwig's Bustard were the most influential species in shaping the sensitivity maps for this area.

Table 1: List of priority species for the Overberg FA 1. Key species in the sensitivity mapping process are shaded in grey.

Species	Scientific name	Threat status		SA Endemism	National sensitivity rating (wind only)	SABAP2 Rep Rate (%)	FA-specific predicted susceptibility to	
		Regional	Global				Wind	Solar
Denham's Bustard	*Neotis denhami*	Vulnerable	Near-threatened	-	19	21.42	High	Moderate
Southern Black Korhaan	*Afrotis afra*	Vulnerable	Vulnerable	Endemic	36	1.93	Moderate	Moderate
Blue Crane	*Anthropoides paradiseus*	Near-threatened	Vulnerable	Near-endemic	13	78.08	High	Moderate
African Fish-Eagle	*Haliaeetus vocifer*	-	-	-	24	17.81	High	Low
Cape Vulture	*Gyps coprotheres*	Endangered	Vulnerable	Near-endemic	1	2.74	Very high	Low
African Marsh-Harrier	*Circus ranivorus*	Endangered	Least concern	-	18	10.27	Moderate	Low
Black Harrier	*Circus maurus*	Endangered	Vulnerable	Near-endemic	7	14.01	Moderate	Moderate
Jackal Buzzard	*Buteo rufofuscus*	-	-	Near-endemic	42	64.63	High	Low
Verreaux's Eagle	*Aquila verreauxii*	Vulnerable	Least concern	-	3	4.98	Very high	Low
Martial Eagle	*Polemaetus bellicosus*	Endangered	Vulnerable	-	5	5.35	Very high	Moderate
Secretarybird	*Sagittarius serpentarius*	Vulnerable	Vulnerable	-	12	8.59	High	Moderate
Lesser Kestrel	*Falco naumanni*	-	-	-	64	1.62	High	Moderate
Lanner Falcon	*Falco biarmicus*	Vulnerable	Least concern	-	20	4.42	High	Low
Peregrine Falcon	*Falco peregrinus*	-	-	-	48	2.93	High	Low
Greater Flamingo	*Phoenicopterus ruber*	Near-threatened	Least concern	-	25	1.43	High	Moderate
Lesser Flamingo	*Phoeniconaias minor*	Near-threatened	Near-threatened	-	26	0.06	High	Moderate
Great White Pelican	*Pelecanus onocrotalus*	Vulnerable	Least concern	-	9	1.62	Very high	Low
Black Stork	*Ciconia nigra*	Vulnerable	Least concern	-	8	1.12	High	Low
Agulhas Long-billed Lark	*Certhilauda brevirostris*	Near-threatened	-	Endemic	54	21.48	Low	High

Table 2: List of priority species for the Komsberg FA 2. Key species in the sensitivity mapping process are shaded in grey.

Species	Scientific name	Threat status		SA Endemism	National sensitivity rating (wind only)	SABAP2 Rep Rate (%)	FA-specific predicted susceptibility to	
		Regional	Global				Wind	Solar
Cape Eagle-Owl	*Bubo capensis*	-	-	-	41	0.00	Moderate	Low
Ludwig's Bustard	*Neotis ludwigii*	Endangered	Endangered	Near-endemic	14	7.09	High	Moderate
Southern Black Korhaan	*Afrotis afra*	Vulnerable	Vulnerable	Endemic	36	2.03	Moderate	Moderate
Karoo Korhaan	*Eupodotis vigorsii*	Near-threatened	Least concern	Near-endemic	49	29.39	Moderate	Moderate
Blue Crane	*Anthropoides paradiseus*	Near-threatened	Vulnerable	Near-endemic	13	1.01	High	Moderate
African Fish-Eagle	*Haliaeetus vocifer*	-	-	-	24	3.72	High	Low
Black Harrier	*Circus maurus*	Endangered	Vulnerable	Near-endemic	7	1.69	Moderate	Moderate
Jackal Buzzard	*Buteo rufofuscus*	-	-	Near-endemic	42	18.58	High	Low
Verreaux's Eagle	*Aquila verreauxii*	Vulnerable	Least concern	-	3	15.88	Very high	Low
Booted Eagle	*Aquila pennatus*	-	-	-	57	14.19	High	Low
Martial Eagle	*Polemaetus bellicosus*	Endangered	Vulnerable	-	5	4.73	Very high	Moderate
Secretarybird	*Sagittarius serpentarius*	Vulnerable	Vulnerable	-	12	0.00	High	Moderate
Lesser Kestrel	*Falco naumanni*	-	-	-	64	0.68	High	Moderate
Lanner Falcon	*Falco biarmicus*	Vulnerable	Least concern	-	20	1.69	High	Low
Peregrine Falcon	*Falco peregrinus*	-	-	-	48	0.00	High	Low
Greater Flamingo	*Phoenicopterus ruber*	Near-threatened	Least concern	-	25	4.73	High	Moderate
Lesser Flamingo	*Phoeniconaias minor*	Near-threatened	Near-threatened	-	26	0.00	High	Moderate
Black Stork	*Ciconia nigra*	Vulnerable	Least concern	-	8	0.68	High	Low
African Rock Pipit	*Anthus crenatus*	Near-threatened	Least concern	Endemic	77	1.35	Low	High

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Table 3: List of priority species for the Cookhouse FA 3. Key species in the sensitivity mapping process are shaded in grey.

Species	Scientific name	Threat status		SA Endemism	National sensitivity rating (wind only	SABAP2 Rep Rate (%)	FA-specific predicted susceptibility to	
		Regional	Global				Wind	Solar
Denham's Bustard	*Neotis denhami*	Vulnerable	Near-threatened	-	19	1.89	High	Moderate
Ludwig's Bustard	*Neotis ludwigii*	Endangered	Endangered	Near-endemic	14	2.83	High	Moderate
Kori Bustard	*Ardeotis kori*	Near-threatened	Near-threatened	-	38	1.65	High	Moderate
Southern Black Korhaan	*Afrotis afra*	Vulnerable	Vulnerable	Endemic	36	8.96	Moderate	Moderate
White-bellied Korhaan	*Eupodotis senegalensis*	Vulnerable	Least concern	-	35	3.77	Moderate	Moderate
Blue Crane	*Anthropoides paradiseus*	Near-threatened	Vulnerable	Near-endemic	13	9.91	High	Moderate
African Fish-Eagle	*Haliaeetus vocifer*	-	-	-	24	12.50	High	Low
Cape Vulture	*Gyps coprotheres*	Endangered	Vulnerable	Near-endemic	1	0.94	Very high	Low
Black Harrier	*Circus maurus*	Endangered	Vulnerable	Near-endemic	7	6.37	Moderate	Moderate
Jackal Buzzard	*Buteo rufofuscus*	-	-	Near-endemic	42	26.18	High	Low
Verreaux's Eagle	*Aquila verreauxii*	Vulnerable	Least concern	-	3	3.30	Very high	Low
Booted Eagle	*Aquila pennatus*	-	-	-	57	5.19	High	Low
Martial Eagle	*Polemaetus bellicosus*	Endangered	Vulnerable	-	5	4.72	Very high	Moderate
African Crowned Eagle	*Stephanoaetus coronatus*	Vulnerable	Near-threatened	-	27	4.25	Very high	Low
Secretarybird	*Sagittarius serpentarius*	Vulnerable	Vulnerable	-	12	5.42	High	Moderate
Lesser Kestrel	*Falco naumanni*	-	-	-	64	0.47	High	Moderate
Amur Falcon	*Falco amurensis*	-	-	-	65	2.59	High	Moderate
Lanner Falcon	*Falco biarmicus*	Vulnerable	Least concern	-	20	2.59	High	Low
Melodious Lark	*Mirafra cheniana*	Least concern	Near-threatened	Near-endemic	92	1.42	Low	High

Table 4: List of priority species for the Stormberg FA 4. Key species in the sensitivity mapping process are shaded in grey.

Species	Scientific name	Threat status		SA Endemism	National sensitivity rating (wind only	SABAP2 Rep Rate (%)	FA-specific predicted susceptibility to	
		Regional	Global				Wind	Solar
Cape Eagle-Owl	*Bubo capensis*	-	-	-	41	0.00	Moderate	Low
Denham's Bustard	*Neotis denhami*	Vulnerable	Near-threatened	-	19	0.61	High	Moderate
Ludwig's Bustard	*Neotis ludwigii*	Endangered	Endangered	Near-endemic	14	1.83	High	Moderate
Blue Korhaan	*Eupodotis caerulescens*	Least concern	Near-threatened	Endemic	34	14.37	Moderate	Moderate
White-bellied Korhaan	*Eupodotis senegalensis*	Vulnerable	Least concern	-	35	0.00	Moderate	Moderate
Grey-crowned Crane	*Balearica regulorum*	Endangered	Endangered	-	15	4.28	High	Low
Blue Crane	*Anthropoides paradiseus*	Near-threatened	Vulnerable	Near-endemic	13	6.42	High	Moderate
African Fish-Eagle	*Haliaeetus vocifer*	-	-	-	24	5.20	High	Low
Bearded Vulture	*Gypaetus barbatus*	Critically Endangered	Least concern	-	2	0.00	Very high	Low
Cape Vulture	*Gyps coprotheres*	Endangered	Vulnerable	Near-endemic	1	9.48	Very high	Low
Black Harrier	*Circus maurus*	Endangered	Vulnerable	Near-endemic	7	5.20	Moderate	Moderate
Jackal Buzzard	*Buteo rufofuscus*	-	-	Near-endemic	42	32.72	High	Low
Verreaux's Eagle	*Aquila verreauxii*	Vulnerable	Least concern	-	3	20.80	Very high	Low
Martial Eagle	*Polemaetus bellicosus*	Endangered	Vulnerable	-	5	2.45	Very high	Moderate
Secretarybird	*Sagittarius serpentarius*	Vulnerable	Vulnerable	-	12	5.20	High	Moderate
Lesser Kestrel	*Falco naumanni*	-	-	-	64	1.53	High	Moderate
Amur Falcon	*Falco amurensis*	-	-	-	65	1.83	High	Moderate
Lanner Falcon	*Falco biarmicus*	Vulnerable	Least concern	-	20	3.67	High	Low
Black Stork	*Ciconia nigra*	Vulnerable	Least concern	-	8	1.22	High	Low
Melodious Lark	*Mirafra cheniana*	Least concern	Near-threatened	Near-endemic	92	0.31	Low	High
Rudd's Lark	*Heteromirafra ruddi*	Endangered	Vulnerable	Endemic	60	0.00	Moderate	High
Yellow-breasted Pipit	*Anthus chloris*	Vulnerable	Vulnerable	Endemic	46	0.00	Moderate	High
African Rock Pipit	*Anthus crenatus*	Near-threatened	Least concern	Endemic	77	13.76	Low	Moderate

Table 5: List of priority species for the Kimberley FA 5. Key species in the sensitivity mapping process are shaded in grey.

Species	Scientific name	Threat status		SA Endemism	National sensitivity rating (wind only	SABAP2 Rep Rate (%)	FA-specific predicted susceptibility to	
		Regional	Global				Wind	Solar
Ludwig's Bustard	*Neotis ludwigii*	Endangered	Endangered	Near-endemic	14	2.67	High	Moderate
Kori Bustard	*Ardeotis kori*	Near-threatened	Near-threatened	-	38	3.23	High	Moderate
Blue Korhaan	*Eupodotis caerulescens*	Least concern	Near-threatened	Endemic	34	5.12	Moderate	Moderate
Grey-crowned Crane	*Balearica regulorum*	Endangered	Endangered	-	15	3.67	Moderate	Low
Blue Crane	*Anthropoides paradiseus*	Near-threatened	Vulnerable	Near-endemic	13	3.23	High	Moderate
Chestnut-banded Plover	*Charadrius pallidus*	Near-threatened	Near-threatened	-	58	2.00	Low	Low
Double-banded Courser	*Rhinoptilus africanus*	Near-threatened	Least concern	-	72	20.49	Moderate	Moderate
Caspian Tern	*Sterna caspia*	Vulnerable	Least concern	-	51	4.01	Moderate	Low
African Fish-Eagle	*Haliaeetus vocifer*	-	-	-	24	15.37	High	Low
White-backed Vulture	*Gyps africanus*	Endangered	Endangered	-	22	11.69	Very high	Moderate
Lappet-faced Vulture	*Aegypius tracheliotus*	Endangered	Vulnerable	-	28	1.34	Very high	Moderate
African Marsh-Harrier	*Circus ranivorus*	Endangered	Least concern	-	18	1.67	Moderate	Low
Jackal Buzzard	*Buteo rufofuscus*	-	-	Near-endemic	42	1.22	High	Low
Tawny Eagle	*Aquila rapax*	Endangered	Least concern	-	29	2.12	High	Moderate
Verreaux's Eagle	*Aquila verreauxii*	Vulnerable	Least concern	-	3	0.22	Very high	Low
Martial Eagle	*Polemaetus bellicosus*	Endangered	Vulnerable	-	5	1.34	Very high	Moderate
Secretarybird	*Sagittarius serpentarius*	Vulnerable	Vulnerable	-	12	11.25	High	Moderate
Lesser Kestrel	*Falco naumanni*	-	-	-	64	19.82	High	Moderate
Amur Falcon	*Falco amurensis*	-	-	-	65	9.35	High	Moderate
Lanner Falcon	*Falco biarmicus*	Vulnerable	Least concern	-	20	5.23	High	Low
Greater Flamingo	*Phoenicopterus ruber*	Near-threatened	Least concern	-	25	11.80	High	Moderate
Lesser Flamingo	*Phoeniconaias minor*	Near-threatened	Near-threatened	-	26	12.03	High	Moderate
Yellow-billed Stork	*Mycteria ibis*	Endangered	Least concern	-	11	4.90	Moderate	Moderate
Melodious Lark	*Mirafra cheniana*	Least concern	Near-threatened	Near-endemic	92	5.68	Low	High

Table 6: List of priority species for the Vryburg FA 6. Key species in the sensitivity mapping process are shaded in grey.

Species	Scientific name	Threat status		SA Endemism	National sensitivity rating (wind only	SABAP2 Rep Rate (%)	FA-specific predicted susceptibility to	
		Regional	Global				Wind	Solar
Kori Bustard	*Ardeotis kori*	Near-threatened	Near-threatened	-	38	0.00	High	Moderate
Blue Crane	*Anthropoides paradiseus*	Near-threatened	Vulnerable	Near-endemic	13	0.00	High	Moderate
African Fish-Eagle	*Haliaeetus vocifer*	-	-	-	24	3.24	High	Low
White-backed Vulture	*Gyps africanus*	Endangered	Endangered	-	22	7.03	Very high	Moderate
Lappet-faced Vulture	*Aegypius tracheliotus*	Endangered	Vulnerable	-	28	1.62	Very high	Moderate
Bateleur	*Terathopius ecaudatus*	Endangered	Near-threatened	-	32	0.54	High	Moderate
Tawny Eagle	*Aquila rapax*	Endangered	Least concern	-	29	0.00	High	Moderate
Martial Eagle	*Polemaetus bellicosus*	Endangered	Vulnerable	-	5	0.00	Very high	Moderate
Secretarybird	*Sagittarius serpentarius*	Vulnerable	Vulnerable	-	12	3.24	Very high	Moderate
Lesser Kestrel	*Falco naumanni*	-	-	-	64	9.19	High	Moderate
Red-footed Falcon	*Falco vespertinus*				98	1.08	High	Moderate
Amur Falcon	*Falco amurensis*	-	-	-	65	5.41	High	Moderate
Greater Flamingo	*Phoenicopterus ruber*	Near-threatened	Least concern	-	25	4.86	High	Moderate
Lesser Flamingo	*Phoeniconaias minor*	Near-threatened	Near-threatened	-	26	1.08	High	Moderate
Great White Pelican	*Pelecanus onocrotalus*	Vulnerable	Least concern	-	9	0.00	Very high	Low
Pink-backed Pelican	*Pelecanus rufescens*	Vulnerable	Least concern	-	21	0.00	Very high	Low
Black Stork	*Ciconia nigra*	Vulnerable	Least concern	-	8	1.08	High	Low
Melodious Lark	*Mirafra cheniana*	Least concern	Near-threatened	Near-endemic	92	0.54	Low	High

Table 7: List of priority species for the Upington FA 7. Key species in the sensitivity mapping process are shaded in grey.

Species	Scientific name	Threat status		SA Endemism	National sensitivity rating (wind only	SABAP2 Rep Rate (%)	FA-specific predicted susceptibility to	
		Regional	Global				Wind	Solar
Ludwig's Bustard	*Neotis ludwigii*	Endangered	Endangered	Near-endemic	14	4.31	High	Moderate
Kori Bustard	*Ardeotis kori*	Near-threatened	Near-threatened	-	38	14.83	High	Moderate
Karoo Korhaan	*Eupodotis vigorsii*	Near-threatened	Least concern	Near-endemic	49	18.66	Moderate	Moderate
African Fish-Eagle	*Haliaeetus vocifer*	-	-	-	24	19.14	High	Low
White-backed Vulture	*Gyps africanus*	Endangered	Endangered	-	22	1.44	Very high	Moderate
Lappet-faced Vulture	*Aegypius tracheliotus*	Endangered	Vulnerable	-	28	1.91	Very high	Moderate
Jackal Buzzard	*Buteo rufofuscus*	-	-	Near-endemic	42	0.48	High	Low
Tawny Eagle	*Aquila rapax*	Endangered	Least concern	-	29	0.96	High	Moderate
Verreaux's Eagle	*Aquila verreauxii*	Vulnerable	Least concern	-	3	6.22	Very high	Low
Booted Eagle	*Aquila pennatus*	-	-	-	57	2.39	High	Low
Martial Eagle	*Polemaetus bellicosus*	Endangered	Vulnerable	-	5	1.91	Very high	Moderate
Secretarybird	*Sagittarius serpentarius*	Vulnerable	Vulnerable	-	12	5.26	High	Moderate
Lesser Kestrel	*Falco naumanni*	-	-	-	64	0.96	High	Moderate
Lanner Falcon	*Falco biarmicus*	Vulnerable	Least concern	-	20	8.13	High	Low
Greater Flamingo	*Phoenicopterus ruber*	Near-threatened	Least concern	-	25	0.00	High	Moderate
Lesser Flamingo	*Phoeniconaias minor*	Near-threatened	Near-threatened	-	26	0.00	High	Moderate
Black Stork	*Ciconia nigra*	Vulnerable	Least concern	-	8	0.00	High	Low
Black-eared Sparrowlark	*Eremopterix australis*	-	-	Endemic	106	3.35	Low	High
Sclater's Lark	*Spizocorys sclateri*	Near-threatened	Near-threatened	Near-endemic	52	0.00	Low	High
African Rock Pipit	*Anthus crenatus*	Near-threatened	Least concern	Endemic	77	5.26	Low	Moderate

Table 8: List of priority species for the Springbok FA 8. Key species in the sensitivity mapping process are shaded in grey.

Species	Scientific name	Threat status		SA Endemism	National sensitivity rating (wind only	SABAP2 Rep Rate (%)	FA-specific predicted susceptibility to	
		Regional	Global				Wind	Solar
Cape Eagle-Owl	*Bubo capensis*	-	-	-	41	0.36	Moderate	Moderate
Ludwig's Bustard	*Neotis ludwigii*	Endangered	Endangered	Near-endemic	14	16.18	High	Moderate
Kori Bustard	*Ardeotis kori*	Near-threatened	Near-threatened	-	38	0.91	High	Moderate
Southern Black Korhaan	*Afrotis afra*	Vulnerable	Vulnerable	Endemic	36	5.64	Moderate	Moderate
Caspian Tern	*Sterna caspia*	Vulnerable	Least concern	-	51	16.00	Moderate	Low
Damara Tern	*Sterna balaenarum*	Critically Endangered	Near-threatened	-	33	0.55	Moderate	Moderate
Black Harrier	*Circus maurus*	Endangered	Vulnerable	Near-endemic	7	2.91	Moderate	Moderate
Jackal Buzzard	*Buteo rufofuscus*	-	-	Near-endemic	42	22.55	High	Low
Verreaux's Eagle	*Aquila verreauxii*	Vulnerable	Least concern	-	3	6.91	Very high	Low
Booted Eagle	*Aquila pennatus*	-	-	-	57	2.00	High	Low
Martial Eagle	*Polemaetus bellicosus*	Endangered	Vulnerable	-	5	2.36	Very high	Moderate
Secretarybird	*Sagittarius serpentarius*	Vulnerable	Vulnerable	-	12	1.64	High	Moderate
Lanner Falcon	*Falco biarmicus*	Vulnerable	Least concern	-	20	11.64	High	Low
Peregrine Falcon	*Falco peregrinus*	-	-	-	48	0.00	High	Low
Cape Cormorant	*Phalacrocorax capensis*	Endangered	Endangered	Near-endemic	37	30.91	High	Low
Greater Flamingo	*Phoenicopterus ruber*	Near-threatened	Least concern	-	25	12.73	High	Moderate
Lesser Flamingo	*Phoeniconaias minor*	Near-threatened	Near-threatened	-	26	10.36	High	Moderate
Great White Pelican	*Pelecanus onocrotalus*	Vulnerable	Least concern	-	9	7.82	Very high	Low
Red Lark	*Calendulauda burra*	Vulnerable	Vulnerable	Endemic	40	5.64	Moderate	High
Barlow's Lark	*Calendulauda barlowi*	Near-threatened	Least concern	Near-endemic	70	10.55	Moderate	High
Black-eared Sparrowlark	*Eremopterix australis*	-	-	Endemic	106	6.18	Low	High
Sclater's Lark	*Spizocorys sclateri*	Near-threatened	Near-threatened	Near-endemic	52	0.00	Low	High

4 ABSOLUTE SENSITIVITY MAPPING

4.1 Identification of absolute sensitivity criteria

Site	Technology	Description of criteria	Source	Application Sensitivity: Buffer Distance
Relevant to all Focus Areas	*Wind*	All wetlands with a surface area >20 000 m^2	Improved wetlands layer from SEA project freshwater specialist team: WSSEA Wetlands, 2014	Medium:2 km from edge
		All protected areas	SAPAD layer, 2014	Very High: 2 km from edge
		From DEM slopes >75°, that probably constitute sheer cliffs that may be used by cliff-nesting/slope soaring birds	CGA, Stellenbosch University	High: 3 km
Relevant to all Focus Areas	*Solar*	All wetlands with a surface area >20 000 m^2	Improved wetlands layer from SEA project freshwater specialist team: WSSEA Wetlands, 2014	Medium: 1 km from edge
		All protected areas	SAPAD layer, 2014	Very High: 1 km from edge
		From DEM slopes >75°, that probably constitute sheer cliffs that may be used by cliff-nesting/slope soaring birds	CGA, Stellenbosch University	High: 1 km
Overberg Focus Area 1	*Wind*	Power lines $\geq$132 kV possibly used by nesting Martial Eagles or other raptors	Eskom Networks layer, 2014	Medium: 5 km
		All Threatened Ecosystem fragments >100 ha considered a likely Black Harrier nesting area	SIPs Remaining Threatened Ecosystems layer, 2013	High: 2 km
		Breede River as an avian fly-way; supports waterbirds and riparian communities	NFEPA Rivers layer, 2011	Very High: 1 km from edge of full river
		Known Cape Vulture colony	Kevin Shaw CapeNature, EWT Knowledge Management Database, BLSA	Very High: 20 km High: 40 km
		Known Verreaux's Eagle nests	L. Rodrigues Unpubl. data, A.R. Jenkins Unpubl. data	Very High: 3 km High: 5 km
		Known Peregrine Falcon nest sites on cliffs or buildings	A.R. Jenkins Unpubl. data	Very High:1 km High:2 km
		Known Martial Eagle nest site in a gum stand	O. Curtis Pers. comm.	Very High: 5 km
		Known African Fish-Eagle nest sites in trees on or close to Breede River	A. Welz, A.R. Jenkins Unpubl. data	Very High: 2 km

Site	Technology	Description of criteria	Source	Application Sensitivity: Buffer Distance
		Known Black Harrier nesting areas in Renosterveld fragments	R.E. Simmons, O. Curtis, Unpubl. data	Very High: 2 km
		Known Blue Crane nesting areas	EWT Knowledge Management Database, Kevin Shaw CapeNature	Very High: 150 m High: 300 m
		Selected CWAC sites, with high total counts, spp. diversities, and presence of Red-listed species	CWAC data base, ADU	Very High: 2 km from edge
		Past and possible future Lesser Kestrel roost site	EWT Knowledge Management Database, BLSA	High: 5 km
		Good wetland located just outside FA	O. Curtis Pers. comm.	High: 2 km from edge
Overberg Focus Area 1	*Solar*	Power lines ≥132 kV possibly used by nesting Martial Eagles or other raptors	Eskom Networks layer, 2014	Medium: 2 km
		All Threatened Ecosystem fragments >100ha considered a likely Black Harrier nesting area	SIPs Remaining Threatened Ecosystems layer, 2013	High: 1 km
		Breede River as an avian fly-way; supports waterbirds and riparian communities	NFEPA Rivers layer, 2011	Very High: 500 m from edge of full river
		Known Cape Vulture colony	Kevin Shaw CapeNature, EWT Knowledge Management Database, BLSA	Very High: 5 km
		Known Verreaux's Eagle nests	L. Rodrigues Unpubl. data, A.R. Jenkins Unpubl. data	Very High: 1 km
		Known Peregrine Falcon nest sites on cliffs or buildings	A.R. Jenkins Unpubl. data	Very High: 500 m
		Known Martial Eagle nest site in a gum stand	O. Curtis Pers. comm.	Very High: 2 km
		Known African Fish-Eagle nest sites in trees on or close to Breede River	A. Welz, A.R. Jenkins Unpubl. data	Very High: 1 km
		Known Black Harrier nesting areas in Renosterveld fragments	R.E. Simmons, O. Curtis Unpubl. data	Very High: 1 km
		Known Blue Crane nesting areas	EWT Knowledge Management Database, Kevin Shaw CapeNature	Very High:150 m High: 300 m
		Selected CWAC sites, with high total counts, spp. diversities, and presence of Red-listed species	CWAC data base, ADU	Very High: 1 km from edge
		Past and possible future Lesser Kestrel roost site	EWT Knowledge Management Database, BLSA	High: 1 km
		Good wetland located just outside FA	O. Curtis Pers. comm.	High: 1 km from edge

Site	Technology	Description of criteria	Source	Application Sensitivity: Buffer Distance
Komsberg Focus Area 2	*Wind*	Power lines ≥132 kV possibly used by nesting Martial Eagles or other raptors	Eskom Networks layer, 2014	Medium: 5 km
		Buffelsrivier as an avian fly-way; supports waterbirds and riparian communities	NFEPA Rivers layer, 2011	Very High: 1 km from edge of full river
		Known Verreaux's Eagle nests, or predicted sites on the basis of spacing and habitat	Lucia Rodrigues Unpubl. data, A.R Jenkins Unpubl. data, Suurplaats WEF monitoring data	Very High: 3 km High: 5 km
		Known Booted Eagle nest sites	Suurplaats WEF monitoring data	Very High: 1 km High: 2 km
		Known Peregrine Falcon nest site	Suurplaats WEF monitoring data	Very High: 1 km High: 2 km
		Known Jackal Buzzard nest site	Suurplaats WEF monitoring data	Very High: 1 km High: 2 km
		Known Martial Eagle nest sites on Droerivier-Muldersvlei and Droerivier-Bachus 400 kV lines, and Droerivier-Boskloof 132 kV line	Jenkins *et al.* 2013, Koos de Goede Unpubl. data	Very High: 5 km
		Known Black Harrier nesting area	A.R. Jenkins Unpubl data	Very High: 2 km
		Selected CWAC site, with high total counts, spp. diversities, and presence of Red-listed species	CWAC data base, ADU	Very High: 2 km from edge
		Good wetland located just outside FA	Identified using SABAP2 flamingo data, ADU	High: 2 km from edge
		Area of high topographic relief considered likely to be used extensively by slope soaring birds, including threatened & sensitive raptors and storks; polygon including Roggeveld escarpment and ridges to the south	This study	Medium: No buffer
Komsberg Focus Area 2	*Solar*	Power lines ≥132 kV possibly used by nesting Martial Eagles or other raptors	Eskom Networks layer, 2014	Medium: 2 km
		Buffelsrivier as an avian fly-way; supports waterbirds and riparian communities	NFEPA Rivers layer, 2011	Very High: 500 m from edge of full river
		Known Verreaux's Eagle nests, or predicted sites on the basis of spacing and habitat	Lucia Rodrigues Unpubl. data, A.R Jenkins Unpubl. data, Suurplaats WEF monitoring data	Very High: 1 km
		Known Booted Eagle nest sites	Suurplaats WEF monitoring data	Very High: 500 m
		Known Peregrine Falcon nest site	Suurplaats WEF monitoring data	Very High: 500 m

Site	Technology	Description of criteria	Source	Application Sensitivity: Buffer Distance
		Known Jackal Buzzard nest site	Suurplaats WEF monitoring data	Very High: 500 m
		Known Martial Eagle nest sites on Droerivier-Muldersvlei and Droerivier-Bachus 400 kV lines, and Droerivier-Boskloof 132 kV line	Jenkins *et al.* 2013, Koos de Goede Unpubl. data	Very High: 2 km
		Known Black Harrier nesting area	A.R. Jenkins Unpubl data	Very High: 1 km
		Selected CWAC site, with high total counts, spp. diversities, and presence of Red-listed species	CWAC data base, ADU	Very High: 1 km from edge
		Good wetland located just outside FA	Identified using SABAP2 flamingo data, ADU	High: 1 km from edge
Cookhouse Focus Area 3	*Wind*	Power lines ≥132 kV possibly used by roosting Cape Vultures and nesting large eagles, buzzards, falcons	Eskom Networks layer, 2014	Medium: 5 km
		Great Fish River as an avian fly-way; supports waterbirds and riparian communities	NFEPA Rivers layer, 2011	Very High: 1 km from edge of full river
		Little Fish River as an avian fly-way; supports waterbirds and riparian communities	NFEPA Rivers layer, 2011	Very High: 1 km from edge of full river
		Koonap River as an avian fly-way; supports waterbirds and riparian communities	NFEPA Rivers layer, 2011	Very High: 1 km from edge of full river
		Selected CWAC site, with high total counts, spp. diversities, and presence of Red-listed species	CWAC data base, ADU	Very High: 2 km from edge
		Known Cape Vulture roost site at Agieskloof / Lichtenstein	EWT Knowledge Management Database, BLSA, Boshoff et al. 2009 a & b	Very High: 20 km High: 40 km
		Known Blue Crane nesting areas	EWT Knowledge Management Database	Very High: 150 m High: 300 m
		Past and possible future migrating kestrel roost site	EWT Knowledge Management Database, BLSA	High: 5 km
		Known Lanner Falcon nest sites	A. Stephenson Unpubl. data, Jenkins *et al.* 2012b, 2013a	Very High: 1 km High: 3 km
		Presence data for a suite of threatened, impact susceptible large terrestrial birds	SABAP2, ADU	Medium: No buffer
Cookhouse Focus Area 3	*Solar*	Power lines ≥ 132 kV possibly used by roosting Cape Vultures and nesting large eagles, buzzards, falcons	Eskom Networks layer, 2014	Medium: 2 km
		Great Fish River as an avian fly-way; supports waterbirds and riparian communities	NFEPA Rivers layer, 2011	Very High: 500 m from edge of full river
		Little Fish River as an avian fly-way; supports	NFEPA Rivers layer, 2011	Very High: 500 m from edge of

Site	Technology	Description of criteria	Source	Application Sensitivity: Buffer Distance
		waterbirds and riparian communities		full river
		Koonap River as an avian fly-way; supports waterbirds and riparian communities	NFEPA Rivers layer, 2011	Very High: 500 m from edge of full river
		Selected CWAC site, with high total counts, spp. diversities, and presence of Red-listed species	CWAC data base, ADU	Very High: 1 km from edge
		Known Cape Vulture roost site at Agieskloof / Lichtenstein	EWT Knowledge Management Database, BLSA, Boshoff *et al.* 2009 a & b	Very High: 4 km
		Known Blue Crane nesting areas	EWT Knowledge Management Database	Very High: 150 m High: 300 m
		Past and possible future migrating kestrel roost site	EWT Knowledge Management Database, BLSA	High: 1 km
		Known Lanner Falcon nest sites	A. Stephenson Unpubl. data, Jenkins *et al.* 2012b, 2013a	Very High: 500 m
		Presence data for a suite of threatened, impact susceptible large terrestrial birds	SABAP2, ADU	Medium: No buffer
Stormberg Focus Area 4	*Wind*	Power lines ≥132 kV possibly used by roosting Cape Vultures and nesting large eagles, buzzards, falcons	Eskom Networks layer, 2014	Medium: 5 km
		Known Cape Vulture colony cliffs and roost sites	EWT Knowledge Management Database, BLSA, Boshoff et al. 2009a & b, K. Webster Pers. Comm., A.R. Jenkins Unpubl. data	Very High: 20 km High: 40 km
		Artificial vulture feeding sites	EWT Knowledge Management Database, Kerri Wolter VulPro, K. Webster Pers. comm., Elliot WEF bird monitoring data	Very High: 10 km Medium: 20 km
		Area of relatively pristine grassland around the top of Penhoek Pass with SABAP1 records for threatened endemic passerines – esp. Rudd's Lark and Yellow-breasted Pipit, and recent pers. comm. records	Smallie 2013, Whyte 2013	Very High: 5 km
		Known Grey-crowned and Blue Crane nesting areas	EWT Knowledge Management Database	Very High: 150 m High: 300 m
		Known migrating kestrel (Amur Falcon) roost site	EWT Knowledge Management Database, BLSA	Very High: 5 km Medium: 10 km
		Known Verreaux's Eagle nest site	Dorper WEF monitoring data	Very High: 3 km High: 5 km

Site	Technology	Description of criteria	Source	Application Sensitivity: Buffer Distance
		Probable Cape Vulture roost	Whyte 2013	Very High: 10 km High: 10 km
		Presence data for a suite of threatened, impact susceptible large terrestrial birds; corroborated by CAR data, which includes records for Southern Bald Ibis (not recorded in SABAP2)	SABAP2, ADU	Medium: No buffer
Stormberg Focus Area 4	*Solar*	Power lines ≥132 kV possibly used by roosting Cape Vultures and nesting large eagles, buzzards, falcons	Eskom Networks layer, 2014	Medium: 2 km
		Known Cape Vulture colony cliffs and roost sites	EWT Knowledge Management Database, BLSA, Boshoff et al. 2009a & b, K. Webster Pers. Comm., A.R. Jenkins Unpubl. data	Very High: 4 km
		Artificial vulture feeding sites	EWT Knowledge Management Database, Kerri Wolter VulPro, K. Webster Pers. comm., Elliot WEF bird monitoring data	Very High: 1 km
		Area of relatively pristine grassland around the top of Penhoek Pass with SABAP1 records for threatened endemic passerines – esp. Rudd's Lark and Yellow-breasted Pipit, and recent pers. comm. records	Smallie 2013, Whyte 2013	Very High: 5 km
		Known Grey-crowned and Blue Crane nesting areas	EWT Knowledge Management Database	Very High: 150 m High: 300 m
		Known migrating kestrel (Amur Falcon) roost site	EWT Knowledge Management Database, BLSA	Very High: 1 km
		Known Verreaux's Eagle nest site	Dorper WEF monitoring data	Very High: 1 km
		Probable Cape Vulture roost	Whyte 2013	Very High: 2 km

Site	Technology	Description of criteria	Source	Application Sensitivity: Buffer Distance
Kimberley Focus Area 5	*Wind*	Important Bird Areas	BLSA	Very High : 2 km from edge
		Kamfers Dam IBA supports up to 40 000 flamingos, including breeding Lesser Flamingo	BLSA, Anderson & Anderson 2010	Very High: 5 km from edge
		Power lines ≥132 kV possibly used by nesting White-backed Vultures, Martial or Tawny Eagles	Eskom Networks layer, 2014	Medium: 5 km
		Grootkop-Kimberley 132 kV power line which supports >20 White-backed Vulture nests and 2 Martial Eagle nests somewhere along its length	Anderson & Hohne 2007	Very High: 5 km
		Vaal River as an avian fly-way; supports waterbirds and riparian communities	NFEPA Rivers layer, 2011	Very High: 1 km from edge of full river
		Modder River as an avian fly-way; supports waterbirds and riparian communities	NFEPA Rivers layer, 2011	Very High: 1 km from edge of full river
		Selected CWAC sites, with high total counts, spp. diversities, and presence of Red-listed species	CWAC data base, ADU	Very High: 3 km from edge
		Known White-backed Vulture colonies/nest sites	C. Murn Unpubl. data, Anderson, A. Maritz Unpubl. data, R. Visagie Unpubl. data, Murn et al. 2007, Murn & Anderson 2008	Very High: 5 km
		Artificial vulture feeding sites	EWT, Kerri Wolter VulPro	Very High: 10 km Medium: 20 km
		Known African Fish-Eagle nest sites	M. Anderson Unpubl. data	Very High: 2 km
		Known migrating kestrel roost sites	EWT Knowledge Management database, BLSA	Very High: 5 km Medium: 10 km
		Langleg Pan: known aggregation point and possible nesting site for Lesser Flamingos	M. Anderson Pers. comm.	Very High: 5 km from edge
		Flamingo tracking data showing movement patterns into and out of Kamfers Dam	McCulloch et al. 2003, G. McCulloch Unpubl. data	Very High: All tracks by 2.5 km
Kimberley Focus Area 5	*Solar*	Important Bird Areas	BLSA	Very High: 1 km from edge
		Kamfers Dam IBA supports up to 40 000 flamingos, including breeding Lesser Flamingo	BLSA, Anderson & Anderson 2010	Very High: 5 km from edge
		Power lines ≥132 kV possibly used by nesting White-backed Vultures, Martial or Tawny Eagles	Eskom Networks layer, 2014	Medium: 2 km

Site	Technology	Description of criteria	Source	Application Sensitivity: Buffer Distance
		Grootkop-Kimberley 132 kV power line which supports >20 White-backed Vulture nests and 2 Martial Eagle nests somewhere along its length	Anderson & Hohne 2007	Very High: 2 km
		Vaal River as an avian fly-way; supports waterbirds and riparian communities	NFEPA Rivers layer, 2011	Very High: 500 m from edge of full river
		Modder River as an avian fly-way; supports waterbirds and riparian communities	NFEPA Rivers layer, 2011	Very High: 500 m from edge of full river
		Selected CWAC sites, with high total counts, spp. diversities, and presence of Red-listed species	CWAC data base, ADU	Very High: 3 km from edge
		Known White-backed Vulture colonies/nest sites	C. Murn Unpubl. data, Anderson, A. Maritz Unpubl. data, R. Visagie Unpubl. data, Murn et al. 2007, Murn & Anderson 2008	Very High: 2 km
		Vulture restaurants	EWT, Kerri Wolter VulPro	Very High: 2 km
		Known African Fish-Eagle nest sites	M. Anderson Unpubl. data	Very High: 1 km
		Known migrating kestrel roost sites	EWT Knowledge Management database, BLSA	Very High: 1 km
		Langleg Pan: known aggregation point and possible nesting site for Lesser Flamingos	M. Anderson Pers. comm.	Very High: 5 km from edge
		Flamingo tracking data showing movement patterns into and out of Kamfers Dam	McCulloch *et al.* 2003, G. McCulloch Unpubl. data	Very High: All tracks by 2.5 km
Vryburg Focus Area 6	*Wind*	Power lines ≥88 kV possibly used by nesting White-backed Vultures or other large raptors	Eskom Networks layer, 2014	Medium: 5 km
		Known migrating kestrel roost site	EWT Knowledge Management Database, BLSA	Very High: 5 km Medium: 10 km
		Presence data for a suite of threatened, impact susceptible large savanna raptors	SABAP2, ADU	High: No buffer
		Unknown area with some data to suggest preferential use by large savanna raptors, broadly located in the arc bordered by the R378 and the N14, and based loosely on the SABAP2 data above	This study	Medium: No buffer

Site	Technology	Description of criteria	Source	Application Sensitivity: Buffer Distance
		Unknown area with habitat features that suggest issues with threatened & sensitive spp, particularly those associated with high abundance of pans; polygon extending west of Vryburg, between N14 and R378, to the edge of the FA	This study	Medium: No buffer
Vryburg Focus Area 6	*Solar*	Power lines ≥88 kV possibly used by nesting White-backed Vultures or other large raptors	Eskom Networks layer, 2014	Medium: 2 km
		Known migrating kestrel roost site	EWT Knowledge Management Database, BLSA	Very High: 1 km
		Presence data for a suite of threatened, impact susceptible large savanna raptors	SABAP2, ADU	High: No buffer
		Unknown area with some data to suggest preferential use by large savanna raptors, broadly located in the arc bordered by the R378 and the N14, and based loosely on the SABAP2 data above	This study	Medium: No buffer
Upington Focus Area 7	*Wind*	Power lines ≥132 kV possibly used by nesting Martial or Tawny Eagles or other raptors	Eskom Networks layer, 2014	Medium: 5 km
		Orange River as an avian fly-way; supports waterbirds and riparian communities	NFEPA Rivers layer, 2011	Very High: 1 km from edge of full river
		Known White-backed Vulture colonies/nest sites	A. Maritz Unpubl. data, R. Visagie Unpubl. data	Very High: 5 km
		Known Verreaux's Eagle nests on cliffs or comms towers, or predicted sites on the basis of spacing and habitat	A. Maritz Unpubl. data, R. Visagie Unpubl. data, Jenkins & du Plessis 2013	Very High: 3 km High: 5 km
		Known Martial Eagle nest sites on Ferrum-Garona 275 kV Tx line	A. Maritz Unpubl. data, R. Visagie Unpubl. data	Very High: 5 km
		Known African Fish-Eagle nest site	R. de Klerk Pers. comm.	Very High: 2 km
		Presence data for a suite of threatened, impact susceptible large savanna raptors	SABAP2, ADU	High: No buffer
		Unknown area with some data to suggest preferential use by large savanna raptors; polygon located north of Orange River buffer, east of Gordonia-Kleinbegin 132 kV Tx line between Upington and Copperton	This study	Medium: No buffer

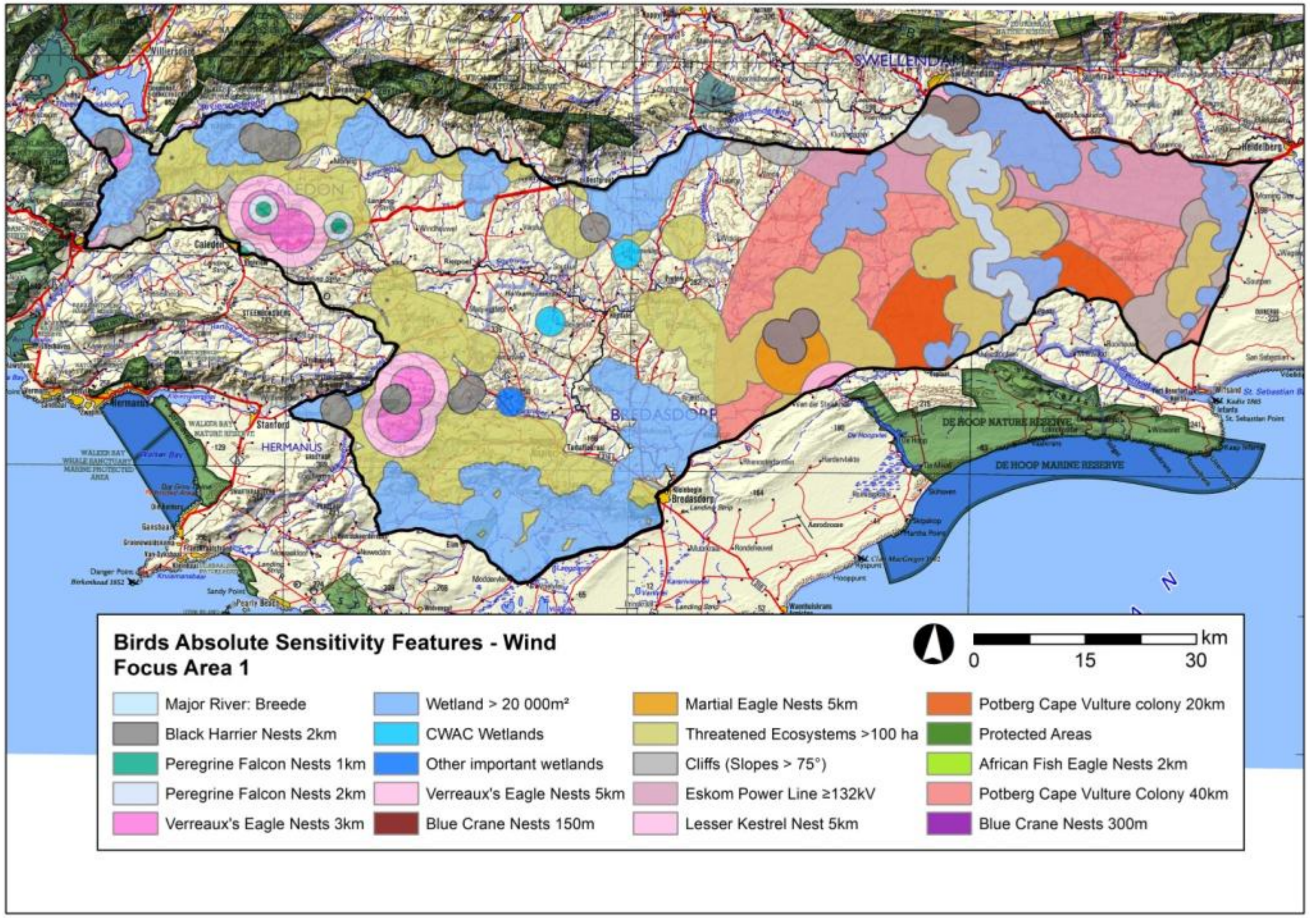
Site	Technology	Description of criteria	Source	Application Sensitivity: Buffer Distance
Upington Focus Area 7	*Solar*	Power lines ≥132 kV possibly used by nesting Martial or Tawny Eagles or other raptors	Eskom Networks layer, 2014	Medium: 2 km
		Orange River as an avian fly-way; supports waterbirds and riparian communities	NFEPA Rivers layer, 2011	Very High: 500 m from edge of full river
		Known White-backed Vulture colonies/nest sites	A. Maritz Unpubl. data, R. Visagie Unpubl. data	Very High: 2 km
		Known Verreaux's Eagle nests on cliffs or comms towers, or predicted sites on the basis of spacing and habitat	A. Maritz Unpubl. data, R. Visagie Unpubl. data, Jenkins & du Plessis 2013	Very High: 1 km
		Known Martial Eagle nest sites on Ferrum-Garona 275 kV Tx line	A. Maritz Unpubl. data, R. Visagie Unpubl. data	Very High: 2 km
		Known African Fish-Eagle nest site	R. de Klerk Pers. comm.	Very High: 1 km
		Presence data for a suite of threatened, impact susceptible large savanna raptors	SABAP2, ADU	High: No buffer
Springbok Focus Area 8	*Wind*	Important Bird Areas	BLSA	Very High: 2 km from edge
		Power lines ≥132 kV possibly used by nesting Martial Eagles	Eskom Networks layer, 2014	Medium: 5 km
		Buffels River as an avian fly-way; supports waterbirds and riparian communities	NFEPA Rivers layer, 2011	Very High: 500 m from edge of full river
		Coastline	CGA, Stellenbosch University	Very High: 1 km inland
		Surveyed cliffs with signs of occupation by breeding raptors Lanner Falcon, Jackal Buzzard, Cape Eagle-Owl but not confirmed	This study	High: 1 km
		Known Verreaux's Eagle nests, or predicted sites on the basis of spacing and habitat	L. Rodrigues Unpubl. data, M. Mostert Unpubl. data, A. Maritz Unpubl. data, R. Visagie Unpubl. data, this study	Very High: 3 km High: 5 km
		Areas (x2) of high topographic relief (ridgelines & koppies) considered likely to be used extensively by slope soaring birds, including threatened & sensitive raptors; polygons including the high-lying areas around Springbok, Concordia and Steinkopf, and the surrounds of the Aggenysberg	This study	Medium: No buffer

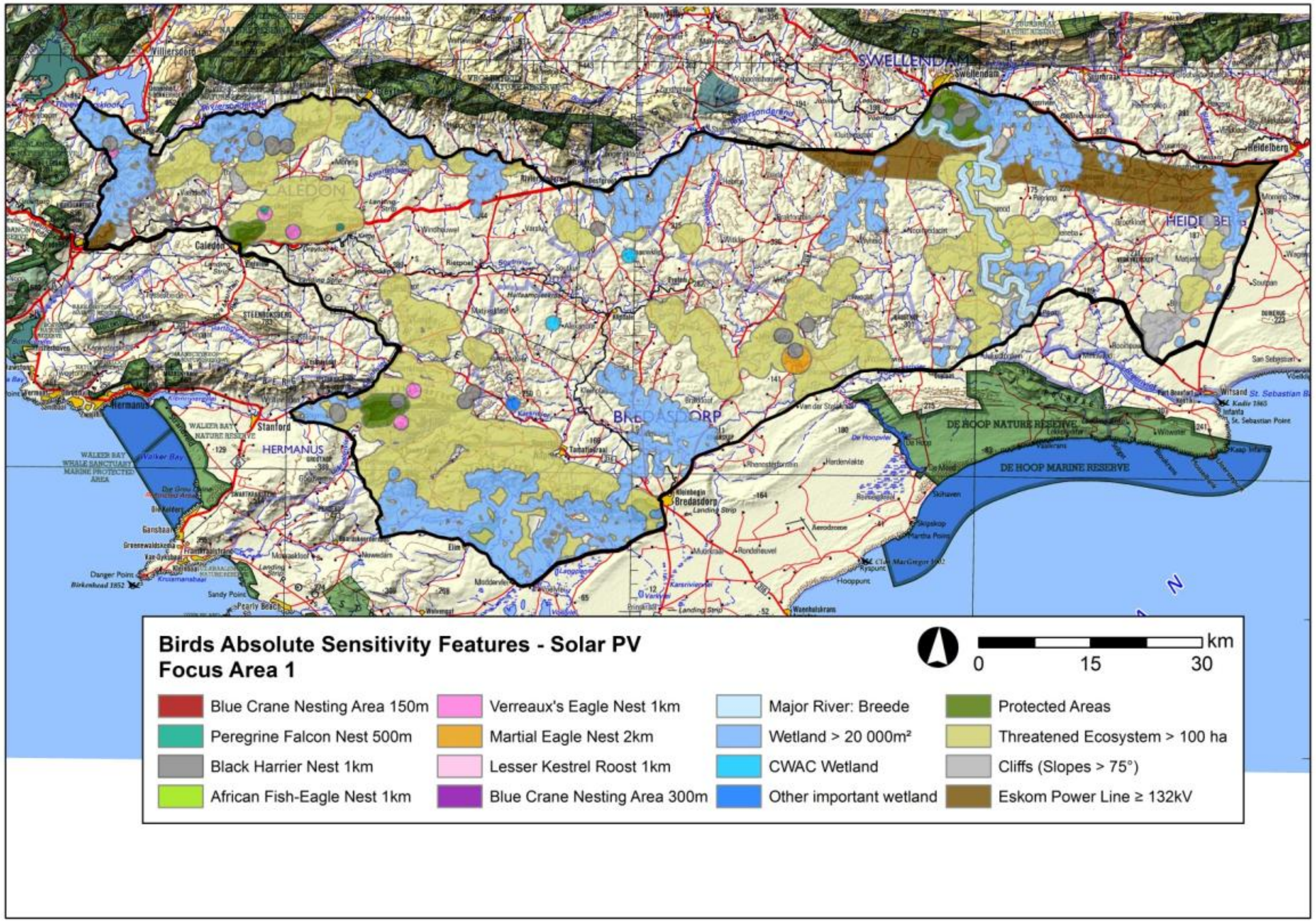
Site	Technology	Description of criteria	Source	Application Sensitivity: Buffer Distance
		Known or suspected Martial Eagle nest sites on Tx and Dx lines	M. Mostert Unpubl. data, A. Maritz Unpubl. data, R. Visagie Unpubl. data, this study	Very High: 5 km
		Known Lanner Falcon nest sites	This study, A.R. Jenkins Unpubl. data	Very High: 1 km High: 3 km
		Known Jackal Buzzard nest site	This study, Kleinzee WEF monitoring data	Very High: 1 km High: 2 km
		Known Black Harrier nesting areas	Kleinzee WEF monitoring data	Very High: 2 km
		Presence data for Red Lark, outside of probable core along Koa River Valley	SABAP2, ADU	Medium: No buffer
		Presence data for Red Lark within probable core along Koa River Valley	SABAP2, ADU, Bio3 2013, Pretorius 2014, this study	Very High: No buffer
		Predicted presence for Red Lark within probable core along Koa River Valley	SABAP1, Dean *et al.* 1991	Very High: No buffer
		Presence data for Barlow's Lark	SABAP2, ADU	High: No buffer
		Salt pan known to support breeding Damara Terns	Barnes 1998, SABAP2	Very High: 5km from edge
		Presence data for threatened, impact susceptible large terrestrial birds	SABAP2, ADU	Medium: No buffer
Springbok Focus Area 8	*Solar*	Important Bird Areas	BLSA	Very High: 1 km from edge
		Power lines ≥132 kV possibly used by nesting Martial Eagles	Eskom Networks layer, 2014	Medium: 2 km
		Buffels River as an avian fly-way; supports waterbirds and riparian communities	NFEPA Rivers layer, 2011	Very High: 500 m from edge of full river
		Coastline	CGA, Stellenbosch University	Very High: 500 m inland
		Surveyed cliffs with signs of occupation by breeding raptors Lanner Falcon, Jackal Buzzard, Cape Eagle-Owl but not confirmed	This study	High: 500 m
		Known Verreaux's Eagle nests, or predicted sites on the basis of spacing and habitat	L. Rodrigues Unpubl. data, M. Mostert Unpubl. data, A. Maritz Unpubl. data, R. Visagie Unpubl. data, this study	Very High: 1 km

Site	Technology	Description of criteria	Source	Application Sensitivity: Buffer Distance
		Known or suspected Martial Eagle nest sites on Tx and Dx lines	M. Mostert Unpubl. data, A. Maritz Unpubl. data, R. Visagie Unpubl. data, this study	Very High: 2 km
		Known Lanner Falcon nest sites	This study, A.R. Jenkins Unpubl. data	Very High: 500 m
		Known Jackal Buzzard nest site	This study, Kleinzee WEF monitoring data	Very High: 500 m
		Known Black Harrier nesting areas	Kleinzee WEF monitoring data	Very High: 1 km
		Presence data for Red Lark, outside of probable core along Koa River Valley	SABAP2, ADU	High: No buffer
		Presence data for Red Lark within probable core along Koa River Valley	SABAP2, ADU, Bio3 2013, Pretorius 2014, this study	Very High: No buffer
		Predicted presence for Red Lark within probable core along Koa River Valley	SABAP1, Dean *et al.* 1991	Very High: No buffer
		Presence data for Barlow's Lark	SABAP2, ADU	High: No buffer
		Salt pan known to support breeding Damara Terns	Barnes 1998, SABAP2	Very High: 1 km from edge
		Presence data for threatened, impact susceptible large terrestrial birds	SABAP2, ADU	Medium: No buffer

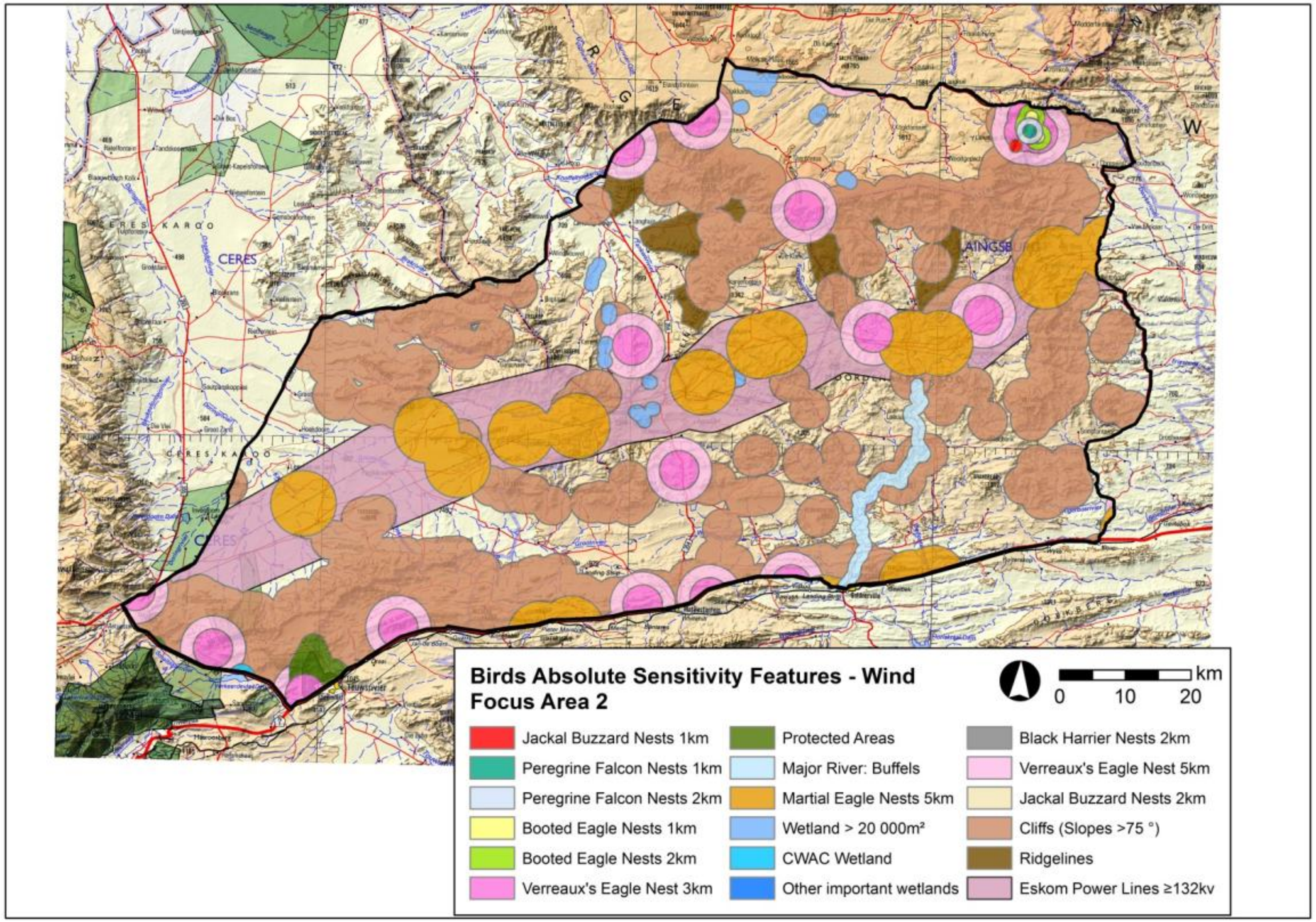
4.2 Absolute sensitivity maps

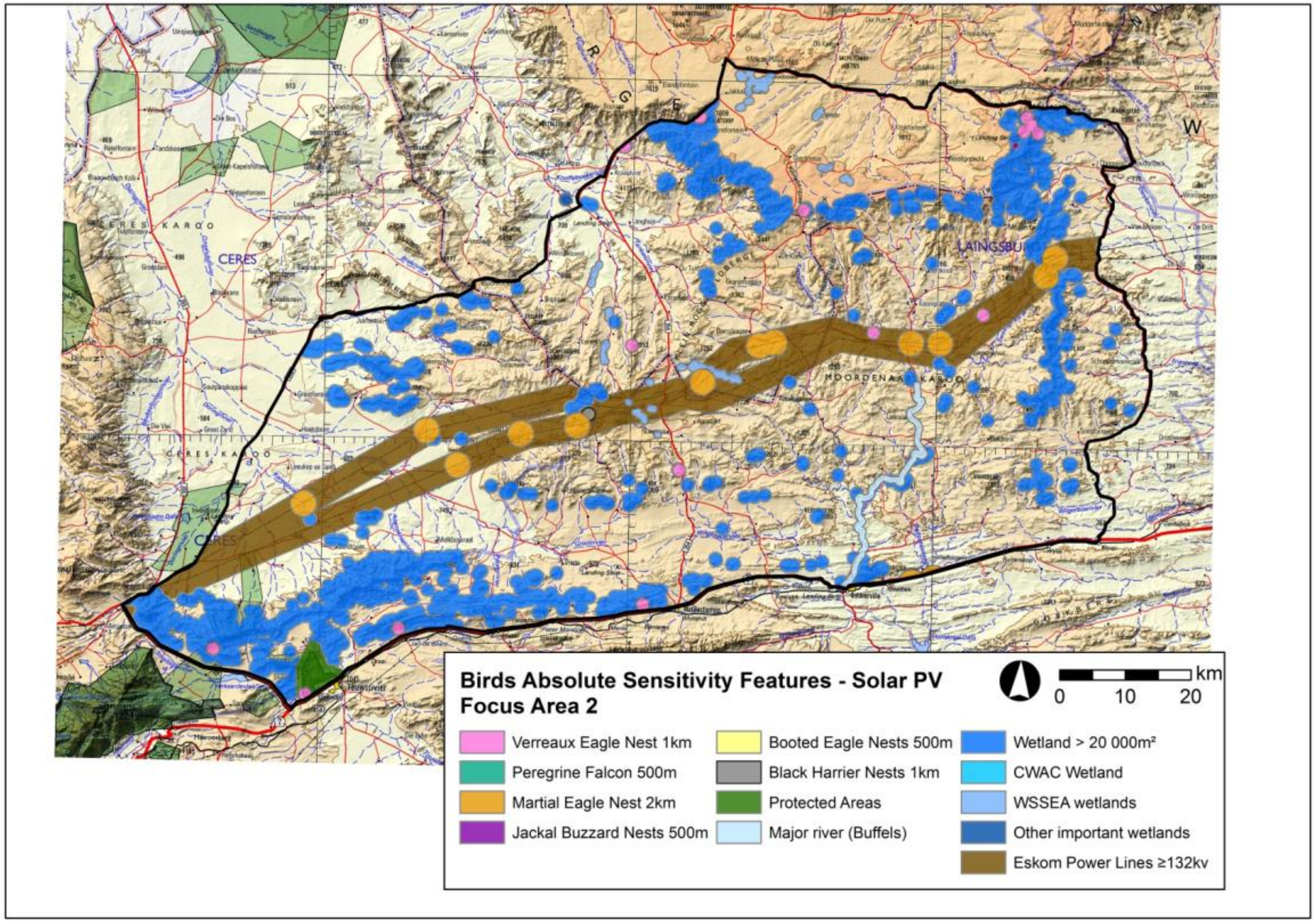
4.2.1 Overberg Focus Area 1



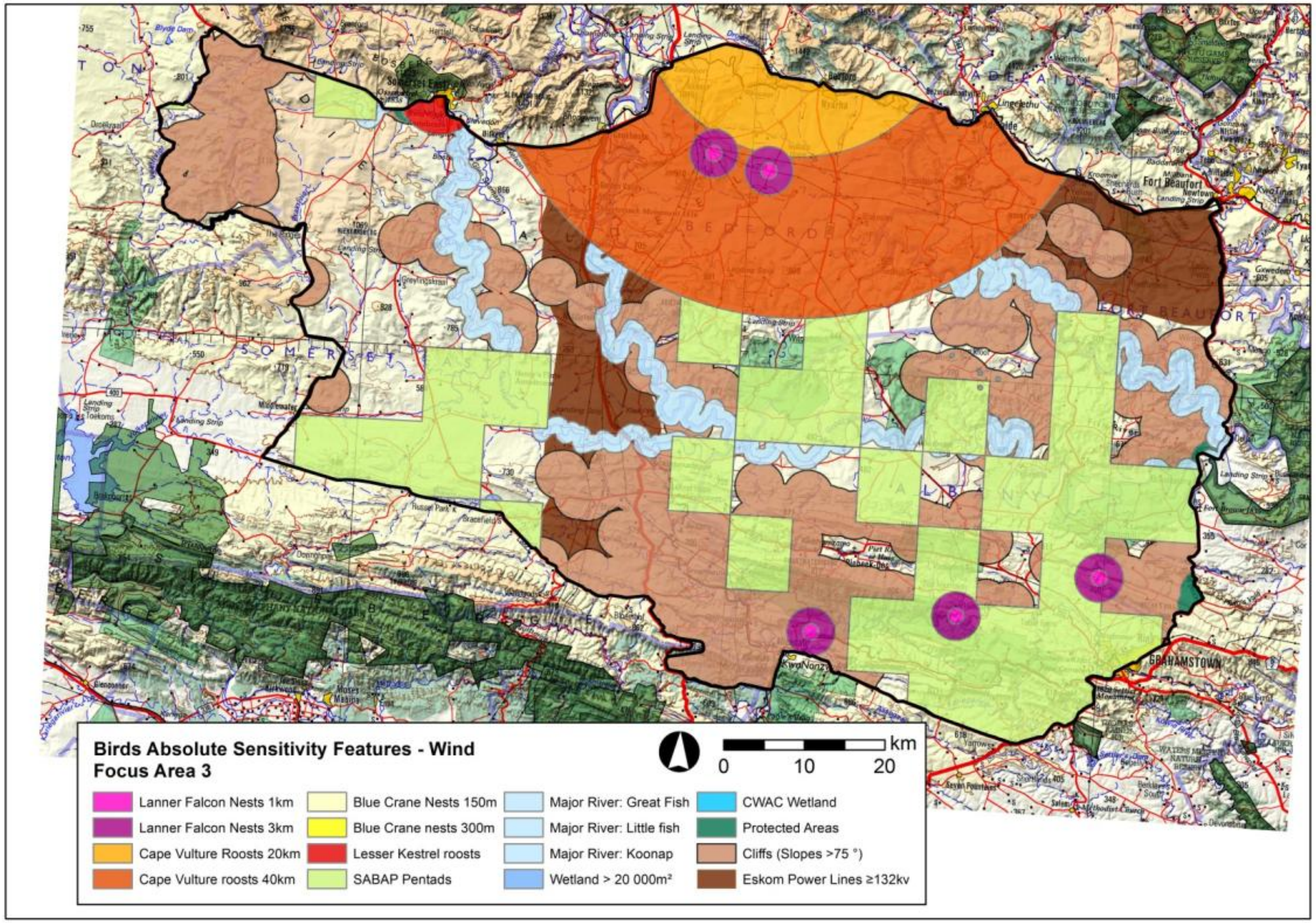

Birds Absolute Sensitivity Features - Solar PV
Focus Area 1
0 15 30 km
Blue Crane Nesting Area 150m
Peregrine Falcon Nest 500m
Black Harrier Nest 1km
African Fish-Eagle Nest 1km
Verreaux's Eagle Nest 1km
Martial Eagle Nest 2km
Lesser Kestrel Roost 1km
Blue Crane Nesting Area 300m
Major River: Breede
Wetland > 20 000m²
CWAC Wetland
Other important wetland
Protected Areas
Threatened Ecosystem > 100 ha
Cliffs (Slopes > 75°)
Eskom Power Line ≥ 132kV
SWELLENDAM
CALEDON
BREDASDORP
HERMANUS
HEIDELBERG
DE HOOP NATURE RESERVE
DE HOOP MARINE RESERVE

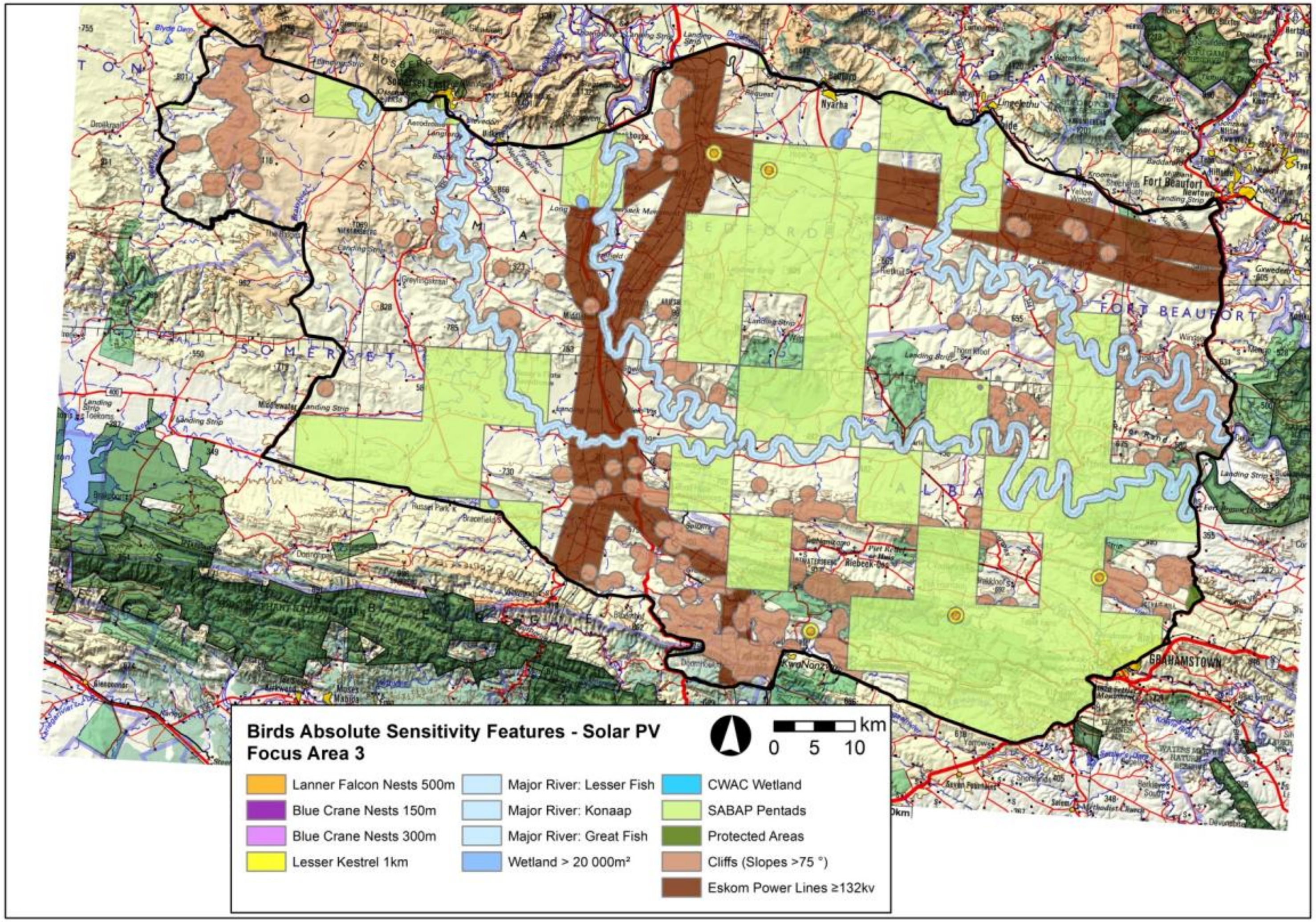
4.2.2 Komsberg Focus Area 2



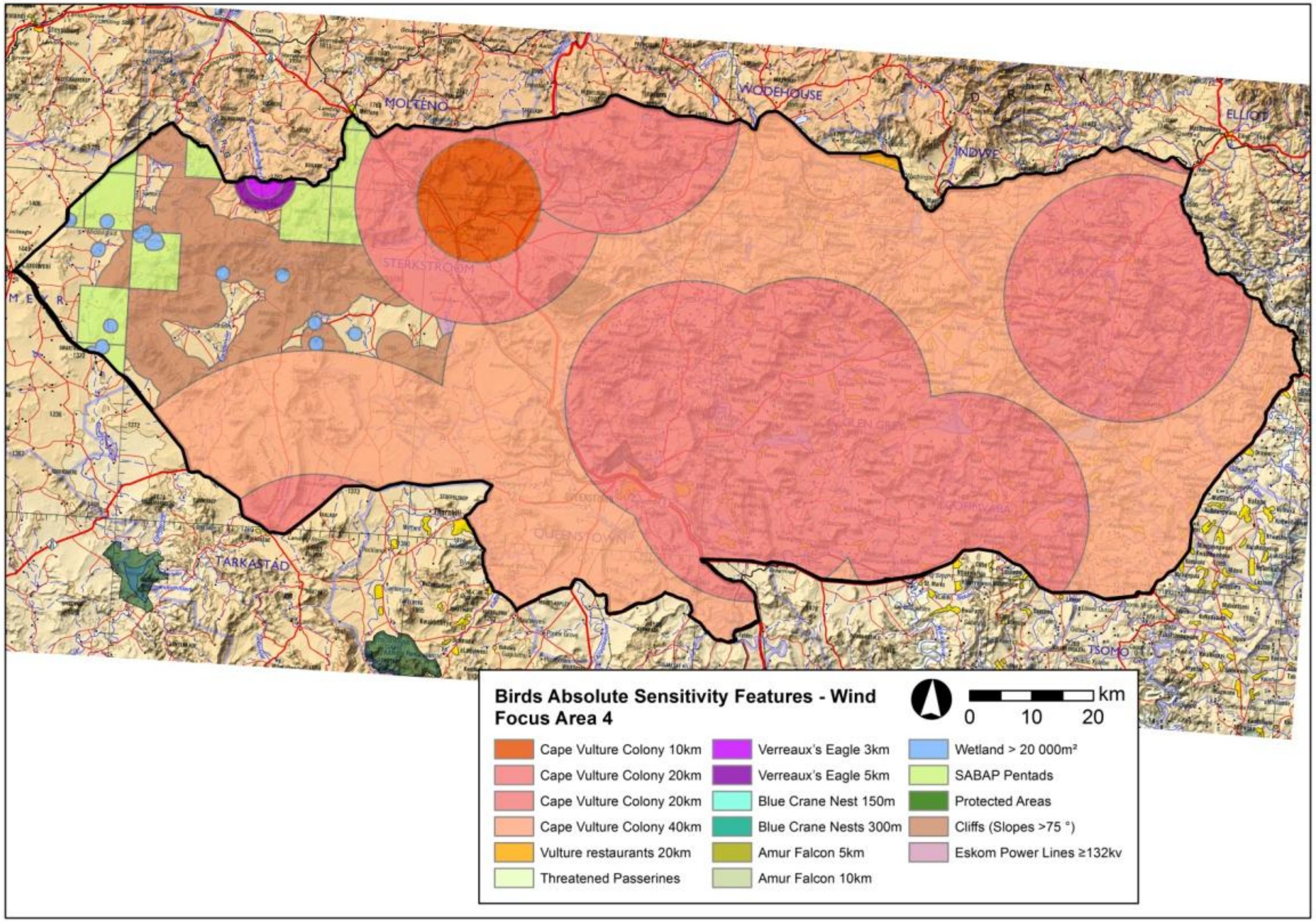

Birds Absolute Sensitivity Features - Solar PV Focus Area 2
km
0 10 20
Verreaux Eagle Nest 1km
Peregrine Falcon 500m
Martial Eagle Nest 2km
Jackal Buzzard Nests 500m
Booted Eagle Nests 500m
Black Harrier Nests 1km
Protected Areas
Major river (Buffels)
Wetland > 20 000m²
CWAC Wetland
WSSEA wetlands
Other important wetlands
Eskom Power Lines ≥132kv
CERES
LAINGSBU
MOORDENAA KAROO
CERES KAROO

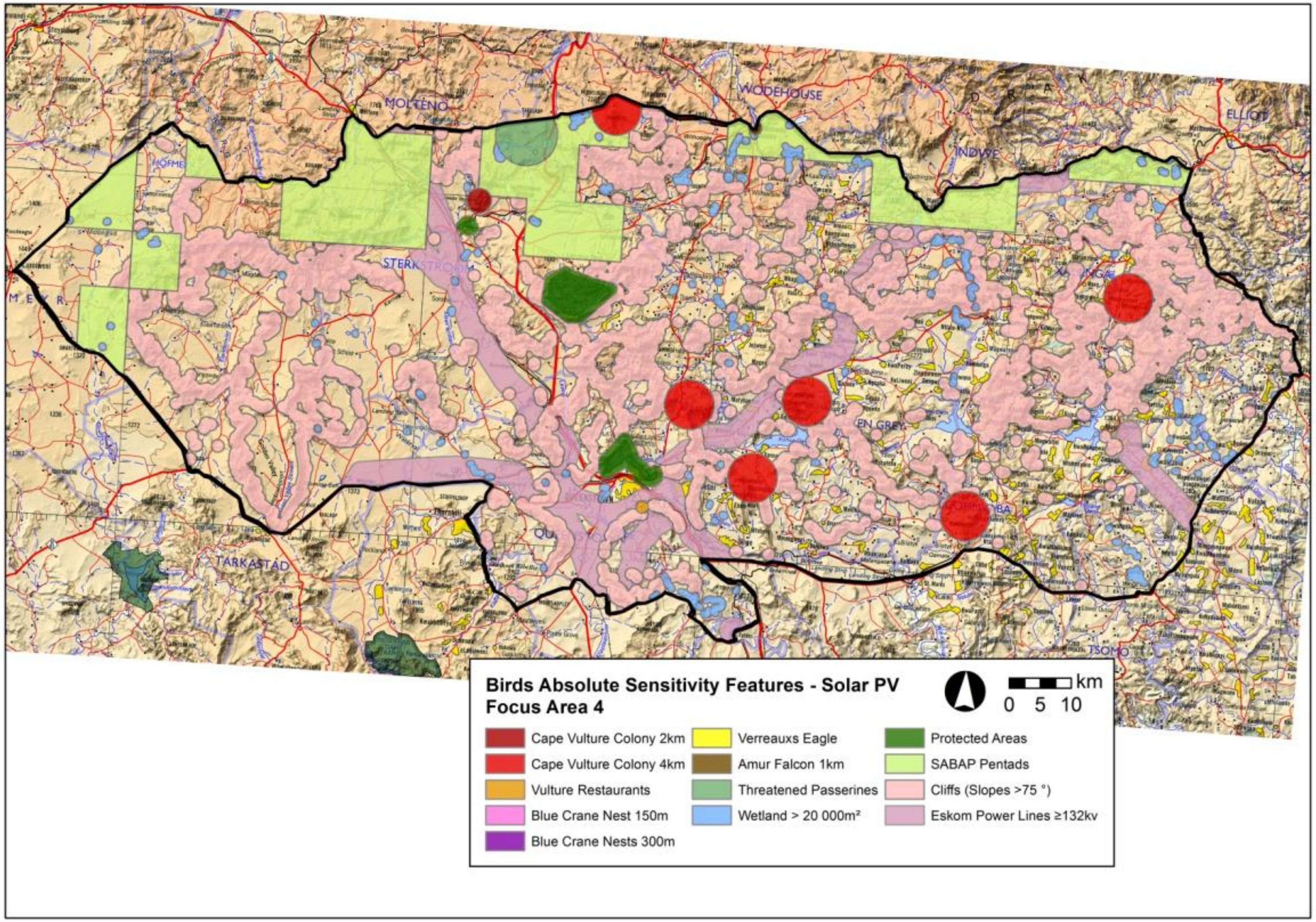
4.2.3 Cookhouse Focus Area 3



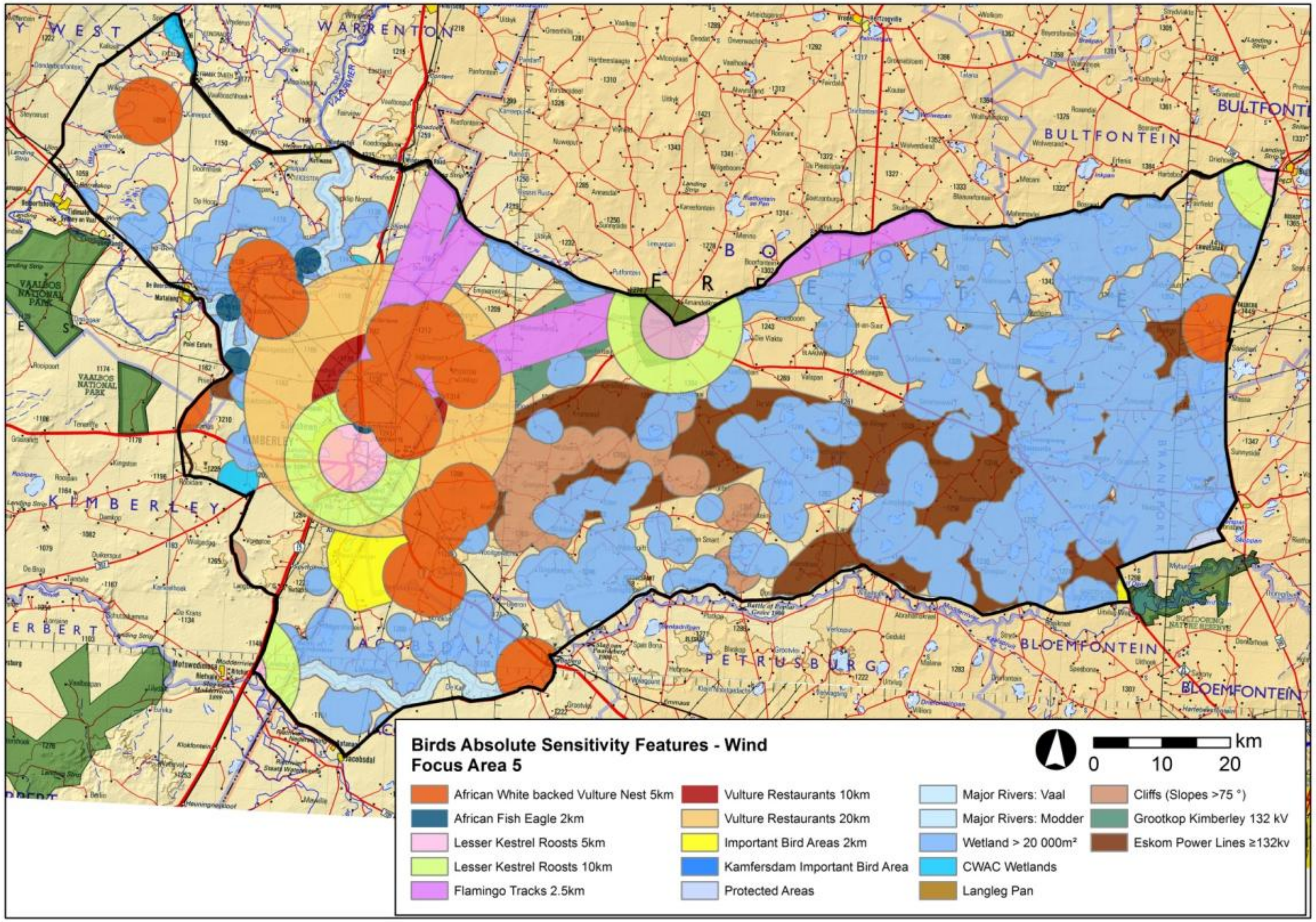

Birds Absolute Sensitivity Features - Solar PV
Focus Area 3
km
0 5 10
Lanner Falcon Nests 500m
Blue Crane Nests 150m
Blue Crane Nests 300m
Lesser Kestrel 1km
Major River: Lesser Fish
Major River: Konaap
Major River: Great Fish
Wetland > 20 000m²
CWAC Wetland
SABAP Pentads
Protected Areas
Cliffs (Slopes >75 °)
Eskom Power Lines ≥132kv
FORT BEAUFORT
GRAHAMSTOWN

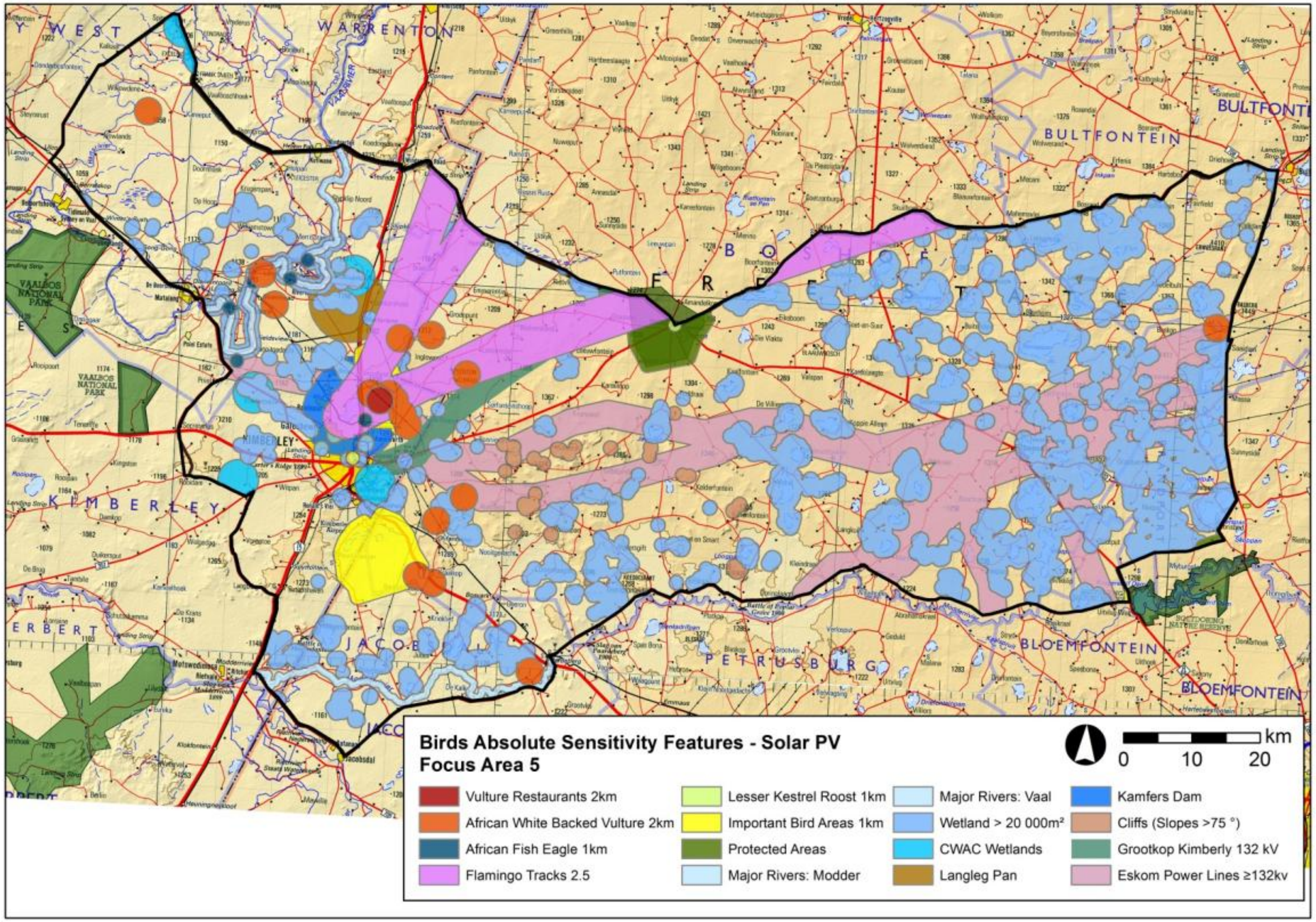
4.2.4 Stormberg Focus Area 4



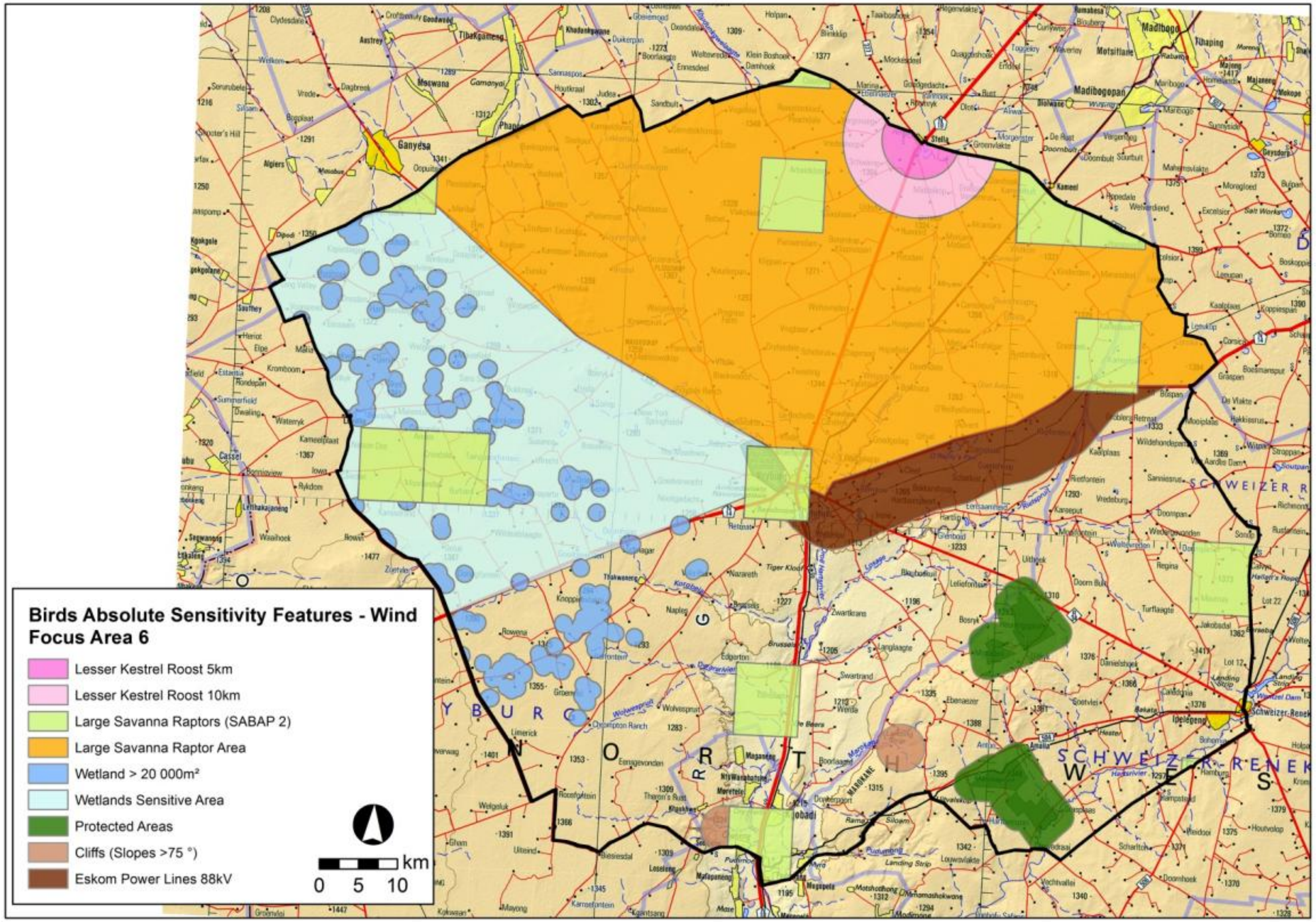

Birds Absolute Sensitivity Features - Solar PV
Focus Area 4
km
0 5 10
Cape Vulture Colony 2km
Cape Vulture Colony 4km
Vulture Restaurants
Blue Crane Nest 150m
Blue Crane Nests 300m
Verreauxs Eagle
Amur Falcon 1km
Threatened Passerines
Wetland > 20 000m²
Protected Areas
SABAP Pentads
Cliffs (Slopes >75 °)
Eskom Power Lines ≥132kv
MOLTENO
WODEHOUSE
INDWE
ELLIOT
STERKSTROOM
TARKASTAD
TSOMO

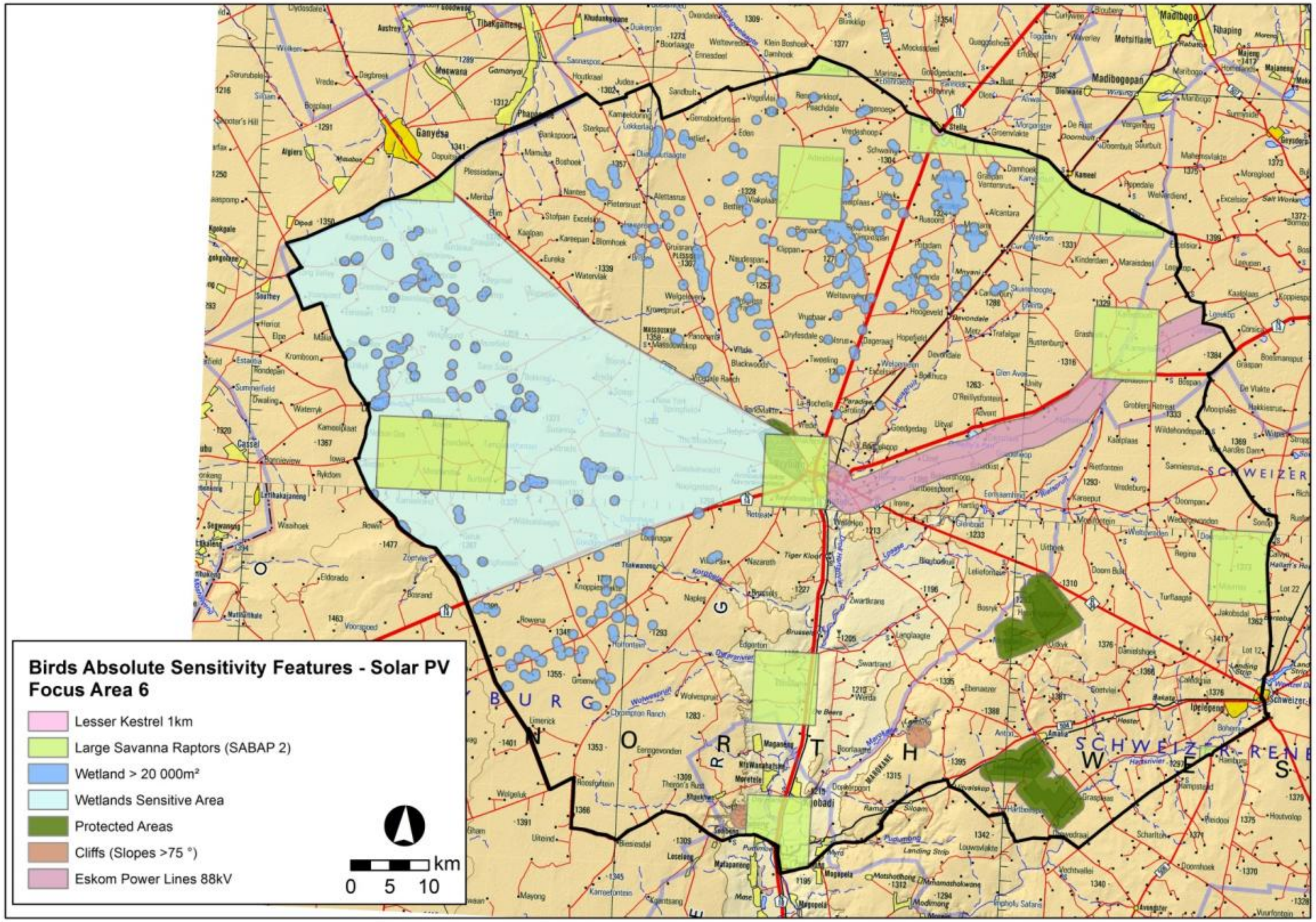
4.2.5 Kimberley Focus Area 5



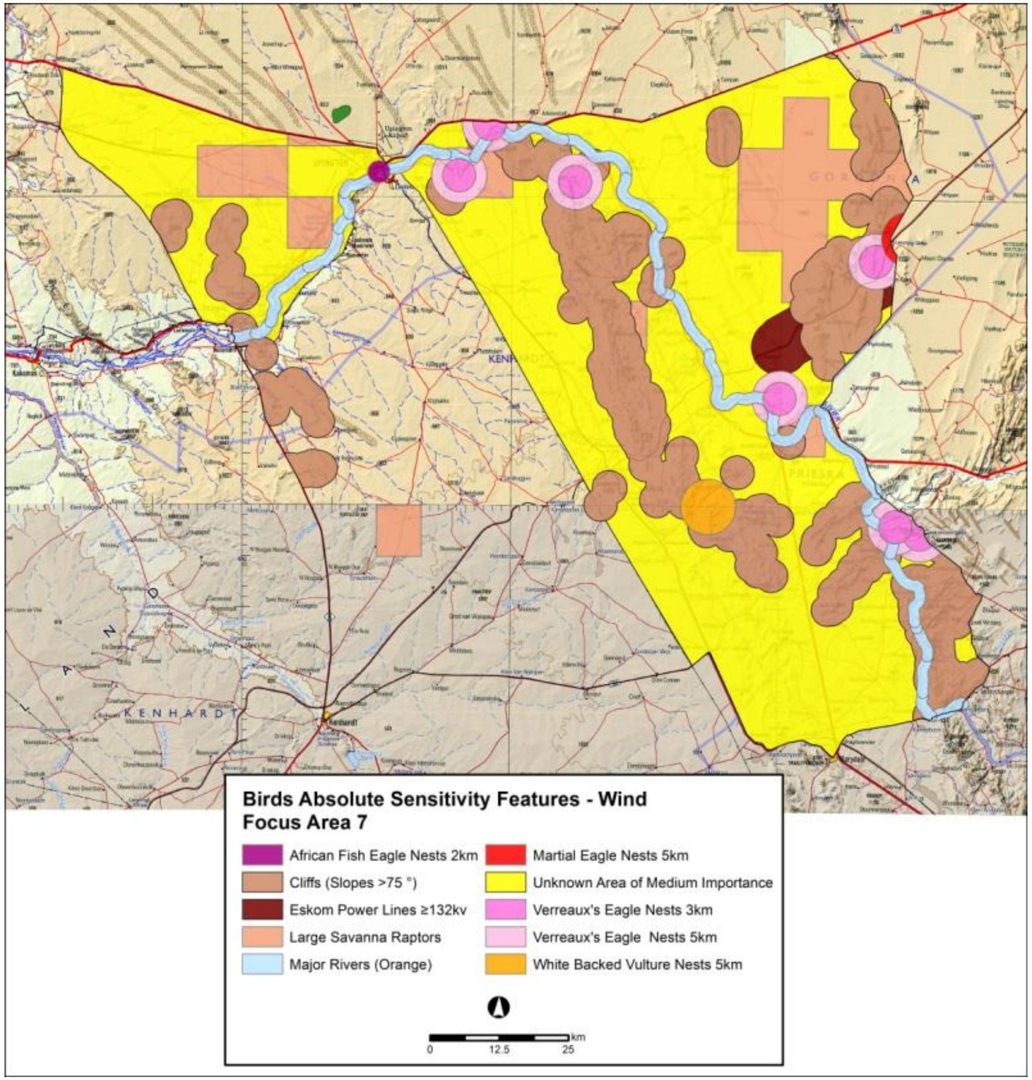

Birds Absolute Sensitivity Features - Solar PV
Focus Area 5
km
0 10 20
Vulture Restaurants 2km
African White Backed Vulture 2km
African Fish Eagle 1km
Flamingo Tracks 2.5
Lesser Kestrel Roost 1km
Important Bird Areas 1km
Protected Areas
Major Rivers: Modder
Major Rivers: Vaal
Wetland > 20 000m²
CWAC Wetlands
Langleg Pan
Kamfers Dam
Cliffs (Slopes >75 °)
Grootkop Kimberly 132 kV
Eskom Power Lines ≥132kv
WARRENTON
BULTFONTEIN
KIMBERLEY
PETRUSBURG
BLOEMFONTEIN
VAALBOS NATIONAL PARK

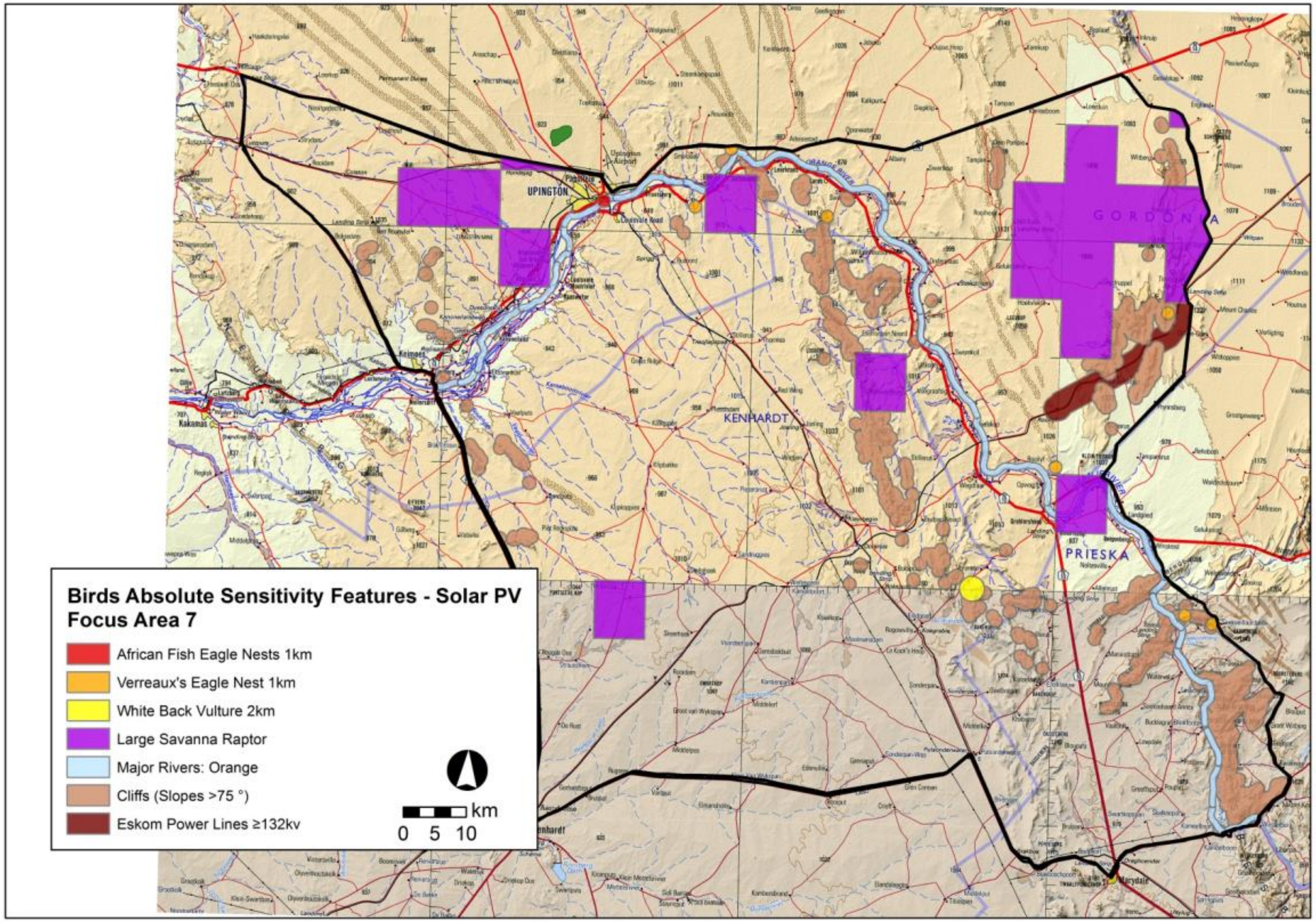
4.2.6 Vryburg Focus Area 6



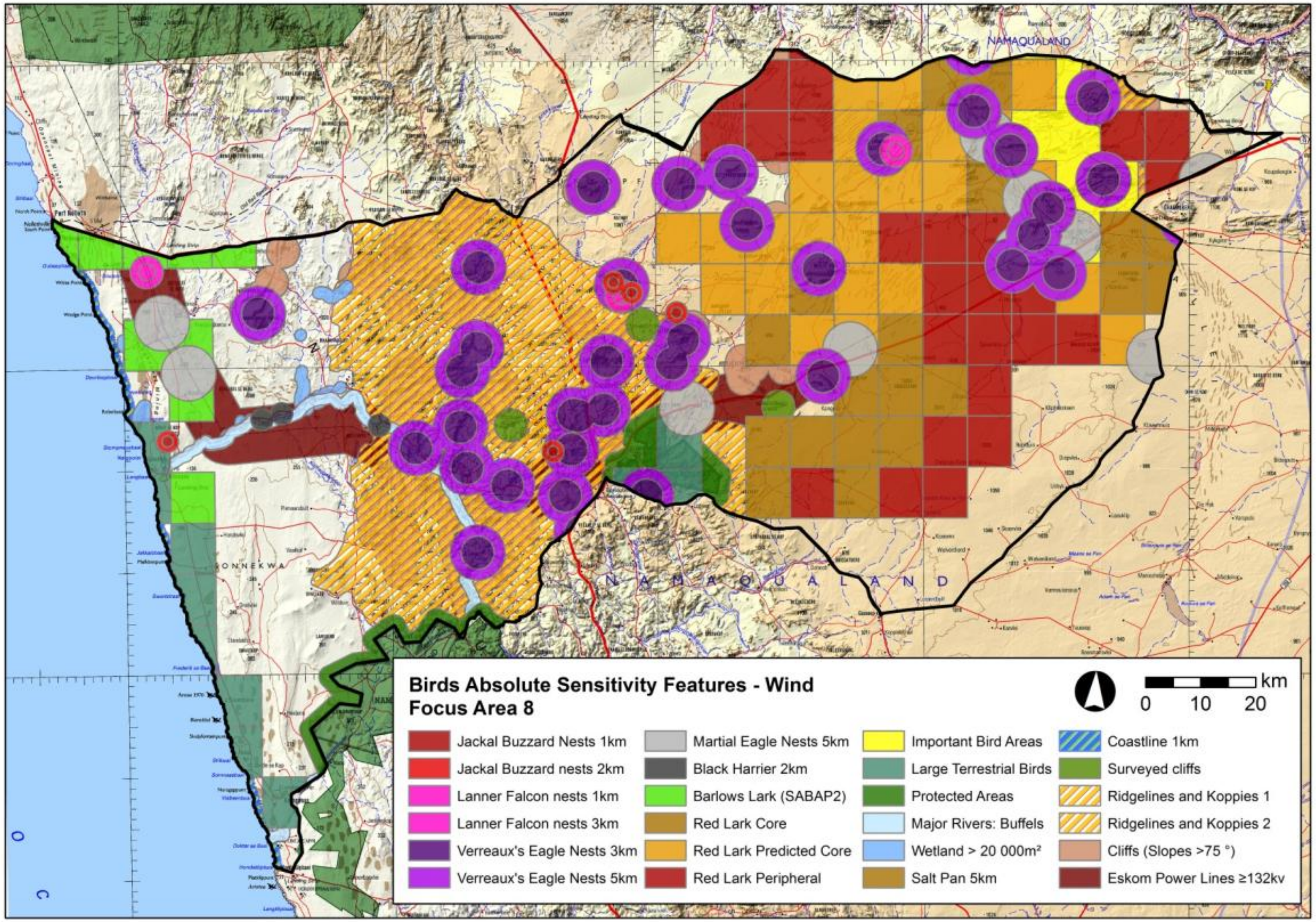

Birds Absolute Sensitivity Features - Solar PV Focus Area 6
Lesser Kestrel 1km
Large Savanna Raptors (SABAP 2)
Wetland > 20 000m²
Wetlands Sensitive Area
Protected Areas
Cliffs (Slopes >75 °)
Eskom Power Lines 88kV
km
0 5 10

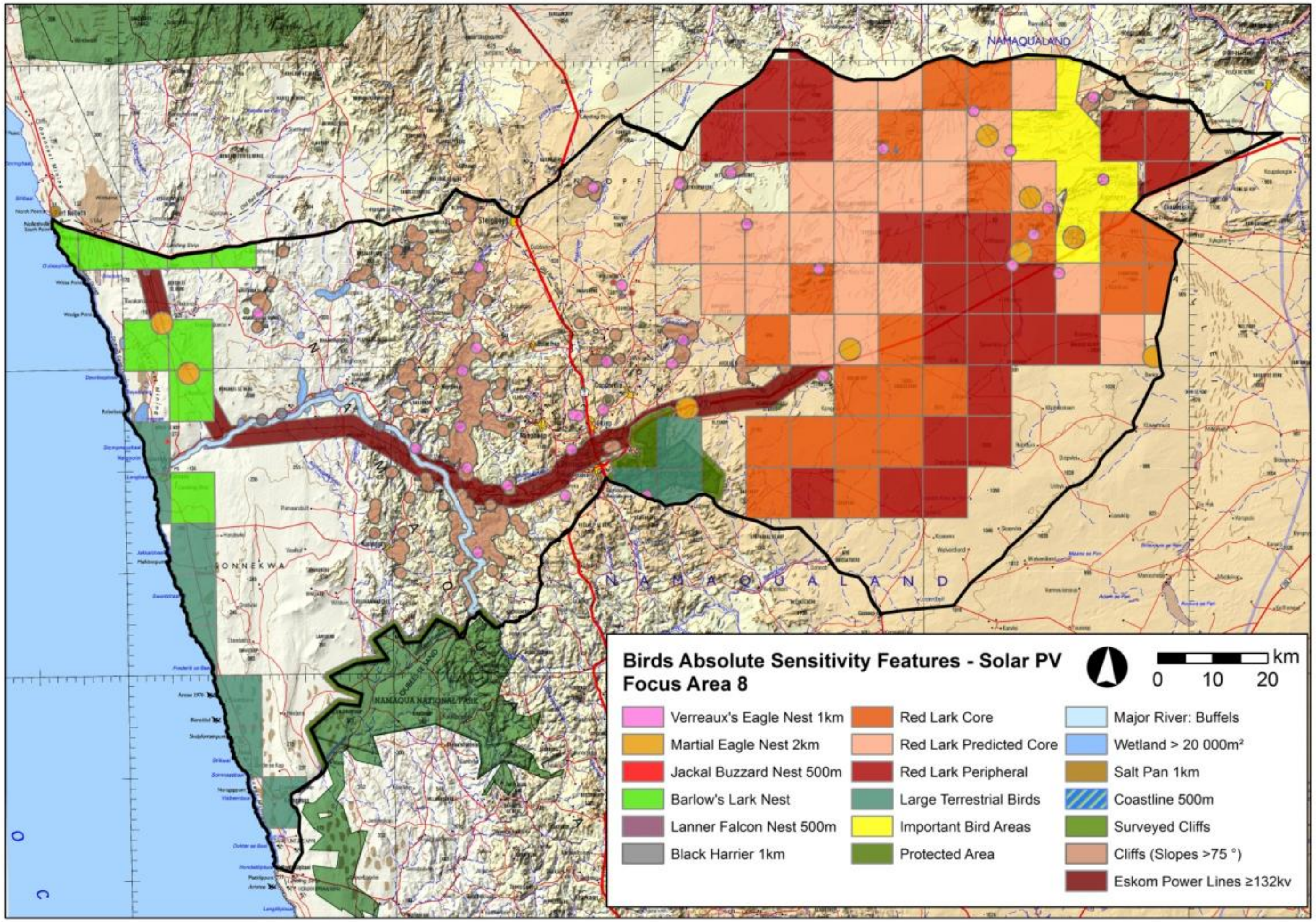
4.2.7 Upington Focus Area 7




Birds Absolute Sensitivity Features - Solar PV Focus Area 7
African Fish Eagle Nests 1km
Verreaux's Eagle Nest 1km
White Back Vulture 2km
Large Savanna Raptor
Major Rivers: Orange
Cliffs (Slopes >75 °)
Eskom Power Lines ≥132kv
km
0 5 10
UPINGTON
KENHARDT
PRIESKA
GORDONIA

4.2.8 Springbok Focus Area 8




Birds Absolute Sensitivity Features - Solar PV
Focus Area 8
km
0 10 20
Verreaux's Eagle Nest 1km
Martial Eagle Nest 2km
Jackal Buzzard Nest 500m
Barlow's Lark Nest
Lanner Falcon Nest 500m
Black Harrier 1km
Red Lark Core
Red Lark Predicted Core
Red Lark Peripheral
Large Terrestrial Birds
Important Bird Areas
Protected Area
Major River: Buffels
Wetland > 20 000m²
Salt Pan 1km
Coastline 500m
Surveyed Cliffs
Cliffs (Slopes >75 °)
Eskom Power Lines ≥132kv
NAMAQUALAND
NAMAQUA NATIONAL PARK

5 COMPARATIVE SENSITIVITY MAPPING

5.1 Very High sensitivity zones

Several "Very High sensitivity" (colour code = dark red in comparative sensitivity maps) areas have been identified in each FA, generally in terms of common area- (land-use designation, habitat) or taxon-specific considerations or criteria, including buffers of sufficient size to adequately mitigate potential impacts. These areas are not considered suitable for development.

By default, all registered national Important Bird Areas (as identified and delineated by the BLSA IBA evaluation and selection process – Barnes 1998 - but excluding the very large and highly modified Overberg Wheatbelt IBA), and all proclaimed Protected Areas (assumed to be important conserved natural habitat for birds generally, and threatened species in particular – e.g. Herremans & Herremans-Tonnoeyr 2000, Thiollay 2006) were considered as Very High sensitivity zones, and were buffered differentially for wind and solar development. Similarly, it was assumed that the courses of all major rivers, as well as the line of the coast, constitute relatively unique avian wetland, riparian and coastal habitats respectively, and also often serve as flyways for large volumes of commuting birds, and should remain as free as possible from RE development. Most (but not all) CWAC wetlands were also considered to be Very Highly sensitive, again on the grounds that they are scarce and important resource areas for waterbirds, and because waterbirds are prone to aggregate at and commute between such locations – behaviours that raise the risk of collision with RE infrastructure (Drewitt & Langston 2006, 2008, Bevanger 1998, Jenkins *et al.* 2010).

Certain species were considered to be more inherently susceptible to the impacts of RE development than others, and were identified mainly in terms of collision, displacement or habitat loss studies of similar taxa from other parts of the world (given that none have yet been done in South Africa). The factors contributing to such susceptibility include current population and conservation status (risk being greater for rare, endemic and/or threatened species), habitat preferences (risk being greater for species found mainly in open, sunny or windy areas, and for species with very restrictive habitat requirements), morphology (risk being greater for large, heavy or fast-flying species), and behaviour (risk being greater for slope-soarers, predators, flock-forming species, species with aerial displays and those that regularly fly at night - Janss 2000, Bevanger 1998, Drewitt & Langston 2006, 2008, NWCC 2011, Smallwood *et al.* 2009, Jenkins et al. 2010, Herera-Alsina *et al.* 2013). These various contributing factors have all been considered and integrated in a broad-scale assessment of sensitivity to the impacts of wind energy development in South African birds (Retief *et al.* 2012). The present study was conducted substantially in terms of an update of this list (which accounts for recent changes in the threat status of a number of species – E. Retief, Pers. comm.) in prioritising the impact sensitivities of certain species, and the imposition of Very High sensitivity zones around locations or habitats considered important for these birds in each of the FAs.

Hence buffered areas around known (and in some cases predicted) nest sites of species such as large eagles, other raptors and cranes were essentially excluded from development, with the extent of the buffers imposed generally reflecting the known or predicted spatial requirements of each taxon. These buffers were necessarily larger for wind energy development than for solar development, given the risk of collision and displacement posed by large wind farms for many of these large, scarce species. However, the disturbance impacts and scales of habitat destruction associated with solar PV projects should not be underplayed, and the imposition of smaller buffers against solar PV development in such situations is equally defensible.

Verreaux's Eagle nests were buffered by a Very High sensitivity area with a 3 km radius (for wind energy projects), with the additional requirement for the developer to investigate space and habitat use by the eagles (by direct observation or even with the use of tracking devices) within a broader, High sensitivity area extending to a 5 km radius, and include any areas of high use (which in many cases will comprise the major ridgelines contained within the buffer) around the core zone of Very High sensitivity. This approach allows for the possible siting of developments in low use areas quite close to eagle nests, but ensures that the predicted core of the eagles' territory remains development and hazard free. The buffer distances applied are consistent with the findings of high-resolution tracking studies of this species in at least three areas of the country (Davies 1994, R. Davies Unpubl. data, M. Murgatroyd Unpubl. data), are broadly comparable with those applied around nests of the very similar Golden Eagle *Aquila chrysaetos* in Europe and North America (Fielding *et al.* 2006, Tapia *et al.* 2009, Martinéz *et al.* 2010, US Fish & Wildlife Service 2013), and approximate the area around the nest cliff that is most frequently used by the eagle pair and (seasonally) by their dependent young (or half the expected mean inter-nest distance for the species – US Fish & Wildlife 2013). Clearly, actual eagle foraging ranges are not uniform in size across different habitats, and they are usually not circular, but shaped to follow the local distribution of optimal foraging habitat. In reality, it might be possible to place wind turbines (or solar panels) well within the buffer distances prescribed here and have no detrimental effects on the birds if their activity focus is located elsewhere. However, in the context of this study, and in the absence of accurate, site-specific information on foraging patterns, the circular buffer approach is the only practical one to apply.

Martial Eagle nest sites were protected by single 5 km Very High sensitivity buffers, reflecting their considerable space requirements (Van Zyl 1992, Hockey *et al.* 2005), with no clear expectation that these open-country eagles are likely to use certain habitats more than others. Nests of this species on power lines in the Karoo are spaced about 20-30 km apart (Boshoff 1993, Machange *et al.* 2005), suggesting that foraging birds fly far as 10-15 km in any direction, and that a 5 km buffer around the nest probably includes the highest-use 30-50% of the total range. Smaller exclusion buffers were imposed on smaller raptor sites according to their known or estimated core foraging ranges (Allan 2001, Pepler *et al.* 2001, Jenkins 2000, Hockey *et al.* 2005, Jenkins & Van Zyl 2005).

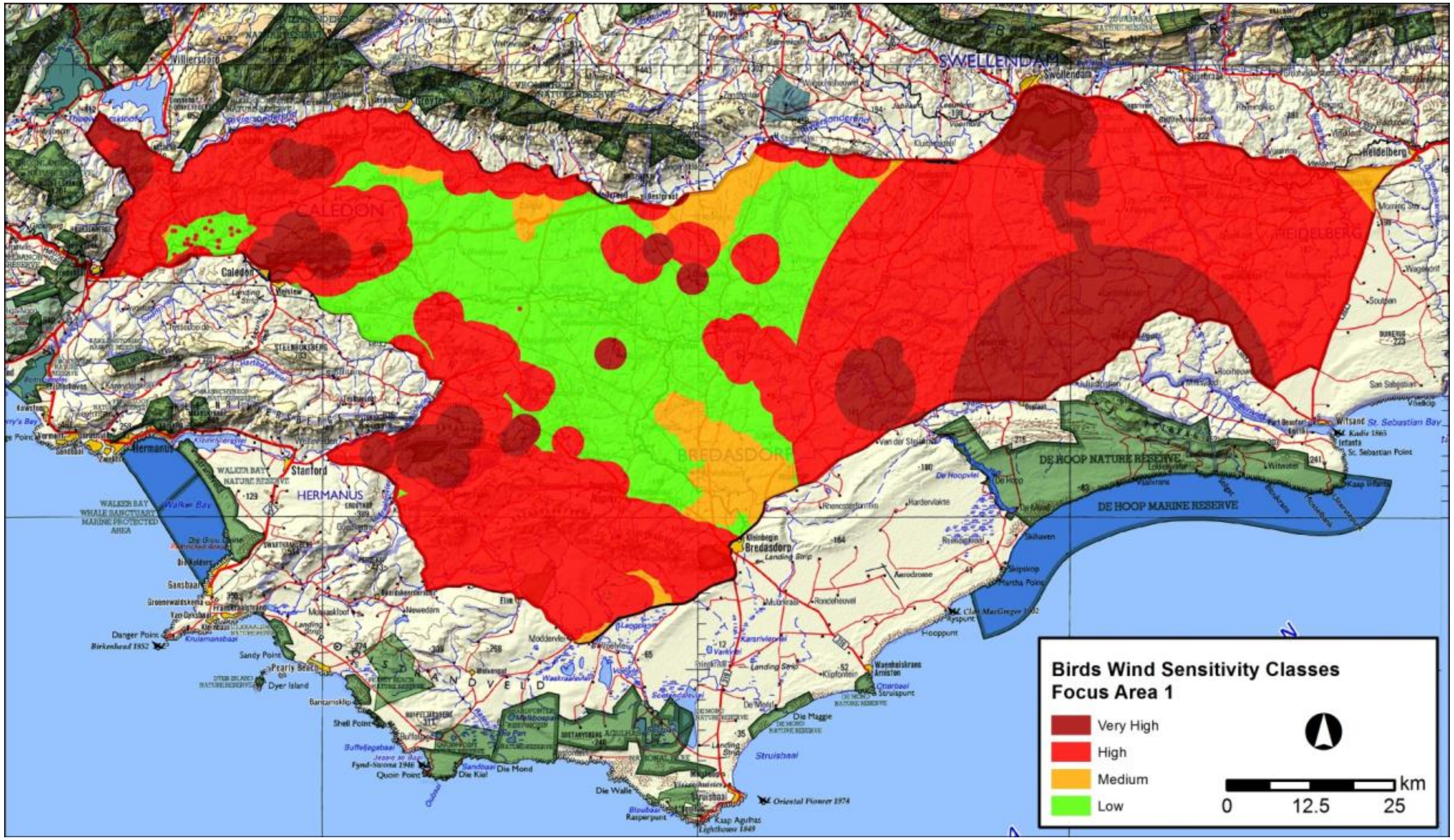
Twenty kilometre Very High sensitivity buffers were imposed (for wind energy projects) on all known Cape Vulture roost and colony sites, overlaid with a 40 km High sensitivity buffer, which requires industry to determine which areas within this zone are regularly used by commuting vultures, and to ensure that such high-use areas are equally excluded from development. Again, this approach allows for the considerable foraging range of this highly threatened (Boshoff & Anderson 2006, Boshoff & Minnie 2011) and very probably highly impact susceptible species (Carrete *et al.* 2012, de Lucas *et al.* 2012), but also acknowledges that beyond a certain distance from the roost or colony, this heavy, slope-soaring bird is likely to use features of the landscape differentially. Ideally, the extent to which this happens, and the exact location of high-traffic areas for vultures in relation to a proposed wind energy project, should be gauged more accurately using a sample of tracked vultures. However, while there is some Cape Vulture tracking work underway at the Eastern Cape colonies located close to or within the FAs examined here, these studies have not yet yielded sufficient data to meaningfully inform this report.

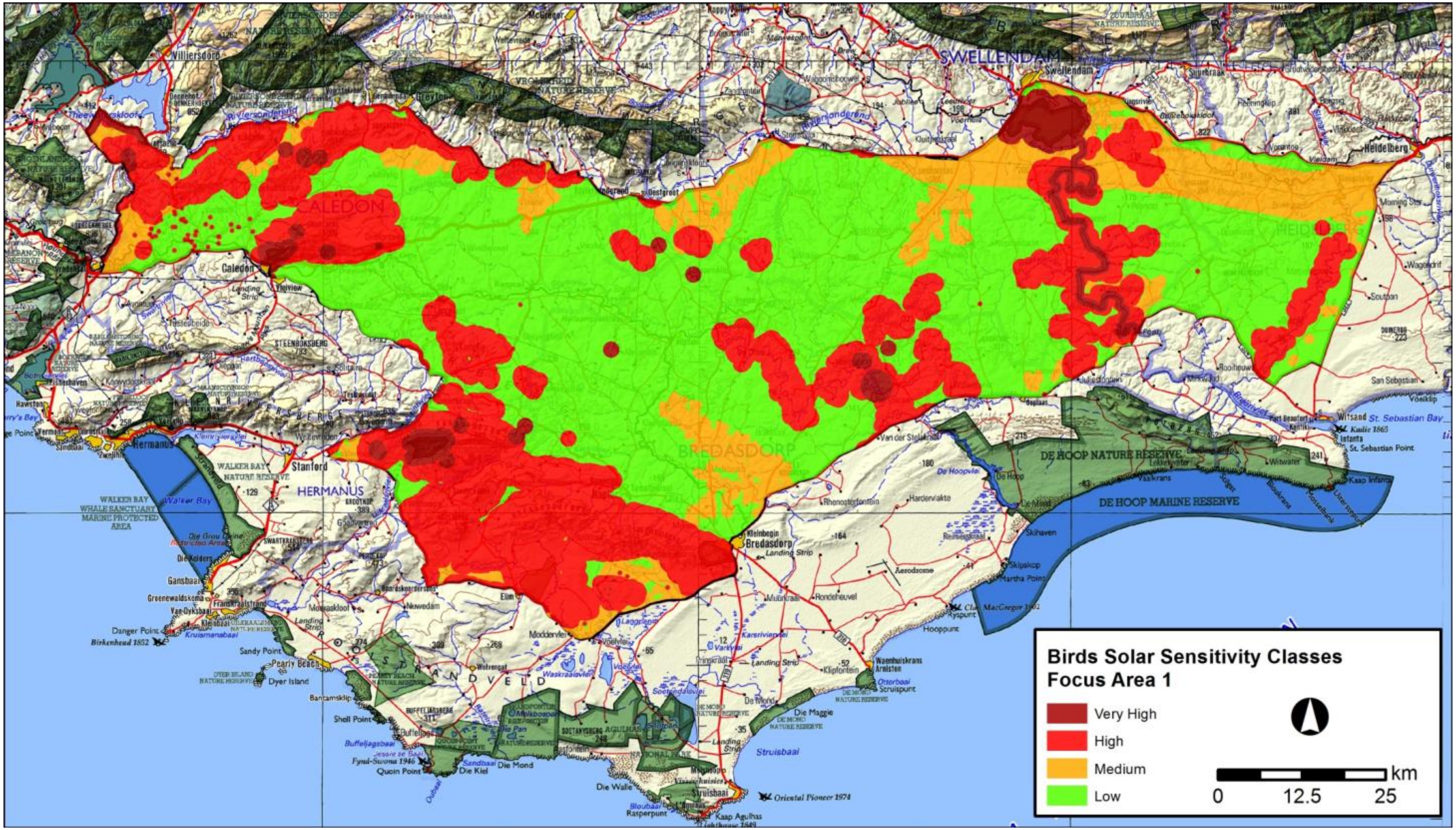
Very High sensitivity buffers of 5 km (for wind energy projects) were imposed on the nest sites and colonies of White-backed Vultures, despite the fact that the foraging ranges of these birds far exceed this distance (e.g. Phipps *et al.* 2013). This was mainly because of our uncertainty about how to reasonably insulate such a wide-ranging species from exposure to turbine collision risk or disturbance/displacement. There is evidence that in the Kimberley area these birds show a marked preference for intact savanna, and for game or mixed-herd farms over pure ranchland (Murn & Anderson 2008), which could offer an opportunity to zone RE development, and protect White-backed Vultures, more effectively in this area. Migrating kestrels – Lesser Kestrels and Amur Falcons occupy summer roost sites (each holding up to 4500 birds) in town centres in at least three of the FAs. These were buffered by a Very High sensitivity area (5 km radius for wind energy projects) sufficient to protect birds as they aggregate around the roost in the evening, or leave it in the early morning, and a "High" sensitivity buffer out to 10 km, requiring would-be developers to ensure that their proposed development does not coincide with an area of concentration of these two potentially collision-prone species.

Very High sensitivity constraints were also imposed on (i) a known Damara Tern nesting area on a pan just north of Port Nolloth (with a 5 km buffer established around the centre of the pan), justified mainly in terms of the scarcity of this species (Barnes 2000), and the apparent susceptibility of tern species to wind turbine collisions (Stienen *et al.* 2008), (ii) the core (both observed and predicted) distribution of the highly range-restricted Red Lark – justified in terms of the possibility that widespread RE development, and perhaps especially solar PV development, could result in damaging levels of habitat loss or degradation, (iii) an area of the Stormberg Plateau thought to support small populations of both Rudd's Lark and Yellow-breasted Pipit, and lastly (iv) Kamfers Dam and the nearby Langleg Pan close to Kimberley to protect the huge numbers of Lesser and Greater Flamingos that aggregate and sometimes breed at these sites (Anderson & Anderson 2010; not yet at Lanleg but a suitable island has been built in the pan for this purpose – M. Anderson pers. comm.), as well as around the tracked flight paths of flamingos to the north of these wetlands (McCulloch *et al.* 2003). Flamingos are known to collide regularly with overhead lines, could be prone to turbine collisions, and could also mistake solar PV arrays for expanses of water (e.g. Horváth *et al.* 2009, Kagan *et al.* 2014), especially when undergoing long-distance movements at night, so these buffers have been imposed on both wind and solar development.

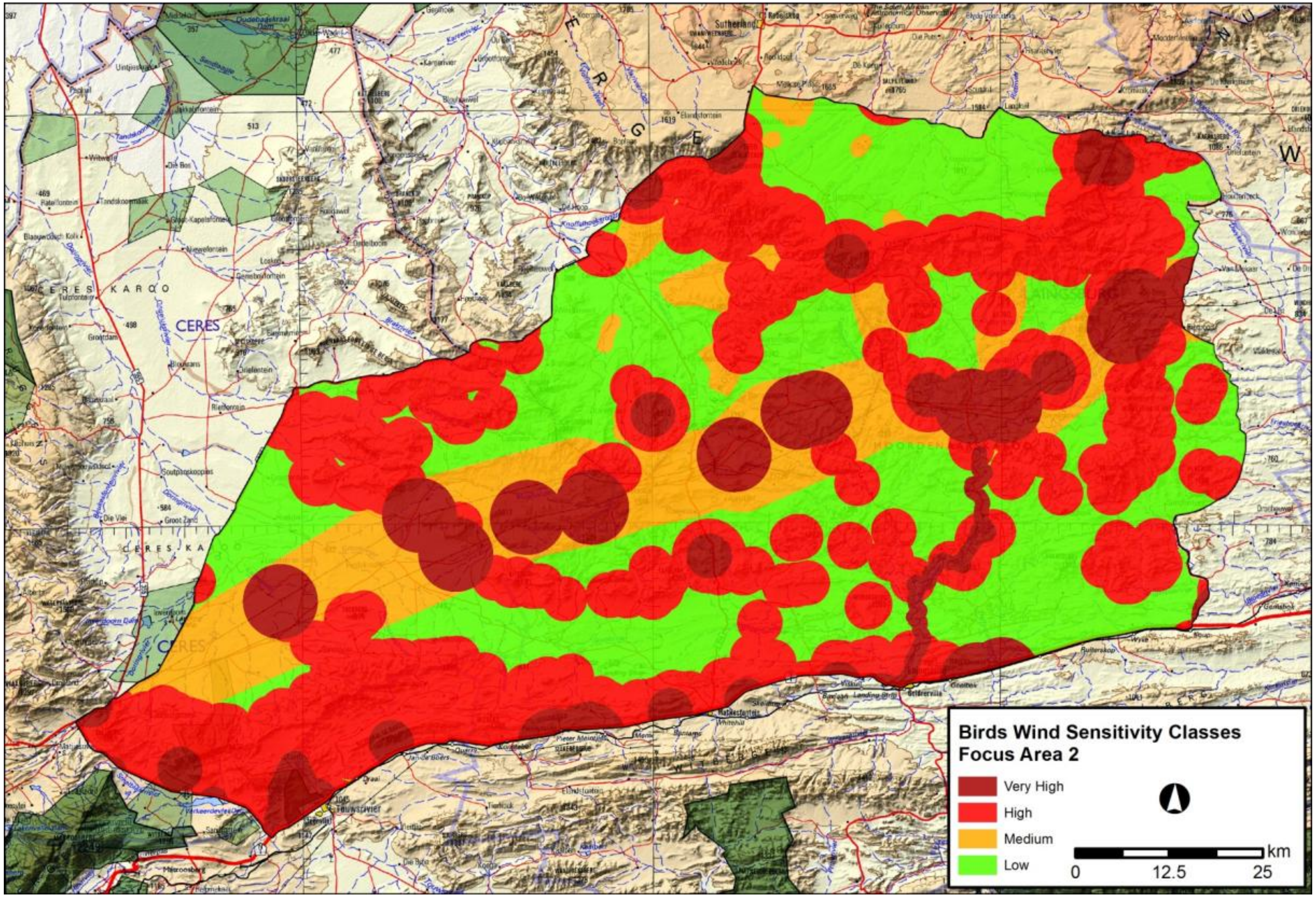
5.2 Four tier sensitivity maps

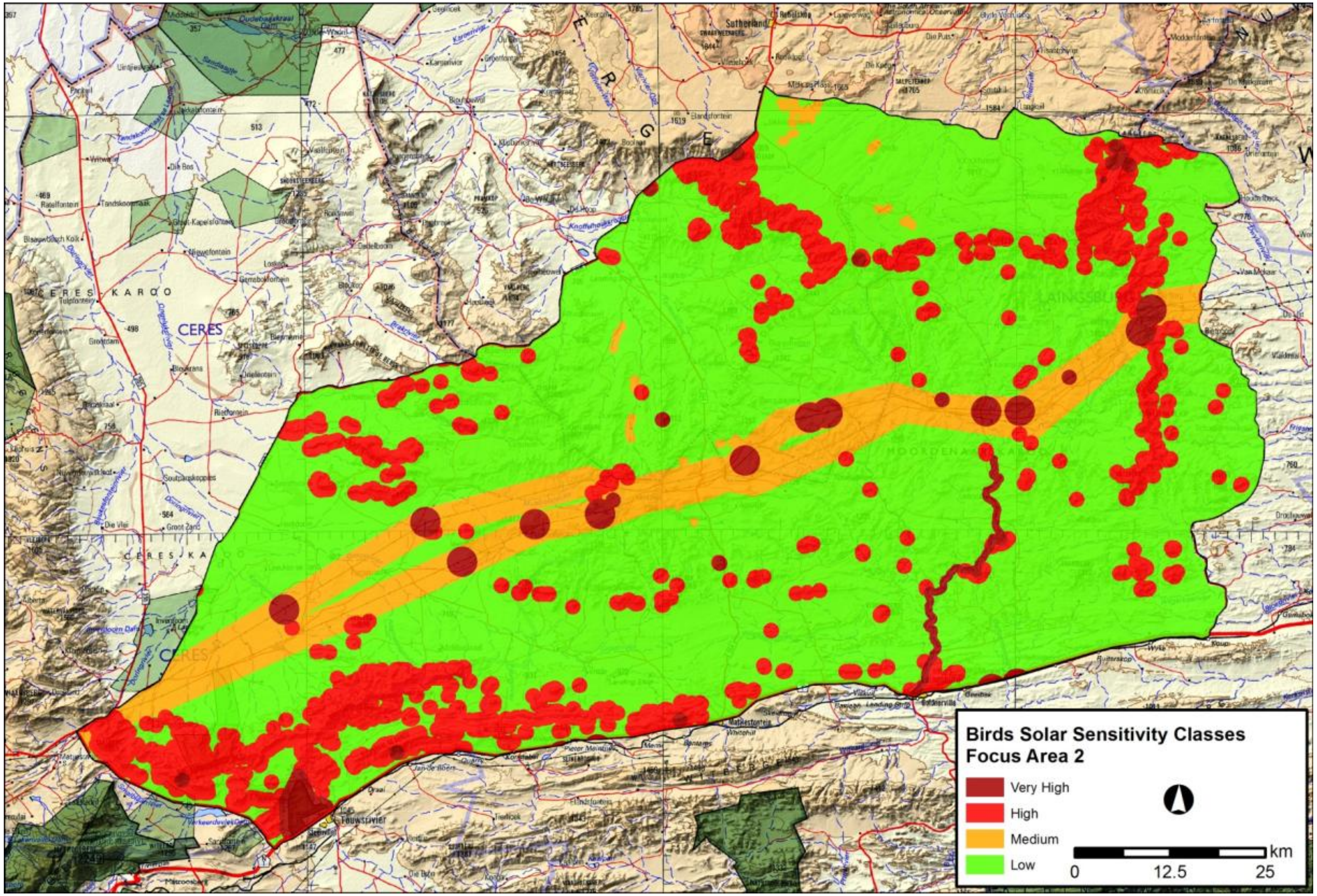
5.2.1 Overberg Focus Area 1



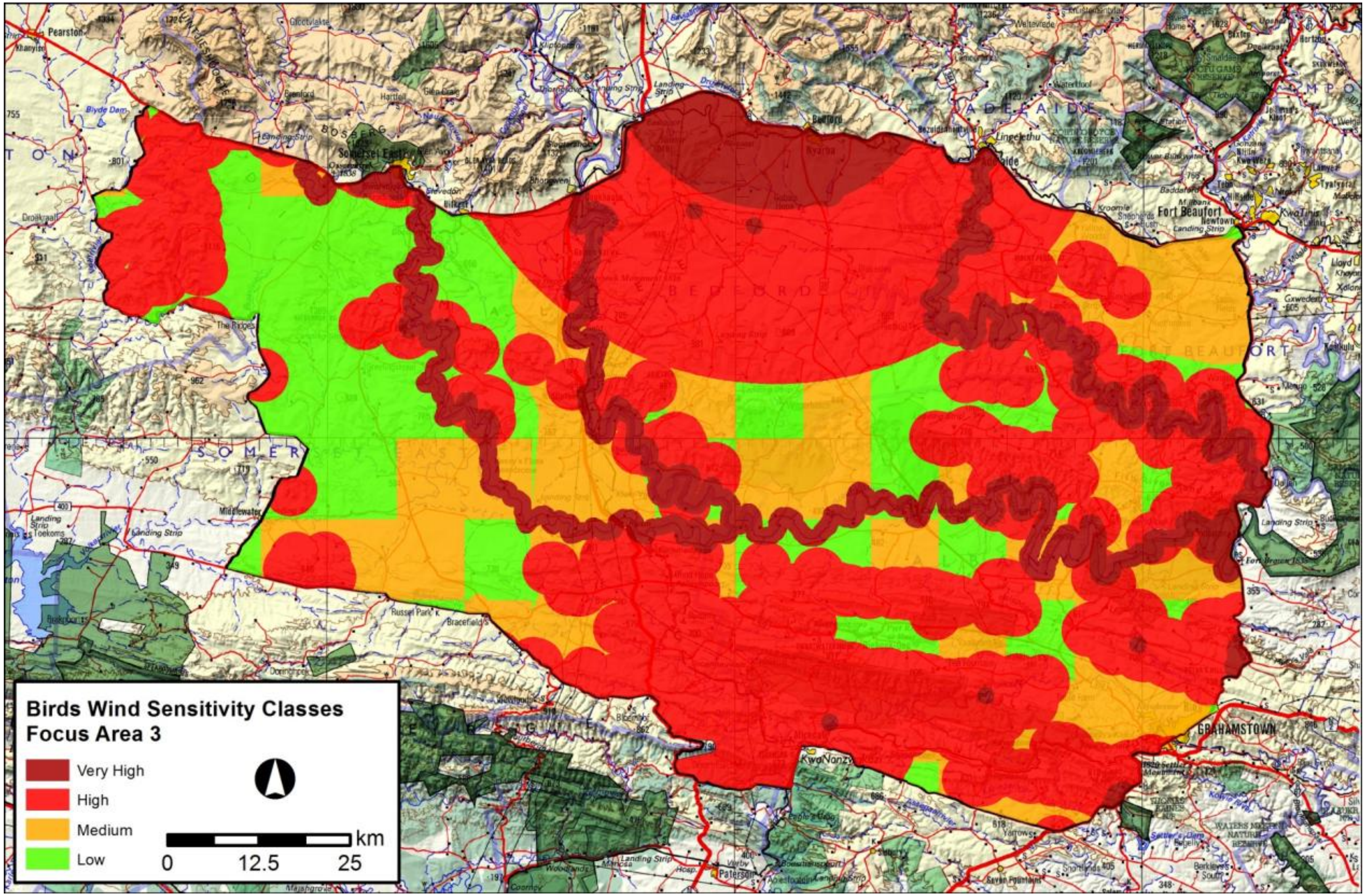

Birds Solar Sensitivity Classes
Focus Area 1
Very High
High
Medium
Low
0
12.5
25
km

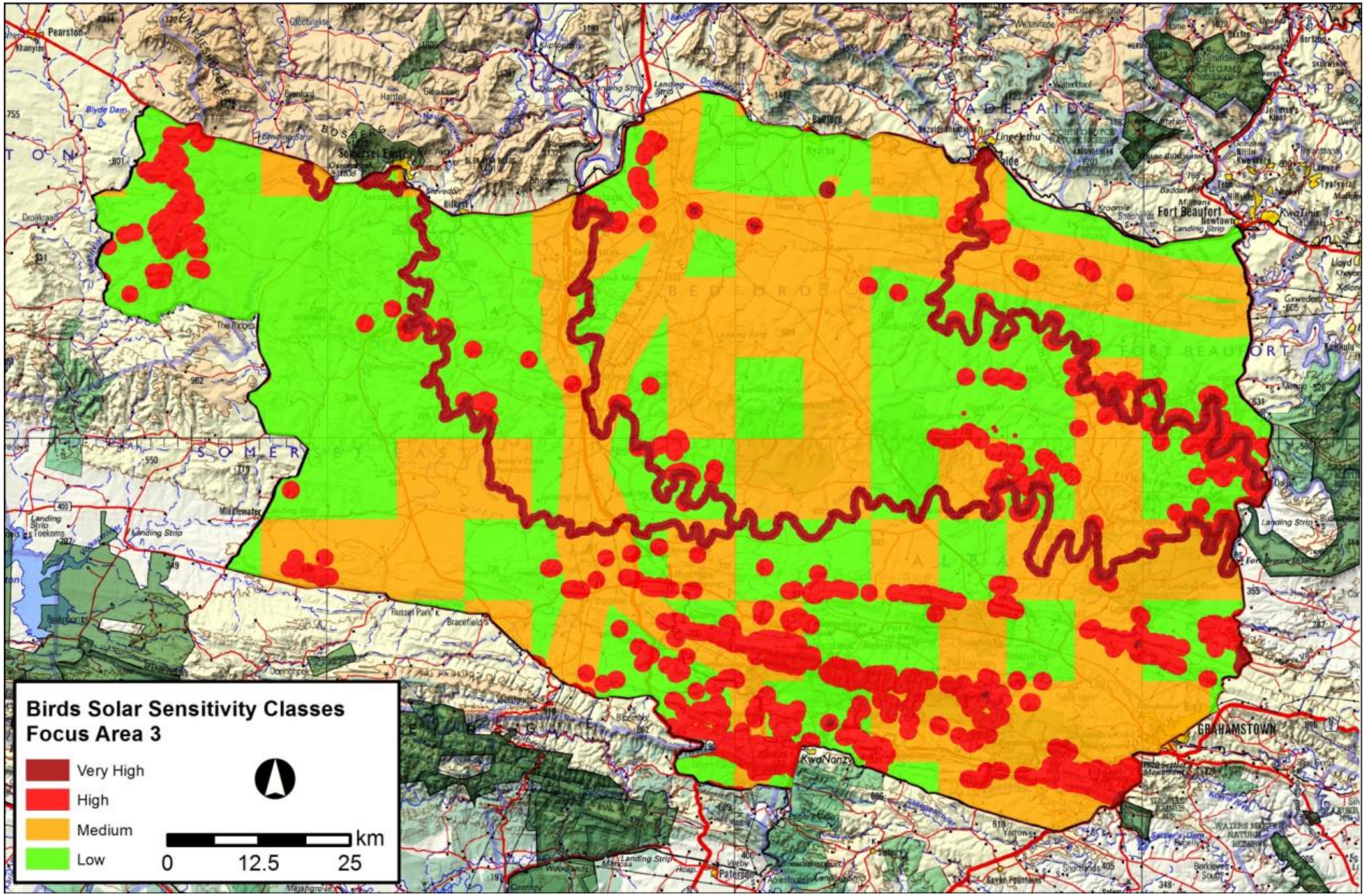
5.2.2 Komsberg Focus Area 2



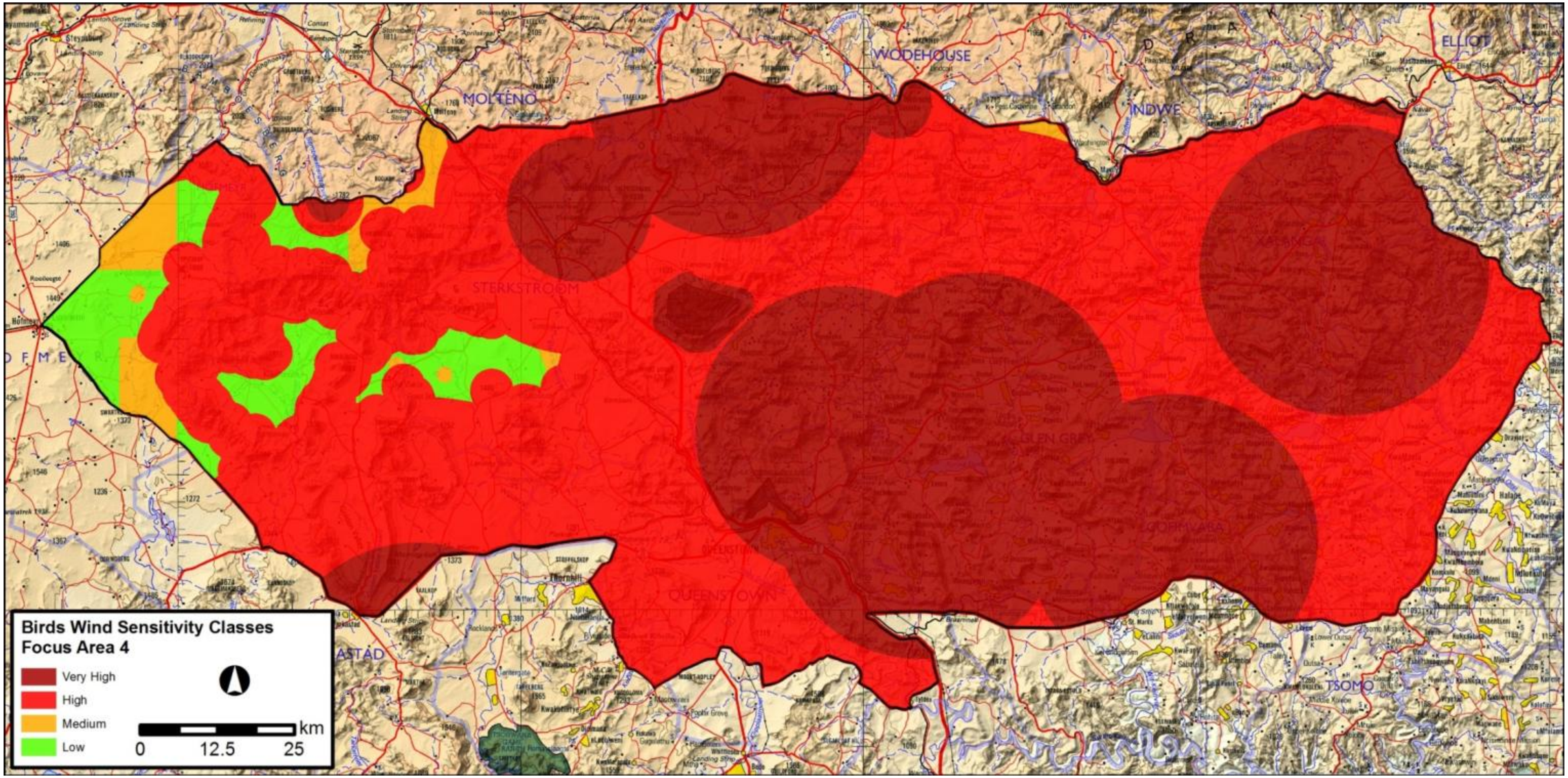

Birds Solar Sensitivity Classes
Focus Area 2
Very High
High
Medium
Low
0
12.5
25
km

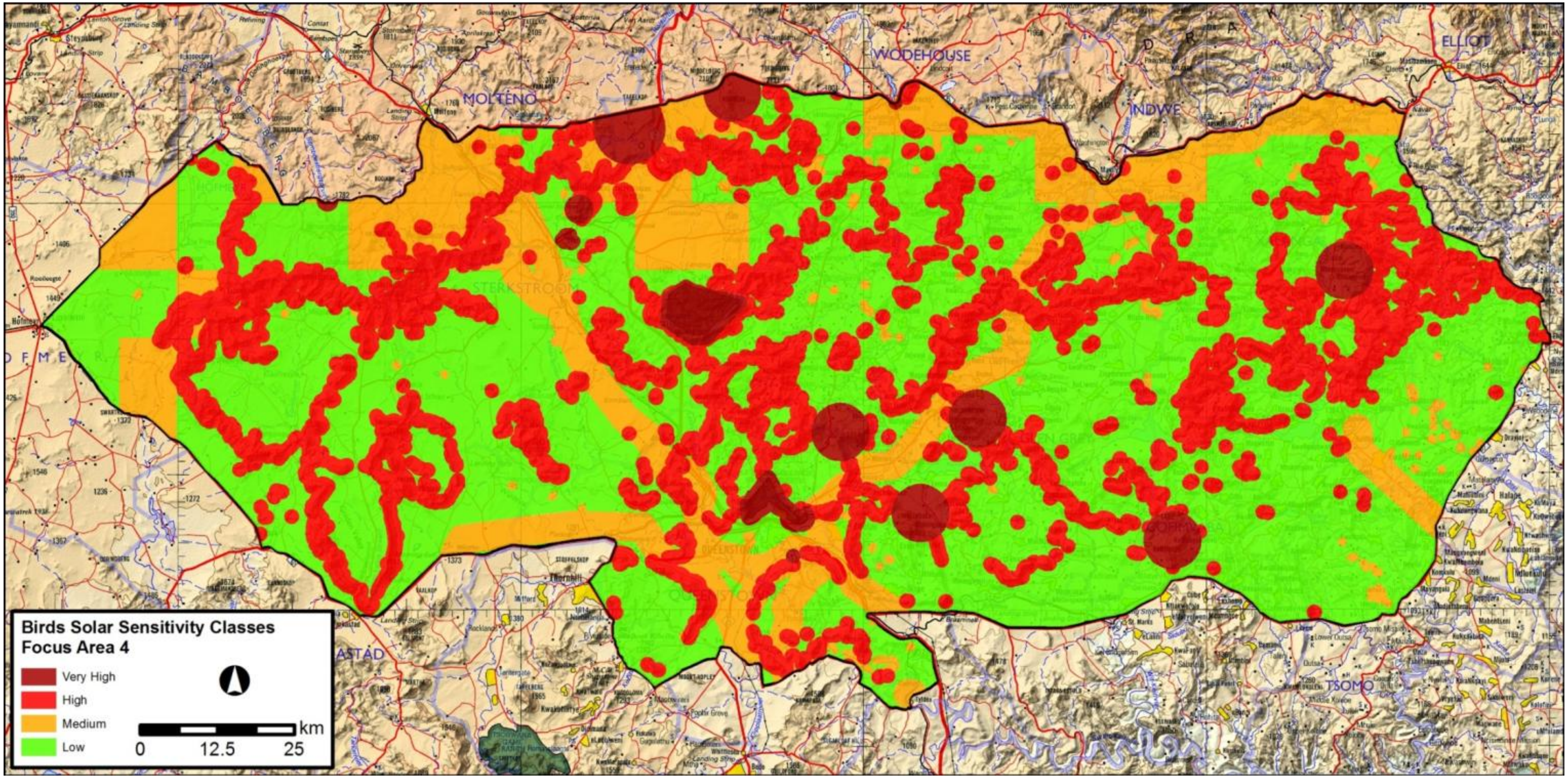
5.2.3 Cookhouse Area 3



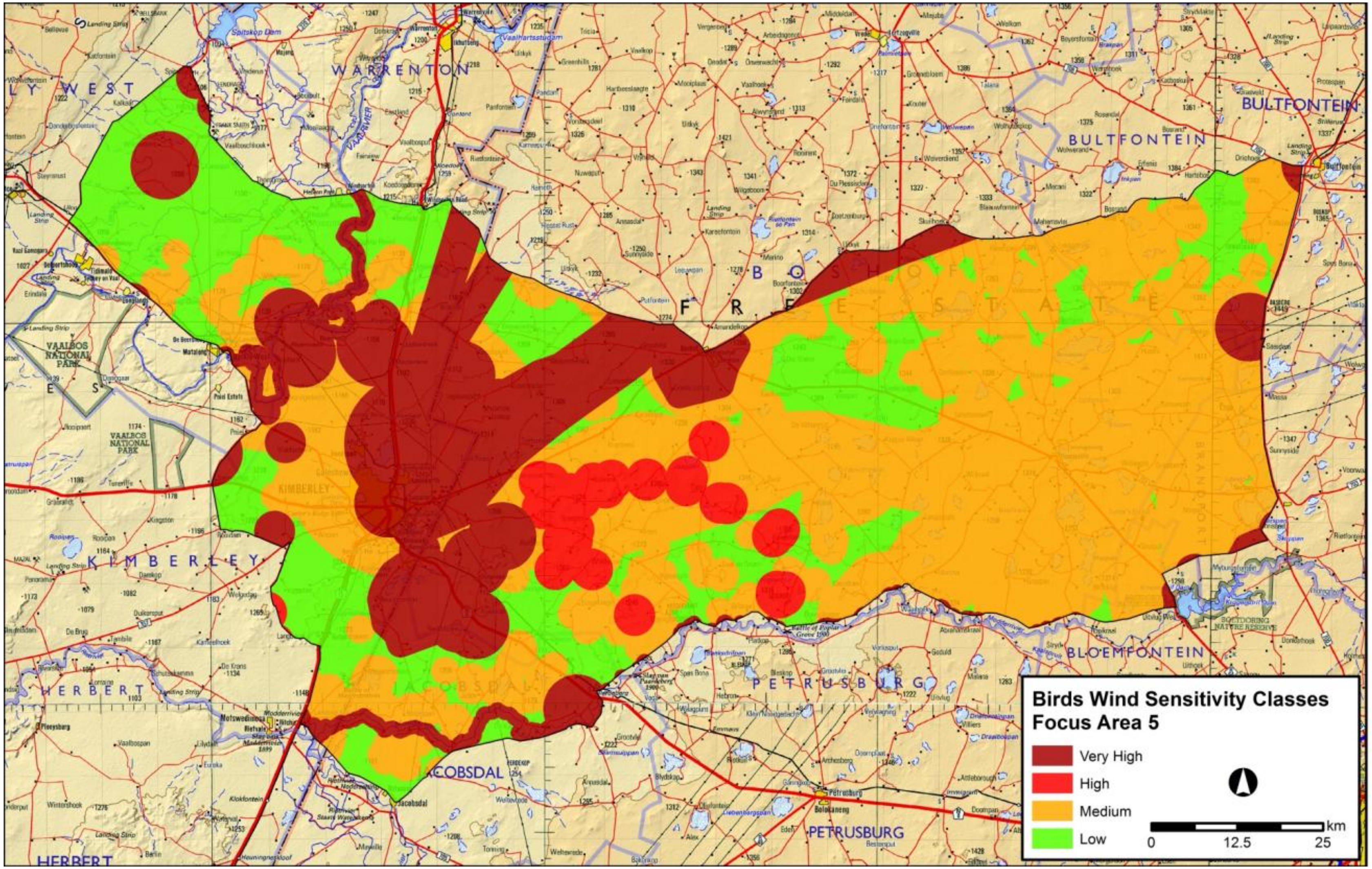

Birds Solar Sensitivity Classes
Focus Area 3
Very High
High
Medium
Low
0
12.5
25
km
GRAHAMSTOWN
Fort Beaufort
Pearston

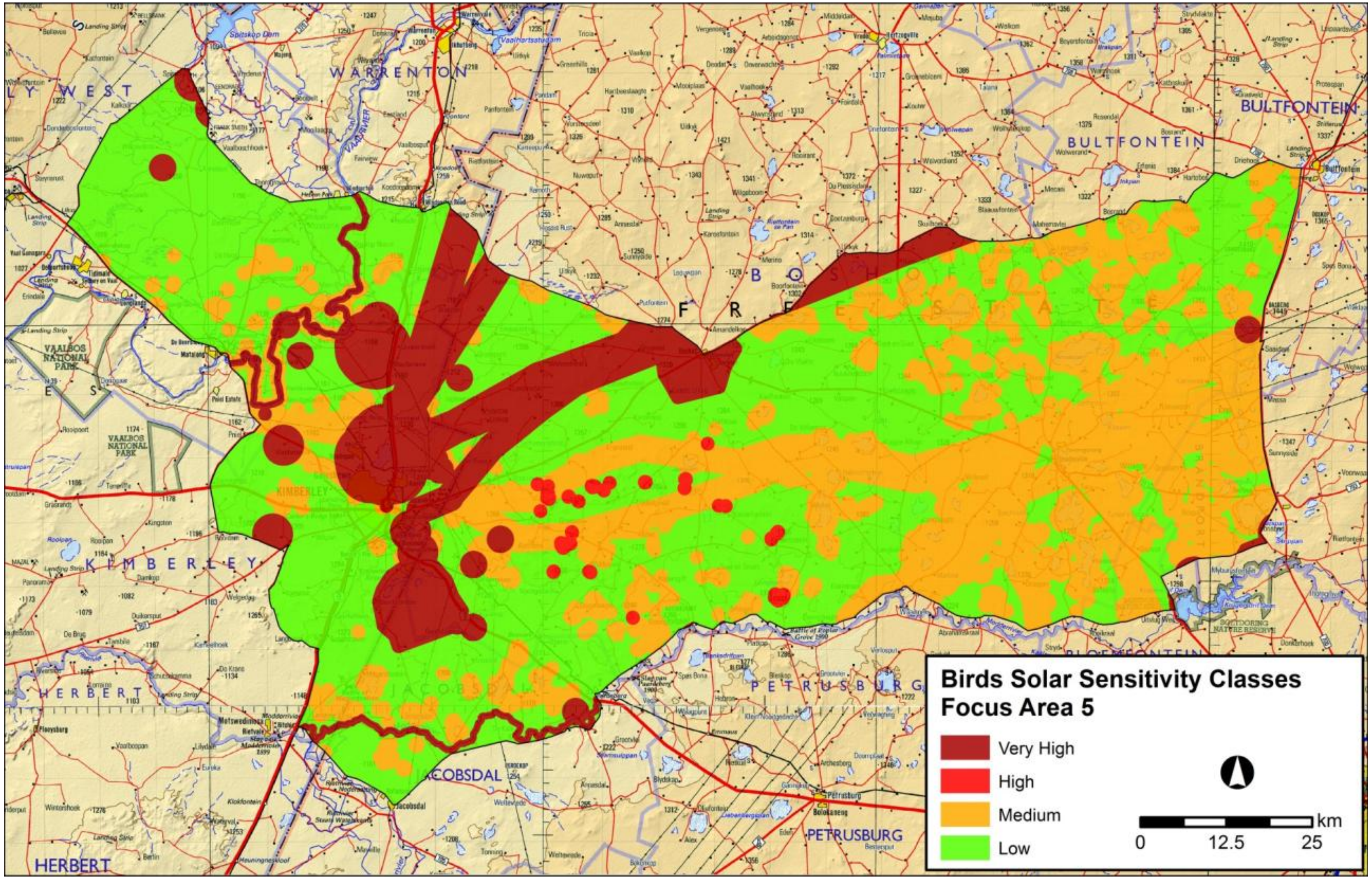
5.2.4 Stormberg Focus Area 4



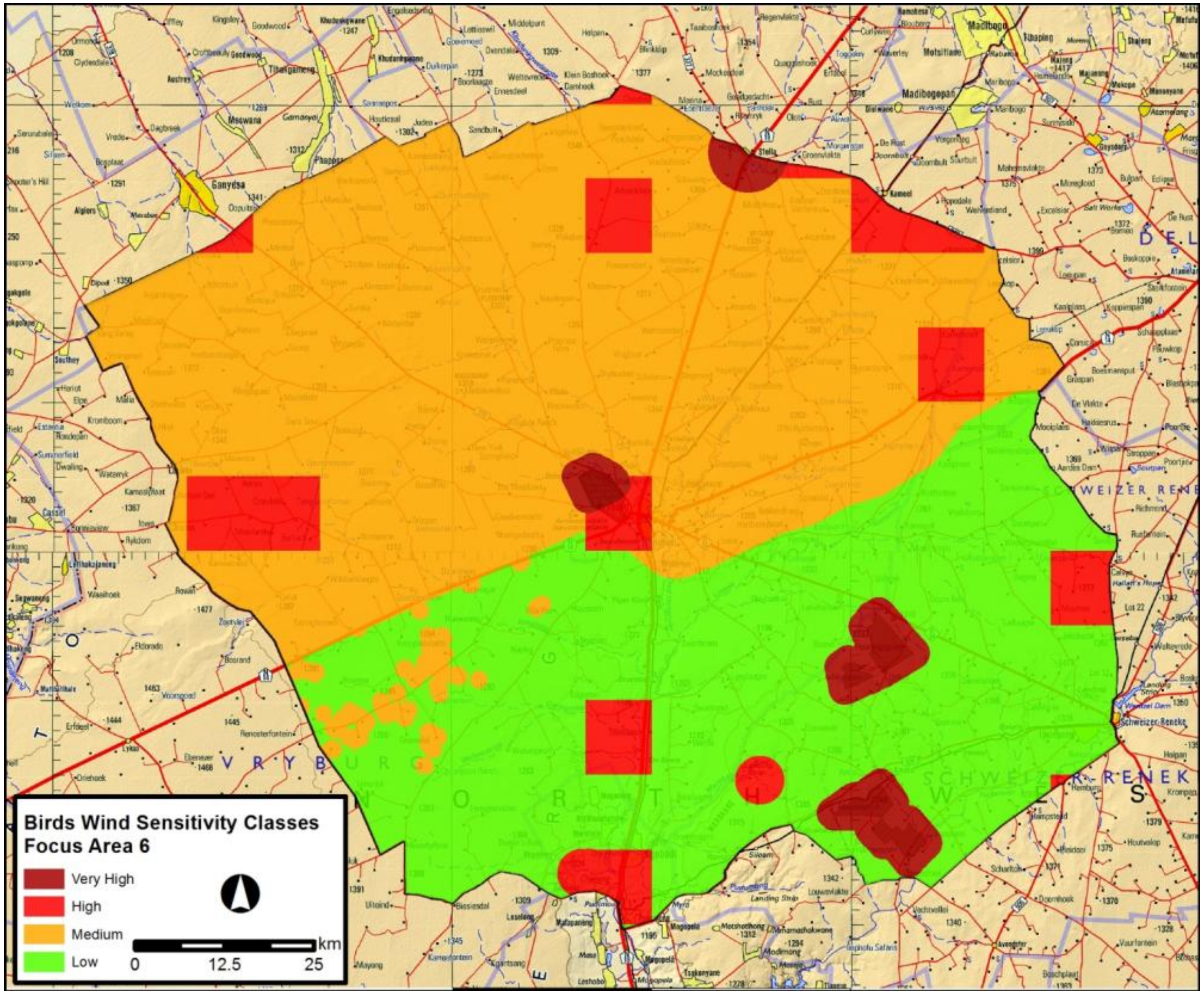

Birds Solar Sensitivity Classes
Focus Area 4
Very High
High
Medium
Low
0
12.5
25
km
MOLTENO
WODEHOUSE
INDWE
ELLIOT
TSOMO

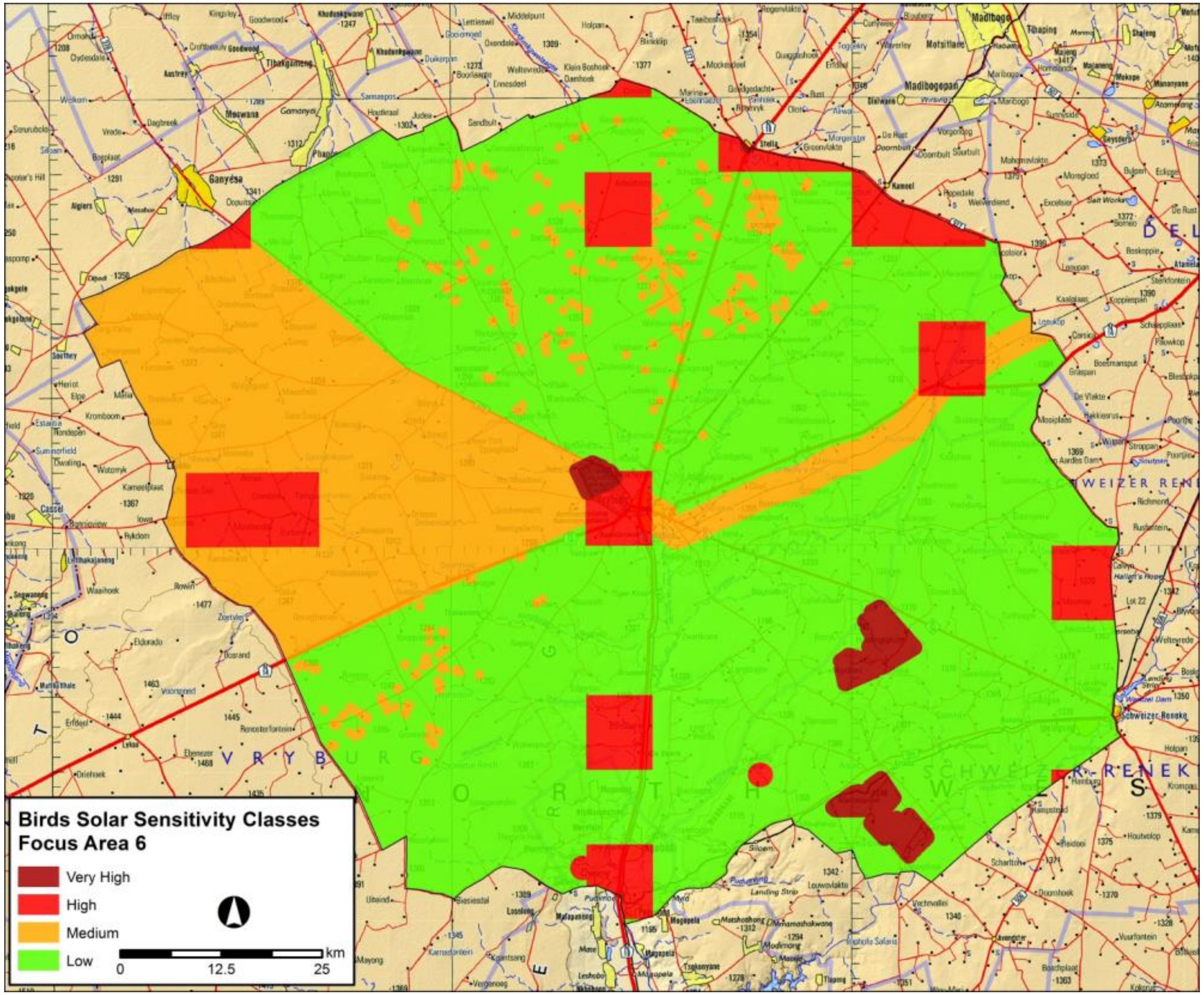
5.2.5 Kimberley Focus Area 5



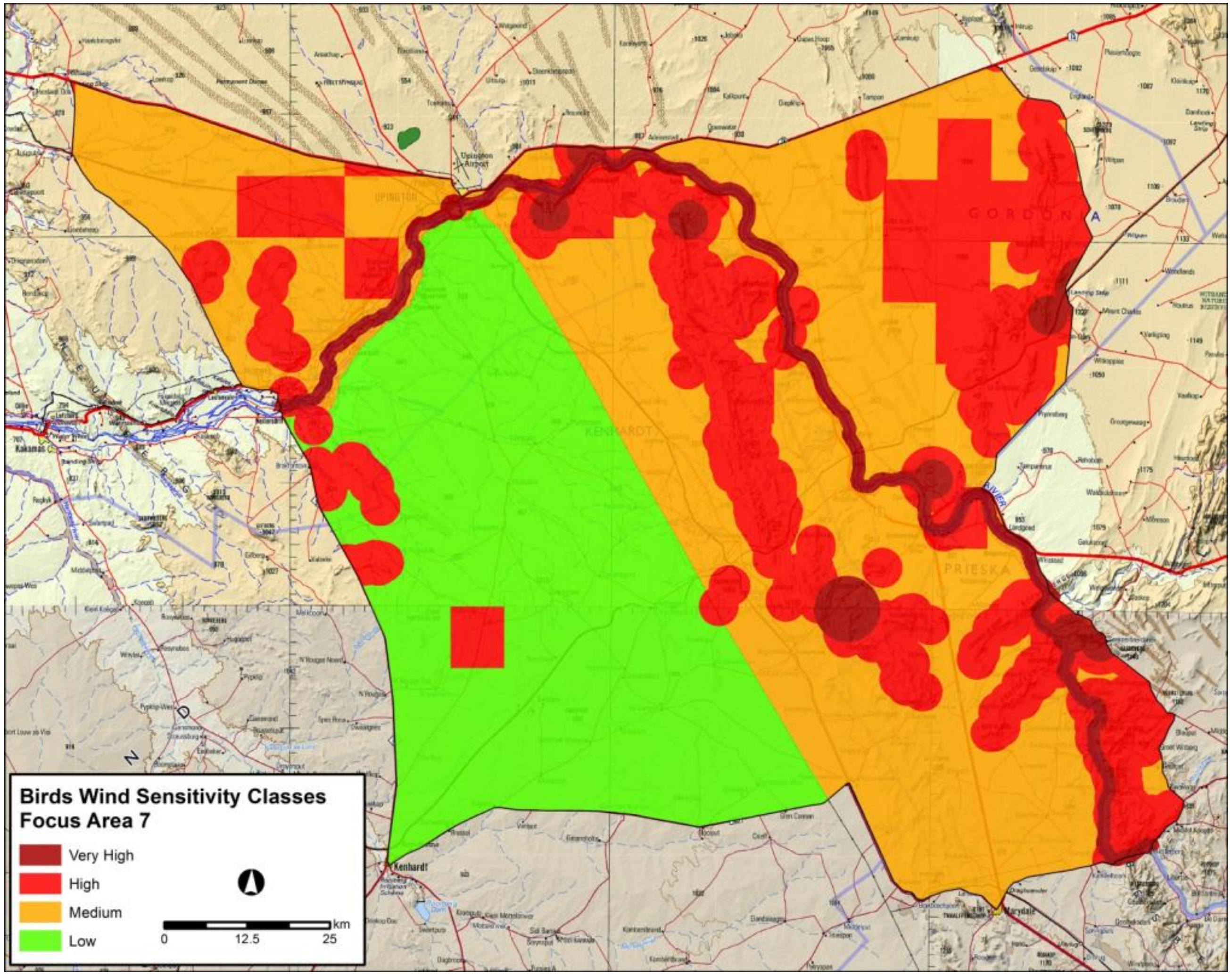

Birds Solar Sensitivity Classes
Focus Area 5
Very High
High
Medium
Low
0
12.5
25
km
KIMBERLEY
BULTFONTEIN
JACOBSDAL
PETRUSBURG
HERBERT
WARRENTON
FREE STATE

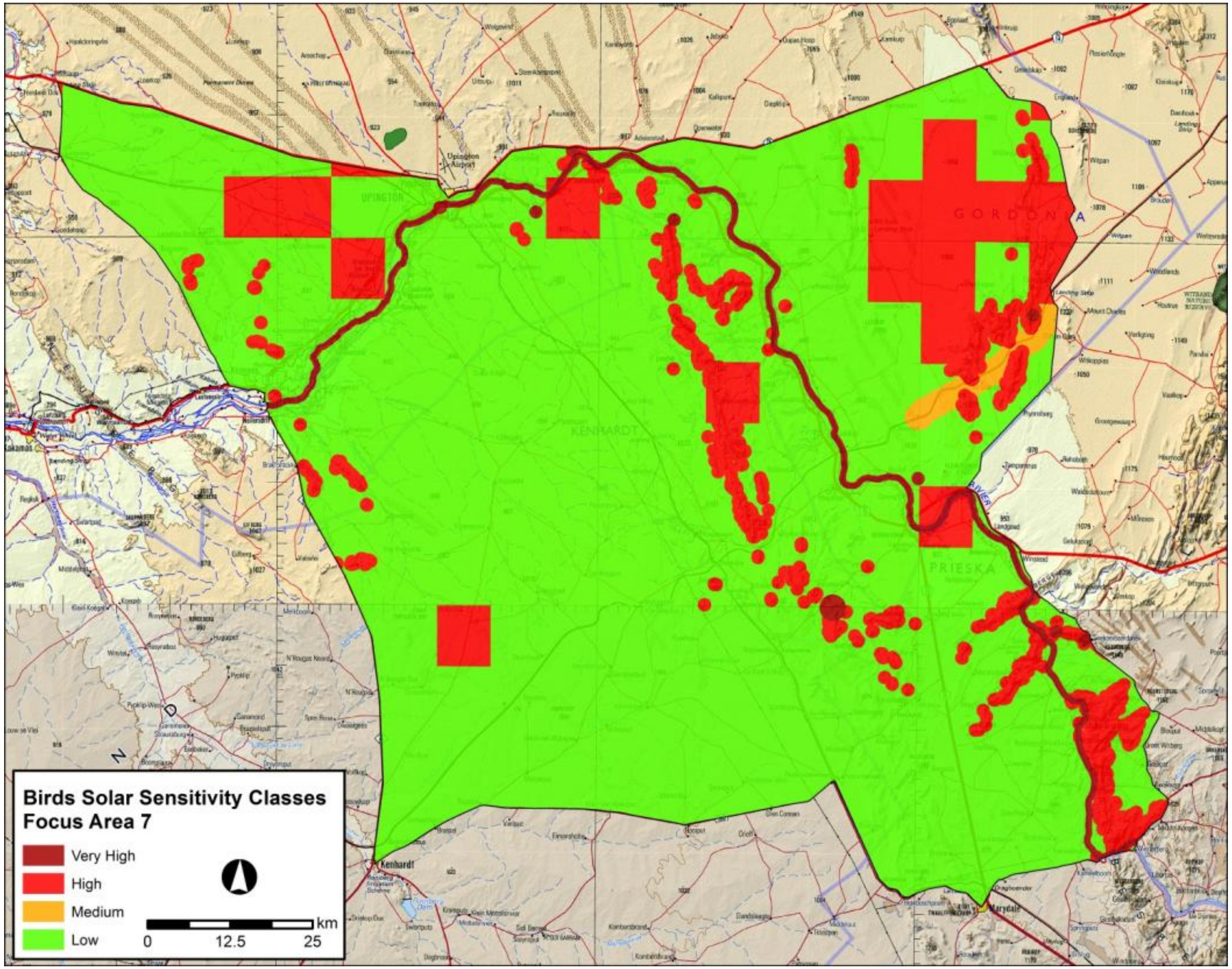
5.2.6 Vryburg Focus Area 6



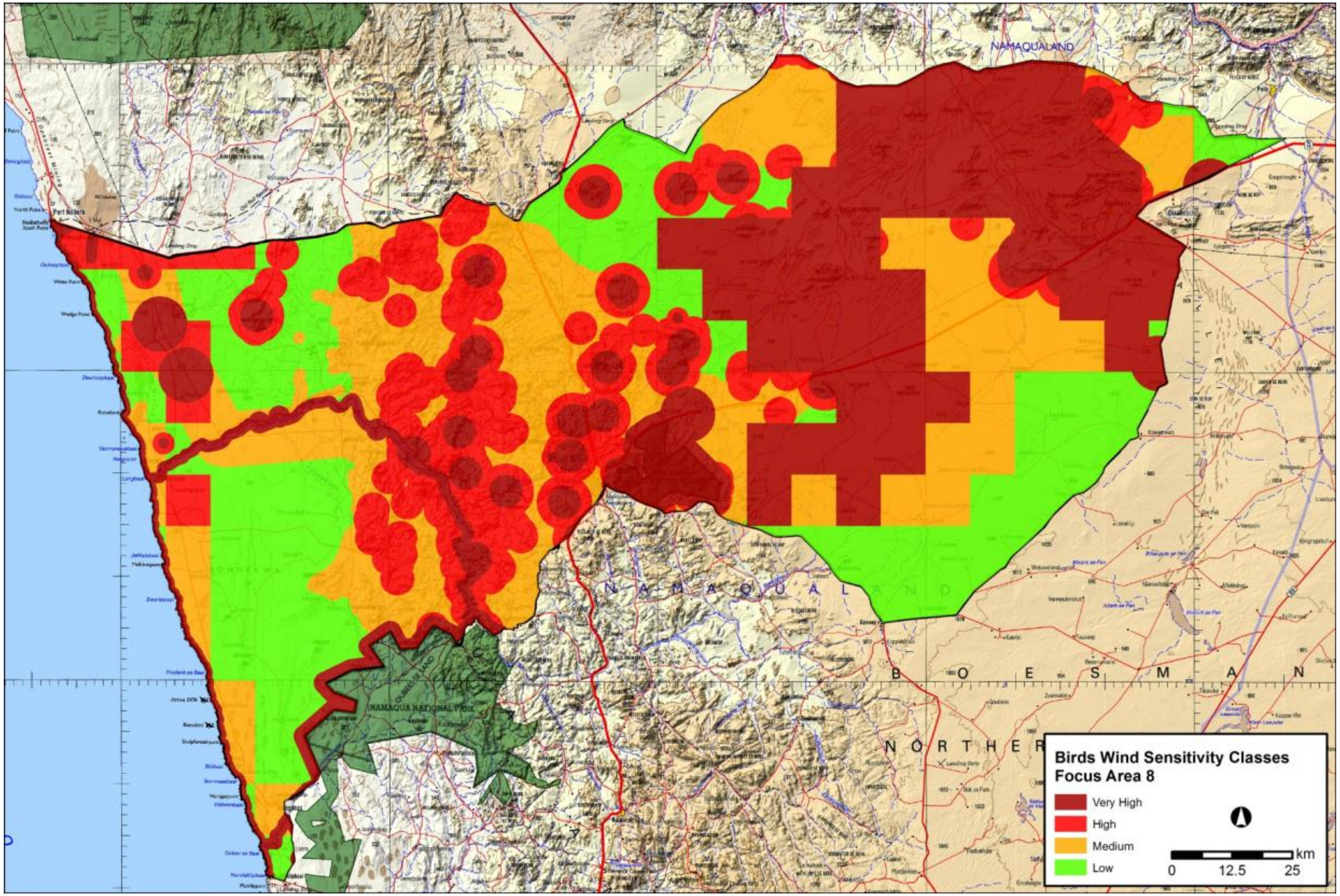

Birds Solar Sensitivity Classes
Focus Area 6
Very High
High
Medium
Low
0
12.5
25
km

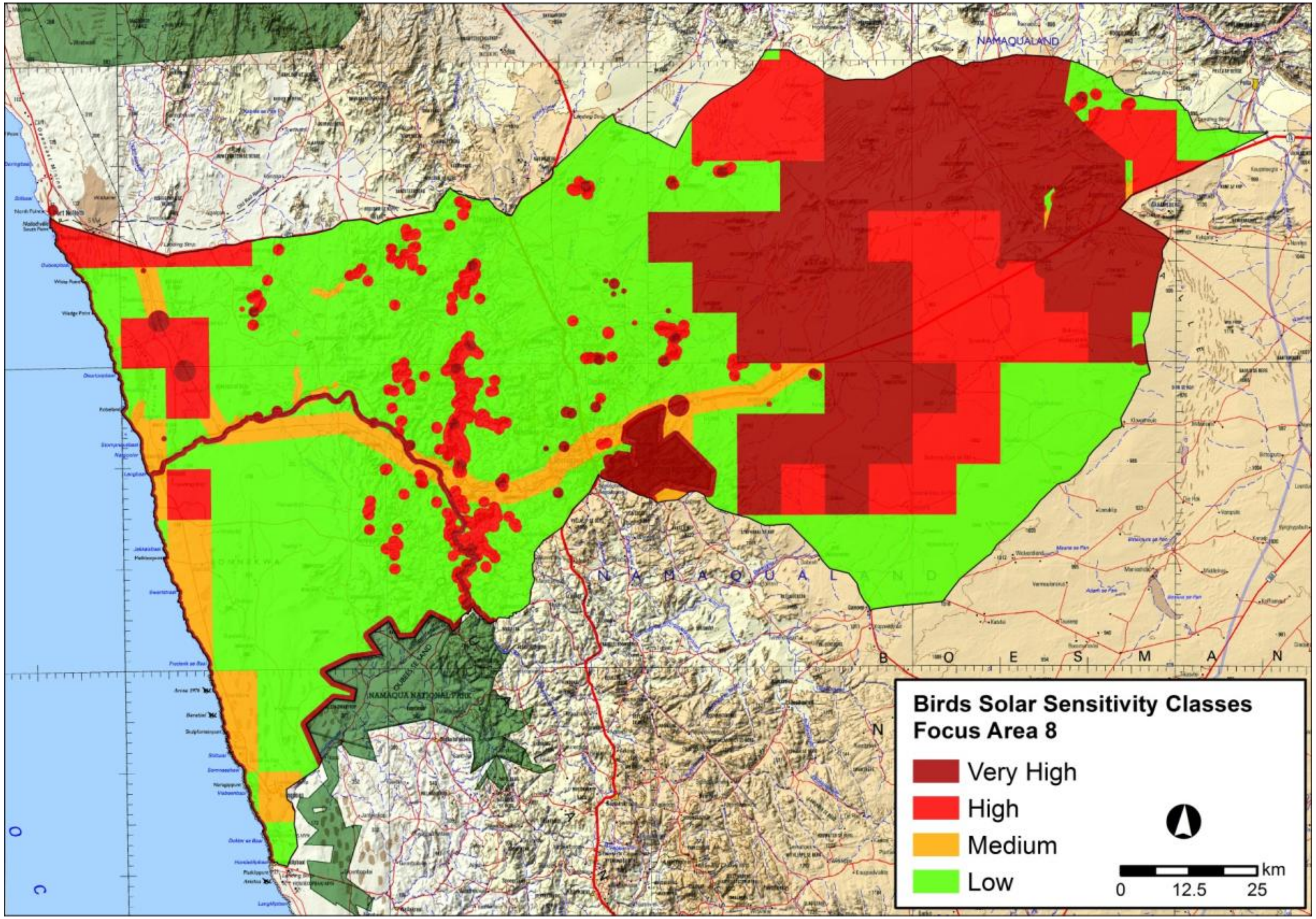
5.2.7 Upington Focus Area 7




Birds Solar Sensitivity Classes
Focus Area 7
Very High
High
Medium
Low
0
12.5
25
km
KENHARDT
PRIESKA
GORDONIA
Upington
Kenhardt
Marydale

5.2.8 Springbok Focus Area 8




Birds Solar Sensitivity Classes
Focus Area 8
Very High
High
Medium
Low
km
0
12.5
25
NAMAQUALAND
N A M A Q U A L A N D
B O E S M A N
NAMAQUA NATIONAL PARK

6 INTERPRETATION AND IMPLEMENTATION OF SENSITIVITY MAPS

6.1 Interpretation and implementation of the four tier wind and solar maps and permit requirements for each focus area

Technology	Sensitivity Class	Interpretation	Implementation and additional assessments at project level	Permit requirements (where applicable)
Wind and Solar PV	Dark red	Very High sensitivity areas known to support important populations of threatened, impact susceptible species. Not suitable for development.	None recommended. Development in these areas is discouraged. The onus is on any would-be developer to provide sound, empirical evidence of sustainability in spite of the impact sensitivities identified.	Authorisation should be denied in terms of NEMA. BLSA should be requested to review any development proposal and to advise accordingly.
	Red	High sensitivity areas likely to support important populations of threatened, impact susceptible species. Not suitable for development unless sensitivities are fully investigated and impacts can be sufficiently mitigated.	No streamlining possible - the full prescribed period of assessment and monitoring is required in accordance with the best practice guidelines for each technology*. Particular attention should be paid to key sensitivities already identified; these may require additional research to ensure sustainability.	BLSA should be requested to review any development proposals, and the outcomes of assessments and monitoring, and to advise accordingly, before authorisation can be considered in terms of NEMA.
	Orange	Medium sensitivity areas that could support important populations of threatened, impact susceptible species. Possibly suitable for development, but potential sensitivities must be fully investigated and effective mitigation options clearly identified.	No streamlining is possible in these areas - the full prescribed period of assessment and monitoring is required in accordance with the best practice guidelines for each technology*. No realistic possibility of relaxing these requirements in light of initial survey results.	BLSA should be requested to review any development proposals, and the outcomes of assessments and monitoring, and to advise accordingly, before authorisation can be considered in terms of NEMA.
	Green (Springbok FA only)	Lower sensitivity areas that probably don't support important populations of threatened, impact susceptible species. Probably suitable for development, with no anticipated unsustainable impacts on birds.	Streamlining of the requirements of the best practice guidelines is advised, in terms of a reduction of the required period of monitoring* (e.g. from 12 to six months for wind energy projects), and possibly in terms of the survey intensity, data quantity, or both. *A condition is that should any unforeseen sensitivities emerge from initial survey work, these will immediately inform a revision of the data requirements for the site.*	BLSA should be requested to review any development proposals, and the outcomes of assessments and monitoring, and to advise accordingly, before authorisation can be considered in terms of NEMA.
	Green (All other FAs)	Lower sensitivity areas that possibly don't support important populations of threatened, impact susceptible species. May be suitable for development, but present levels of knowledge preclude confident predictions on the sustainability of impacts.	Streamlining is unlikely in these areas - the full prescribed period of assessment and monitoring is required in accordance with the best practice guidelines for each technology*. *It may be possible to relax some of these requirements in light of initial survey results.*	BLSA should be requested to review any development proposals, and the outcomes of assessments and monitoring, and to advise accordingly, before authorisation can be considered in terms of NEMA.

*Note that at the time of writing the best practice guidelines for solar development are under major review. The outcomes of that review, and the stipulations of the revised guidelines document should be rigorously applied to the REDZ development protocols / permit requirements.

7 GENERAL COMMENTS AND DISCUSSION

7.1 Key impacts and mitigation

Site	Key Impacts	Site specific description	Mitigation
Features relevant to more than one FA	**Slopes and Ridges:** Collision mortality and/or displacement of various cliff-nesting and soaring species, including various red-listed raptors and Black Stork.	-	Search areas for nest sites of cliff-nesting species and buffer these accordingly (see section 4). Monitor thoroughly to determine which ridgelines are frequented by threatened slope-soaring species and buffer accordingly.
	Power lines: Disturbance or permanent displacement of sensitive or priority species, especially raptors and vultures, that use pylon infrastructure for nesting or roosting. These impact susceptible species play an integral part in the local ecology and could permanently be removed from the system, either through displacement or mortality with the operational RE facility.	-	All existing power infrastructure should be surveyed for possible nesting or roosting sites. Any newly identified sites should be buffered accordingly to ensure these areas are protected from possible disturbance (see section 4).
	Wetlands (>20 000 m^2): Disturbance or permanent displacement of wetland species, and possible destruction of unique habitat types. Collision mortality of birds that use flight lines in and out of these large wetland areas, which attract and support both impact susceptible and priority species.	-	All major wetlands larger than 20 000 m^2 should be surveyed to determine the abundance and diversity of wetland and other birds present. Where these represent locally or regionally significance resource areas they should be buffered accordingly (see section 4).

Site	Key Impacts	Site specific description	Mitigation
	Cliff-nesting raptor nests: Collision mortality and/or permanent displacement of montane, cliff-nesting raptors. A suite of cliff-nesting and slope-soaring raptors – including Cape Vulture, Verreaux's Eagle, Jackal Buzzard, Booted Eagle, Peregrine Falcon, Lanner Falcon - are thought to be highly susceptible to collision mortality with wind turbines, especially where these are placed on ridgelines, close to active nests, colonies or roosts, or on favoured flight-lines.	-	All known cliff-nesting raptor nests are buffered as Very High sensitivity zones (see section 4). The High sensitivity outer buffer should be regularly surveyed to determine whether or not particular landscape features are favoured by foraging birds. Detailed information on ranging behaviour could be derived from direct observation or by remote tracking of individual birds - only embark on tracking studies in collaboration with accredited ornithologists. Based on findings, all high traffic areas need to be effectively buffered from development.
	Crane nesting areas: Disturbance or displacement of Blue or Grey-crowned Cranes from favoured breeding areas by expansive wind or solar PV development	-	Keep RE development outside of the designated Very High sensitivity buffer areas (See section 4). Search the designated High sensitivity buffer areas for other nests during the breeding season – October-February and buffer Very High sensitivity accordingly.
	Migrating Kestrel roosts: Collision mortality and/or permanent displacement of Lesser Kestrels and Amur Falcons from summer roost sites.	-	Keep wind farm developments well outside the Very High sensitivity buffers imposed (See section 4). Survey the movements of birds within the surrounding High sensitivity buffer to ensure that there are no other, unforeseen points of aggregation that might heighten collision risk.
	Vulture Restaurants: Collision or electrocution mortality of various vulture species visiting artificial feeding sites could have significant negative impacts on populations of these threatened birds.	-	Keep wind farms out of buffered Very High sensitivity areas around known vulture feeding sites. Survey movements of vultures in surrounding high sensitivity buffer and if required avoid placing wind turbines in these areas. All new peripheral power infrastructure should be fully insulated, marked and bird friendly.

Site	Key Impacts	Site specific description	Mitigation
Overberg Focus Area 1	Collision mortality of Cape Vultures with wind turbines	Multiple casualties annually of vultures foraging out from the Potberg breeding colony; could be sufficient to de-stabilise colony and result in a negative population growth rate.	Keep wind farms outside of the designated Very High sensitivity buffer area around the colony. Survey vulture foraging patterns within the High sensitivity buffer around the colony to determine areas of high use and buffer accordingly. Best done using tracking devices on a representative sample of birds from the colony. Only embark on tracking studies in collaboration with accredited ornithologists. Investigate management of vulture access to stock mortalities to ensure that opportunities to feed close to or within a wind farmed area are minimised.
	Displacement of nesting Blue Cranes	Permanent disturbance of cranes from favoured breeding areas by expansive wind or solar PV development areas – perhaps particularly relevant in the west of the FA, close to Caledon.	Keep RE development outside of the designated Very High sensitivity buffer areas. Search the designated High sensitivity buffer areas for other nests during the breeding season – October-February.
	Collision mortality of large terrestrial birds with wind turbines	Multiple casualties of Blue Crane and/or Denham's Bustard annually, particularly associated with non-breeding flocks of cranes at regular points of aggregation – feed lots, roost sites - and perhaps especially in the east of the FA, around Bredasdorp and Swellendam. Added to existing very high power line collision rates (Shaw *et al.* 2010a & b); could be sufficient to de-stabilise either/both local populations.	Thoroughly survey crane and bustard numbers, activities and habitat use around and within a proposed development area from as early in the development process as possible. Identify wetland areas that may serve as major roosting sites for cranes, and areas of habitat that regularly attract large numbers of either species and buffer these from impacts.
	Displacement of Black Harriers	Disturbance of harriers from known or possible nesting areas in Renosterveld fragments, or destruction of these fragments, by extensive wind or solar development – further reducing already catastrophically depleted availability of optimal nesting habitat (Curtis *et al* 2004).	Keep RE development out of and away from the designated buffer areas around Renosterveld fragments.

Site	Key Impacts	Site specific description	Mitigation
Komsberg Focus Area 2	Collision mortality of Verreaux's Eagles with wind turbines	Multiple casualties of eagles annually; could be sufficient to de-stabilise local population, particularly if large numbers of adult birds are killed.	Keep wind farms outside of the designated Very High sensitivity buffers around known nest sites, and thoroughly survey the surrounding High sensitivity buffer areas to determine high-use areas and buffer these accordingly. Survey the designated High sensitivity area containing steep ridgelines and sheer cliffs for new nest sites and high-use areas for eagles and buffer accordingly. Eagle foraging range information perhaps best obtained by using tracking devices, but explore passive observation first; always work with accredited ornithologists.
	Collision mortality of Martial Eagles with wind turbines, or displacement by disturbance	Multiple casualties of eagles annually, and desertion of established nest sites; could be sufficient to de-stabilise local population, particularly if large numbers of adult birds are killed.	Keep wind and solar farms outside of the designated Very High sensitivity buffers around known nest sites. Survey all nearby transmission lines (and possibly also stands of large trees) for new nest sites and buffer accordingly. Ideally, gather information on eagle foraging behaviour in relation to the proposed wind energy development – either by direct observation or by deploying tracking devices on adult birds. Only embark on tracking studies in collaboration with accredited ornithologists.
Cookhouse Focus Area 3	Collision mortality of Cape Vultures with wind turbines	Multiple casualties annually of vultures foraging on livestock carcasses on open farmland; could be sufficient to prevent successful re-colonisation of the western part of the Eastern Cape (Boshoff *et al.* 2011).	Keep wind farms outside of the designated Very High sensitivity buffer area around the Aggieskloof roost site. Survey vulture foraging patterns within the High sensitivity buffer around the roost to determine areas of high use and buffer accordingly. Best done using tracking devices on a representative sample of birds from the area. Only embark on tracking studies in collaboration with accredited ornithologists Investigate management of vulture access to stock mortalities to ensure that opportunities to feed close to or within a wind farmed area are minimised.
	Collision mortality of large terrestrial birds with wind turbines	Multiple casualties of Blue Crane and/or Denham's Bustard and/or White-bellied Korhaan and/or Southern Black Korhaan annually. Added to what may be high power line collision rates, could be sufficient to de-stabilise local populations.	Thoroughly survey crane, bustard and korhaan numbers, activities and habitat use around and within a proposed development area from as early in the development process as possible. Identify wetland areas that may serve as major roosting sites for cranes, and areas of habitat that regularly attract large numbers of either species and buffer these from impacts.

Site	Key Impacts	Site specific description	Mitigation
Stormberg Focus Area 4	Collision mortality of Cape Vultures with wind turbines	Multiple casualties annually of vultures foraging out from any of the surrounding breeding colonies or roosts; could be sufficient to de-stabilise the local population.	Keep wind farms outside of the designated Very High sensitivity buffer areas around each colony/roost. Survey vulture foraging patterns within the High sensitivity buffers around each colony/roost to determine areas of high use and buffer accordingly. Best done using tracking devices on a representative sample of birds from the area. Work of this nature is already underway, and the results should significantly inform the prospects of wind energy development in this highly sensitive area Investigate management of vulture access to stock mortalities to ensure that opportunities to feed close to or within a wind farmed area are minimised.
	Collision mortality of Verreaux's Eagles with wind turbines	Multiple casualties of eagles annually; could be sufficient to de-stabilise local population, particularly if large numbers of adult birds are killed.	Keep wind farms outside of the designated Very High sensitivity buffers around the single known nest site, and thoroughly survey the surrounding High sensitivity buffer to determine high-use areas and re-buffer these accordingly. Survey the designated High sensitivity area containing sheer cliffs for new nest sites. SABAP2 reporting rates for this species are high, so there may be many more sites in the area. Buffer these accordingly.
	Collision mortality of large terrestrial birds with wind turbines	Multiple casualties of Blue and Grey-crowned Crane and/or Blue Korhaan annually. Added to what may be high power line collision rates, could be sufficient to de-stabilise local populations.	Thoroughly survey crane and korhaan numbers, activities and habitat use around and within a proposed development area from as early in the development process as possible. Identify wetland areas that may serve as major roosting sites for cranes, and areas of habitat that regularly attract large numbers of either species and buffer these from impacts.
	Displacement of Rudd's Lark and/or Yellow-breasted Pipit	Habitat loss for or displacement of possible populations of these two threatened and range-restricted endemics. Could result from construction or operation of either wind or solar facilities, and likely to result in local extinction.	Thoroughly survey the pristine grasslands in the Penhoek Pass area for both species. If either is reliably present, this area should be buffered Very High sensitivity and all forms of RE development kept well away.

Site	Key Impacts	Site specific description	Mitigation
Kimberley Focus Area 5	Collision mortality of Lesser and/or Greater Flamingos with wind turbines and/or with PV solar arrays	If these birds are susceptible to turbine collisions, or to mistaking solar arrays for waterbodies (Kagan *et al.* 2014), given the numbers of birds regularly present at Kamfers Dam and Langleg Pan, this could result in significant numbers of casualties.	All forms of RE development should be kept out of the designated Very High sensitivity areas around Kamfers Dam, Langleg Pan and along the tracked routes to the north-east.
	Collision mortality of White-backed Vulture with wind turbines, or displacement by disturbance	Multiple casualties of vultures annually could be sufficient to de-stabilise the population and result in a negative growth rate; established nest sites could be deserted.	Keep wind and solar farms well outside of the Very High sensitivity buffers imposed around all vulture nesting sites/colonies in the general area. Ideally, study vulture foraging behaviour out from the local nesting areas to determine the extent to which these wide-ranging birds still interact with wind turbines located outside the imposed buffers. Best done using tracking devices on a representative sample of birds from the area. Only embark on tracking studies in collaboration with accredited ornithologists. Investigate management of vulture access to stock mortalities to ensure that opportunities to feed close to or within a wind farmed area are minimised.
	Collision mortality of migrating kestrels with wind turbines	Given the location of four quite large Lesser Kestrel/Amur Falcon roost sites in this FA, should these birds prove susceptible to collision, casualty rates could be considerable.	Keep wind farm developments well outside the Very High sensitivity buffers imposed. Survey the movements of birds within the surrounding High sensitivity buffer to ensure that there are no other, unforeseen points of aggregation that might heighten collision risk.
	Collision mortality of large terrestrial birds with wind turbines	Multiple casualties of Blue and Grey-crowned Crane, Kori and Ludwig's Bustard and/or Blue Korhaan annually. Added to what may be high power line collision rates, could be sufficient to de-stabilise local populations.	Thoroughly survey crane, bustard and korhaan numbers, activities and habitat use around and within a proposed development area from as early in the development process as possible. Identify wetland areas that may serve as major roosting sites for cranes, and areas of habitat that regularly attract large numbers of either species and buffer these from impacts.
Vryburg Focus Area 6	Collision mortality of Large savanna raptors with wind turbines, or displacement by disturbance	Multiple casualties of White-backed Vultures, Lappet-faced Vulture (and possibly Bateleur) annually, or desertion of established nest sites; could be sufficient to cause local extinction of these threatened species.	Survey the High sensitivity area identified in the northern sector of the FA for nesting pairs of these birds and buffer any sites found accordingly. If necessary, investigate management of vulture access to stock mortalities to ensure that opportunities to feed close to or within a wind farmed area are minimised.

Site	Key Impacts	Site specific description	Mitigation
	Collision mortality of migrating kestrels with wind turbines	Should these birds prove susceptible to collision, casualty rates at the Stella roost could be considerable.	Keep wind farm developments well outside the Very High sensitivity buffers imposed around the Stella roost Survey the movements of birds within the surrounding High sensitivity buffer to ensure that there are no other, unforeseen points of aggregation that might heighten collision risk.
Upington Focus Area 7	Collision mortality of Verreaux's Eagles with wind turbines	Multiple casualties of eagles annually; could be sufficient to de-stabilise local population, particularly if large numbers of adult birds are killed.	Keep wind farms outside of the designated Very High sensitivity buffers around known nest sites, and thoroughly survey the surrounding High sensitivity buffer areas to determine high-use areas and buffer these accordingly. Survey the designated High sensitivity area containing steep ridgelines and sheer cliffs for new nest sites and high-use areas for eagles and buffer accordingly. Eagle foraging range information perhaps best obtained by using tracking devices, but explore passive observation option first, and only embark on tracking studies in collaboration with accredited ornithologists.
	Collision mortality of Large savanna raptors with wind turbines, or displacement by disturbance	Multiple casualties of Martial Eagles, Tawny Eagles, White-backed Vultures and/or Lappet-faced Vultures annually, or desertion of established nest sites; could be sufficient to cause localised extinction of these threatened birds	Keep wind and solar farms outside of the designated Very High sensitivity buffers around known nest sites. Survey all nearby transmission lines (and possibly also stands of large trees) for new nest sites and buffer accordingly. Ideally, gather information on eagle foraging behaviour in relation to the proposed wind energy development – either by direct observation or by deploying tracking devices on adult birds. Only embark on tracking studies in collaboration with accredited ornithologists.
Springbok Focus Area 8	Collision mortality of Verreaux's Eagles with wind turbines	Multiple casualties of eagles annually; could be sufficient to de-stabilise local population, particularly if large numbers of adult birds are killed.	Keep wind farms outside of the designated Very High sensitivity buffers around known nest sites, and thoroughly survey the surrounding High sensitivity buffer areas to determine high-use areas and buffer these accordingly. Survey the designated High sensitivity area containing steep ridgelines and sheer cliffs for new nest sites and high-use areas for eagles and buffer accordingly. Eagle foraging range information perhaps best obtained by using tracking devices, but explore passive observation option first, and only embark on tracking studies in collaboration with accredited ornithologists.

Site	Key Impacts	Site specific description	Mitigation
	Collision mortality of Martial Eagles with wind turbines, or displacement by disturbance	Multiple casualties of eagles annually, and desertion of established nest sites; could be sufficient to de-stabilise local population, particularly if large numbers of adult birds are killed.	Keep wind farms and solar farms outside of the designated Very High sensitivity buffers around known nest sites. Survey all nearby transmission lines (and possibly also stands of large trees) for new nest sites and buffer accordingly. Ideally, gather information on eagle foraging behaviour in relation to the proposed wind energy development – either by direct observation or by deploying tracking devices on adult birds. Only embark on tracking studies in collaboration with accredited ornithologists.
	Displacement of Red Lark from core or peripheral areas of its distribution, or collision mortality with wind turbines	Construction or completed footprint of developments could destroy prime habitat, or construction or operational activities may disturb or displace larks from critical areas, and/or multiple casualties annually in collisions; possibly sufficient to de-stabilise the population and even jeopardise the survival of the species.	Keep wind and solar farms outside of the designated Very High sensitivity core areas of the Red Lark range. Survey all High sensitivity peripheral areas of the range to determine presence/absence and relative abundance of larks and buffer accordingly.
	Displacement of Barlow's Lark from important parts of its limited distribution, or collision mortality with wind turbines	Construction or completed footprint of developments could destroy prime habitat, or construction or operational activities may disturb or displace larks from critical areas, and/or multiple casualties annually in collisions.	Survey all High sensitivity areas of the range to determine presence/absence and relative abundance of larks and buffer accordingly.

7.2 General comments

Site	Overall Suitability	Comment
Overberg Focus Area 1	Low suitability for wind energy development, moderate for solar PV	Populations of Cape Vulture, large terrestrial birds and Black Harrier are probably too important to subject to large scale wind energy development. No obvious problems with solar PV provided that there is no development in Renosterveld fragments.
Komsberg Focus Area 2	Suitable for wind energy development and solar PV	No serious obstacles for either technology, provided that (i) existing guidelines are adhered to, (ii) the area is adequately surveyed for large eagle nests, and (iii) these sites and the high-use areas for the eagles are adequately buffered.
Cookhouse Focus Area 3	Moderate suitability for wind energy development, suitable for solar PV	Presence of Cape Vultures in the area presents problems for wind energy development. These problems may be surmountable provided that the existing guidelines and all suggested mitigation measures are adhered to, and the scale/extent of development is limited. No obvious problems with solar PV.
Stormberg Focus Area 4	Low suitability for wind energy development, moderate for solar PV	Too close to too many Cape Vulture sites for wind energy development to be a responsible or sustainable option. No obvious problem with solar PV.
Kimberley Focus Area 5	Low suitability for wind energy development, low-moderate for solar PV	The importance of this area for both Lesser Flamingo and White-backed Vulture suggest that wind energy development is a poor option. Solar PV may also be problematic. The scale/extent of both technologies (but especially wind) should be limited and strict adherence to the guidelines and extra work suggested in this report is non-negotiable.
Vryburg Focus Area 6	Suitable for wind energy development and solar PV	No obvious problems with either technology in this area, although current knowledge of the avifauna is limited.
Upington Focus Area 7	Moderately suitable for wind energy development, suitable for solar PV	Some issues with proximity to Verreaux's Eagle nest sites and areas used by large savanna raptors, but otherwise few obstacles to development for both technologies.
Springbok Focus Area 8	Moderately suitable for wind energy development, moderately suitable for solar PV	Both technologies are an option, but only in selected areas of the FA. Availability of field data greatly raised confidence in mapping sensitivities, to the point that monitoring requirements in Lower sensitivity areas can be reduced. Both technologies should be discouraged from exploring development opportunities within the distribution of Red Lark, at least until our understanding of the population size, distribution and habitat requirements of this species are vastly improved.

8 CONCLUSIONS AND FURTHER RECOMMENDATIONS

The following conclusions can be reached in assessing the outcomes of this study:

1. RE development is encouraged as a sustainable option in terms of likely bird impacts in at least 6-7 of the eight proposed FAs, although there are significant problems with large-scale wind energy development in at least three of these areas.
2. Opportunities for sustainable wind energy development in the Overberg and Stormberg FAs seem to be extremely limited (Table 9), while those in the Kimberley and Springbok FAs are constrained and conditional respectively.
3. Solar PV is far less constrained, and is a realistic option in all eight FAs (Table 9), provided that cumulative impacts are controlled, and PV arrays do not impinge on key habitats for red-listed, range-restricted endemic passerines or significant waterbodies that support large populations of threatened wetland birds.
4. The best areas for both technologies appear to be the Komsberg and Vryburg FAs.
5. Given the lack of recent, reliable and extensive field data for the majority of the FAs assessed, the confidence around most of these findings is low, and with the exception of the Springbok FA, there is little, if any, scope at present to relax the existing baseline monitoring requirements listed in the best practice guidelines documents (Jenkins *et al.* 2012c, Smit 2012).
6. One of the central issues that prompted the need for additional survey and monitoring to inform responsible authorisation of RE developments in this country, and especially of wind farms, is our poor knowledge and understanding of the daily, nomadic or seasonal movements of birds, and the extent to which these movements expose them to collision risk. Very little information of this type was used in the compilation of these maps (because so little is available). For the most part, this is not an issue that can be adequately addressed in an SEA-type study, and must be deferred to project-specific field studies.
7. Some of the areas identified as Very High sensitivity in each FA are situated adjacent to the current FA boundary. It might be easier from a legislative and administrative perspective to simply excise these areas from their respective FAs by adjusting the FA boundaries, than to retain them within the FA.
8. The addition of recent, extensive and reliable field data for the Springbok FA – derived from 10 days spent surveying aspects of the site - tripled the amount of information contributing to the assessment of this area at relatively little additional time or expense, and vastly improved the accuracy of the maps produced and our ability to identify genuinely low sensitivity areas for development within the FA. As a result, a strong recommendation of this report is that more ground-work be done in a follow-up to this study, aimed at refining the maps presented here for the remaining seven FAs. Without wanting to pre-empt the findings of such work, current knowledge suggests that there may well be opportunities to relax the guidelines for solar PV development in all/most of the remaining FAs, and for wind energy development in the Komsberg, Vryburg and Upington FAs.
9. Even though the present report does not offer many immediate opportunities to directly streamline the development authorisation process, the findings still have considerable worth for both DEA and the industry. By highlighting and mapping the avian sensitivities within each FA at this scoping level, the SEA offers developers early clarity on the bird-related obstacles they are likely to encounter at any given location within each of the FAs. Hence there is greater certainty in pursuing development options, and less likelihood of unexpected and costly delays. The value of this indirect streamlining function should not be underestimated.

Table 9: Proportions of Focus Areas occupied by each development sensitivity class, for each technology, with an indication of the likelihood of being able to relax some of the baseline monitoring work currently required by the respective guidelines documents.

Focus Area	Technology	% of total area per sensitivity class				Streamlining of guidelines requirements?
		Very High	High	Medium	Lower	
Overberg 1	Wind	18.1	54.4	5.2	22.3	No
	Solar PV	4.6	32.1	13.0	50.3	Possible
Komsberg 2	Wind	15.4	42.8	11.1	30.7	Possible
	Solar PV	3.2	17.6	9.7	69.5	Likely
Cookhouse 3	Wind	16.0	50.8	17.0	16.3	Possible
	Solar PV	6.7	14.4	37.7	17.0	Possible
Stormberg 4	Wind	45.1	49.3	1.9	3.7	No
	Solar PV	4.1	31.1	16.2	48.6	Possible
Kimberley 5	Wind	23.9	4.7	66.7	4.7	No
	Solar PV	14.8	0.9	74.1	10.3	No
Vryburg 6	Wind	3.3	8.0	52.3	36.5	Likely
	Solar PV	1.8	8.0	49.8	40.6	Likely
Upington 7	Wind	5.7	27.5	39.2	27.5	Possible
	Solar PV	2.2	15.9	53.3	28.5	Likely
Springbok 8	Wind	35.4	16.9	24.5	23.2	Definite
	Solar PV	28.0	6.5	17.0	48.6	Definite

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10 SPECIALISTS' SHORT CVS

DR ANDREW ROBERT JENKINS, Pr. Sci. Nat. Zool. Ecol.

Date & Place of Birth: 11 June 1966; Glasgow, Scotland.
Nationality: South African & British.
Address: *AVISENSE* Consulting cc, 10 Harrier Circle, Imhoff's Gift, Kommetjie 7975, RSA; Tel. RSA (021) 786 4358 (w), 082 959 9238, Fax. RSA (021) 786 3279; Email: *Andrew@avisense.co.za*

Education

1989-1998: MSc upgraded to PhD, Percy FitzPatrick Institute, University of Cape Town. Thesis title: *Behavioural ecology of Peregrine and Lanner Falcons in South Africa.*

1988: BSc Hons in Zoology, University of Natal, Pietermaritzburg (with distinction). Project title: *Bill morphology, feeding ecology and niche partitioning in six sympatric species of granivorous birds.*

1984-1987: BSc, University of Natal, Pietermaritzburg, majoring in Zoology and African & Experimental Zoology.

Recent employment & relevant experience

April 2009-Present: Set up own business as a full-time avifaunal consultant - *AVISENSE* Consulting cc, with a strong emphasis on impact assessments for energy developments. Currently involved in EIA assessments and pre-construction monitoring for >30 proposed wind energy developments and >15 proposed solar energy developments in the Western, Eastern and Northern Cape Provinces, South Africa, as well as in hydropower, mining and dam construction projects in South Africa, Namibia and Lesotho.

May 2011: Primary author of the EWT/BirdLife SA best practice guidelines for avian monitoring at wind energy development sites, and of the revision of this document in 2012.

January 2003-March 2009: Retained by various agencies to do EIA work as an avian specialist for development projects in the Greater Cape Town area, and more broadly in the Western Cape.

March 2007-Present: Retained as an Honorary Research Associate, and latterly as a Research Associate at the FitzPatrick Institute, UCT, and as an Honorary Research Associate at the Animal Demography Unit, UCT. During this time continued to conduct my own work on falcon biology and co-supervised a Masters mini-thesis on power line collision risk in Blue Cranes, a PhD on power line collision risk in Ludwig's Bustard, a PhD on the foraging ecology of Verreaux's Eagle, and an MSc on the conservation of the Martial Eagle in SA in relation to the distribution of the national power grid.

September 2007-March 2009: Employed as a research scientist by the Wildlife & Energy Interaction Group of the Endangered Wildlife Trust, tasked with (i) consolidating and strengthening existing research, and initiating new research initiatives, in the field of wildlife/power line interactions, and particularly in the mitigation of bird mortalities associated with electrical infrastructure, and (ii) doing in-depth EIA assessments for major proposed developments in energy infrastructure.

March 2002-February 2007: Employed as research scientist at FitzPatrick Institute, UCT from March 2002, managing the *Western Cape Raptor Research Programme*, and overseeing various raptor-based projects, including a collaboration with electricity supplier Eskom to reduce the incidence of line faults associated with large eagle nests on electricity transmission pylons in the Karoo, and a collaboration with the Critical Ecosystem Partnership Fund to investigate the value of the Black Harrier as a surrogate species in the conservation of lowland Fynbos and Renosterveld. During this period, co-supervised one MSc thesis, three MSc Conservation Biology mini-theses, and two BSc Hons projects on various aspects of raptor biology and conservation.

2005-2006: Employed by Maloti-Drakensberg Ecological Consultants in collaboration with David Allan of the Durban Museum of Natural History to survey the populations of Bearded and Cape Vultures in the Lesotho Highlands, as part of a strategic conservation initiative stemming from the Maloti-Drakensberg Transfrontier Project.

January 2003-2004: Retained to design and oversee monitoring of impacts on avifauna of the Eskom Demonstration Wind Farm facility at Klipheuwel, W Cape.

April 2001-2004: Produced initial scoping report and conducted subsequent monitoring of the potential impact of the proposed Darling National Demonstration Wind Farm facility on the local avifauna.

IZAK JOHANNES DU PLESSIS

Nationality: South African.
Address: 4 Sea Breeze Crescent, Noordhoek 7979, RSA; Tel. RSA 072 342 9798, Email: johan@avisense.co.za

Education

2007–2009: MSc Zoology, University of Stellenbosch. *Resource partitioning among four sympatric lacertid lizards species of the Tankwa Karoo Basin of South Africa.*

2003–2006: BSc Conservation Ecology and Entomology, University of Stellenbosch; Majors: Biology (1yr), Chemistry (1yr), Geology (1yr), Biological Mathematics (1yr), Computer Studies (1yr), Biochemistry (2yr), Microbiology (2yr), Soil Science (2yr), Business Management (2yr), Conservation Ecology (2-4 yr), Biometry (2yr), Botany (2yr), Sociology (2yr), Biodiversity & Ecology (2-4yr), Genetics (3yr), Agronomy (Veld Management) (4yr), Geographical and Environmental information systems (GIS) (4yr), Agricultural Economics (4yr), Entomology (4yr), Industrial Physiology (3yr).

Employment and relevant experience

2013–2014: Sub-contracted to Avisense Consulting to conduct specialist avifaunal assessments and monitoring. The work was conducted as part of various Environmental Impact Assessments on a number of renewable energy projects for Aurecon Group. This resulted in co-authorship on Environmental Impact Reports for the following projects: Du Plessisdam Photo-Voltaic (PV) Facility (De Aar, Northern Cape); Badenhorstdam PV Facility, (De Aar, Northern Cape); Klipgats Pan PV facility (Copperton, Northern Cape); Hoekplaas PV facility (Copperton, Northern Cape); and Boegoeberg Hydro-Power Station, (Groblershoop, Northern Cape).

2012 – 2014: Environmental Manager in Commercial Unit of NCC Environmental Services: Avifaunal Monitoring and assessment for proposed Wind Farm Facilities throughout South Africa. Involved a large amounts of time spent in the field gathering data on species assemblages, population sizes and flight behavior as part of the Environmental Impact Assessment and impact mitigation schemes.

Conduct regular (quarterly) site visits to all the relevant sites on a regular basis. Gather data (bird and other) on the wind energy projects through transects focal points, absolute counts, vantage points and other methods utilizing the prescribed and documented research and monitoring protocols; Aiding in on the ground problem solving through team work and individual initiative; Assisting with compiling the Standard Operating Procedures and company guidelines; Assisting with land owner liaison including face-to-face, via phone and email; and compiling site reports based on data collected during monitoring iterations. Correspondence with independent specialists regarding the interpretation of the data through the on-going review of reports prior to submission.

Co-Author on various Avian Impact and Mitigation Schemes for a number of Wind Energy Facilities (WEFs) throughout South Africa: Biotherm WEF, West Coast 1 WEF, Rheboksfontein WEF, Clover Valley WEF, Nooitgedacht WEF & Paardekraal WEF (Western Cape); Suurplaats WEF, Victoria West WEF (Northern Cape); Msenge Emoyeni WEF, Riverbank WEF (Eastern Cape).

2012-2014: Avifaunal and Radar Monitoring work within Commercial Unit of NCC Environmental Services. Sub-contracted to EchoTrack Pty. Ltd. to deploy and conduct Radar-Acoustic Monitoring on proposed Wind Energy Facilities. Responsible for the all relevant technical aspects and application of the Radar-Acoustic Monitoring equipment, and baseline monitoring of airborne wildlife (birds and bats). Radar-acoustic data was collected on two separate WEF along the West Coast of SA. A more species specific approach on one of the two sites meant that I was required to play an integral part in the redesign of the sampling process and entire monitoring regime.

2011: Environmental Officer within NCC Environmental Services Industrial Unit, working in Umthatha on Eskom's Eros - Vuyani 400 kV power line construction in the Eastern Cape South Arica. Core duties involved acting as an environmental officer for Eskom. Responsibilities included the overseeing of various construction activities and to ensure that all aspects of the Environmental Management Plan where adhered too in this regard. I was required to produce bi-monthly reports for the Environmental Control Officer of the project, which in turn was passed onto the Department of Environmental Affairs as per the adherence the Record of Decision.

10.1 Specialist Declaration

I, Andrew Jenkins, as the appointed independent specialist hereby declare that I:

- act/ed as the independent specialist in this application;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct;
- do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed;
- have and will not have any vested interest in the proposed activity proceeding;
- have disclosed any material information that have or may have the potential to influence the objectivity of any report or decisions base thereon; and
- am aware that a false declaration is an offence in terms of regulation 71 of GN No. R. 543.

Signature of the specialist:

Name of company:
AVISENSE Consulting:

Professional Registration:
Pr. Sci. Nat. Zool. Ecol. 400117/14

Date:
09 June 2014

STRATEGIC ENVIRONMENTAL ASSESSMENT FOR WIND AND SOLAR PHOTOVOLTAIC ENERGY IN SOUTH AFRICA

Appendix A6

Bats Scoping Assessment Report

Specialist name:
Kate MacEwan
Natural Scientific Services CC

contents

LIST OF FIGURES

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ABBREVIATIONS AND ACRONYMS

CBD	Convention on Biological Diversity
CI	Conservation Important
CoP	Conferences of the Parties
CoP 15	15th Conference of the Parties
CoP 18	18th Conference of the Parties
CR	Critically Endangered
CSIR	Council for Scientific and Industrial Research
D	Declining
DD	Data Deficient
DEA	Department of Environmental Affairs
DEAT	Department of Environmental Affairs and Tourism
ECA	Environmental Conservation Act
EIA	Environmental Impact Assessment
EN	Endangered
FA	Focus Areas
I	Increasing
JPoI	Johannesburg Declaration and Plan of Implementation
LC	Least Concern
LoO	Likelihood of Occurrence
MAP	Mean Annual Precipitation
MAT	Mean Annual Temperature
NBSAP	National Biodiversity Strategy and Action Plan
NE	Not Evaluated
NEM: PAA	National Environment Management: Protected Areas Act
NEM:BA	National Environmental Management: Biodiversity Act
NEMA	National Environmental Management Act
NEMAA	National Environmental Management Amendment Act
NEPAD	New Partnership for Africa's Development
NFEPA	National Freshwater Ecosystem Priority Areas
NPAES	National Protected Areas Expansion Strategy:
NSBA	National Spatial Biodiversity Assessment
NSS	Natural Scientific Services CC
NT	Near Threatened
PV	Photo Voltaic
PS	Protected Species
PWA	Protected Wild Animal
REDZ	Renewable Energy Development Zone
S	Stable
SA	South Africa
SABAAP	South African Bat Assessment Advisory Panel
SANBI	South African National Biodiversity Institute
SEA	Strategic Environmental Assessment
SEF	Solar Energy Facility
SPWA	Specially Protected Wild Animal
U	Unknown
UNCED	UN Conference on Environment and Development
UNEP	Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
VU	Vulnerable
WEF	Wind Energy Facility
WSSD	World Summit on Sustainable Development

1 INTRODUCTION

1.1 Project Background

The Department of Environmental Affairs (DEA) appointed the Council for Scientific and Industrial Research (CSIR) to undertake a Strategic Environmental Assessment (SEA), which aims to identify geographical areas best suited for the roll-out of wind and solar photovoltaic (PV) energy projects, referred to as Renewable Energy Development Zones (REDZs). Phase 2a of the wind and solar PV SEA identified eight focus areas (FAs) where further investigation during Phase 2b is now being focused (**Figure 1**). Phase 2b entails the refinement of these FAs through broad stakeholder consultation, as well as specialist scoping assessments. Refinement of the areas includes sensitivity mapping, as well as the possible enlargement, reduction or elimination of the identified FAs. Natural Scientific Services CC (NSS) was appointed to conduct the Scoping-level Bat Specialist Assessment for the eight FAs.

Whilst most biologists would support the development of potentially cleaner renewable energy sources, such as wind and solar energy, the impacts that wind energy facilities (WEFs) and solar energy facilities (SEFs) may have on South African wildlife are concerning. A brief summary of recent literature on this subject is provided below.

1.2 Bats and Wind Energy

Whilst fatality through barotrauma[1] and direct collision[2],[3] is the most apparent impact that wind turbines are having on bats internationally, other suspected direct and indirect impacts include disturbance to or loss of roost sites, the loss or alteration of foraging habitat through the construction of WEFs[4], alteration of bat species composition due to artificial light at WEFs[5] and the barrier or fragmentation effect to dispersing or migrating bats[6].

Up to 1 308 378 bats were killed by wind turbines in the USA and Canada over a 13 year period between the years 2000 and 2012[7].

Published research from one of three experimental WEFs in South Africa, the Coega facility in the Eastern Cape, reported 18 bat fatalities for one single turbine over a 12 month period[8]. Considering that the study did not take into account scavenger removal trials (hence, the fatality estimate was probably higher) and that most WEF in SA will have more than 9 turbines, with some facilities having 40 to 60 turbines, the annual fatalities at individual WEFs are likely to far exceed the 18 fatalities reported above. Whilst this is the only published account of a 12 month post-construction study in SA, fatalities at turbines in South Africa continue to be found and reported and results from more concentrated post-construction bat monitoring studies will provide a better understanding on the South Africa reality of bat fatalities at WEFs.

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1 Baerwald, E.F., D'amours, GH., Klug, B.J., & Barclay, R.M.R. (2008). Barotrauma is a significant cause of bat fatalities at wind turbines. Current Biology Vol 18 No 16.

2 Horn, Jason W., Arnett, Edward B., Kunz, Thomas H. (2008). Behavioral Responses of Bats to Operating Wind Turbines, Journal of Wildlife Management 72(1):123–132; 2008.

3 Rollins, K.E, Meyerholz, D.K., Johnson, G.D., Capparella, A.P. and Loew, S.S. (2012). A Forensic Investigation Into the Etiology of Bat Mortality at a Wind Farm: Barotrauma or Traumatic Injury? Veterinary Pathology 49(2) 362-371

4 Rydell, J., Engström, H., Hedenström, A., Larsen, J.K., Pettersson, J., Green, M. (2012). The Effect of Wind Power on Birds and Bats – A Synthesis. Swedish Environmental Protection Agency, Report 6511, p. 152.

5 Rydell, J., Bach, L., Dubourg-Savage, M., Green, M., Rodrigues, L. & Hedenström, A. (2010). Bat mortality at wind turbines in north-western Europe. Acta Chiropterologica 12: 261-274.

6 Rodrigues, L.L., Bach, M.J., Dubourg-Savage, Goodwin, J., & Harbusch, C. (2008). Guidelines for consideration of bats in wind farm projects. EUROBATS Publication Series No. 3(English version). UNEP/EUROBATS Secretariat, Bonn, Germany, 51pp.

7 Arnett, E.B., and Baerwald, E.F. (2013). Impacts of Wind Energy Development on Bats: Implications for Conservation. In: Adams, R.A. and Pedersen, S.C. (eds.) Bat Evolution, Ecology and Conservation, Spinger, New York, USA, pp. 435-456.

8 Doty, A.C., and Martin, A.P. (2012). Assessment of bat and avian mortality at a pilot wind turbine at Coega, Port Elizabeth, Eastern Cape, South Africa, New Zealand Journal of Zoology, DOI:10.1080/03014223.2012.741068.

Several hypotheses relating to potential attraction factors (e.g., insects, heat, visual, sound, roosting opportunities) at wind turbines have been proposed[9]. The hypothesized causes of bat fatalities at turbines fall into two general categories—proximate and ultimate[10]. Proximate causes explain the direct means by which bats die at turbines and include collision with towers and rotating blades, and barotrauma. Ultimate causes explain why bats come close to turbines and include three general types: random collisions, coincidental collisions, and collisions that result from attraction of bats to turbines. In addition to the hypotheses listed above, another possible hypothesis is emerging – bats mistaking the smooth surfaces of the turbines as water. As an extension to previous work conducted[11], one study supported that bats may be attracted to wind turbines because they perceive the smooth surfaces as water[12]. This research has shown that bats display the same drinking behaviour on the towers, as they do on smooth adjacent water bodies. From this, it is clear that the impacts caused by this energy alternative remain largely un-quantified and unclear and that on-going research focused on bat fatalities at wind turbines is critical to our understanding of the issue and hence effective mitigation.

Certain bat species are at a higher risk of fatality by wind turbines due to their specific flight behaviours[13]. High flying, open-air foraging bats, such as the free-tailed bats (family Molossidae) and migrating and clutter-edge foraging species from the families Miniopteridae and Vespertilionidae are most likely to be at the greatest risk of fatality because they fly at heights coinciding with the rotor sweep zone. Gregarious cave-dwelling bats, such as the Natal long-fingered bat (*Miniopterus natalensis*) that migrates in potentially large groups are of particular concern in terms of mass fatalities. However, many other families, for instance, fruit-eating bats (family Pteropodidae) could also be at risk. The Egyptian free-tailed bat (*Tadarida aegyptiaca*) and the Cape serotine bat (*Neoromicia capensis*), both insectivores, are species that have been found dead under South African turbines so far[14].

1.3 Bats and Solar Energy

Whilst there has not been nearly as much research and concern regarding the impacts of solar energy on bats, compared to wind energy, some deductions regarding the potential impacts on bats that could arise due to the construction and operation of large-scale SEFs can be made.

Various forms of solar energy generation exist; however, the current SEA is only concerned with that of solar PV farms. For the construction phase, large stands of land are required to be cleared. This could result in the loss of valuable bat foraging habitat, especially considering that the land remains relatively sterile for the life of the SEF. Also, if the development of a SEF is constructed near to bat roosting habitat, such as trees, buildings or caves, there may be a disturbance and displacement impact.

Bats face a great risk of dehydration, so sensory mechanisms for water recognition are crucial for their survival.[15] It is well documented[16] that bats have an innate ability to echolocate water by recognising the echo from smooth surfaces, and that bats may therefore perceive all smooth surfaces as water. Whilst NSS

9 Kunz, Thomas H., Arnett, Edward B., Cooper, Brian M., Erickson, Wallace P., Larkin, Ronald P., Mabee, Todd., Morrison, Michael L., Strickland, M. Dale., Szewczak, Joseph M. (2007) Assessing Impacts of Wind-Energy Development on Nocturnally Active Birds and Bats: A Guidance Document. Journal of Wildlife Management 71(8):2449–2486; 2007.

10 Cryan, P.M., & Barclay, R.M.R. (2009). Causes of Bat Fatalities at Wind Turbines: Hypotheses & Predictions. Journal of Mammalogy, 90(6):1330–1340

11 Greif, S. and Siemers, B.M. (2010). Innate recognition of water bodies in echolocating bats. Nature Communications 1:107

12 Hale, A. (2013). A test of a Novel Attraction Hypothesis – Why are Bats Attracted to Wind Turbines? Presentation at the International Bat Research Conference, 13 August 2013, San Jose, Costa Rica.

13 Sowler, S., & Stoffberg, S. (2014). South African Good Practice Guidelines for Surveying Bats at Wind Energy Facility Developments - Pre-construction: Third Edition: A guideline document distributed by and produced in cooperation with the Wildlife & Energy Programme of the Endangered Wildlife Trust and the South African Bat Assessment Advisory Panel.

14 Doty, A.C., and Martin, A.P., 2012. Assessment of bat and avian mortality at a pilot wind turbine at Coega, Port Elizabeth, Eastern Cape, South Africa, New Zealand Journal of Zoology, DOI:10.1080/03014223.2012.741068.

15 Russo D, Cistrone L, Jones G (2012) Sensory Ecology of Water Detection by Bats: A Field Experiment. PLoS ONE 7(10): e48144. doi:10.1371/journal.pone.0048144

16 Greif, S. and Siemers, B.M. (2010). Innate recognition of water bodies in echolocating bats. Nature Communications 1:107

is not aware of any reported cases, the smooth solar panel surfaces may mislead bats as a potential drinking water source.

1.4 Bats and Power Lines

Whilst the scope of this assessment did not include looking at the effects of power lines on bats, power lines are an integral part of any energy generation facility, as this energy needs to be distributed. Therefore, NSS has just provided a brief summary of what is known regarding this, for further consideration and research in the future.

The potential impacts to bats during the construction phase could include roost disturbance and foraging habitat loss associated with clearing the right of way (which is expected to continue into the operational phase) and sensory disturbance due to increased levels of noise and dust associated with heavy vehicles and other machinery. During the operational phase, bats (particularly fruit bats) could potentially be negatively impacted by collision with power lines and to a lesser extent electrocution by them. Such cases have only been reported in Australia and Sri Lanka where large flying foxes are involved[17]. Other impacts associated with the operational phase include electromagnetic radiation emitted by the power lines and its potential repellent effects, which may in turn lead to habitat fragmentation of certain species. Electromagnetic radiation is also said to have behavioural effects on bats and rats[18,19]. The impacts suggested may be compounded if the power line is erected along bat migratory routes.

1.5 Conservation Significance of Bats

Bats represent a significant portion of vertebrate biodiversity[20], and are among the most overlooked, yet economically and ecologically important, non-domesticated animals. Insectivorous bats are known to significantly limit damaging herbivory by arthropods and they also eat substantial quantities of insect vectors such as mosquitoes[21,22]. Additionally, seed-dispersal and pollination of numerous plant species is carried out almost solely by certain species of fruit bats[23,24], thereby assisting habitat maintenance and regeneration. By fulfilling these important ecological roles, bats are also excellent indicators of environmental disturbance[25] and can guide conservation efforts.

These critical ecosystem services provided by bats also have tremendous economic value[26]. Numerous agricultural pest insects have been shown to be favoured forage for many insectivorous bat species. In the USA, predation on cotton bollworm moths by bats results in a saving of between \$ 121 000 to \$ 1 725 000 of the \$ 4.6 to \$ 6.4 million in cotton production per year[27] and bats reduce fruit crop damage to pears by corn ear moths by 55%[28]. Moreover, peaks in the activity of three families of bats coincided with peaks in the numbers of Macadamia Nut borer moths and two species of stinkbugs (both of

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17 Kryštufek, B. (2009). On the Indian flying fox (Pteropus giganteus) colony in Peradeniya botanical gardens, Sri Lanka. Hystrix the Italian Journal of Mammology, 20: 29-35.

18 Nicholls, B. & Racey, P.A. (2007). Bats avoid radar installations. Could electromagnetic fields deter bats from colliding with wind turbines? PLOS One 3 ed297.

19 Nicholls, B. & Racey, P.A. (2009) The Aversive Effect of Electromagnetic Radiation on Foraging Bats—A Possible Means of Discouraging Bats from Approaching Wind Turbines. PLoS ONE 4(7): e6246. doi:10.1371/journal.pone.0006246

20 Simmons, N. B. (2005). Order Chiroptera. In: Wilson D. E. and Reeder D. M. (eds.) Mammal species of the world. Volume 1, 3rd edition. Johns Hopkins University Press, Baltimore, USA pp. 312-529.

21 Kalka, M.B., Smith, A.R. & Kalko, E.K.V. (2008). Bats limit arthropods and herbivory in a tropical forest. Science 320: 71.

22 Gonsalves, L., Law, B., Webb, C. & Monamy, V. (2013). Foraging ranges of insectivorous bats shift relative to changes in mosquito abundance. PLOS ONE 8:1-11.

23 Fleming, T.H., Geiselman, C. & Kress, W.J. (2009). The evolution of bat pollination: a phylogenetic perspective. Annals of Botany, Invited review, doi:10.1093/aob/mcp197

24 Kunz, T.H., De Torrez, E.B., Bauer, D., Lobova, T. & Fleming, T.H. (2011). Ecosystem services provided by bats. Annals of the New York Academy of Sciences, 1223: 1-38.

25 Fenton, M.B. & Ratcliffe, J.M. (2010). Bats. Current Biology 20: 1060-1062.

26 Boyles, J.G., Cryan, P.M., McCracken G.F. & Kunz, T.H. (2011). Economic importance of bats in agriculture. Science 332:41-42.

27 Cleveland, C.J., Betke, M., Federico, P., Frank, J.D., Hallam, T.G., Horn, J., Lopez, J.D.JR., McCracken, G.F., Medellin, R.A., Moreno-Valdez, A., Sansone, C.G., Westbrook, J.K. & Kunz, T.H. (2006). Economic value of the pest control service provided by Brazilian free-tailed bats in south-central Texas. Front. Ecol. Environ. 4(5): 238-243.

28 Long RF, Simpson T, Ding T, et al. (1998). Bats feed on crop pests in Sacramento Valley. Cal Ag 52(1):8–10.

which are known pests of Macadamias)[29]. Bats were also shown to be more active within Macadamia orchards than adjacent riparian vegetation during these periods of increased pest insect numbers and this trend – increased bat activity over agricultural lands in response to increased pest insect density – was also found over sugarcane fields in Swaziland[30]. As of yet, the monetary value of agricultural pest control is unquantified in southern Africa, however, it is likely to be substantial based on the figures reported internationally. The conservation of healthy bat populations is thus in the best interests of national and international economies and biodiversity[31].

Many bat species roost in large aggregations and concentrate in small areas. Therefore, any major disturbance to that area can adversely impact many individuals of a population at the same time[32]. Secondly, the reproduction rates of bats are much lower than those of most other small mammals, because usually only one or two pups are born per female annually. Bats are long-lived for their size, they may live for up to 30 years[33]. Under natural circumstances, a population's numbers can only build up over a long period of time, due to their longevity and the relatively low predation on bats, when compared to other small mammals. Therefore, the rate of recovery of bat populations is slow after major die-offs and roost disturbances. This has implications for any development that can potentially kill bats and the population affects should be seriously considered at both a local and regional scale. Due to the mobility of bats and their ability to fly long distances, consideration must be given what affects fatalities may be having on the greater population in terms of migratory species. Isotope studies in Europe have also revealed that wind farms may kill bats from populations more than 1,000 km away[34].

29 Taylor, P.J., Monadjem, A. & Steyn, J. N. (2013). Seasonal patterns of habitat use by insectivorous bats in a subtropical African agro-ecosystem dominated by macadamia orchards. Afr. J. Ecol. 1-10. DOI: 10.1111/aje.12066

30 Noer, C. L, Dabelsteen, T., Bohmann, K., & Monadjem, A., (2012). Molossid bats in an African agro-ecosystem select sugarcane fields as foraging habitat. African Zoology, 47(1): 1–12.

31 Boyles, J.G., Cryan, P.M., McCracken G.F. & Kunz, T.H. (2011). Economic importance of bats in agriculture. Science 332:41-42.

32 Hester S.G., & Grenier M.B. (2005). A conservation plan for bats in Wyoming. Lander, WY: Wyoming Game and Fish Department, Nongame Program.

33 O'Shea, T.J., Bogan M.A., & Ellison L.E., (2003). Monitoring trends in bat populations of the United States and territories: Status of the science and recommendations for the future. Wildlife Society Bulletin, 31(1), pp.16-29.

34 Voigt, C.V., Popa-Lisseanu, A.G., Niermann, I. & Kramer-Schadt, S. (2012). The catchment area of wind farms for European bats: A plea for international regulations. Biological Conservation, 153: 80-86.

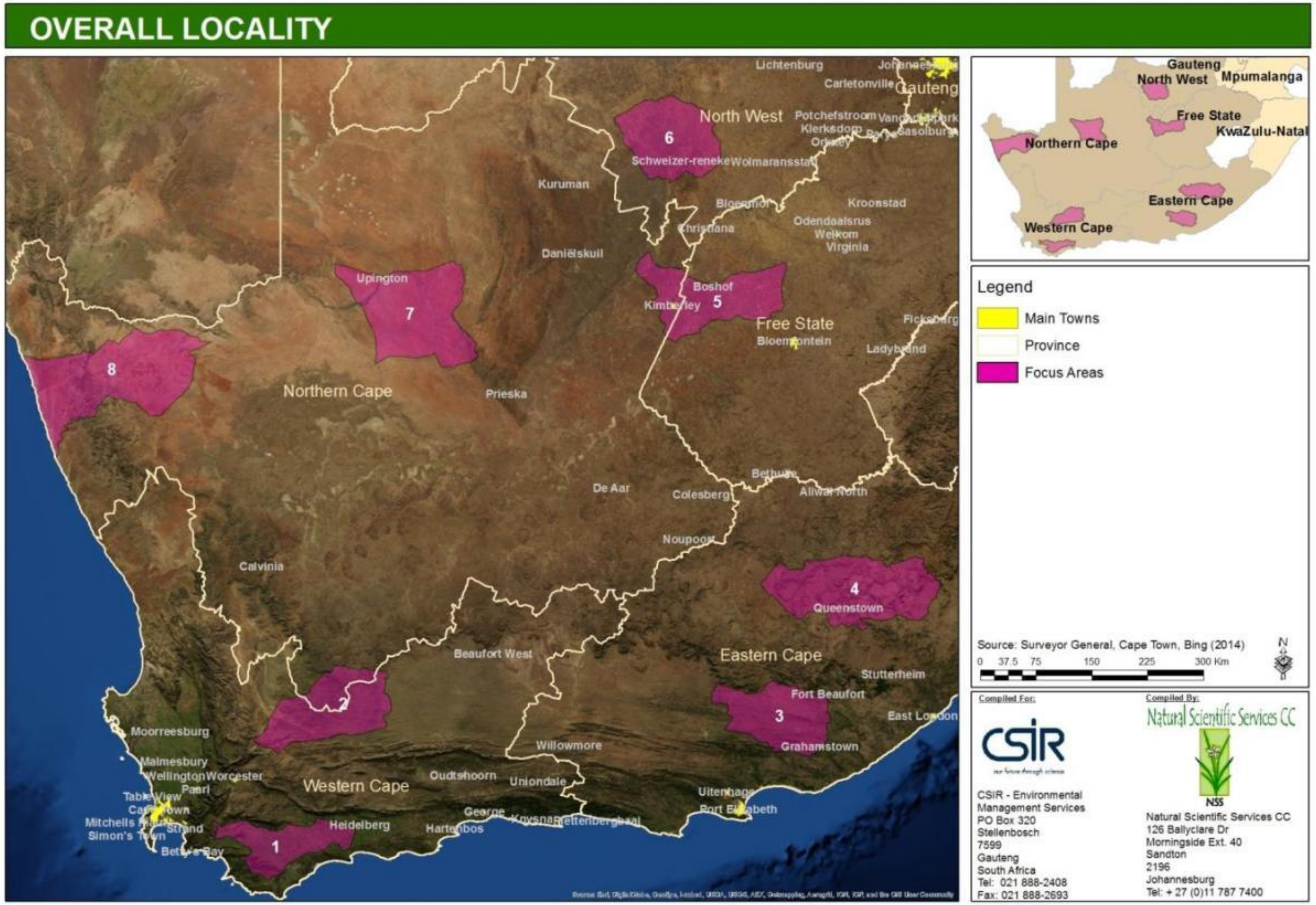


Figure 1: Locality of the Eight FAs

2 APPROACH AND METHODOLOGY

As per the terms of reference supplied, the current study was mostly based on desktop review and mapping, with limited field verification. The various data sources consulted are listed in **Section 2.2** below.

2.1 Desktop Review

The desktop review consisted of:

- Gathering and reviewing of as many Bat Impact Assessments for WEFs, as were available to NSS, applicable to the eight FAs and/ or applicable to bats. The CSIR and NSS managed to source over 30 **publically available** Scoping Assessments, EIAs and Monitoring studies that may have had relevance to the FAs and bats. NSS reviewed all of these reports. However, only 14 were partially or wholly suitable to get information relevant to bats and the FAs – two for FA1[35] [36], five for FA2[37] [38] [39] [40] [41], one for FA3[42], two for FA4[43] [44], none for FAs 5 and 6, two for FA7[45] [46]and two for FA8[47] [48].
- Analysing NSS collected data from 13 WEF Pre-construction Monitoring Studies within the various Terrestrial Ecoregions to determine an average annual bat activity level per Ecoregion for comparative analysis;
- Conducting literature reviews of environmental parameters relevant to bat ecology and their distributions;
- Potential bat species lists were compiled for each of the eight FAs according to various sources; and
- Reviewing the various bat cave roost localities provided by various bat specialists in Phase 1 of the SEA process.
- Consultation with international bat advisors.

2.2 Spatial Data Used

Whilst various environmental parameters and spatial data sources were considered for the bat sensitivity spatial mapping exercise, only those parameters considered important for bats, as either important for roosting or foraging were selected and used. The relevant sensitive environmental spatial layers were selected on the maps and buffered according to defendable criteria. This is further explained in **Table 1** and **Section 4.3**.

35 Jacobs, D. (2012) Bat Echolocation Surveys at Proposed Biotherm Wind Energy Sites 2010-2011

36 Gaia Environmental Services (2014) Klipheuwel Dassiefontein Wind Energy Facility Bat Specialist Study: Draft Secondary Environmental Impact Assessment Report

37 Natural Scientific Services (2010). Roggeveld Wind Farm: Bat Assessment Report. Final Draft.

38 Natural Scientific Services (2013). Pre-construction Bat Monitoring for the Witberg Wind Energy Facility, Final Report, pp 1-93

39 Natural Scientific Services (2013). Pre-construction Bat Monitoring for the Perdekraal Wind Energy Facilities, Final Report.

40 Savannah Environmental (2014). Final EIA Report. Proposed Construction of the Roggeveld Wind Farm Phase 1 and Associated Infrastructure

41 Animalia (2014). Long-term Bat Monitoring Study for the Proposed Hidden Valley Wind Energy Facility, Western Cape Province, pp 1-114.

42 Natural Scientific Services (2013). Amakhala Emoyeni 1 Final Bat Monitoring and Impact Assessment Report, pp 1-119.

43 Bio 3 (2012). Dorper Wind Energy Facility. Bat Communities Monitoring Report 1 (Pre-construction).

44 Endangered Wildlife Trust (2013). Networx Eolos Renewables (Pty) Ltd. Proposed Stormberg Renewable Energy Project. Eastern Cape Province. Bat Impact Desktop Study.

45 Endangered Wildlife Trust (2012). Juwi Renewable Energy (Pty) Ltd. Garob Wind Farm Project, Northern Cape Province. Bat Impact Assessment Report.

46 Animalia (2012). 2nd Progress Report of a 12 Month Long Term Bat Monitoring Study: 16 Aug – 30 Oct 2012 – For the Proposed Garob Wind Energy Facility near Copperton, Northern Cape.

47 Natural Scientific Services (2013). Pre-construction Bat Monitoring and Impact Assessment Report for the Proposed Richtersveld Wind Energy Facility, Northern Cape

48 Bio Insight South Africa (2014). Blue Wind Energy Facility Bat Monitoring, Pre-construction Phase 2013/2014

Table 1: Spatial Data Used in the Bat Scoping Assessment

Data title	Source and date	Data Description
Terrestrial Ecoregions	Terrestrial ecoregions of the world: a new map of life on Earth. Bioscience 51(11):933-938, 2001.	WWF (http://www.worldwildlife.org/biomes) defines an ecoregion as a "large unit of land or water containing a geographically distinct assemblage of species, natural communities, and environmental conditions".
Biomes of South Africa, Lesotho and Swaziland	Jonas, Z., Daniels, F., Driver, A., Malatji, K.N., Dlamini, M., Malebu, T., April, V. & Holness, S. (2012). National Biodiversity Assessment 2011: Technical Report. Volume 1: Terrestrial Component. South African National Biodiversity Institute, Pretoria. Spatial layer available from: http://bgis.sanbi.org/vegmap/biomes.asp	The nine Biomes of South Africa, Lesotho and Swaziland
Vegetation Map of South Africa, Lesotho and Swaziland	Mucina, L. & Rutherford, M.C. (2006). The vegetation map of South Africa, Lesotho and Swaziland. Strelitzia 19, South African National Biodiversity Institute. Spatial layer available from: http://bgis.sanbi.org/vegmap/map.asp	The broader Ecoregion level data was used for mapping, however, the vegetation units were used for describing the climatic conditions within the FAs.
National Freshwater Ecosystem Priority Areas (NFEPA)	Nel, J.L., Murray, K.M., Maherry, A.M., Petersen, C.P., Roux, D.J., Driver, A., Hill, L., Van Deventer, H., Funke, N., Swartz, E.R., Smith-Adao, L.B., Mbona, N., Downsborough, L. and Nienaber, S. (2011). Technical Report for the National Freshwater Ecosystem Priority Areas project. WRC Report No. K5/1801. Spatial layer available from: http://bgis.sanbi.org/nfepa/NFEPAmap.asp	There is strong support for the importance of rivers and riparian areas for bats[49 50 51].
Field Crop Boundaries	Department of Agriculture, Forestry and Fisheries (2013)	Not only can irrigated crop areas provide valuable foraging habitat for insectivorous bats, but bats can provide natural crop pest control to farmers.
Geology: Lithology Layer	Council for GeoSciences (1974 to present)	Geological features in the form of rock crevices and caves are essential roosting habitats for many bats species.
Buildings	SPOT Building Count (SBC) satellite Landsat imagery from 2013	2009 SPOT Building Count
Caves Localities	NSS (2014) Fieldwork from the period 2011-2014; Herselman, J.C., & Norton, P.M. (1985) The distribution and status of bats (Mammalia: Chiroptera) in the Cape Province. Annals of the Cape Province Museum (Natural History) 16: 73-126; EWT (2013) Bat Roost Location within South Africa Map.	A combination of sources to identify caves for field verification purposes and to refine the EWT (2013) map.
Coastline polyline	*	There are numerous caves along the SA coastline
National Protected Areas Expansion Strategy (NPAES)	SANBI (2011)	National Protected Areas Expansion Strategy: Focus areas for protected area expansion

49 Serra-Cobo J., López-Roig M., Marquès-Lopez T., Lahuerta E. (2000). Rivers as possible landsmarks in the orientation flight of *Miniopterus schreibersii*. Acta Theriol. 45(3): 347-352.

50 Akasaka, T. Nakano, D. and Nakamura, F. (2009). Influence of prey variables, food supply, and river restoration on the foraging activity of Daubenton's bat (*Myotis daubentonii*) in the Shibetsu River, a large lowland river in Japan. Biological Conservation, Vol 142:1302–1310

51 Hagen, E.M. and J.L. Sabo. (2012). Influence of river drying and insect availability on bat activity along the San Pedro River, Arizona (USA). The Journal of Arid Environments 84, 1-8

2.3 Field Work

Even though this study was only intended to be undertaken at a desktop level (as per the terms of reference supplied), a few focused field verification visits were undertaken by NSS. Many cave-type roost localities were supplied by various bat specialists to the Endangered Wildlife Trust (EWT) for the mapping of the Phase I SEA Exclusion areas. In addition, NSS had located various cave localities through desktop literature searches, consultation with landowners and other bat specialists and pre-construction bat monitoring surveys conducted by NSS. Two or more key cave-type roosts per each of the three Cape provinces, not recently surveyed by NSS or other bat specialists to NSS's knowledge, were chosen for verification visits as part of this project. At each of the caves, visual species identification and count estimates were performed. Where appropriate, hand netting or mist-netting was performed, photographs were taken and echolocation calls were recorded using a hand held Wildlife Acoustics Echo Metre 3 (EM3). In addition to the numerous other caves that NSS has verified through pre-construction bat monitoring projects between the period 2011 and 2014, the caves selected for verification visits, as part of the Bat SEA Scoping Assessment were as follows (Photographic evidence in
Figure 2):

- In the Western Cape:
    - Montagu Gauno Cave, near Montagu
    - Die Hel Cave in the Groot Winterhoek Wilderness Area
- In the Eastern Cape:
    - Suspected cave localities in the Molteno and Strekstroom areas.
    - Maitland Mines, near Port Elizabeth.
- In the Northern Cape:
    - Wonderwerk Cave, south of Kuruman.
    - Soetfontein Cave, near Postmasberg.
    - Blinkgat, near Postmasberg.
    - Eye of Kuruman, near Kuruman

Based on the cave roost information gathered through desktop review, field work as part of other NSS projects, field work as part of the current SEA and through consultation with land owners and other bat specialists, all cave-type roosts within the provinces making up the SEA project area were divided into:

- Confirmed large roosts - >2000 bats
- Confirmed medium roosts – 500 – 2000 bats
- Confirmed small roosts - >500 bats
- Unconfirmed but suspected roosts i.e. roosts marked by EWT, still considered plausible by NSS, but not confirmed.
- Limestone or Dolomite Geological formations known to host caves.

All data gathered, as per the above methodologies were used to compile the sensitivity maps within each of the eight FAs.

One entrance of Maitland Mine

Maitland Mines – historical reports of large colonies of bats

Rhinolophus clivosus at Maitland Mines – approximately 24 in March and May 2014

Rhinolophus clivosus at Maitland Mines – approximately 24 in March and May 2014

Large rock crevices near Molteno

Large rock crevice near Molteno – historical reports of +/-40 bats, however, too dangerous to enter.

Die Hel gorge decent

Die Hel entrance

Approximately 2000 *Miniopterus natalensis* and 500 *Rhinolophus capensis* at Die Hel

Approximately 1500 *Rousettus aegyptiacus* at Die Hel

Montagu Guano Cave

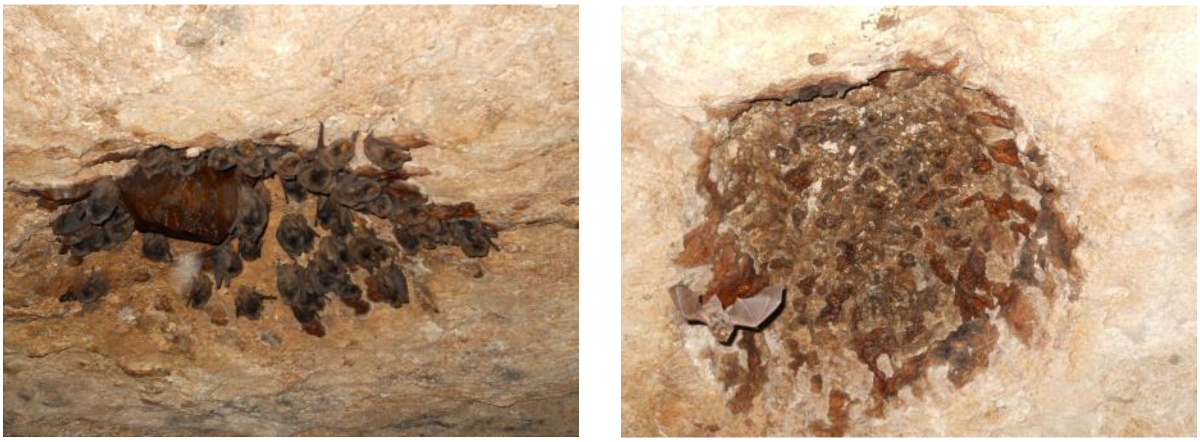
Montagu Guano Cave entrance


Approximately 1000 *Miniopterus natalensis* and 500 *Rhinolophus capensis* and 500 *Myotis tricolor* at Montagu Gauno Cave


Blinkgat Cave


Blinkgat Cave - 12 *Nycteris thebaica* recorded, 1 *Miniopterus natalensis* captured; 12 *Rhinolophus denti* caught

Soetfontein Caves



Soetfontein Caves - 100 *Rhinolophus denti,* 12 *Rhinolophus clivosus*, 100 *Miniopterus natalensis* and *Hipposideros caffer* recorded but numbers unclear

Wonderwerk Cave - No confirmation of bats roosting in cave, but lots of evidence of night roosting and *Rhinolophus denti*, *Rhinolophus darlingi* and *Miniopterus natalensis* activity recorded outside cave mouth. Established owl roost within cave. *Tadarida aegyptiaca* and *Neoromicia capensis* roosting in rock crevices at cave entrance.

Figure 2: Photographs from the SEA Cave Roost Field Visits

2.4 Limitations and Assumptions

Table 2: Bat SEA Scoping Assessment Limitations and Assumptions

Limitation	Included in the scope of this study	Excluded from the scope of this study	Assumption
Not all caves in South Africa are known or yet discovered.	However, there are still many cave-type roosts represented in this study.	Extent of study restricted to FAs, and was mostly a desktop study, therefore, did not allow for all potential caves in South Africa to be surveyed.	It is assumed that the most significant cave-type roosts applicable to the FAs were recorded in this study.
Determining actual bat population numbers within caves takes many seasons of detailed investigations.	Only bat number estimates within roosts were included.	Actual bat population numbers were excluded.	Assumptions regarding the numbers of bats utilizing roosts were made.
Study was predominantly undertaken at a desktop level	A few key roost locations in or surrounding the FAs were visited. Bat species were visually identified by morphological features and roost numbers estimated.	Further longer term passive bat echolocation monitoring in scarcely covered or additional Ecoregions	It was assumed for this project that bat activity level data can be extrapolated per Ecoregion or Biome.
Not all FAs had suitable bat data collected within the FA to work with, either due to no Bat EIAs or Bat Monitoring having been conducted in the FAs or the studies were inadequate.	There was available EIA monitoring data for FA1, FA2, FA3 and FA8.	There was no available EIA monitoring data information for FA4, FA5, FA6 and FA7.	It was assumed for this project that bat activity level data can be extrapolated per Ecoregion or Biome.
Due to the various data collection methods employed by different bat specialists in the first rounds of projects, data between specialists is difficult to compare.	In order to calculate comparable activity levels, data from 11 long-term pre-construction surveys in 5 Ecoregions conducted by NSS in the W., N. and E. Cape for the period 2011 to 2013 were used.	Many studies where activity data or species identification was questionable were omitted.	It was assumed for this project that bat activity level data can be extrapolated for similar Ecoregions and Biomes.
Within the five wind and solar PV SEA provinces, bat activity level data is not available for the Savannah and Grassland Ecoregions, making up FAs 5 and 6.	Average annual bat activity levels for five Ecoregions (NSS collected data) The Drakensberg Grassland Ecoregion data were used to extrapolate for FAs 5 and the Nama Karoo for FA6.	Accurate activity data for FAs 5 and 6 were not available	It was assumed for this project that bat activity level data can be extrapolated for similar Ecoregions and Biomes.
There is very limited information regarding bats and solar energy.	A brief literature review.	No reports on actual impacts on bats due to solar energy.	Assumptions regarding the potential impacts on bats and appropriate buffers have been made.
NSS cannot be certain that pre-construction bat activity levels will be indicative of operational fatality levels until detailed post-construction surveys are conducted.	A risk ranking exercise based on activity levels in the various Ecoregions, species distributions within the FAs was conducted.	One set of four-tiered sensitivity maps were produced for each FA, separately for wind and solar energy each.	NSS has assumed for the comparative analysis, that high activity means higher risk of collision.

Limitation	Included in the scope of this study	Excluded from the scope of this study	Assumption
NSS cannot be certain that only Medium to High risk bat species will be killed by wind turbines, until detailed post-construction surveys are conducted.	The current SEA Bat Scoping study concentrated on mostly Medium to High risk species.	Species considered to be at Low risk of fatality were mentioned, but not incorporated into the conclusions.	NSS has assumed that species considered to be at low risk of collision with wind turbines, due to their foraging and movement ecology, are actually at low risk.
Whilst there is knowledge regarding the seasonality of occupancy of many roosts in SA, the actual migration routes and distances travelled between roosts is unknown.	Known roost localities and literature regarding genetic connectivity between roosts.	Unknown roosts and actual migration path flight ways are excluded.	NSS has assumed that bats will travel the flight of least resistance and a path that allows for adequate foraging, drinking and rest.
Bat population level data is lacking in order to adequately quantify what the true impact of WEF and SEF development and operation will be.	Known roosts, approximate numbers occupying the roosts and species distributions.	Absolute population numbers and dynamics.	NSS has assumed for the comparative analysis high activity means higher risk of collision.

2.5 Relevant Regulatory Instruments

The instruments presented in **Table 3** below include conventions, treaties, conferences, frameworks, acts, policies and guidelines. Whilst many of the below instruments do not protect bats directly, the principles and legislation behind them are for the protection of biodiversity, including bats and the ecosystem services they provide.

Table 3: Relevant Regulatory Instruments and their Key Objectives

Instrument	Key objective
International Instrument	
Convention on the Conservation of Migratory Species of Wild Animals	This Convention, also known as the Bonn Convention, aims to conserve terrestrial, marine and avian migratory species throughout their range. The treaty was signed in 1979 in Bonn, France, and entered into force in 1983. It is an intergovernmental treaty, concluded under the aegis of the United Nations Environment Programme (UNEP), which is concerned with the conservation of wildlife and habitats on a global scale. South Africa is a party to this Convention, and several bat species in South Africa are known or suspected to be migratory, e.g. the Natal Long-fingered Bat (Miniopterus natalensis)
Convention on Biological Diversity (CBD)	This Convention, also referred to as the Biodiversity Convention, was established during the 1992 UN Conference on Environment and Development (UNCED), also known as the 1992 Earth Summit, held in Rio de Janeiro, Brazil. It represented the first global, comprehensive, legally-binding agreement to address all aspects of biological diversity ranging from genetic resources to species and ecosystems. It is regarded as the key document regarding sustainable development. The CBD has three main goals: conservation, sustainable use of biodiversity and equitable sharing of benefits arising from genetic resources. South Africa signed the treaty in 1998 showing further commitment to the conservation of biodiversity, including inter- and intra-specific bat diversity and bat habitat.

Instrument	Key objective
Johannesburg Declaration and Plan of Implementation (JPoI)	The Johannesburg Declaration and JPoI originated from the 2002 UN Conference on Sustainable Development in Johannesburg, which was convened as the World Summit on Sustainable Development (WSSD), otherwise known as the 2002 Earth Summit. The Declaration builds on earlier declarations made during the UN conferences at Stockholm in 1972 and Rio de Janeiro in 1992. A general target to achieve by 2010 is a significant reduction of the current rate of biodiversity loss at global, regional and national levels, as a contribution to poverty alleviation and to benefit all life on Earth. South Africa uses the National Biodiversity Strategy and Action Plan (NBSAP) as a means to achieve the JPoI biodiversity targets.
Copenhagen Accord	The 2009 UNFCCC in Copenhagen, also referred to as the Copenhagen Summit, included the 15th Conference of the Parties (CoP 15) to the UNFCCC and the 5th Meeting of the Parties (MoP 5) to the Kyoto Protocol. A framework for climate change mitigation beyond 2012, the Copenhagen Accord, was drafted during the Summit by the United States, China, India, Brazil and South Africa. It was "taken note of," but not "adopted," in a debate of all the participating countries, and it was not passed unanimously. The Accord recognizes that climate change is one of the greatest challenges of the present day and that actions should be taken to keep any temperature increases to below 2°C. The document is not legally binding and does not contain any legally binding commitments for reducing CO2 emissions. Many countries and non-governmental organisations were opposed to this agreement, but since 2010 >138 countries have formally signed the agreement. South Africa has agreed to cut emissions by 34% below current expected levels by 2020. As wind farms produce no or little greenhouse gases, there is growing interest in this form of energy production in South Africa. However, potential impacts of wind turbines on the environment and biodiversity in South Africa have not yet been comprehensively assessed.
18th Conference of the Parties (CoP 18)	The 2012 UNFCCC in Qatar, Doha Durban was held to establish a new treaty to limit carbon emissions. This Convention reached an agreement to extend the life of the Kyoto Protocol, which had been due to expire at the end of 2012, until 2020, and to reify the 2011 Durban Platform, meaning that a successor to the Protocol is set to be developed by 2015 and implemented by 2020. Wording adopted by the conference incorporated for the first time the concept of "loss and damage", an agreement in principle that richer nations could be financially responsible to other nations for their failure to reduce carbon emissions.
Ramsar Convention (The Convention of Wetlands of International Importance (1971 and amendments)	Protection and conservation of wetlands. Wetlands are very important for bats for drinking and foraging. Bats are very dependent on water sources.
United Nations Framework Convention on Climate Change (UNFCCC)	The UNFCCC, which was also established during the 1992 Earth Summit, is an international agreement to stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climatic system. The treaty itself sets no mandatory limits on greenhouse gas emissions for individual countries and contains no enforcement mechanisms. It is, therefore, non-binding. However, it does provide for updates called "protocols," which set mandatory emission limits. The principal update is the Kyoto Protocol. The UNFCCC entered into force in 1994 and has approximately 194 parties including South Africa. The parties to the Convention have met annually from 1995 in Conferences of the Parties (CoP) to assess progress in dealing with climate change.
Regional Instrument	
Action Plan of the Environmental Initiative of NEPAD	This New Partnership for Africa's Development (NEPAD) Action Plan was established during the 2003 African Convention on Conservation of Nature and Natural Resources held in Maputo. As a contracting state, South Africa has undertaken to adopt measures to ensure the conservation, utilization and development of soil, water, floral and faunal resources in accordance with

Instrument	Key objective
	scientific principles and with due regard to the best interests of the people. The Action Plan encourages sustainable development and associated conservation and wise use of biodiversity in Africa. It has been recognised that a healthy and productive environment is a prerequisite for the success of NEPAD, together with the need to systematically address and sustain ecosystems, biodiversity and wildlife.
National Instrument	
Environmental Conservation Act (ECA; Act 73 of 1989)	The ECA is mentioned here because it is necessary to ensure that, for the remainder of its phasing out period, it is enforced in terms of the new enforcement provisions in the current National Environmental Management Act (NEMA), which were added to NEMA under the National Environmental Management Amendment Act (NEMAA; Act 8 of 2004). ECA is already partially repealed, and although it is envisaged that ECA will eventually be repealed in its totality, it is still being applied for a number of reasons. For example, regulations are being applied for authorisation of activities in certain coastal areas, which were published in terms of Sections 26 and 28 of the ECA in Government Notice R. 1528 of 27 November 1998.
Constitution of the Republic of South Africa (Act 108 of 1996)	According to South Africa's Constitution, South African citizens have the right to have the environment protected for the benefit of present and future generations.
National Environmental Management Act (NEMA; Act 107 of 1998)	NEMA is an umbrella Act covering broad principles of environmental management. NEMA can be regarded as the most important piece of general environmental legislation covering three main areas namely: Land, planning and development; Natural and cultural resources use and conservation; Pollution control and waste management. According to NEMA sustainable development requires the consideration of all relevant factors including: • That the disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and remedied; • That the development, use and exploitation of renewable resources and the ecosystems of which they are part, do not exceed the level beyond which their integrity is jeopardised. Sensitive, vulnerable, highly dynamic or stressed ecosystems require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure.
National Environmental Management: Biodiversity Act (NEM:BA; Act 10 of 2004)	One of the objectives of NEM:BA is to provide for the management and conservation of South Africa's biodiversity within the framework of NEMA and to ensure the sustainable use of indigenous biological resources. Chapter 4, Part 2 of NEM:BA provides for listing of species that are threatened or in need of protection to ensure their survival in the wild while regulating the activities, including trade, which may involve such listed threatened or protected species and activities which may have a potential impact on their long-term survival. According to Section 56(1) of NEM:BA, in February 2007 the Minister of Environmental Affairs and Tourism published a list of Threatened (Critically Endangered, Endangered and Vulnerable) or Protected Species (referred to as TOPS). According to the NEM:BA TOPS Regulations a person may not carry out a restricted activity involving a specimen of TOPS without a permit. The Regulations fail, however, to recognise most Conservation Important (CI) bat species, as only the Large-eared Free-tailed Bat (Otomops martiensseni) is included on the ToPS List.
National Biodiversity Strategy and Action Plan (NBSAP)	The development of the NBSAP is part of South Africa's obligations as a signatory to the CBD, and was compiled by the Department of Environmental Affairs and Tourism (DEAT 2005). The NBSAP is based on the recognition that South Africa is extremely rich in terms of biodiversity, but is also a developing country where the majority of the population resides in poverty. It provides an overarching

Instrument	Key objective
	framework for the conservation and sustainable use of South Africa's biodiversity, and equitable sharing of benefits from use of genetic resources. As far we know South Africa is the first country to include a comprehensive spatial assessment of biodiversity (the NSBA) as part of its NBSAP. Through the NBSAP it is recognized that biodiversity cannot be conserved through protected area networks only. All stakeholders, from private landowners and communities to business and industry must get involved in biodiversity management.
National Spatial Biodiversity Assessment (NSBA) Priority Areas & Threatened Ecosystems	The NSBA, which is part of the NBSAP, was led by the SANBI (Driver et al. 2011). Its main focus was on mainstreaming biodiversity priorities and making links between biodiversity and socio–economic development in South Africa. The NSBA represents South Africa's first national assessment of spatial priorities for conservation action, integrating terrestrial, river, estuarine and marine ecosystems, using available spatial data, biodiversity planning software and a series of expert and stakeholder workshops. The NSBA involved systematic biodiversity planning based on three principles: • The need to conserve a representative sample of biodiversity pattern, such as species and habitats (the principle of representation). • The need to conserve the ecological and evolutionary processes that allow biodiversity to persist over time (the principle of persistence). • The need to set quantitative biodiversity targets that tell us how much of each biodiversity feature should be conserved in order to maintain functioning landscapes and seascapes. During the NSBA, nine geographic Priority Areas were identified for conservation in South Africa (Driver et al. 2004). Priority Areas were allocated where broad-scale habitat remained unprotected, or was inadequately conserved.
National Red Data Mammal Species Listings	Lists of National Red Data Species have been produced for all five vertebrate classes. The National Red Data conservation status of mammals, including bat species, in South Africa was last assessed in 2004 (Friedmann & Daly 2004). However, SANBI are currently in the process of updating these listings and they are soon to be released.
South African Good Practice Guidelines for Surveying Bats at Wind Energy Facility Developments - Pre-construction: 3rd Edition[13].	These guidelines seek to provide technical guidance for consultants charged with carrying out impact assessments for proposed wind energy facilities, in order to ensure that pre-construction monitoring surveys produce the required level of detail and answers for authorities evaluating applications for wind energy facility developments. It outlines basic standards of good practice and highlights specific considerations relating to the pre-construction monitoring of proposed wind farm sites for bats.
Draft South African Good Practise Guidelines for Operational Monitoring for Bats at Wind Energy Facilities[52]	The objective of this document is to provide practitioners with a standard protocol to monitor and estimate bat mortality, facilitating comparison between fatality rates across different WEF's. This is a 'living document' and the protocol prescribed will change as the impacts of wind turbines on bats in South Africa emerge.
Provincial Instrument	
Protected Area Management Plans	In compliance with the National Environment Management: Protected Areas Act (NEM: PAA) (Act No. 57 of 2003), CapeNature is required to develop management plans for each of its nature reserves. The objective of a management plan is to ensure the protection, conservation and management of the protected area concerned in a manner that is consistent with the objectives of the NEM: PAA and for the purpose it was declared.

52 Aronson, J., Richardson, E., MacEwan, K., Jacobs, D., Marais, W., Aiken, S., Taylor, P., Sowler, S. and Hein, C. (2014). 1st Edition South African Good Practice Guidelines for Operational Monitoring for Bats at Wind Energy Facilities. Produced by the South African Bat Assessment Advisory Panel (SABAAP)

Instrument	Key objective
Western Cape Nature Conservation Laws Amendment Act, No. 3 of 2000.	Prohibition on killing or capturing of protected wild animals in excess of daily bag. no person shall hunt any protected wild animal, unless he or she is the holder of a permit or of a licence. No person authorised by any provision of this ordinance to hunt any wild animal shall at any time kill or capture a greater number of any species of protected wild animal than the daily bag limit determined in respect of such species by [proclamation] notice under section 79(a). 79. The [Administrator may by proclamation] Board may by notice in the Provincial Gazette, in respect of the Province or any area therein specified in such [proclamation] notice and either indefinitely or for a specified period- (a) determine the number of any species of protected wild animal or of fish specified in such [proclamation] notice which may subject to the provisions of this ordinance be killed, captured or caught- (i) in the case of protected wild animals, during the period commencing one hour before sunrise and ending one hour after sunset.
Northern Cape Nature Conservation Act, No. 1374 of 2010.	The objectives of this Act are: To provide for the sustainable utilization of wild animals, aquatic biota and plants; to provide for the implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora; to provide for offences and penalties for contravention of the Act; to provide for the appointment of nature conservators to implement the provisions of the Act; to provide for the issuing of permits and other authorizations; and to provide for matters connected herewith.
Broad and Fine-scale Provincial Conservation Plans	Both the Western and the Eastern Cape have Conservation Planning instruments.
Ciskei Nature Conservation Act, No. 10 of 1987	To consolidate and amend the laws relating to the conservation, management and protection of fauna, flora and fish and their habitats generally, to provide for the establishment and management of nature reserves, hiking trails, water catchment areas and a coastal conservation area, to provide for matters relating to the sea and the seashore and to provide for incidental matters.
Provincial Permits for the capture and release or hunting (killing) of indigenous fauna.	All provinces require that permits be sought for scientific research, hunting or transporting indigenous fauna. The relevant provincial authorities must contacted in this regard.

3 FA DESCRIPTIONS IN RELATION TO BATS

3.1 Potential Bat Species Richness and Estimated Activity Levels

A total of 27 bat species have the potential to occur within the focus areas, but vary in their likelihood of occurrence (LoO) , their distribution across the different FAs, and their fatality risk due to turbines. Refer to **Table 4** for a list of all species, their LoO for the different FAs, their turbine fatality risk levels and their conservation status. A description of the habitat preferences and behaviour of each of the species with a Medium to High LoO are provided below in **Section 3.2**. Within the parameters of the limitations described in Section 2.4, average annual activity levels were calculated for each of the FAs, according the percentage area of each Ecoregion within each FA (
Figure 3). The activity levels and species richness per FA is graphically represented in **Figure 4**. It is interesting to note that despite their closeness in locality, FA1 has the highest bat passes per hour and FA2 has the lowest, suggesting that Ecoregion type does play an important role.

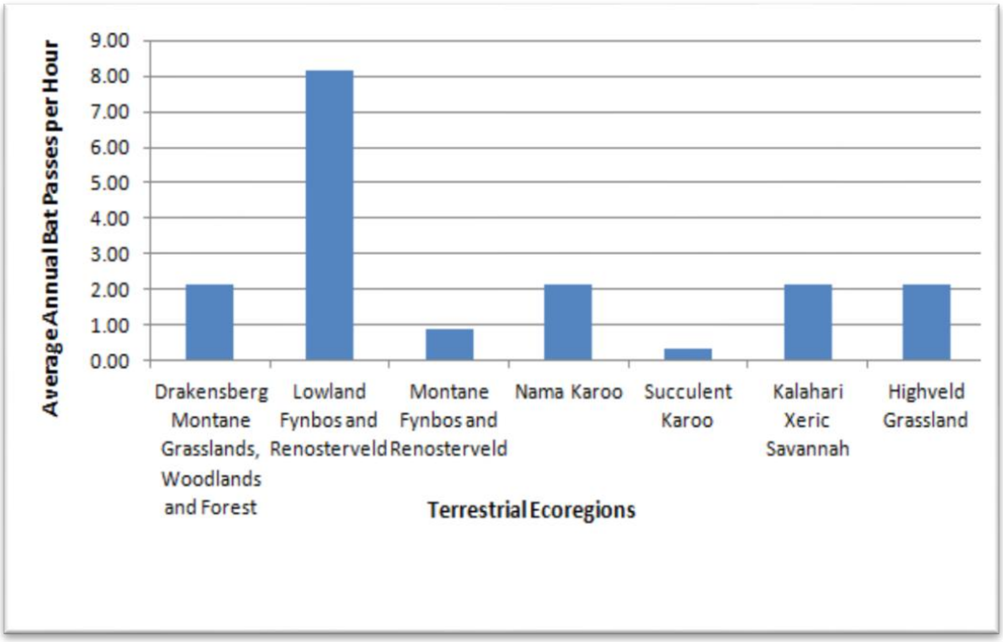


Figure 3: Average Annual Bat Passes per Hour per Ecoregion

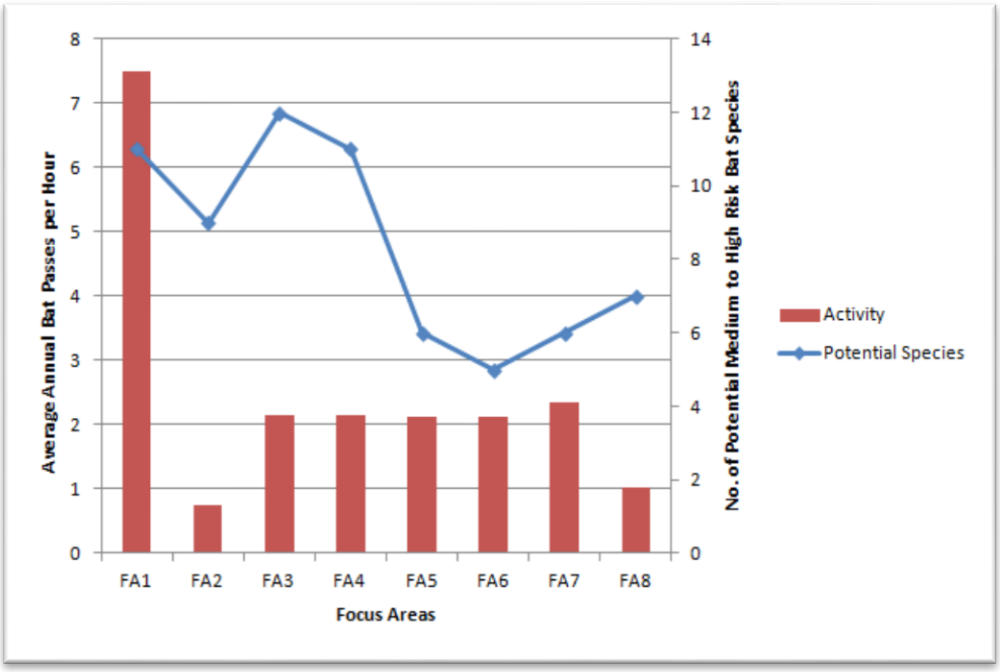


Figure 4: Extrapolated Average Annual Bat Passes per Hour per FA and No. of Potentially Occurring Medium-High Risk Bat Species

Table 4: Potential Bat Species List for Each of the Eight FAs

FAMILY[62]	SCIENTIFIC NAME[63]	COMMON NAME[64]	CONSERVATION STATUS			LIKELIHOOD OF OCCURRENCE [53,54,55,56,57,58,59,60]								TURBINE FATALITY RISK[61]
			GLOBAL IUCN[65]	S.A. RED DATA[66]	PROV-INCIAL[67,68,69]	FA 1	FA 2	FA 3	FA 4	FA 5	FA 6	FA 7	FA 8	
EMBALLONURIDAE	*Taphozous mauritianus*	Mauritian Tomb Bat	LC (U)	LC	PWA	3/4	3	3/4						HIGH
MOLOSSIDAE	*Sauromys petrophilus*	Roberts's Flatheaded Bat	LC (S)	LC	PWA	1	1					2	2/3	HIGH
MOLOSSIDAE	*Chaerephon pumilus*	Little Freetailed Bat	LC (U)	LC	PWA, PS			4	4					HIGH
MOLOSSIDAE	*Tadarida aegyptiaca*	Egyptian Freetailed Bat	LC (U)	LC	PWA	1	1	1	2	2	2	2	1	HIGH
PTEROPODIDAE	*Eidelon helvum*	African Strawcoloured Fruit Bat	LC (S)	LC	PWA, PS				4	4	4	4	4	MEDIUM-HIGH
PTEROPODIDAE	*Epomophorus wahlbergi*	Wahlberg's Epauletted Fruit Bat	LC (S)	LC	PWA, SPWA, PS	4	3	3						MEDIUM-HIGH
PTEROPODIDAE	*Rousettus aegyptiacus*	Egyptian Rousette	LC (S)	LC	PWA	2	3	2	2/3				3/4	MEDIUM-HIGH
MINIOPTERIDAE	*Miniopterus fraterculus*	Lesser Longfingered Bat	LC (U)	LC	PWA, SPWA, PS	4		4	4					MEDIUM-HIGH
MINIOPTERIDAE	*Miniopterus natalensis*	Natal Longfingered Bat	LC (U)	NT	PWA, PS	1	1	1	1	3	3	2	1	MEDIUM-HIGH
VESPERTILIONIDAE	*Neoromicia capensis*	Cape Serotine	LC (S)	LC	PWA	1	1	1	1	2	2	2	1	MEDIUM-HIGH

53 Natural Scientific Services (2013). Amakhala Emoyeni 1 Final Bat Monitoring and Impact Assessment Report, pp 1-119.

54 Natural Scientific Services (2013). Pre-construction Bat Monitoring for the Witberg Wind Energy Facility, Final Report, pp 1-93.

55 Natural Scientific Services (2013). Pre-construction Bat Monitoring for the Perdekraal Wind Energy Facilities, Final Report

56 Natural Scientific Services (2013). Pre-construction Bat Monitoring and Impact Assessment Report for the Proposed Richtersveld Wind Energy Facility, Northern Cape

57 Jacobs, D. (2012) Bat Echolocation Surveys at Proposed Biotherm Wind Energy Sites 2010-2011

58 Bio 3 (2012). Dorper Wind Energy Facility. Bat Communities Monitoring Report 1 (Pre-construction).

59 Animalia (2014). Long-term Bat Monitoring Study for the Proposed Hidden Valley Wind Energy Facility, Western Cape Province, pp 1-114.

60 Bio Insight South Africa (2014). Blue Wind Energy Facility Bat Monitoring, Pre-construction Phase 2013/2014.

61 Sowler, S., & Stoffberg, S. (2014). South African Good Practice Guidelines for Surveying Bats at Wind Energy Facility Developments - Pre-construction: Third Edition: by the Wildlife & Energy Programme of the EWT and the SABAAP.

62 Monadjem, A., Taylor, P.J., Cotterill, F.P.D. and Schoeman, M.C. (2010). Bats of southern and central Africa – A biogeographic and taxonomic synthesis. Wits University Press, Johannesburg.

63 Friedmann, Y. , & Daly, B., (eds.) (2004). Red data book of the mammals of South Africa: A conservation assessment. CBSG Southern Africa, Conservation Breeding Specialist Group (SSC/IUCN). Endangered Wildlife Trust, Johannesburg.

64 Monadjem, A., Taylor, P.J., Cotterill, F.P.D. and Schoeman, M.C. (2010). Bats of southern and central Africa – A biogeographic and taxonomic synthesis. Wits University Press, Johannesburg.

65 IUCN (2013). IUCN Red List of Threatened Species. Version 2013.1. <www.iucnredist.org>. Downloaded on 15 May 2014.

66 Friedmann, Y. , & Daly, B., (eds.) (2004). Red data book of the mammals of South Africa: A conservation assessment. CBSG Southern Africa, Conservation Breeding Specialist Group (SSC/IUCN). Endangered Wildlife Trust, Johannesburg.

67 Schedule 2 of the Western Cape Nature Conservation Laws Amendment Act, No. 3 of 2000 – Protected Wild Animal (PWA)

68 Schedule 1 of the Ciskei Nature Conservation Act, No. 10 of 1987 – Specially Protected Wild Animal (SPWA)

69 Schedule 2 of the Northern Cape Conservation Act, No. 9 of 2009 – Protected Species (PS)

FAMILY[62]	SCIENTIFIC NAME[63]	COMMON NAME[64]	CONSERVATION STATUS			LIKELIHOOD OF OCCURRENCE [53,54,55,56,57,58,59,60]								TURBINE FATALITY RISK[61]
			GLOBAL IUCN[65]	S.A. RED DATA[66]	PROV-INCIAL[67,68,69]	FA 1	FA 2	FA 3	FA 4	FA 5	FA 6	FA 7	FA 8	
VESPERTILIONIDAE	*Myotis tricolor*	Temminck's Myotis	LC (U)	LC	PWA	1	3	1	2	4				MEDIUM-HIGH
VESPERTILIONIDAE	*Scotophilus dinganii*	Yellowbellied House Bat	LC (U)	LC	PWA			1	3					MEDIUM-HIGH
VESPERTILIONIDAE	*Eptesicus hottentotus*	Longtailed Serotine Bat	LC (U)	LC	PWA, SPWA, PS	1	3	1	3	3	3	3	1	MEDIUM
VESPERTILIONIDAE	*Pipistrellus hesperidus*	Dusky Pipistrelle	LC (U)	LC	PWA	4		2	4					MEDIUM
HIPPOSIDERIDAE	*Hipposideros caffer*	Sundevall's Leafnosed Bat	LC (D)	LC	PWA, PS			4	4					LOW
HIPPOSIDERIDAE	*Cloeotis percivali*	Percival's Shorteared Trident Bat	LC (U)	VU	PWA, PS	4		4	4	4	4			LOW
RHINOLOPHIDAE	*Rhinolophus clivosus*	Geoffroy's Horseshoe Bat	LC (U)	LC	PWA	1	1	1	3	2	2	4	3	LOW
RHINOLOPHIDAE	*Rhinolophus darlingi*	Darling's Horseshoe Bat	LC (U)	LC	PWA			3/4	3/4	3/4	3	2/3	2/3	LOW
RHINOLOPHIDAE	*Rhinolophus blasii*	Blasius's Horseshoe Bat	LC (D)	NT	PWA				4		4			LOW
RHINOLOPHIDAE	*Rhinolophus capensis*	Cape Horseshoe Bat	LC (D)	NT	PWA. SPWA	1	3	2	3					LOW
RHINOLOPHIDAE	*Rhinolophus simulator*	Bushveld Horseshoe Bat	LC (D)	LC	PWA			4	4		4			LOW
RHINOLOPHIDAE	*Rhinolophus denti*	Dent's Horseshoe Bat	LC (U)	DD	PWA					3	2/3	3/4		LOW
RHINOLOPHIDAE	*Rhinolophus swinnyi*	Swinny's Horseshoe Bat	LC (U)	NT	PWA, SPWA			3/4	3/4					LOW
NYCTERIDAE	*Nycteris thebaica*	Egyptian Slitfaced Bat	LC (U)	LC	PWA	2	3	1	3	2/3	2/3	2/3	2/3	LOW
VESPERTILIONIDAE	*Cistugo seabrae*	Angolan Wingglang Bat	LC (U)	NT	PWA, PS		4					4	2	LOW
VESPERTILIONIDAE	*Cistugo lesueuri*	Lesueur's Wingglang Bat	LC (D)	VU	PWA, PS	3	3	2	3					LOW
VESPERTILIONIDAE	*Kerivoula lanosa*	Lesser Woolly Bat	LC (U)	NT	PWA, SPWA, PS	2/3		2	3					LOW
VESPERTILIONIDAE	*Laephotis namibiensis*	Namibian Long-eared Bat	LC (S)	NE	PWA	1	4							LOW

Key:
Status: CR = Critically Endangered; D = Declining; DD = Data Deficient; EN = Endangered; I = Increasing; LC = Least Concern; NE = Not Evaluated; NT = Near Threatened; PS = Protected Species; PWA = Protected Wild Animal; SPWA = Specially Protected Wild Animal; S = Stable; U = Unknown population trend; VU = Vulnerable
Likelihood of Occurrence (LoO): 1 = Present; 2 = High; 3 = Moderate; 4 = Low or as a individual migrant record; Blank block = Unlikely

3.2 Description of Medium to High Risk Species

The following species information is provided for bat species potentially occurring within the FAs and only for those that are of a Medium, Medium-High or High risk of fatality by wind turbines. The information is compiled from two sources and references therein: Bats of southern and central Africa – A biogeographic and taxonomic synthesis[70], and the African Chiroptera Report[71].

PTEROPODIDAE

Eidelon helvum

The Straw-coloured Fruit bat occurs throughout most of Africa even up into Arabia, Yemen and Oman, favouring lowland rainforests and savannah zones. This species is known to fly long distances between roost sites and foraging locations. In Nigeria these bats have been recorded flying at least 24km from roosts to favoured foraging sites. The fruits of numerous tree species have been recorded in their diet. Flights of over 15km have also been recorded in Zambia. *Eidelon helvum* is a large bat with long, narrow wings that have high wing-loading, allowing very fast straight-line flight. Hence, when commuting, these bats will fly well above canopy height. It is also known to migrate in certain parts of its range as a result of seasonal shifts in food supply.

Epomophorus wahlbergi

Wahlberg's Epauletted Fruit bat is fairly ubiquitous throughout most of sub-Saharan Africa with sporadic records in North and West Africa. This species seems to favour forest or forest-edge habitats, riparian forest and have also been recorded in extensively wooded gardens in peri-urban areas. It is thus mostly absent from arid regions. Fruits, nectar, pollen and flowers of numerous tree species are eaten by *E. wahlbergi* and individuals have been recorded travelling over 13km between roosting and foraging sites. Similar to *E. helvum*, Wahlberg's Epauletted Fruit bat has broad wings with high wing loading and low aspect ratio which facilitate fast straight-line flight and allow for long commuting distances.

Rousettus aegyptiacus

This species occurs patchily throughout sub-Saharan Africa and parts of North Africa. However, the distribution of this species is mostly dependent on two factors: roosts and forage. Egyptian Fruit bats roost gregariously in caves and so appropriate roost sites influences their distribution more so than habitat. Moreover, the species occurs mainly in moist areas as a result of their reliance of fruiting trees hence *R. aegyptiacus* is absent from the dry, western parts of southern Africa. Again, the high wing loading and low aspect ratio of these bats allows them to undergo flights of ≈25km between roost caves and foraging grounds; which are usually well-wooded areas dominated by *Ficus* sp. However, migratory flights between roost sites may be in excess of 450km.

EMBALLONURIDAE

Taphozous mauritianus

The Mauritian Tomb bat is widespread and abundant across most of southern Africa and favours open habitats, where it is often closely associated with granite hills, but avoids closed forest interiors. While this species is common in savannahs, grasslands, savannah-woodlands, semi-arid scrub, and agricultural land, it is absent from the arid savannahs of the Kalahari and in other arid areas its presence is strongly associated with permanent water bodies, which have concentrated densities of prey. Similar to the bats of the family Molossidae, *Taphozous mauritianus* is an open-air, aerial forager. Its long, narrow wings and low frequency, narrow-band echolocation calls facilitate fast, agile flight and the capture of insect prey in open, uncluttered airspace.

MOLOSSIDAE

Sauromys petrophilus

The Flat-headed Freetail bat is widely dispersed and abundant throughout the arid western parts of southern Africa. It is closely associated with, particularly quartzitic, rocky habitats, scrubland and fynbos.

70 Monadjem, A., Taylor P.J., Cotterill, F.P.D. & Schoeman M.C. (2010). Bats of southern and central Africa – A biogeographic and taxonomic synthesis. Wits University Press, Johnnesburg.

71 ACR. 2013. African Chiroptera Report (2013). AfricanBats, African Chiroptera Project, Pretoria. i-xix + 6330 pp.

This species is an open-air aerial forager. Its long, narrow wings and medium duration, low frequency, narrow-band echolocation calls facilitate fast, agile flight and the capture of insect prey in open, uncluttered airspace.

Chaerephon pumilus
This species occurs in a wide range of habitats across southern Africa. Like all Molossids, the Little Freetail bat is an open-air aerial forager. Its long, narrow wings and medium duration, low frequency, narrow-band echolocation calls facilitate fast, agile flight and the capture of insect prey in open, uncluttered airspace.

Tadarida aegyptiaca
Foraging over desert, semi-arid scrub, savannah, grassland, agricultural land and often associated with granite hills, the Egyptian Freetail bat is widespread and extremely common in southern Africa. Similar to most open-air, aerial foraging bat species the only habitat *Tadarida aegyptiaca* avoids is forest interiors. The long, narrow wings and medium duration, low frequency, narrow-band echolocation calls of this species are ill-suited for effective foraging within highly cluttered environments such as forests. Instead, these adaptations facilitate fast, agile flight and the capture of insect prey in open, uncluttered airspace.

MINIOPTERIDAE
Miniopterus fraterculus
The core distribution of this, predominantly temperate, species is in the montane grasslands of the South African escarpment. However, it is cave dependent hence the availability of suitable roosting sites may be more critical in determining its distribution than habitat. The Lesser Long-fingered bat is an aerial clutter-edge forager. It has shorter and broader wings than those of Molossid bats and echolocates with short duration, high frequency, broad-band calls. This call structure allows these bats to distinguish prey-items from background clutter (such as vegetation) and their wing morphology facilitates enough manoeuvrability to capture prey-items in moderately cluttered environments. However, the species is thought to make seasonal migrations between maternity roosts and winter hibernacula during which time they commute at much higher flying heights, above the canopy.

Miniopterus natalensis
The Natal Long-fingered bat occurs widely across southern Africa, predominantly in temperate or subtropical savannahs and grasslands, but is less abundant in the arid west. Like *M. fraterculus*, however, it is cave dependent and hence the availability of suitable roosting sites may be more critical in determining its presence in an area than habitat. This species is also an aerial clutter-edge forager, however, with longer wings and a lower peak frequency to that of *M. fraterculus*. It is known to make long migrations between summer maternity roosts and winter hibernacula that may be up to 150km apart; the higher wing loading of this species likely facilitates these long flights.

VESPERTILIONIDAE
Pipistrellus capensis
The Cape Serotine may have the most widespread distribution of any southern African bat species. It occurs from arid semi-desert to montane grassland, forests and savannah although it is less abundant in low-lying hot savannahs. This species is an aerial clutter-edge forager. Its moderate peak frequency, short duration, broad-band echolocation calls, coupled with relatively short, broad wings allows Cape Serotines to forage effectively on insect prey in the presence of background clutter, such as vegetation.

Myotis tricolor
This species is a gregarious cave-rooster and so is typically found in mountainous areas or areas with significant rock outcrops. Temminck's Myotis is a clutter to clutter-edge foraging species. Its echolocation calls are of very short duration, moderate peak frequency and very broad-band. Coupled with short, relatively broader wings, these parameters facilitate manoeuvrability and prey-capture within relatively cluttered environments but restrict these bats to capture prey only whilst in flight. However, these bats are also known to migrate between summer maternity roosts and winter hibernacula, during which time they may fly well above the canopy layer.

Scotophilus dinganii
The Yellow-bellied House bat occurs throughout the savannah biome of southern Africa but avoids open habitats like grassland and Karoo scrublands. It is closely associated with the presence of trees and is a clutter-edge forager. Although it is a relatively large bat with relatively long wings, they are also proportionately broad to facilitate manoeuvrability in moderately cluttered environments. However, it has a lower peak frequency and narrower band-width than many other Vesper bats which suggests that it forages more effectively along the edges of cluttered environments.

Eptesicus hottentotus
The Long-tailed Serotine has a slightly lower peak frequency, narrower band-width echolocation call but slightly shorter wings than *S. dinganii*. Hence, although this clutter-edge forager is able to forage effectively in relatively cluttered environments, it is far more proficient along habitat edges. Indeed, it is closely associated rocky outcrops, granitic hills, gorges and miombo woodland. This species occurs widely across southern Africa but generally in relatively low numbers.

Pipistrellus hesperidus
Relatively little is known about the ecology of this species. It appears to be associated with well-wooded areas and forest patches, especially near water sources, such as riparian zones. The Dusky Pipistrelle is a clutter-edge forager. Its short duration, broad-band echolocation calls have a similar peak frequency to that of *M. natalensis*, however its wings are shorter and broader. This species is thus well-suited to foraging in and around moderately cluttered environments.

3.3 Environmental Description Summaries for the FAs

Summary descriptions of each of the FAs from an environmental and bat perspective are presented in **Table 5** below.

Table 5: Environmental Description Summaries for the FAs

Site	Brief description
Overberg FA 1	The predominant Ecoregion for FA1 is the Lowland Fynbos and Renosterveld, consisting mainly of the Western, Central and Eastern Rûens Shale Renosterveld vegetation units[72]. The. Mean Annual Precipitation (MAP) ranges between 270-700 mm (mean≈400 mm), with peaks in winter (May-August) and lows in summer (December-February). Mean maximum and minimum daily temperatures for January and July, respectively, range between 27.3 °C and 5.6 °C. Frost incidence is only about 3 days per year. There are several key bat roosts of significance within or adjacent to this FA. Genetic connectivity[73] between the various caves around FA1 implies that there is bat movement between these caves. Whilst the movement path is unknown, it is highly likely that seasonal movements of high numbers of bats do transect FA1. Seventeen (17) bat species have the potential to occur within FA1, with 11 of them having a Medium to High risk of fatality due to wind turbines. Additionally, FA1 has the highest annual average bat passes per hour.
Komsberg FA 2	Whilst the eastern corner of FA2 is Succulent Karoo, the two dominant Ecoregions are Montane Fynbos and Renosterveld and Nama Karoo. Climate data for FA2 were obtained from the predominant vegetation units, namely the Roggeveld Shale Renosterveld and the Tanqua, Koedoesberge-Moordenaars and Gamka Karoos[72]. The Roggeveld Shale Renosterveld has the highest MAP of this group (mean≈300 mm) with a slight peak in March. The remaining units have lower MAPs, ranging from as little as 40 mm up to a maximum of 240 mm. This precipitation occurs mainly during winter (May-August) and March except for the Gamka Karoo which has very little winter and spring rainfall. Mean Maximum and minimum monthly temperatures for January and July, respectively, range between 38.7 °C and -3.2 °C except for the Roggeveld Shale Renosterveld which has a slightly smaller range and doesn't often drop below freezing (0.2 °C – 29.3 °C). Frost incidences in this group are relatively high (≈15 days in the Tanqua Karoo and 30-70 days in the Roggeveld Shale Renosterveld and Koedoesberge-

72 Mucina, L. & Rutherford, M.C. (2006). The vegetation map of South Africa, Lesotho and Swaziland. Strelitzia 19, South African National Biodiversity Institute.
73 Miller-Butterworth, C.M., Jacobs, D., & Harley, E.H., 2003. Strong population substructure is correlated with morphology and ecology in a migratory bat. Nature 424: 187-191

Site	Brief description
	Moordenaars Karoo) except for the Gamka Karoo which seldom receives frost, rather it experiences strong north-westerly winds during winter. Whilst not all bat roosts are known in SA, there are no known roosts within the vicinity of FA2. This is consistent with FA2 having the lower bat activity levels compared to the other FAs. Fourteen (14) bat species have the potential to occur within FA2, with 9 of them having a Medium to High risk of fatality due to wind turbines. The lower activity levels are extrapolated for this FA.
Cookhouse FA 3	The majority of FA3 consists of the Drakensberg Montane Grasslands, Woodlands and Forest Ecoregion, with a smaller western portion consisting of the Nama Karoo Ecoregion. Climate data for FA3 were obtained from the predominant vegetation units, namely the Albany Broken Veld, Bedford Dry Grassland and Great Fish Thicket[72]. These units have non-seasonal to bimodal rainfall patterns with peaks falling mainly in March and October/November. MAP for the three units is very similar, ranging from 290-600 mm. Mean daily temperatures range between 0 °C in July to 30 °C in January. Frost incidences vary greatly with the Great Fish Thicket and Bedford Dry Grassland experiencing 3-60 and 3-30 days, respectively, whereas the Albany Broken Veld rarely has more than 10 days/year of frost. FA3 has the highest bat species richness, as to be expected for the south eastern parts of the country, however, activity levels are relatively low to medium. Twenty two (22) bat species have the potential to occur within FA3, with 12 of them having a Medium to High risk of fatality due to wind turbines. FA3 encroaches into the buffer zones of various medium to large confirmed and unconfirmed roosts and has a moderate bat activity.
Stormberg FA 4	FA4 consists predominantly of the Drakensberg Montane Grasslands, Woodlands and Forest Ecoregion. Climate data for FA4 were obtained from the predominant vegetation units, namely the Stormberg Plateau, Karoo Escarpment and Tsomo Grasslands[72]. With mostly dry winters these units either show late summer rainfall or bimodal peaks in spring and autumn (MAP ranges between 300-790 mm). Mostly cold-temperature region with an MAT of 13 °C and coldest recorded winter temperature of -18.9 °C in the Stormberg Plateau Grassland. Frost incidences vary across these units (7-65 days/year in Tsomo Grassland and <20->100 days/year in the remaining two units) with higher incidences usually at higher elevations; a few days of snow per year may occur at high elevations in the Karoo Escarpment Grassland. FA4 has similar activity levels and species richness to FA3, being in predominantly the same Ecoregion. Twenty two (22) bat species have the potential to occur within FA4, with 11 of them having a Medium to High risk of fatality due to wind turbines. Historical roost sites are reported for the Molteno area, however, NSS only found one small roost. Further effort to locate roosts in this region is required.
Kimberley FA 5	Climate data for FA5 were obtained from the predominant vegetation units, namely the Western Free State Clay Grassland and Kimberley Thornveld[72]. Mainly summer-autumn rainfall with mostly dry winters (MAP ranges between 300-500mm). While mostly a cold-temperate region mean monthly temperatures range from -4 °C in July to 38 °C in January. Frost occurs frequently, particularly in winter. FA5 has the second lowest bat species richness, and jointly the third highest activity levels; the activity levels are approximately equal to the mean activity level value for all Ecoregions. As discussed in Section 2.4, FA 5 is situated in an Ecoregion where NSS has not conducted long-term monitoring, and it appears that no-one else has either. Therefore, extrapolation of data from other similar Ecoregions was used. Eleven (11) bat species have the potential to occur within FA5, with 6 of them having a Medium to High risk of fatality due to wind turbines. Whilst no cave-type roosts are marked within the immediate vicinity of FA5, it is anticipated that this is only because that area is under surveyed. Further effort to locate roosts in this region is required. In addition, this area has several NFEPA wetlands and hence activity levels could be higher than expected.
Vryburg FA 6	Climate data for FA6 were obtained from the predominant vegetation units, namely the Stella Bushveld and Ghaap Plateau Vaalbosveld[72]. The area receives mainly summer, and some autumn, rainfall with very dry winters (MAP ranges between 300-500 mm). Frost occurs frequently during winter and mean monthly temperatures for January and July, respectively, range from 36.6 °C to -7.5 °C. Due to the carbonaceous rock types within FA6, it is suspected that un-discovered cave roosts are present. As discussed in Section 2.4, FA 6 is situated in an Ecoregion where NSS has not conducted long-term monitoring, and it appears that no-one else has either. FA6 has the lowest number of potentially occurring medium to high risk bats and moderate activity levels. Twelve (12) bat species have the potential to occur within FA6, with 5 of them having a Medium to High risk of fatality due to wind turbines.
Upington FA 7	FA7 is situated mainly in the Nama Karoo Ecoregion. Climate data for FA7 were obtained from the predominant vegetation units, namely the Bushmanland Arid Grassland and Gordonia Duneveld[72]. The regions show mainly late summer to autumn rainfall with dry winters. MAP is

Site	Brief description
	relatively low, ranging from 70-260 mm. Mean monthly temperatures range from 41.5 °C in December-January to -4 °C in July. Frost is fairly frequent in winter and incidences range from 10-35 days/year. Whilst there is only one un-confirmed cave roost near FA7, there is evidence that migrant bats travel south-west from Koegelbeen Cave to hibernate at Steenkampskraal, 560 km away[74]. They could possibly cross over FA7 on route. This requires further investigation. There are no Protected Areas within or immediately surrounding this FA. The species richness and activity levels at FA7 are relatively low to moderate, with 11 bat species potentially occurring within FA7, with 6 of them having a Medium to High risk of fatality due to wind turbines.
Springbok FA 8	Three Ecoregions occur within FA8 – Succulent Karoo and Nama Karoo dominate, with a small piece of Montane Fynbos and Renosterveld in the middle. Climate data for FA8 were obtained from the predominant vegetation units, namely the Bushmanland Arid Grassland, Namaqualand Klipkoppe Shrubland and Namaqualand Strandveld[72]. Bushmanland Arid Grassland receives late summer to autumn rainfall of up to between 70-200 mm whereas the two Namaqualand vegetation units are arid and receive mostly low levels of winter rainfall (up to 160 mm) and episodic droughts of 1-2 years. These two units also do not drop below freezing during winter (lowest daily winter temperature = 5 °C), have summer maximums of about 30 °C and have no to infrequent frost (about 8 days/year). This contrasts to the Bushmanland Arid Grassland which can have up to 35 days of frost and temperatures ranging from 40.6 °C in January to -3.7 °C in July. Whilst activity levels at FA8 are low, there are several un-confirmed, small and large roosts within and surrounding FA8, including coastal caves. In addition, it is the site that has the highest likelihood of having the Namibian species *Cistugo seabrae*. This species is Near Threatened, but is at low risk of fatality. Much of this site and surrounds are also ear-marked for Protected Area Expansion which should be taken into consideration.

3.4 Bat Strategic Assessment

Several environmental factors can influence bat species distribution at a regional scale, such as elevation[75], climate[76], land use[77],[78], vegetation[79], habitat heterogeneity[80] and geology[81], with other factors such as the availability of roosts, food and water affecting local species distributions. At a broad strategic level, the following three main environmental considerations were taken into account for the Bat SEA Scoping Assessment, however, the sensitivity mapping took into consideration various factors, as described in **Section 4** :

- Terrestrial Ecoregions - large units of land containing a geographically distinct assemblage of species, natural communities, and environmental conditions [82] The Ecoregion concept is similar to the Biome concept, incorporating both vegetation communities and climate. A map of the Terrestrial Ecoregions within the eight FAs is displayed in **Figure 5**. There is evidence to suggest that bats might adapt to local environmental conditions at a Biome level[74]. The nine Biomes of South Africa are broader scale than the more detailed than the 15 Ecoregions of South Africa[83].

74 Miller-Butterworth, C.M., Jacobs, D., & Harley, E.H., 2003. Strong population substructure is correlated with morphology and ecology in a migratory bat. Nature 424: 187-191

75 Hof, A.R., Jansson, R., & Nilsson, C. (2012). The usefulness of elevation as a predictor variable in species distribution modeling. Ecological Modelling 246 (2012) 86– 90.

76 Field, R., Hawkins, B.A., Cornell, H.V., Currie, D.J., Diniz Filho, J.A.F., Guégan, J.F., Kaufman, D.M., Kerr, J.T., Mittelbach, G.G. and Oberdorff, T. (2009). Spatial species-richness gradients across scales: a meta-analysis. J. Biogeogr. 36, 132–147.

77 Hurst, Z.M., McCleery, R.A., Collier, B.A., Silvy, N.J., Taylor, P.J., & Monadjem, A. (2014). Linking changes in small mammal communities to ecosystem functions in an agricultural landscape. Mammalian Biology 79 (2014) 17– 23.

78 Threlfall, C.G., Law, B. and Banks, P.B. (2012). Sensitivity of insectivorous bats to urbanization: Implications for suburban conservation planning. Biological Conservation, Vol. 146: 41–52.

79 Lloyd, A., Law, B.S. & Goldingay, R.L. (2006). 'Bat activity on riparian zones and upper slopes in Australian timber production forests and the effectiveness of riparian buffers', Biological Conservation, vol. 129, no. 2, pp. 207-220

80 Schoeman, M.C., Cotterill, F. P. D., Taylor, P.J., & Monadjem, A. (2013). Using potential distributions to explore environmental correlates of bat species richness in southern Africa: effects of model selection and taxonomy. Current Zoology 58

81 Kunz, T.H., Murray, S.W., & Fuller, N.W. (2012). Bats. Encyclopedia of Caves Second Edition (2012) 45–54

82 WWF 2014 http://www.worldwildlife.org/biomes. Accessed on 4 June 2014.

83 WWF 2014 http://www.worldwildlife.org/biomes. Accessed on 4 June 2014.

Based on long-term bat monitoring data collected by NSS from 11 WEFs between 2011 and 2013 in the Western, Northern and Eastern Cape, bat activity levels do vary between the different Ecoregions (

- **Figure** 3).
- Geology - geology is a significant environmental parameter for bats, as many South African bats are crevice or hollow-roosting species[84],[85]. Crevice roosting bats utilizing rock cracks, bridge expansion joints, under tree bar, etc. usually roost individually or in small groups, although they can congregate in larger numbers, especially in the eastern parts of the country. Hollow-roosting bats utilize larger hollows, such as caves, tunnels and roofs of houses. Solution caves are the most frequently occurring caves and such caves form in rock that is soluble, such as limestone, dolomite and salt. In South Africa, caves or karst formations are mostly associated with rocks such carbonate rocks like limestone and dolomite. The distribution of cave areas in carbonate rocks in South Africa is displayed in **Figure 6**. Key confirmed and un-confirmed roosts and associated buffers are included in Appendix 2. These areas do coincide with the carbonate rocks displayed in **Figure 6**.

Although there is not much known about the migration routes of bats in South Africa, it is known that three cave dwelling species conduct seasonal migrations. In Gauteng, Limpopo and the Western Cape (South Africa)[86], it has been reported that *Miniopterus natalensis* (Natal long-fingered bat) migrates up to 260 km[87] between warmer maternity caves where females give birth in summer (e.g. the De Hoop Guano Cave in the Western Cape, and several caves in the lowveld of Limpopo), and colder caves in winter, where mating and hibernation occurs (e.g. several caves in the interior of the Western Cape, and on the highveld of Gauteng). *Myotis tricolor* (Temminck's hairy bat) undertakes similar seasonal migrations, although the details are not yet known. Both these species are insectivorous bats. One frugivorous bat species, *Rousettus aegyptiacus* (Egyptian rousette) is a gregarious cave-dweller also known to migrate distances of 50 to 500 km[85].

- Land use change in the form of buildings that represent roosting habitat for specific crevice and hollow-roosting species and field crop areas, representing altered foraging land for bats. Human induced land-use changes can be beneficial for certain species of bats, with irrigated and fertile crop lands potentially being hotspots for insectivorous bat foraging[88,89].

84 Kunz, T.H., Murray, S.W., & Fuller, N.W., (2012). Bats. Encyclopedia of Caves Second Edition (2012) 45–54

85 Monadjem, A., Taylor, P.J., Cotterill, F.P.D. and Schoeman, M.C. (2010). Bats of southern and central Africa – A biogeographic and taxonomic synthesis. Wits University Press, Johannesburg.

86 Miller-Butterworth, C.M., Jacobs, D., & Harley, E.H. (2003). Strong population substructure is correlated with morphology and ecology in a migratory bat. Nature 424: 187-191

87 Van der Merwe, M. (1975). Preliminary study on the annual movements of the Natal clinging bat, *Miniopterus schreibersi natalensis*. South African Journal of Science 71,237-241.

88 Taylor, P.J., Monadjem, A. & Steyn, J. N. (2013). Seasonal patterns of habitat use by insectivorous bats in a subtropical African agro-ecosystem dominated by macadamia orchards. Afr. J. Ecol. 1-10. DOI: 10.1111/aje.12066

89 Sirami, C., Jacobs, D.S., & Cumming, G.S. (2013). Artificial wetlands and surrounding habitats provide important foraging habitat for bats in agricultural landscapes in the Western Cape, South Africa. Biological Conservation 164 (2013) 30–38.

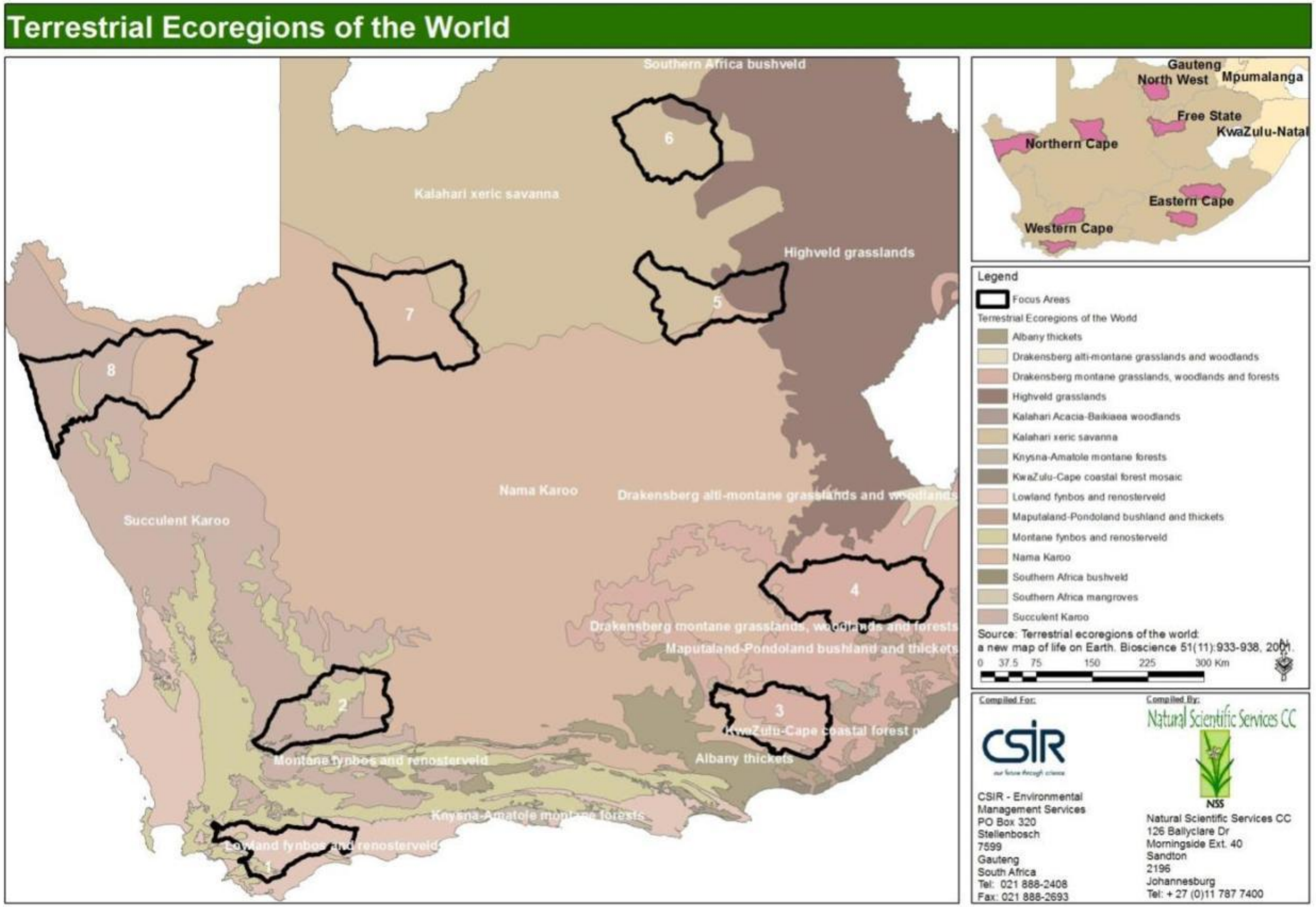


Figure 5: Terrestrial Ecoregions within the Eight FAs

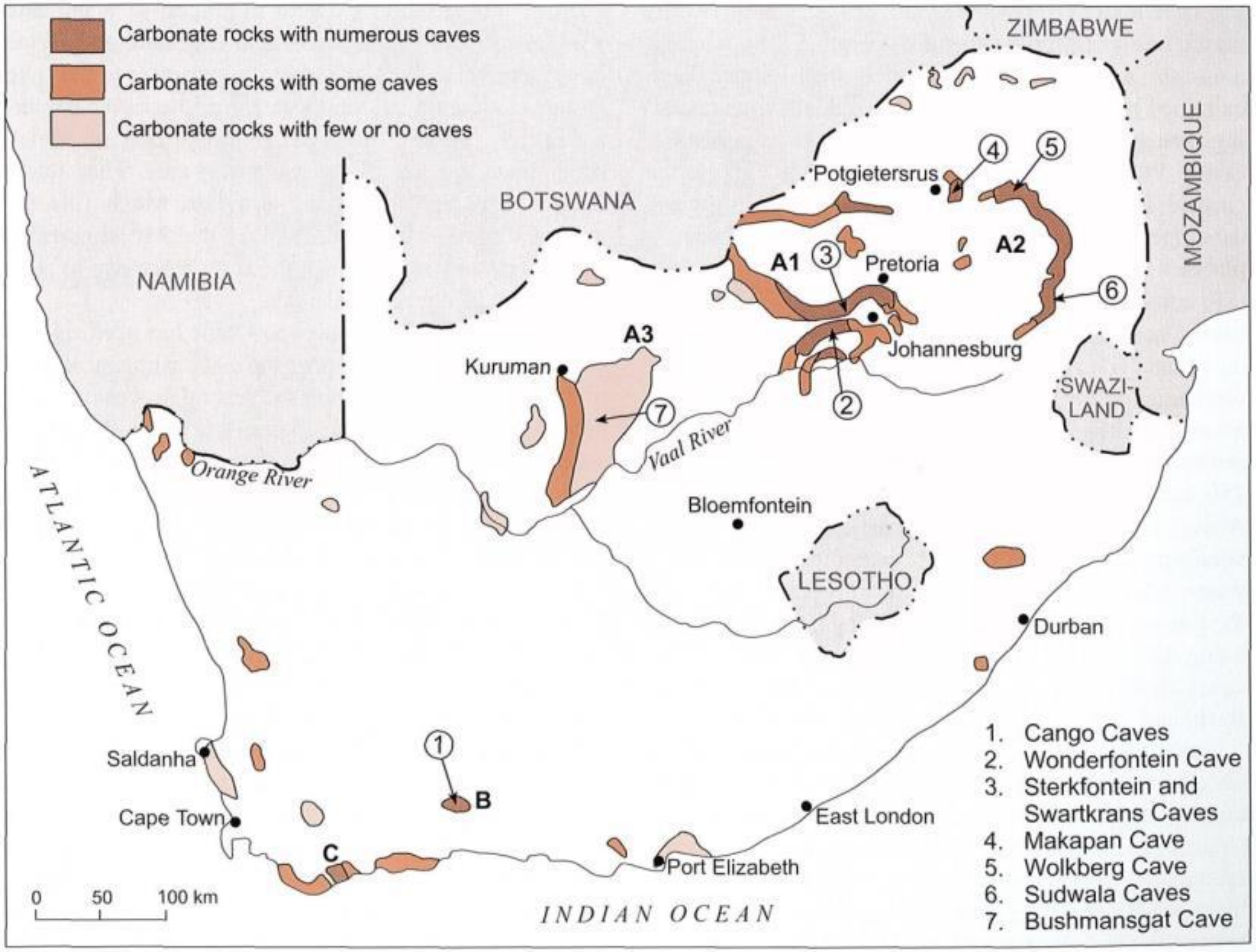


Figure 6: Cave Areas in Carbonate Rocks in South Africa[90]

90 Martini, J.E.J. (2006). Karsts and Caves. In, The Geology of South Africa. Eds. Johnson, M.R., Anhaeusser, C.R. and Thomas, R.J.

4 SENSITIVITY MAPPING

As per the terms of reference provided, two sets of sensitivity maps were produced for each FA for both wind and solar PV respectively. The set of absolute sensitivity maps was produced to show the bat habitat features and associated buffers for wind and solar PV separately. The set of relative sensitivity maps were compiled with a four-tier approach (low, medium, high and very high sensitivity) associated with each of the bat habitat features and the associated buffers. These maps were based mainly on desktop assessment and spatial data, with limited field verification. The sensitivity criteria applied to all FAs is presented in

Technology	Description of feature	Identification (source)	Application (use)
Wind	Rivers and Wetlands	NFEPA River and Wetland data (2011)	Sensitivities applied to this feature were buffered as follows: [91] • Very High Sensitivity – the river and wetland layer • High Sensitivity – 200 meters on the river and wetland layer • Medium Sensitivity – 500 meters on the river and wetland layer
	Geology - Lithology	SA Council for Geoscience	All Dolomite and Limestone outcrops were marked as High Sensitivity.
	Vegetation - Forest	Mucina & Rutherford (2006)	All Forest habitats were marked as High Sensitivity.
	Buildings	SPOT Building Count Data (2013)	All buildings, plus a 1 kilometre Medium Sensitivity buffer, were applied for wind.
	Croplands	Field Crop Boundaries - Department of Agriculture, Forestry and Fisheries (2013)	All croplands were marked as Medium Sensitivity
	Confirmed Small Cave Roosts	Various sources (Section 2.2) and NSS field verifications	Sensitivities applied to this feature were buffered as follows: • Very High Sensitivity – 2.5 kilometre radius from roost point • High Sensitivity – 5 kilometre radius from roost point • Medium Sensitivity – 10 kilometre radius from roost point
	Confirmed Medium Cave Roosts	Various sources (Section 2.2) and NSS field verifications	Sensitivities applied to this feature were buffered as follows: • Very High Sensitivity – 5 kilometre radius from roost point • High Sensitivity – 10 kilometre radius from roost point • Medium Sensitivity – 20 kilometre radius from roost point
	Confirmed Large Cave Roosts	Various sources (Section 2.2) and NSS field verifications	Sensitivities applied to this feature were buffered as follows: • Very High Sensitivity – 10 kilometre radius from roost point • High Sensitivity – 20 kilometre radius from roost point • Medium Sensitivity – 50 kilometre radius from roost point
	Unconfirmed Cave Roosts	Various sources (Section 2.2) and NSS field verifications	A 30 kilometre Medium Sensitivity radial buffer was applied from roost point
	Coastline (numerous caves along the coastline)	Surveyor General (2006) 1:50 000 topographical maps	Sensitivities applied to this feature were buffered as follows: • Very High Sensitivity – 5 kilometre distance from coastline • High Sensitivity – 10 kilometre distance from coastline • Medium Sensitivity – 20 kilometre distance from coastline

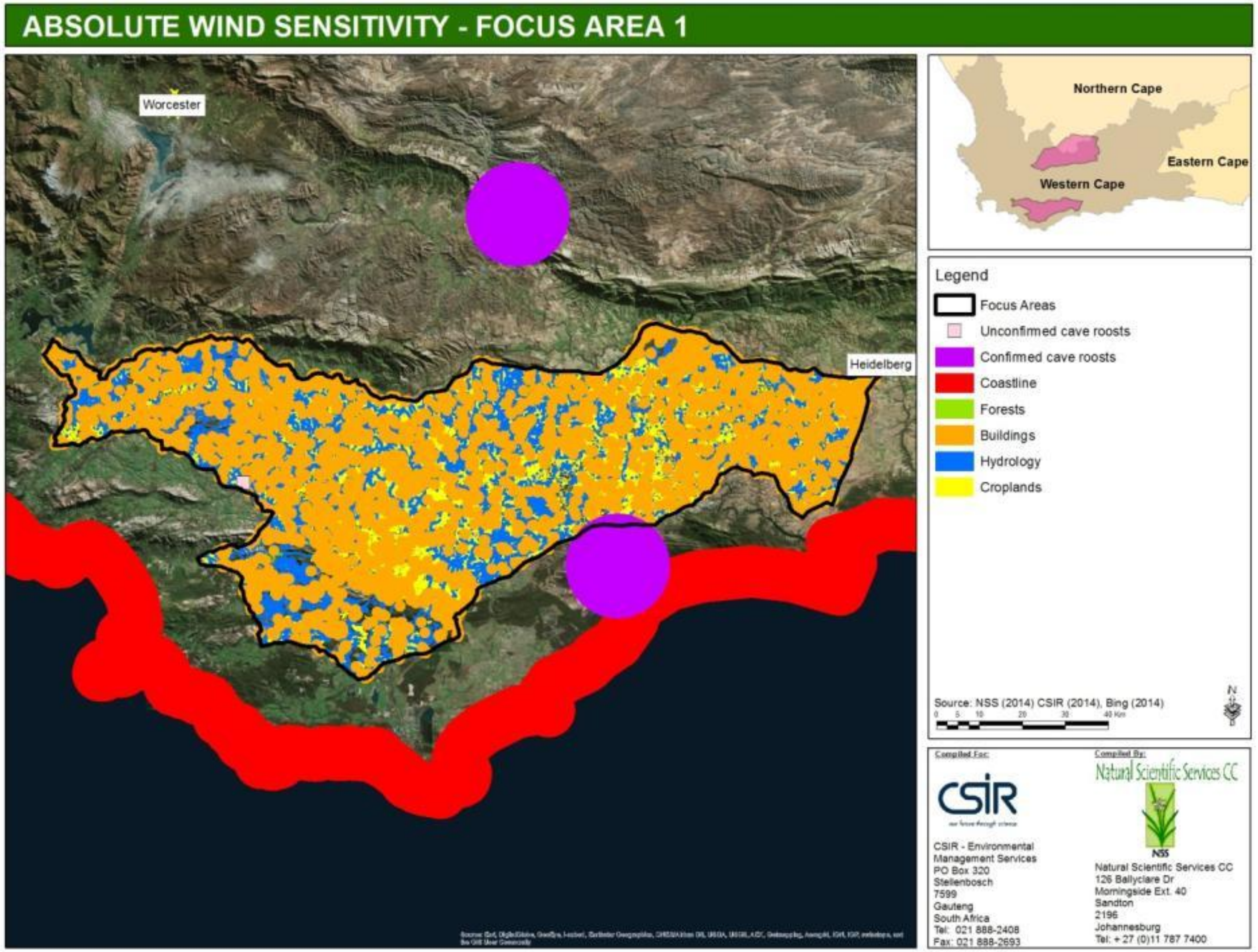
91 Adapted from the SABAAP agreed roost buffer recommendations, included in Appendix 1

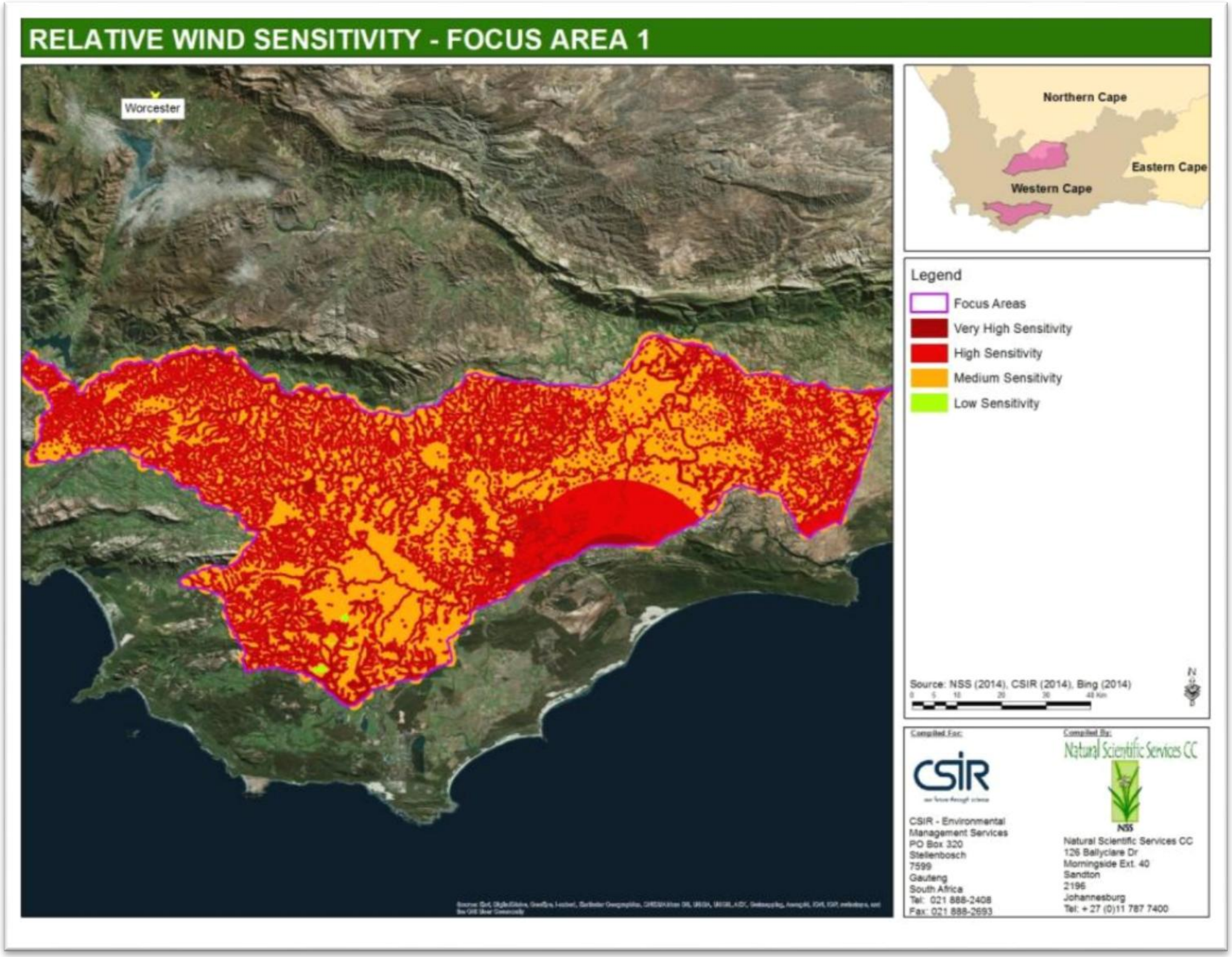
Technology	Description of feature	Identification (source)	Application (use)
Solar	Rivers and Wetlands	NFEPA River and Wetland data (2011)	Sensitivities applied to this feature were buffered as follows: [92] • Very High Sensitivity – the river and wetland layer • High Sensitivity – 200 meters on the river and wetland layer
	Geology - Lithology	SA Council for Geoscience	All Dolomite and Limestone outcrops were marked as High Sensitivity
	Vegetation - Forest	Mucina & Rutherford (2006)	All Forest habitat was marked as High Sensitivity
	Buildings	SPOT Building Count Data (2013)	All buildings, plus a 500 meter Medium Sensitivity buffer, were applied for solar.
	Croplands	Field Crop Boundaries - Department of Agriculture, Forestry and Fisheries (2013)	All croplands were marked as Medium Sensitivity
	Confirmed Small Cave Roosts	Various sources (Section 2.2) and NSS field verifications	Sensitivities applied to this feature were buffered as follows: • Very High Sensitivity – 500 meter radius from roost point
	Confirmed Medium Cave Roosts	Various sources (Section 2.2) and NSS field verifications	Sensitivities applied to this feature were buffered as follows: • Very High Sensitivity – 500 meter radius from roost point • Medium Sensitivity – 2.5 kilometre radius from roost point
	Confirmed Large Cave Roosts	Various sources (Section 2.2) and NSS field verifications	Sensitivities applied to this feature were buffered as follows: • Very High Sensitivity – 1 kilometre radius from roost point • Medium Sensitivity – 20 kilometre radius from roost point
	Unconfirmed Cave Roosts	Various sources (Section 2.2) and NSS field verifications	A 20 kilometre Medium Sensitivity radial buffer was applied from roost point
	Coastline (numerous caves along the coastline)	Surveyor General (2006) 1:50 000 topographical maps	Sensitivities applied to this feature were buffered as follows: • Very High Sensitivity – 5 kilometre distance from coastline • High Sensitivity – 10 kilometre distance from coastline • Medium Sensitivity – 20 kilometre distance from coastline

92 Adapted from the SABAAP agreed roost buffer recommendations, included in Appendix 1

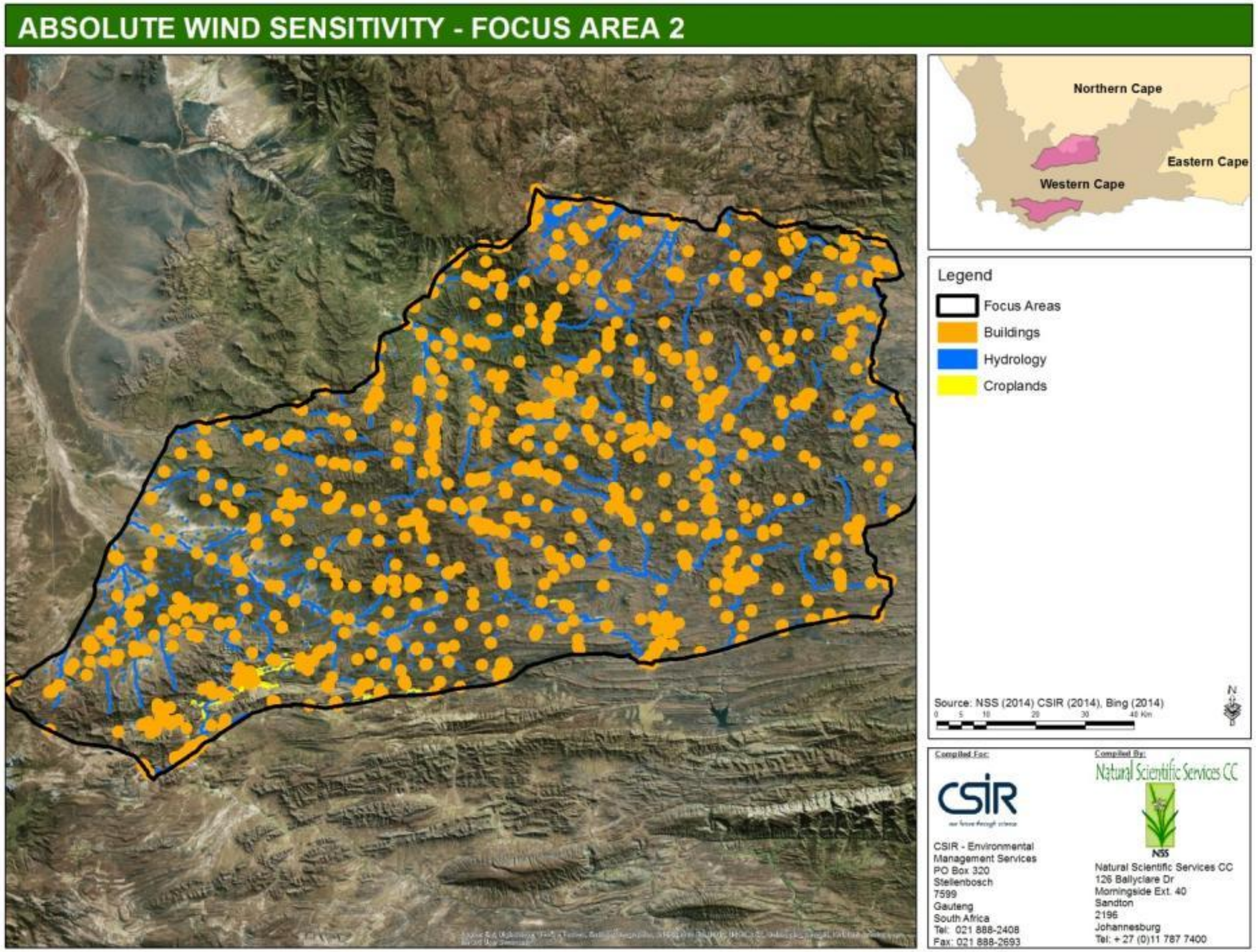
4.1 Wind Sensitivity maps

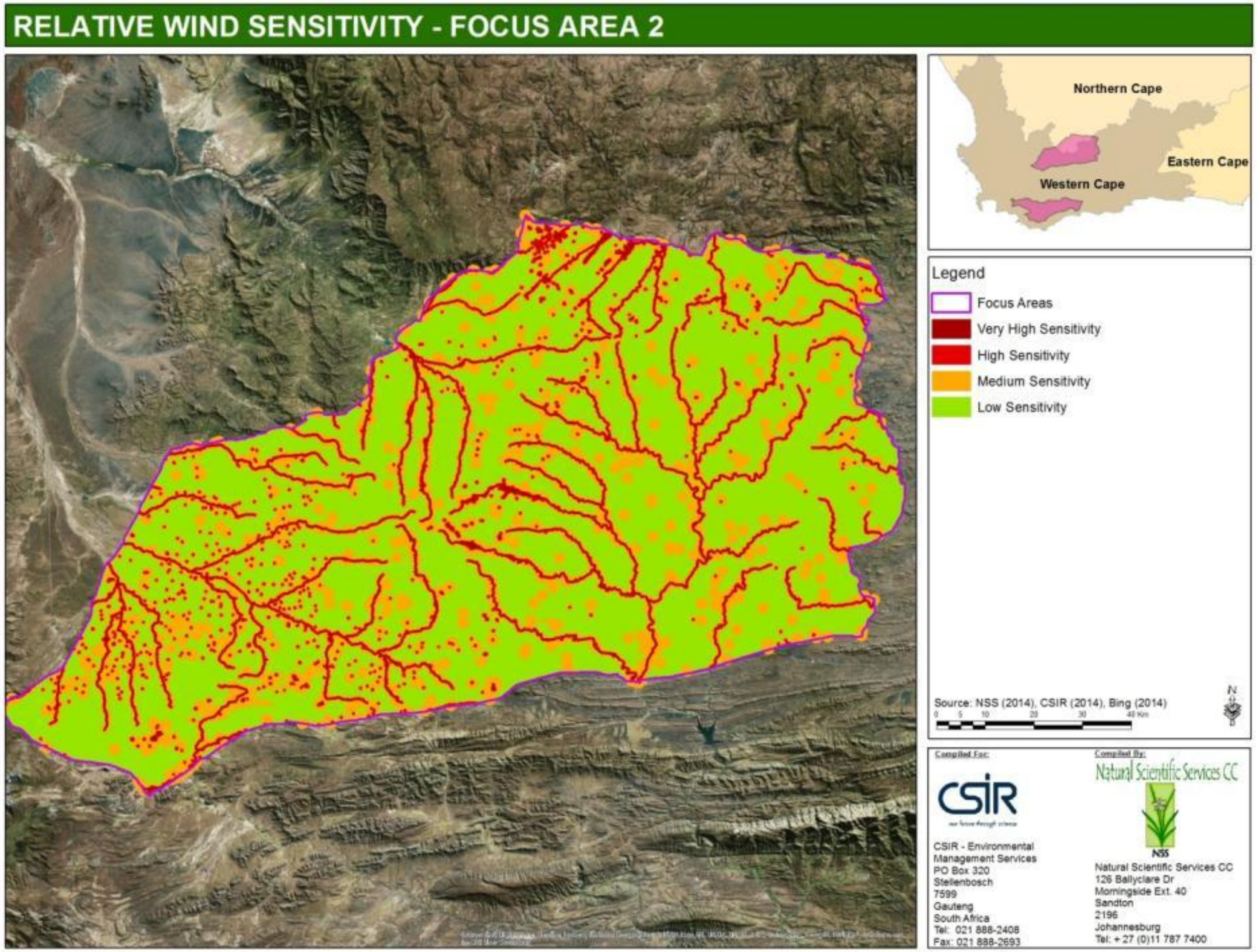
4.1.1 Overberg FA 1



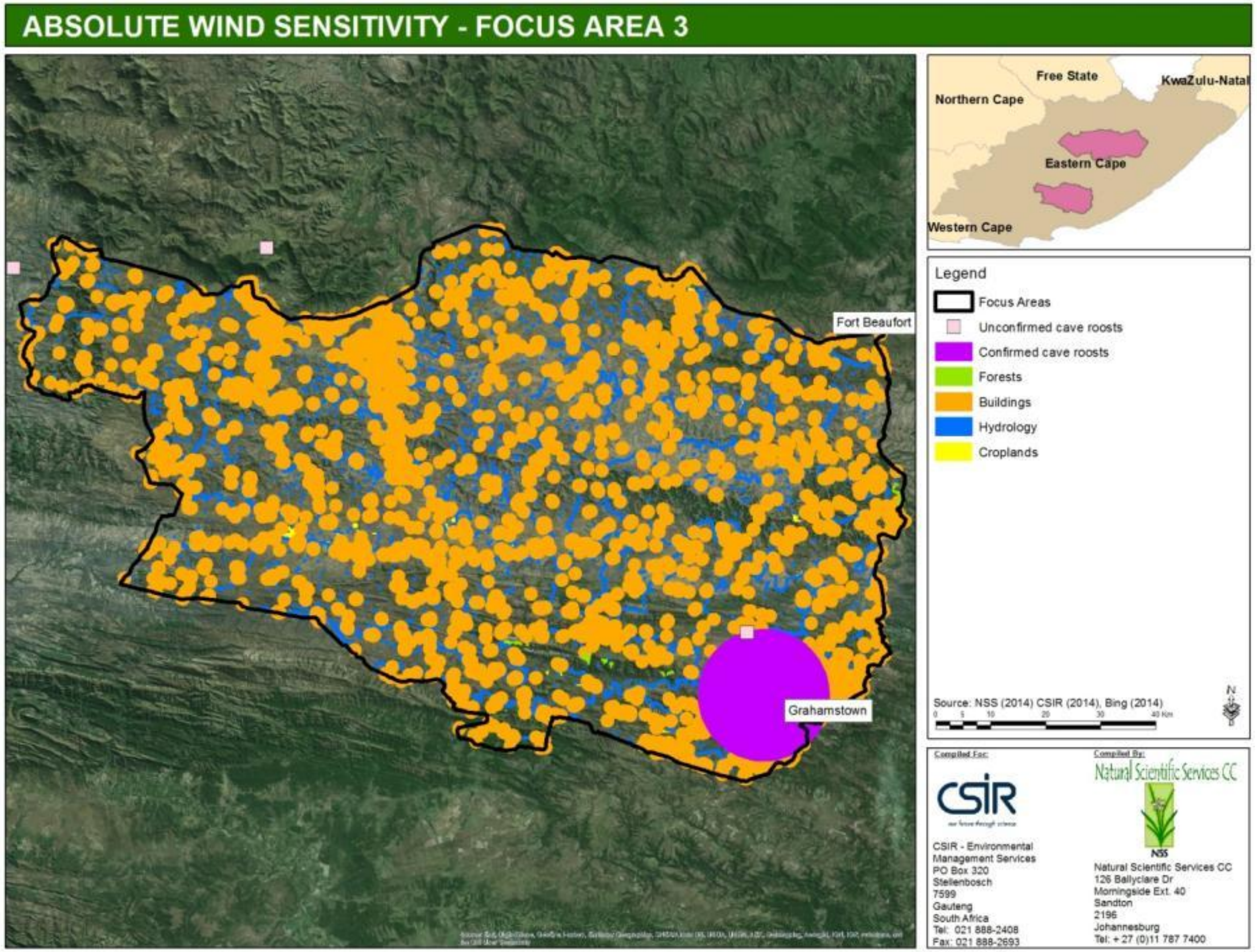

RELATIVE WIND SENSITIVITY - FOCUS AREA 1
Worcester
Northern Cape
Eastern Cape
Western Cape
Legend
Focus Areas
Very High Sensitivity
High Sensitivity
Medium Sensitivity
Low Sensitivity
Source: NSS (2014), CSIR (2014), Bing (2014)
Compiled For:
CSIR - Environmental
Management Services
PO Box 320
Stellenbosch
7599
Gauteng
South Africa
Tel: 021 888-2408
Fax: 021 888-2693
Compiled By:
Natural Scientific Services CC
NSS
Natural Scientific Services CC
126 Ballyclare Dr
Morningside Ext. 40
Sandton
2196
Johannesburg
Tel: + 27 (0)11 787 7400

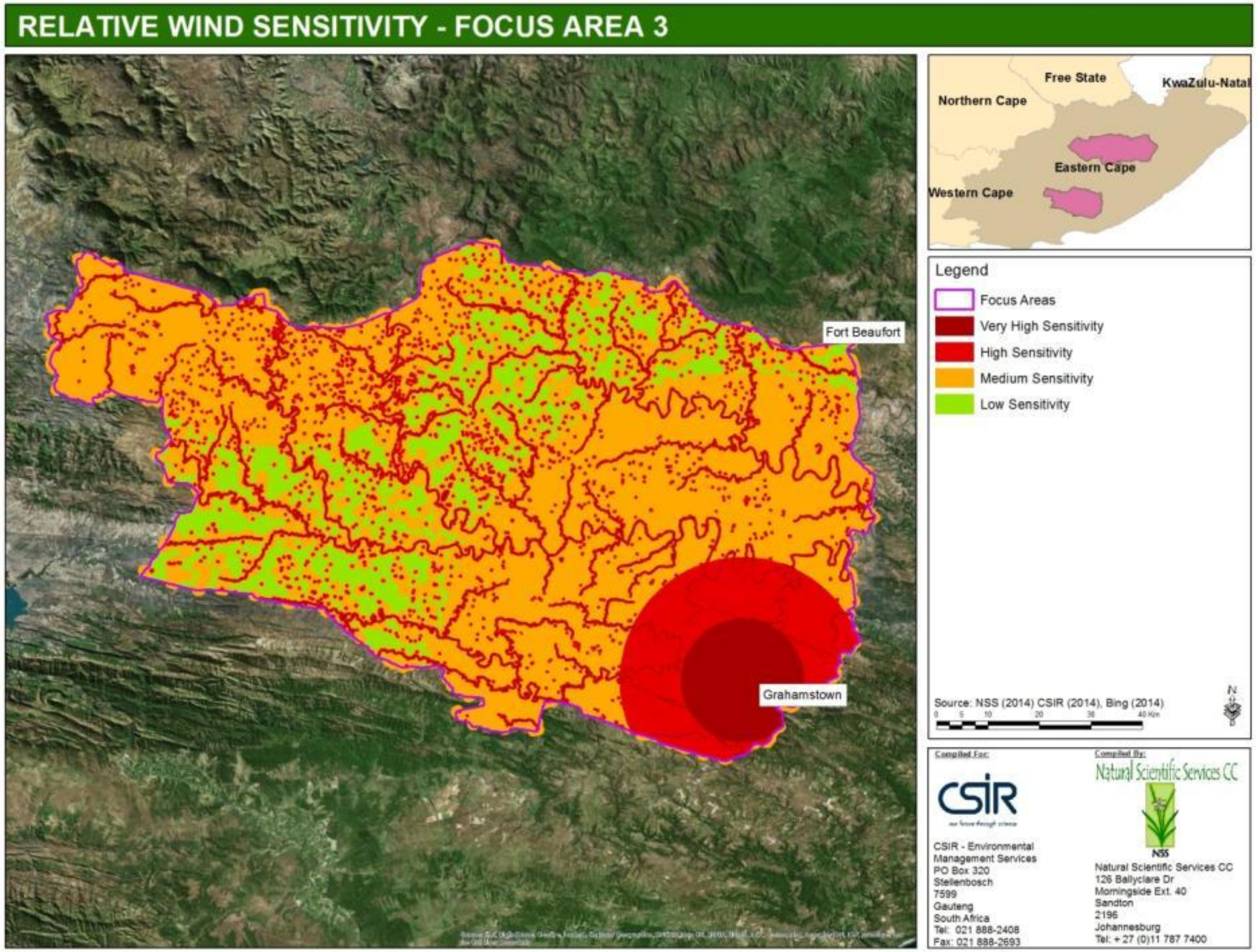
4.1.2 Komsberg FA 2




RELATIVE WIND SENSITIVITY - FOCUS AREA 2
Northern Cape
Eastern Cape
Western Cape
Legend
Focus Areas
Very High Sensitivity
High Sensitivity
Medium Sensitivity
Low Sensitivity
Source: NSS (2014), CSIR (2014), Bing (2014)
N
Compiled For:
CSIR - Environmental
Management Services
PO Box 320
Stellenbosch
7599
Gauteng
South Africa
Tel: 021 888-2408
Fax: 021 888-2693
Compiled By:
Natural Scientific Services CC
Natural Scientific Services CC
126 Ballyclare Dr
Morningside Ext. 40
Sandton
2196
Johannesburg
Tel: + 27 (0)11 787 7400

4.1.3 Cookhouse FA 3




RELATIVE WIND SENSITIVITY - FOCUS AREA 3
Fort Beaufort
Grahamstown
Free State
KwaZulu-Natal
Northern Cape
Eastern Cape
Western Cape
Legend
Focus Areas
Very High Sensitivity
High Sensitivity
Medium Sensitivity
Low Sensitivity
Source: NSS (2014) CSIR (2014), Bing (2014)
Compiled For:
CSIR - Environmental Management Services
PO Box 320
Stellenbosch
7599
Gauteng
South Africa
Tel: 021 888-2408
Fax: 021 888-2693
Compiled By:
Natural Scientific Services CC
NSS
Natural Scientific Services CC
126 Ballyclare Dr
Morningside Ext. 40
Sandton
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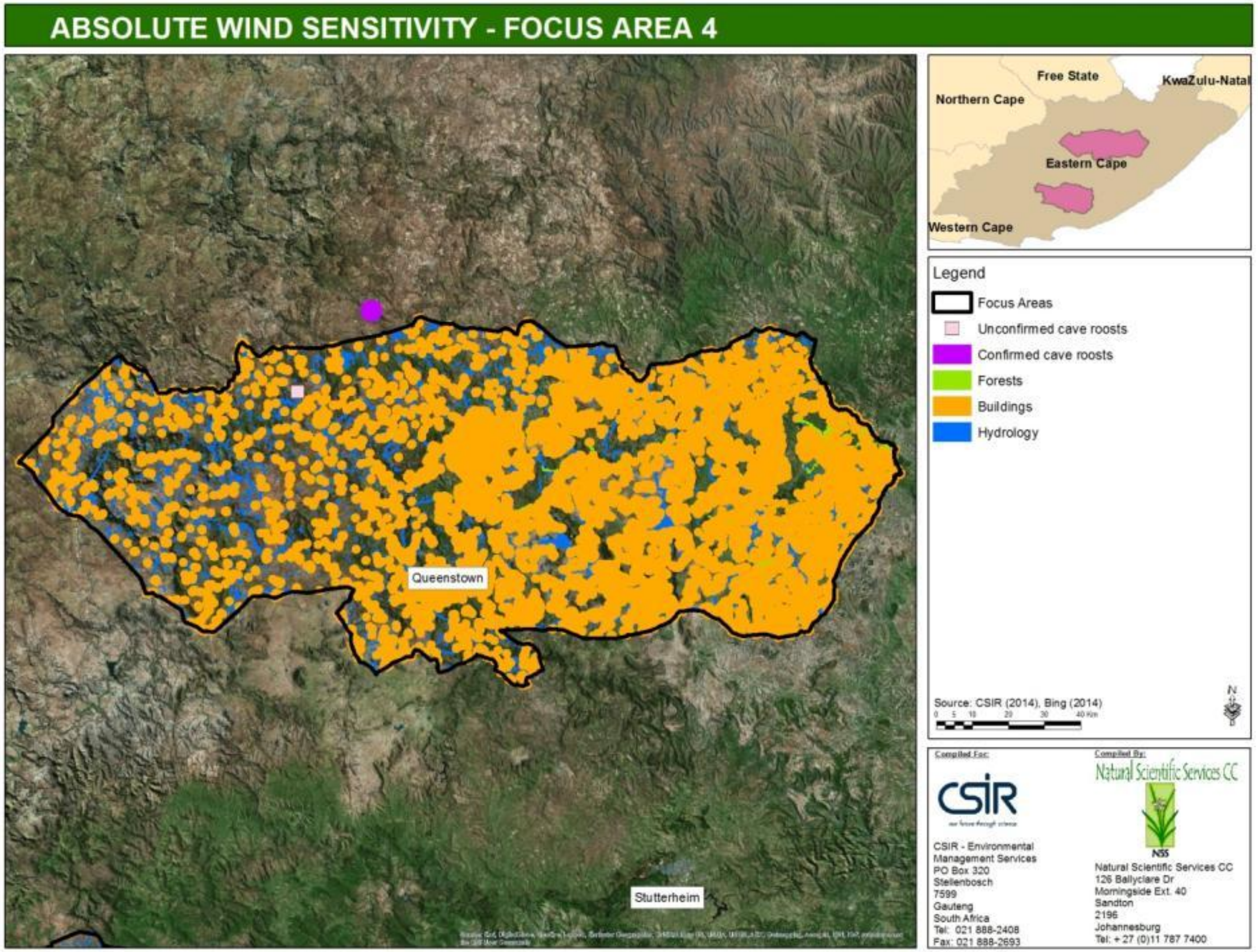
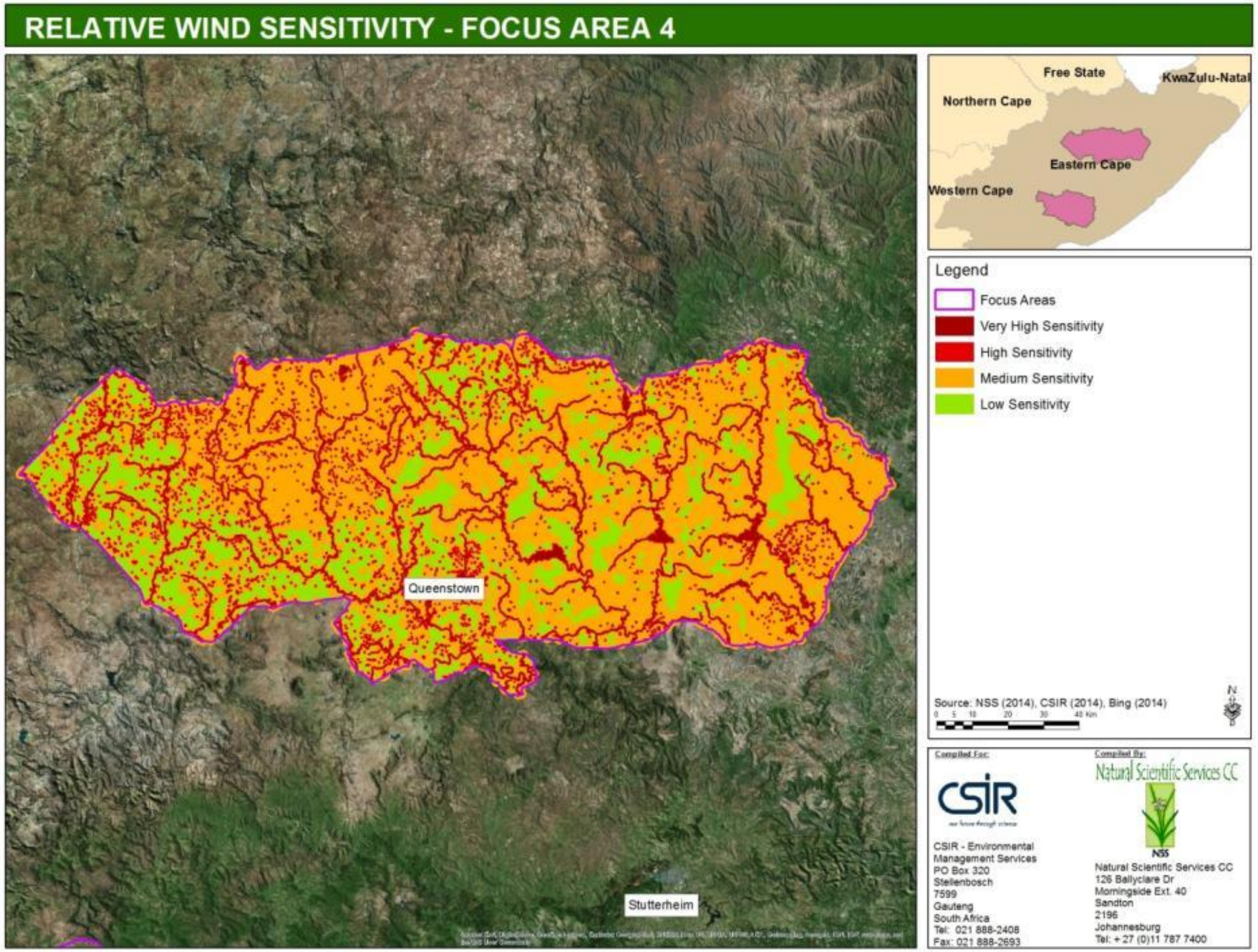
Johannesburg
Tel: + 27 (0)11 787 7400

4.1.4 Stormberg FA 4




RELATIVE WIND SENSITIVITY - FOCUS AREA 4
Free State
KwaZulu-Natal
Northern Cape
Eastern Cape
Western Cape
Legend
Focus Areas
Very High Sensitivity
High Sensitivity
Medium Sensitivity
Low Sensitivity
Queenstown
Stutterheim
Source: NSS (2014), CSIR (2014), Bing (2014)
0 5 10 20 30 40 Km
N
Compiled For:
CSIR - Environmental
Management Services
PO Box 320
Stellenbosch
7599
Gauteng
South Africa
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Fax: 021 888-2693
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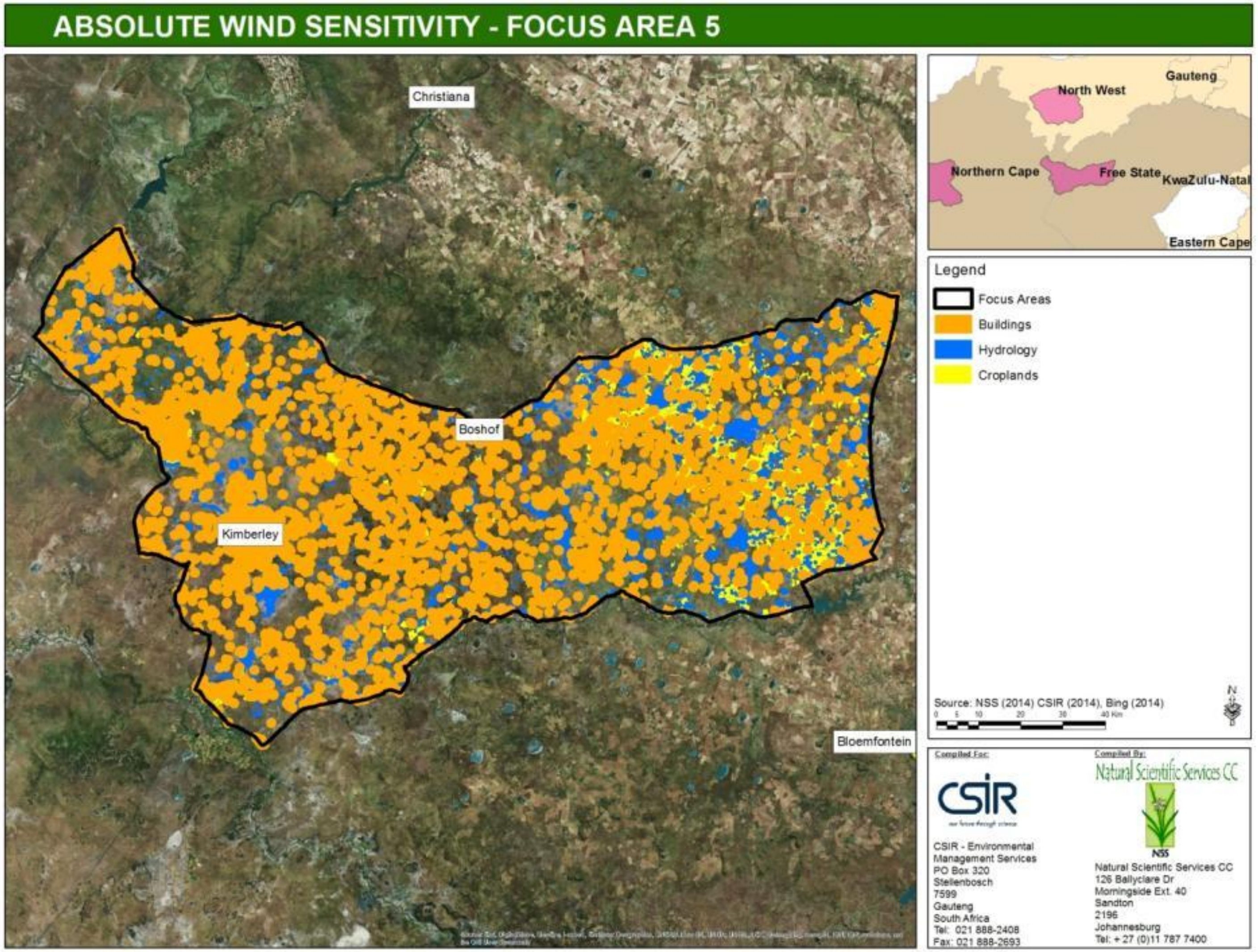
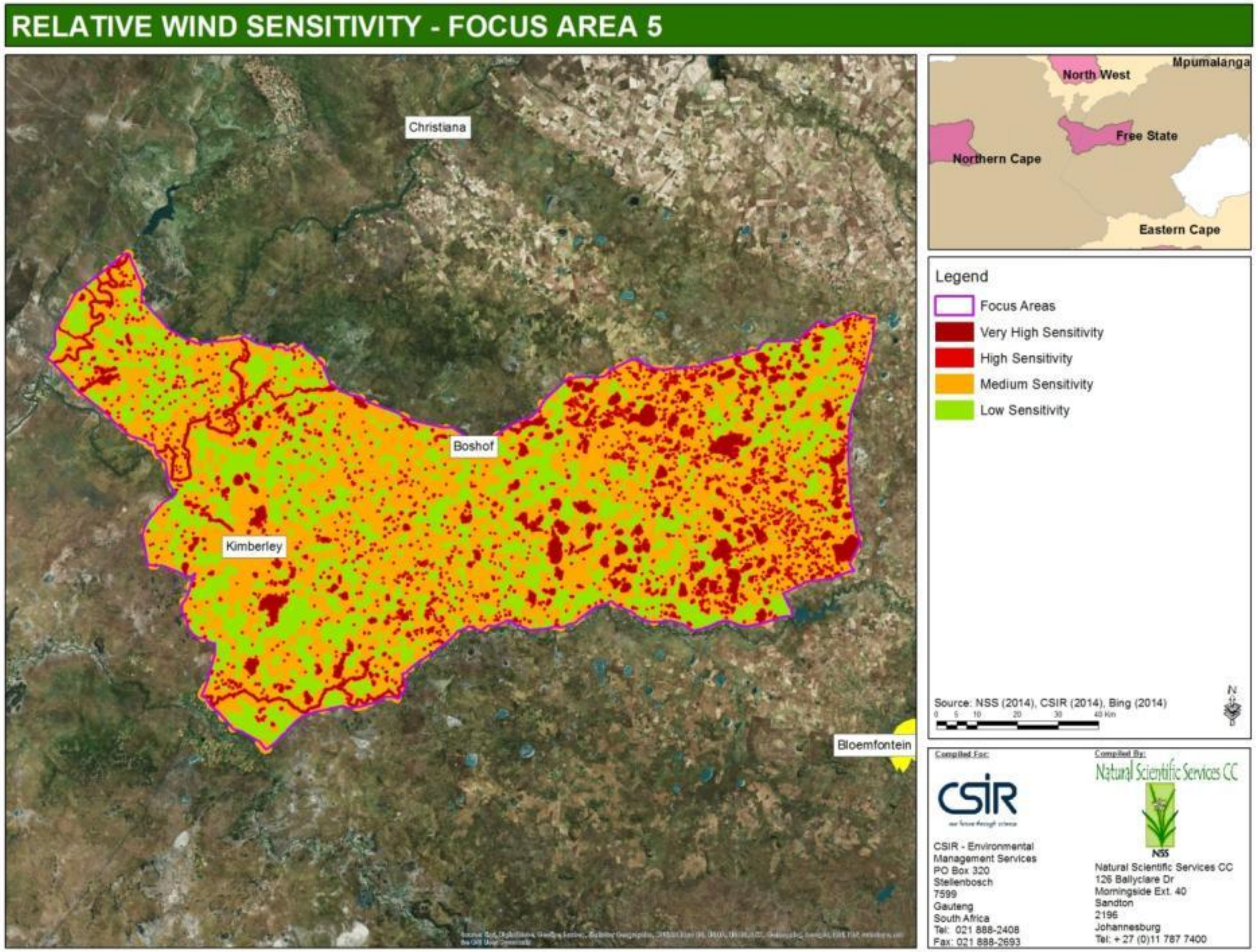
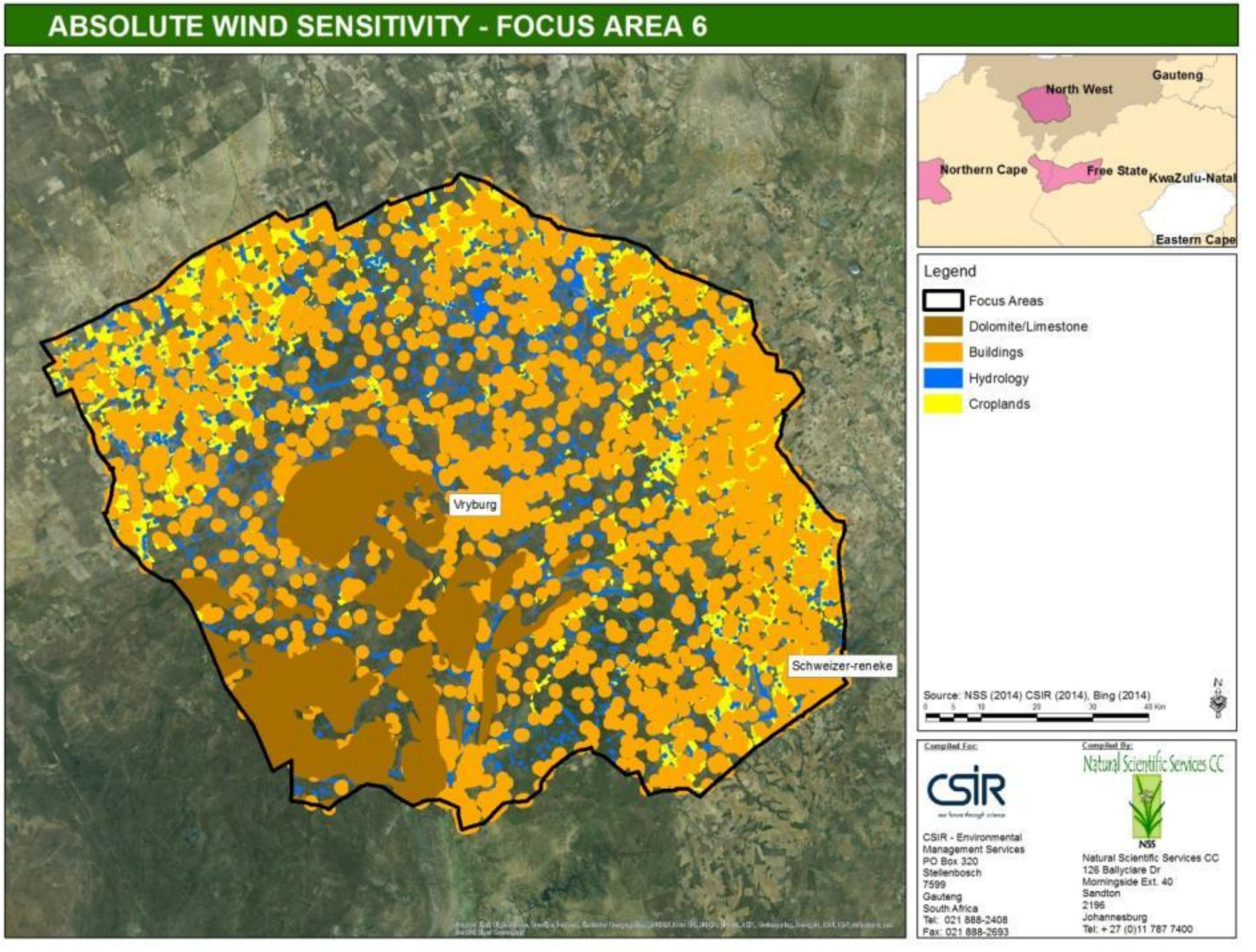
Sandton
2196
Johannesburg
Tel: + 27 (0)11 787 7400

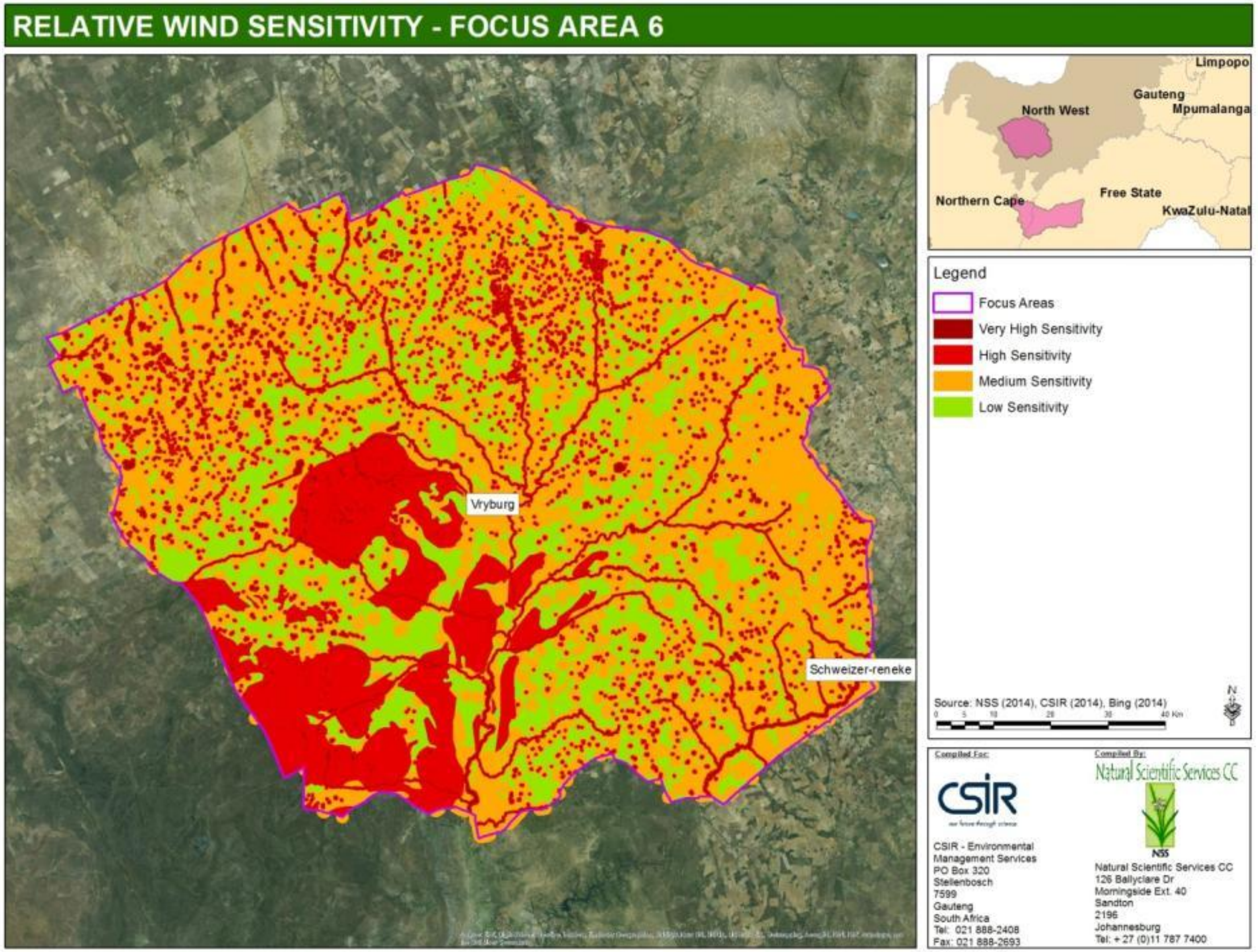
4.1.5 Kimberley FA 5



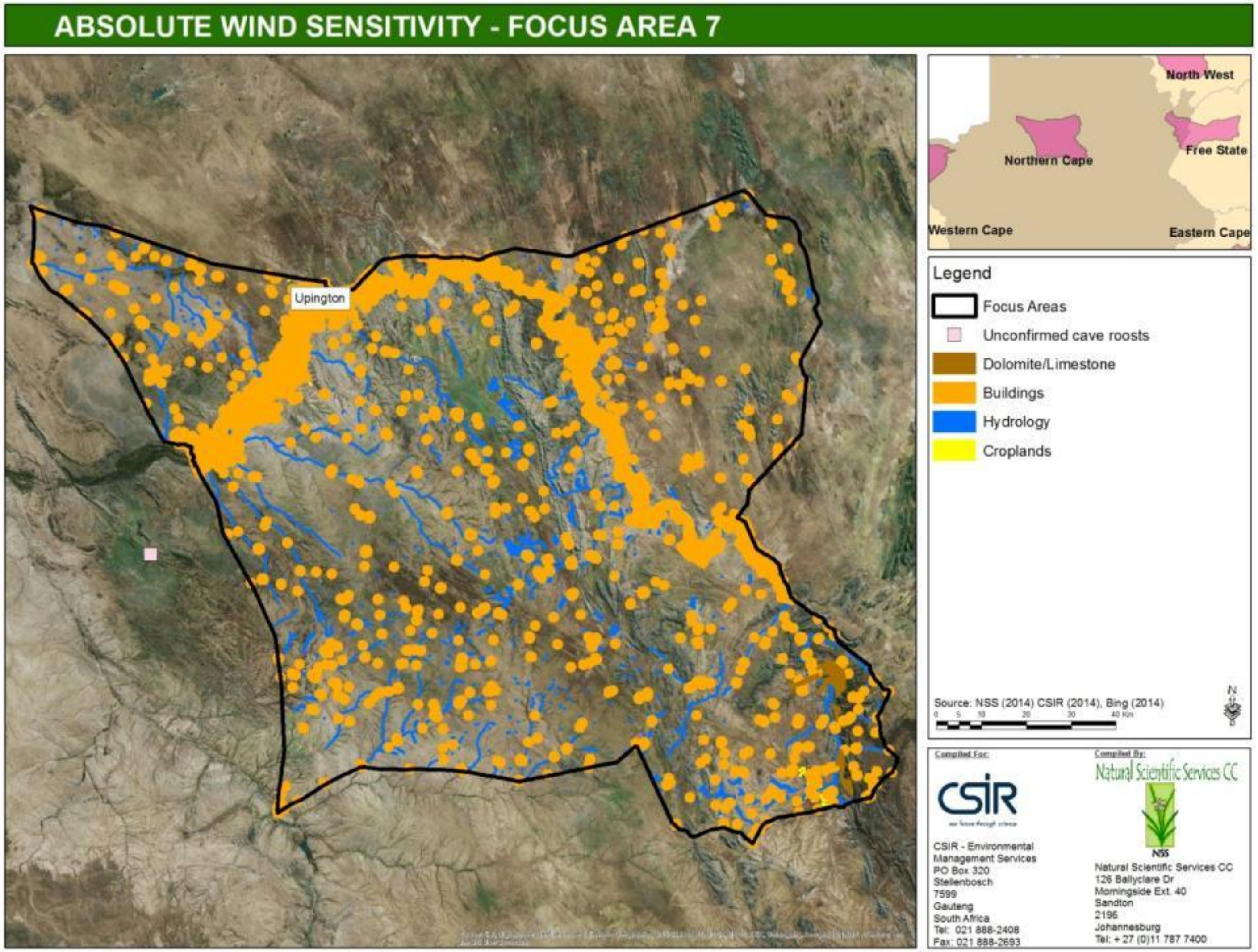

RELATIVE WIND SENSITIVITY - FOCUS AREA 5
Christiana
Boshof
Kimberley
Bloemfontein
North West
Mpumalanga
Free State
Northern Cape
Eastern Cape
Legend
Focus Areas
Very High Sensitivity
High Sensitivity
Medium Sensitivity
Low Sensitivity
Source: NSS (2014), CSIR (2014), Bing (2014)
Compiled For:
CSIR - Environmental Management Services
PO Box 320
Stellenbosch
7599
Gauteng
South Africa
Tel: 021 888-2408
Fax: 021 888-2693
Compiled By:
Natural Scientific Services CC
Natural Scientific Services CC
126 Ballyclare Dr
Morningside Ext. 40
Sandton
2196
Johannesburg
Tel: + 27 (0)11 787 7400

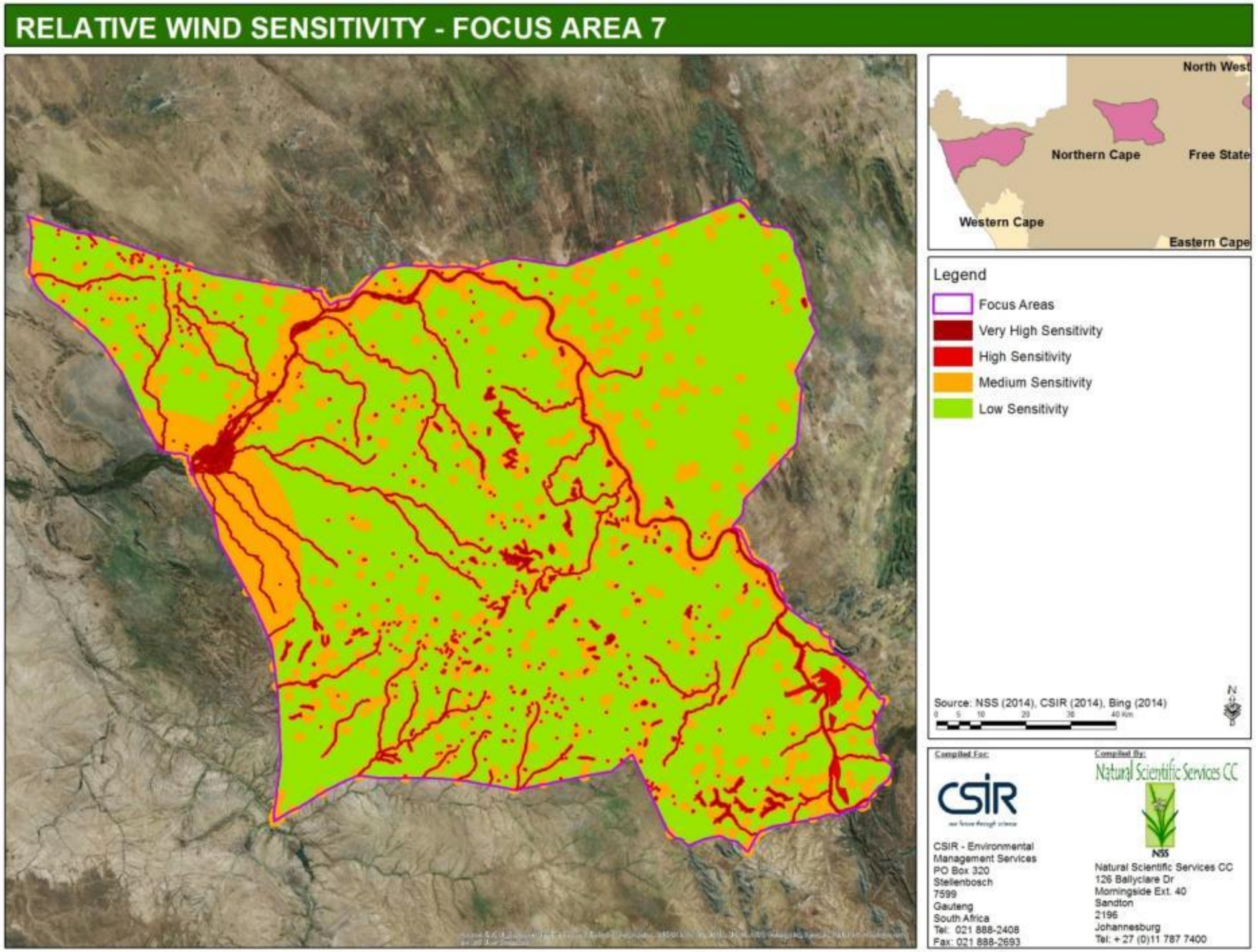
4.1.6 Vryburg FA 6



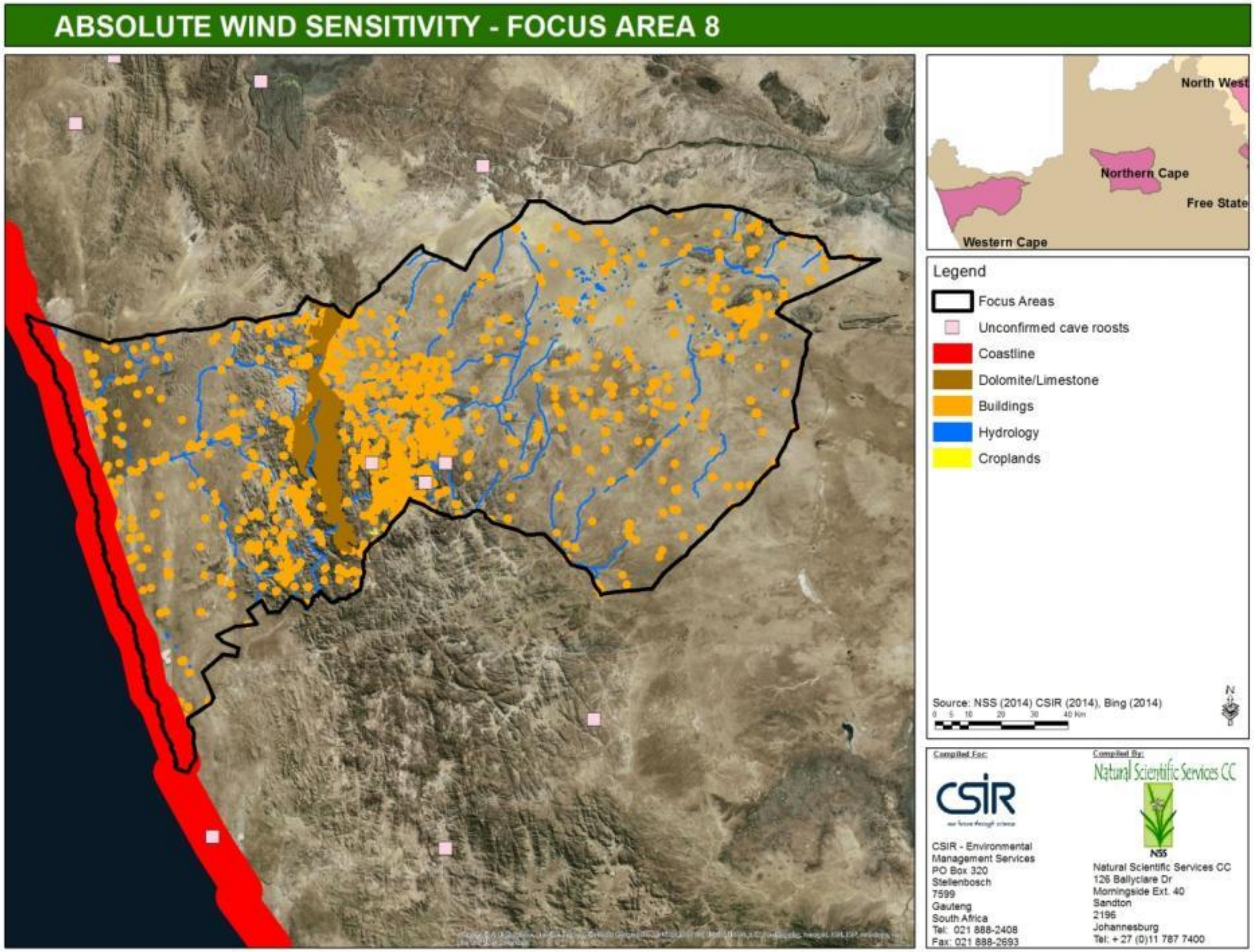

RELATIVE WIND SENSITIVITY - FOCUS AREA 6
Vryburg
Schweizer-reneke
Limpopo
North West
Gauteng
Mpumalanga
Northern Cape
Free State
KwaZulu-Natal
Legend
Focus Areas
Very High Sensitivity
High Sensitivity
Medium Sensitivity
Low Sensitivity
Source: NSS (2014), CSIR (2014), Bing (2014)
N
Compiled For:
CSIR - Environmental Management Services
PO Box 320
Stellenbosch
7599
Gauteng
South Africa
Tel: 021 888-2408
Fax: 021 888-2693
Compiled By:
Natural Scientific Services CC
NSS
Natural Scientific Services CC
126 Ballyclare Dr
Morningside Ext. 40
Sandton
2196
Johannesburg
Tel: + 27 (0)11 787 7400

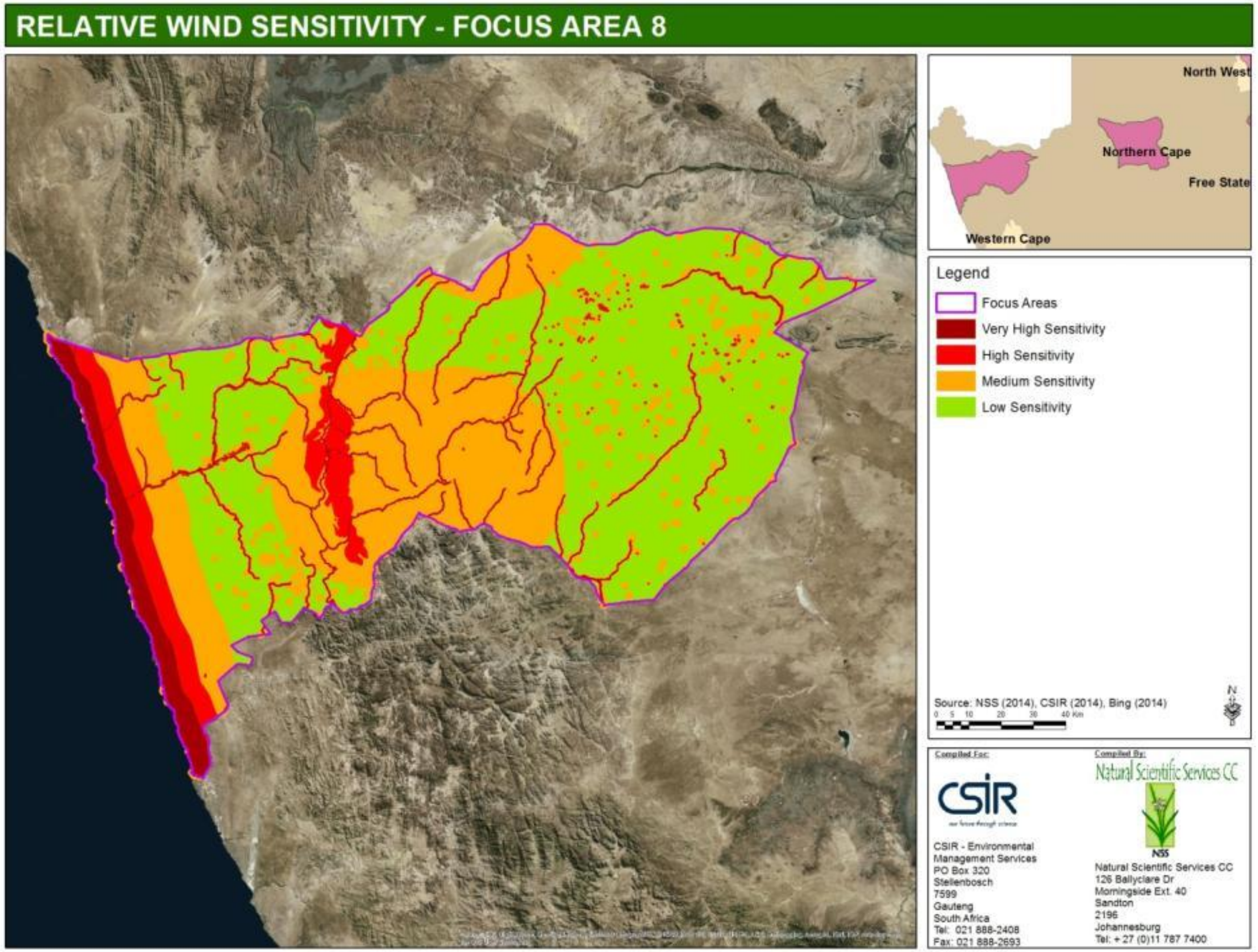
4.1.7 Upington FA 7




RELATIVE WIND SENSITIVITY - FOCUS AREA 7
North West
Northern Cape
Free State
Western Cape
Eastern Cape
Legend
Focus Areas
Very High Sensitivity
High Sensitivity
Medium Sensitivity
Low Sensitivity
Source: NSS (2014), CSIR (2014), Bing (2014)
Compiled For:
CSIR - Environmental Management Services
PO Box 320
Stellenbosch
7599
Gauteng
South Africa
Tel: 021 888-2408
Fax: 021 888-2693
Compiled By:
Natural Scientific Services CC
Natural Scientific Services CC
126 Ballyclare Dr
Morningside Ext. 40
Sandton
2196
Johannesburg
Tel: + 27 (0)11 787 7400

4.1.8 Springbok FA 8




RELATIVE WIND SENSITIVITY - FOCUS AREA 8
North West
Northern Cape
Free State
Western Cape
Legend
Focus Areas
Very High Sensitivity
High Sensitivity
Medium Sensitivity
Low Sensitivity
Source: NSS (2014), CSIR (2014), Bing (2014)
Compiled For:
CSIR - Environmental Management Services
PO Box 320
Stellenbosch
7599
Gauteng
South Africa
Tel: 021 888-2408
Fax: 021 888-2693
Compiled By:
Natural Scientific Services CC
Natural Scientific Services CC
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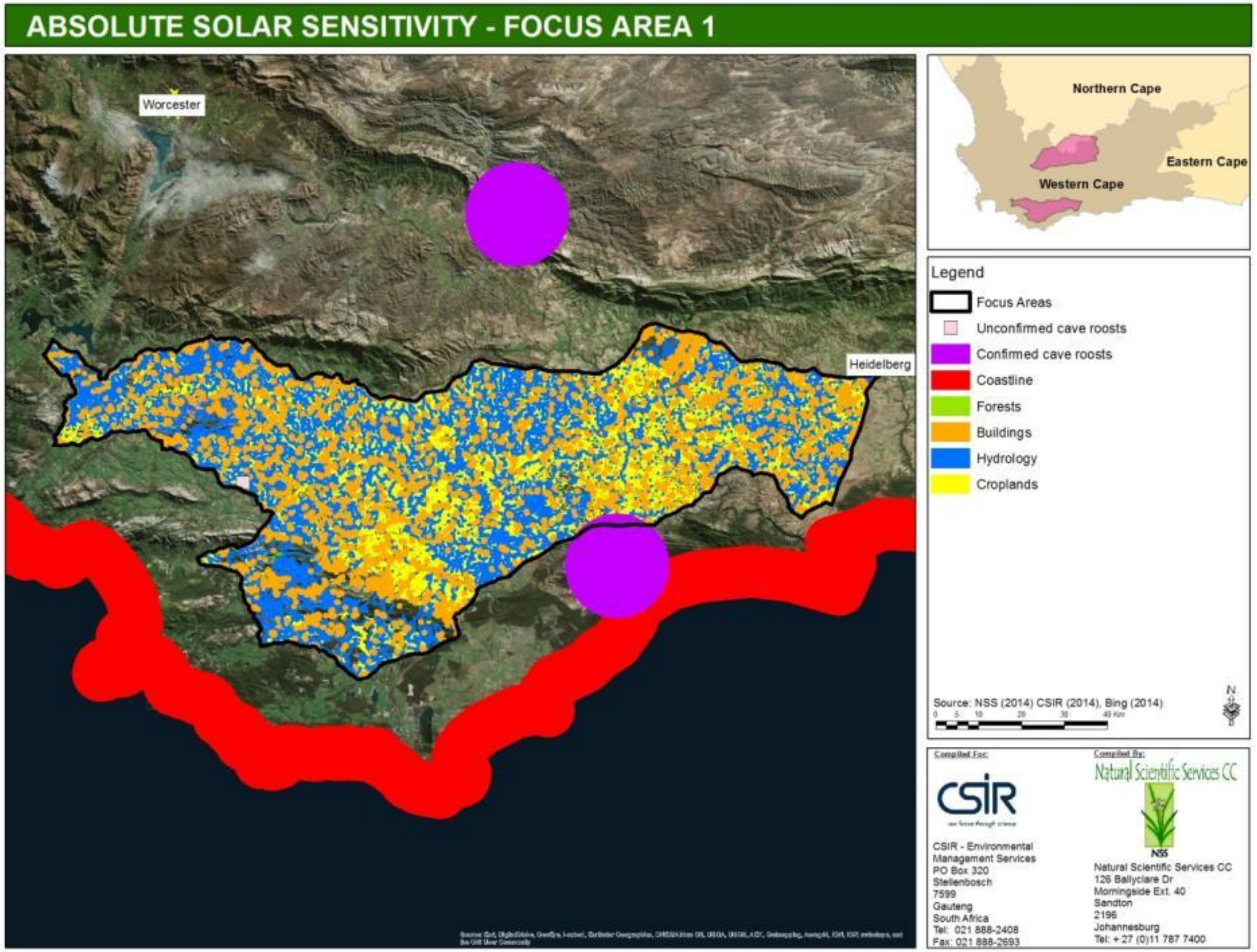
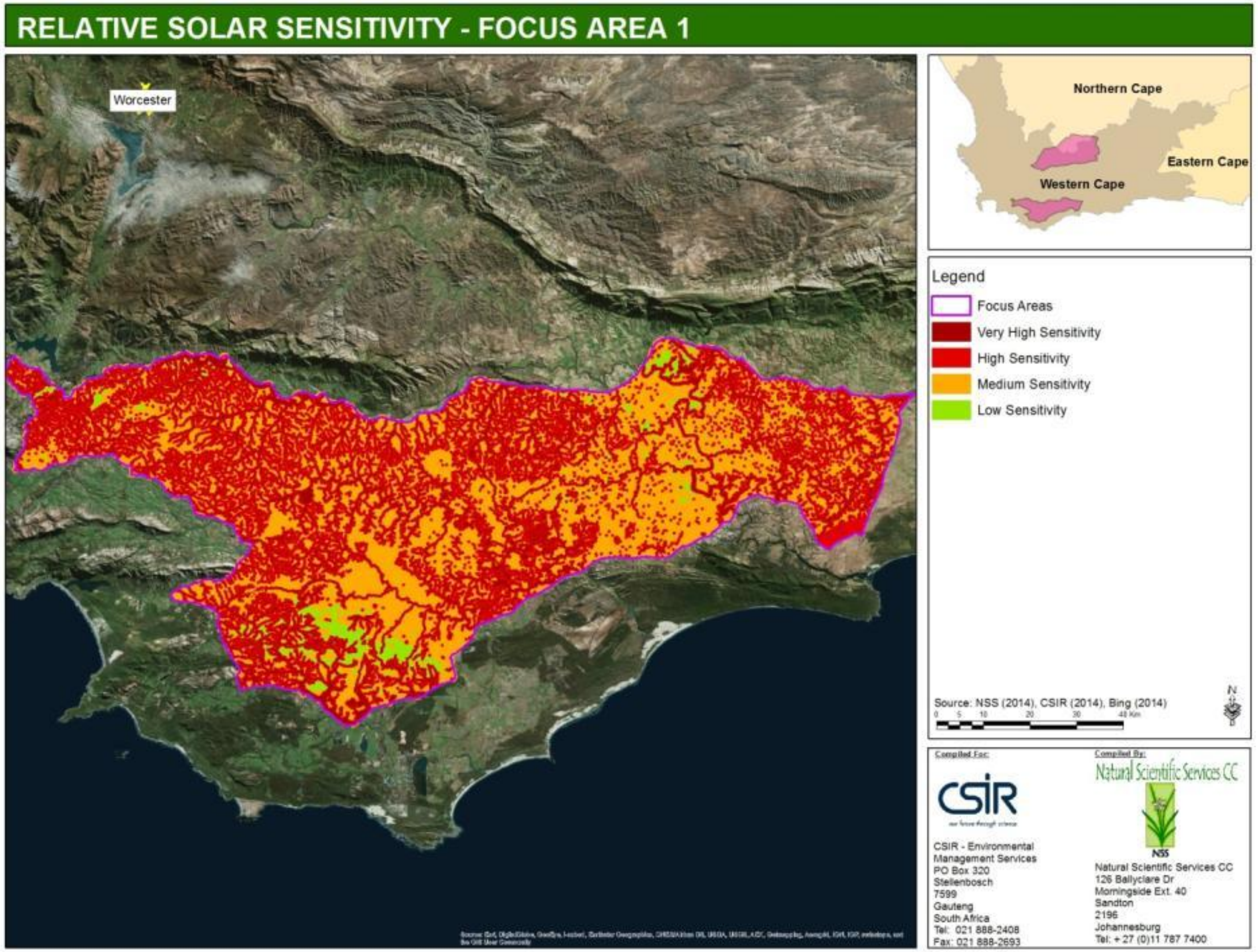
4.2 Solar Sensitivity maps

4.2.1 Overberg FA 1




RELATIVE SOLAR SENSITIVITY - FOCUS AREA 1
Worcester
Northern Cape
Eastern Cape
Western Cape
Legend
Focus Areas
Very High Sensitivity
High Sensitivity
Medium Sensitivity
Low Sensitivity
Source: NSS (2014), CSIR (2014), Bing (2014)
Compiled For:
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Johannesburg
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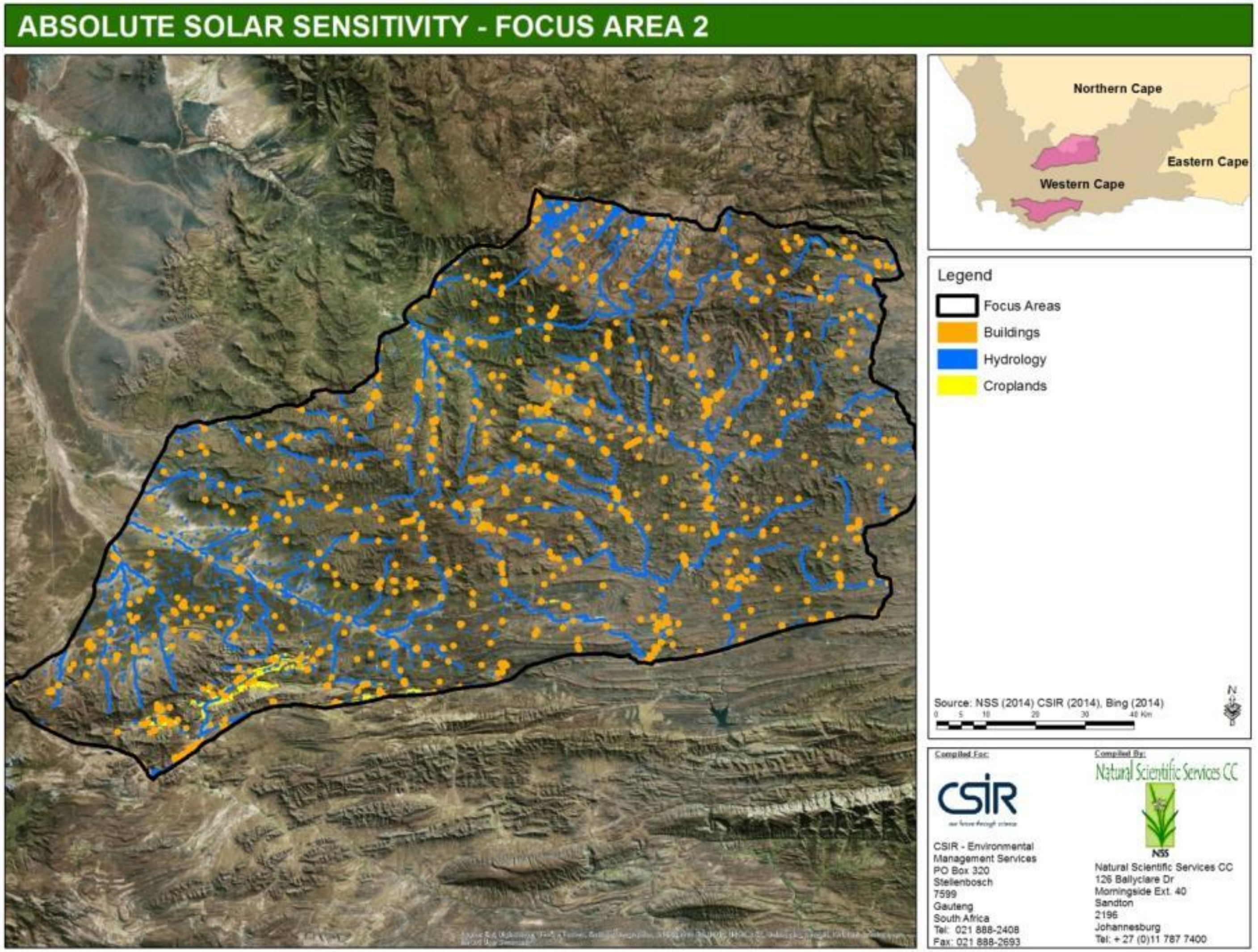
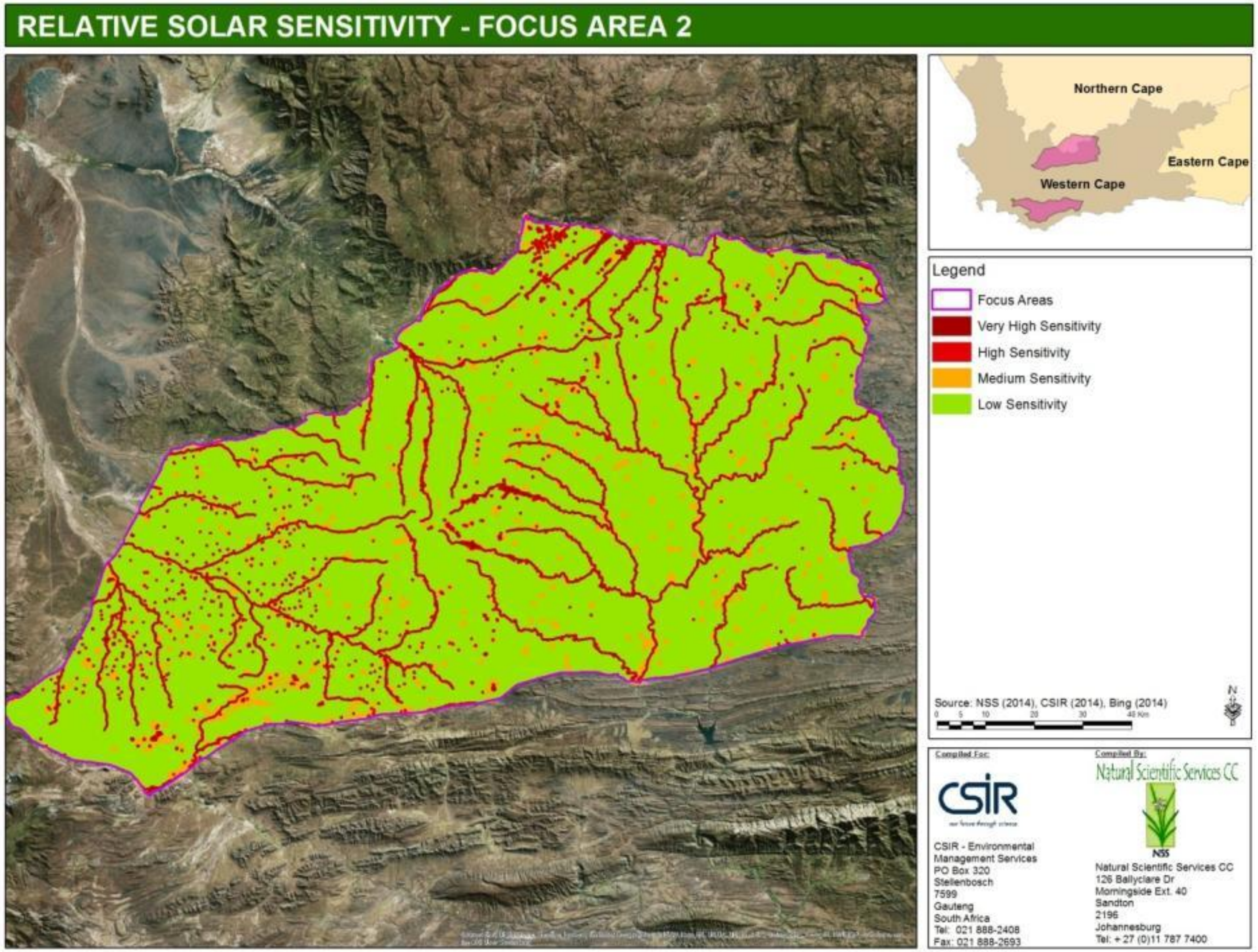
4.2.2 Komsberg FA 2




RELATIVE SOLAR SENSITIVITY - FOCUS AREA 2
Northern Cape
Eastern Cape
Western Cape
Legend
Focus Areas
Very High Sensitivity
High Sensitivity
Medium Sensitivity
Low Sensitivity
Source: NSS (2014), CSIR (2014), Bing (2014)
Compiled For:
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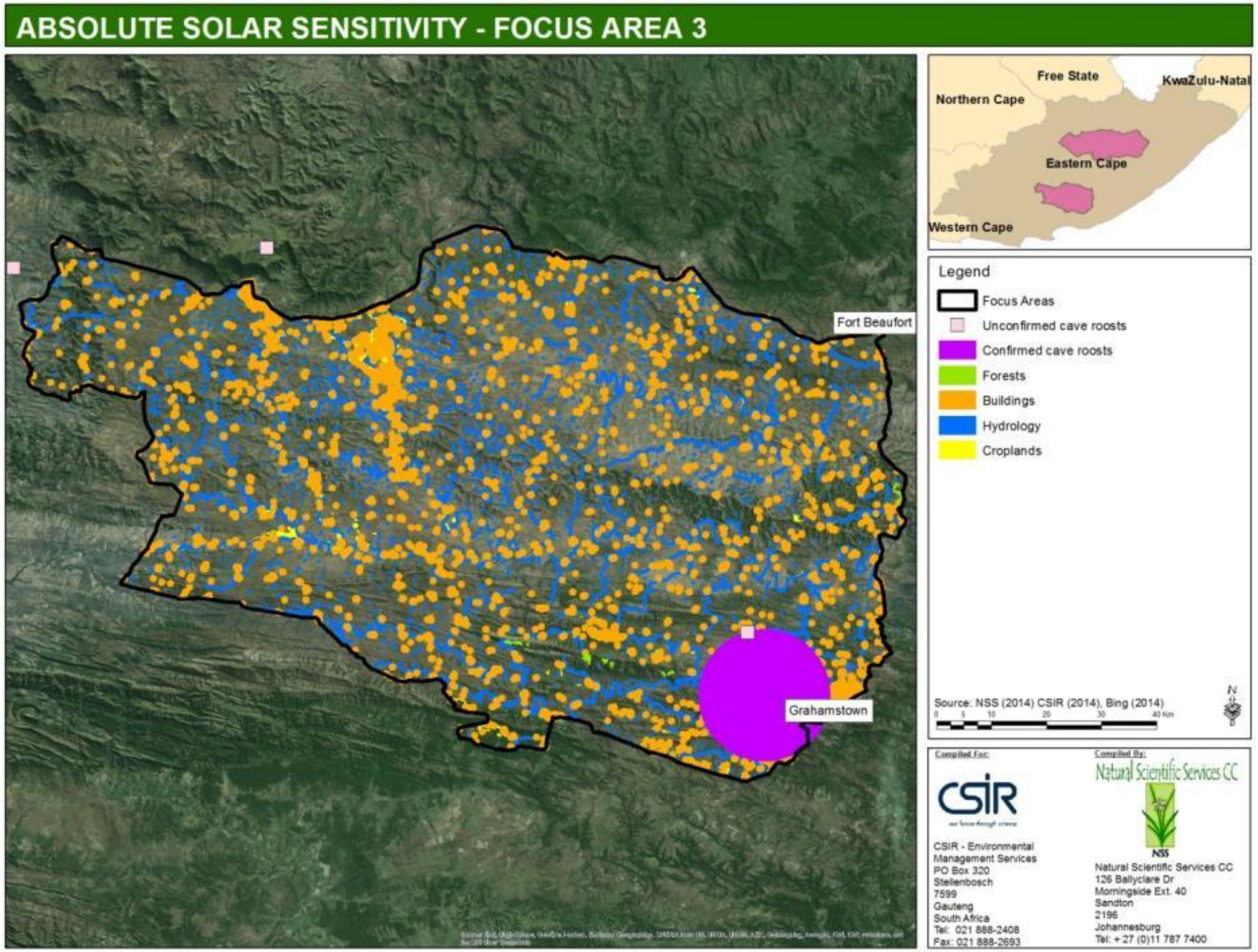
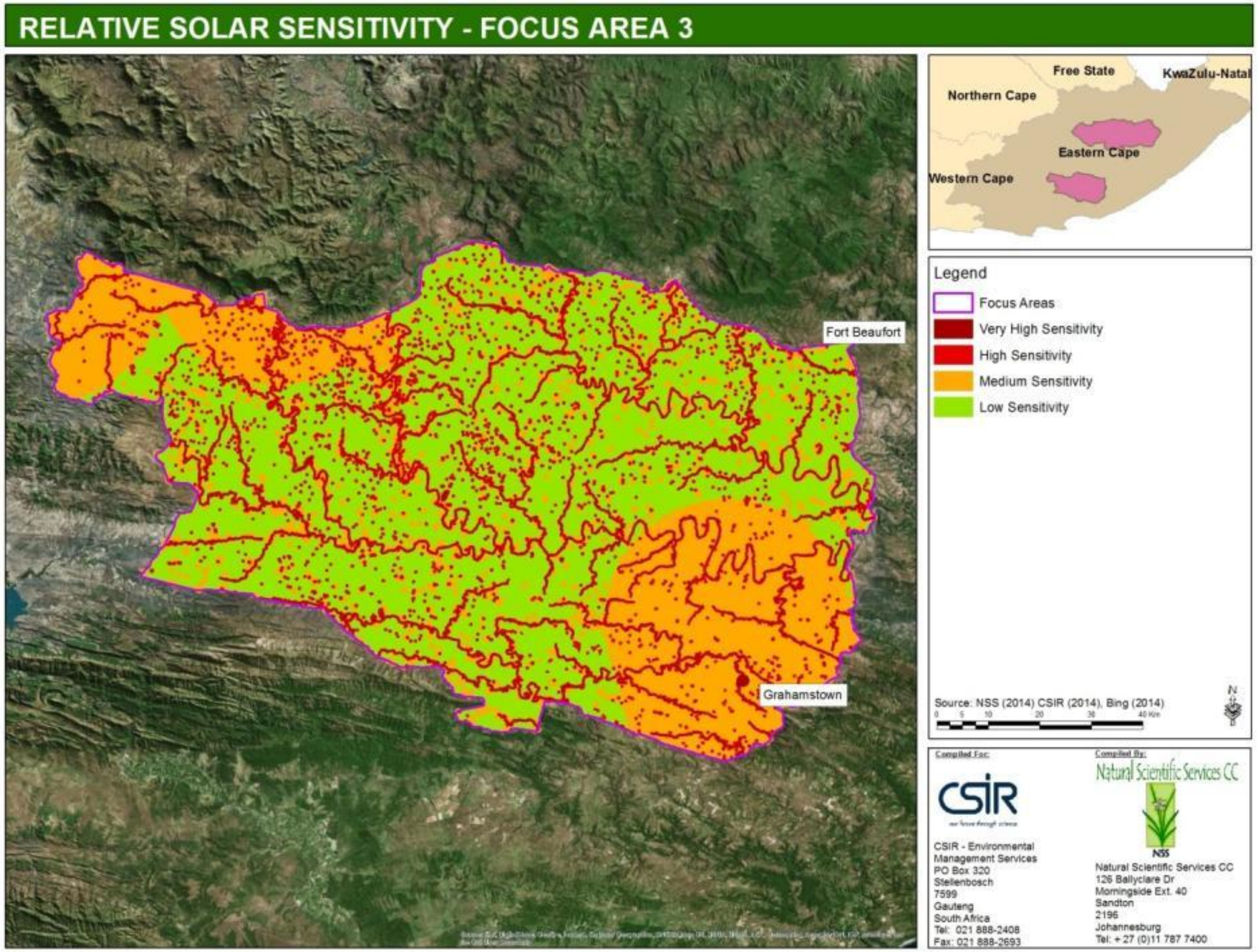
4.2.3 Cookhouse FA 3




RELATIVE SOLAR SENSITIVITY - FOCUS AREA 3
Fort Beaufort
Grahamstown
Free State
KwaZulu-Natal
Northern Cape
Eastern Cape
Western Cape
Legend
Focus Areas
Very High Sensitivity
High Sensitivity
Medium Sensitivity
Low Sensitivity
Source: NSS (2014) CSIR (2014), Bing (2014)
0 5 10 20 30 40 Km
N
Compiled For:
CSIR - Environmental
Management Services
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Stellenbosch
7599
Gauteng
South Africa
Tel: 021 888-2408
Fax: 021 888-2693
Compiled By:
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NSS
Natural Scientific Services CC
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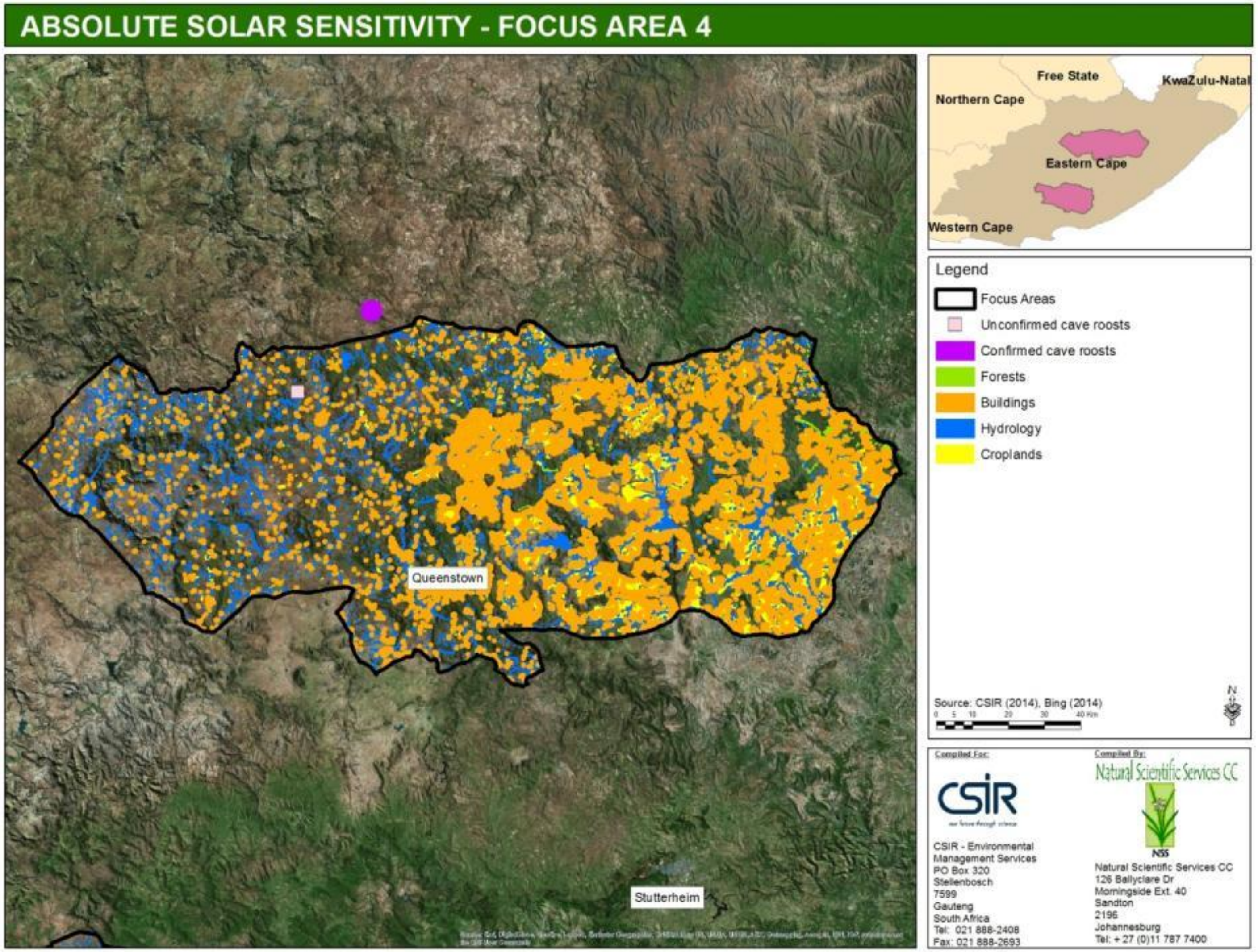
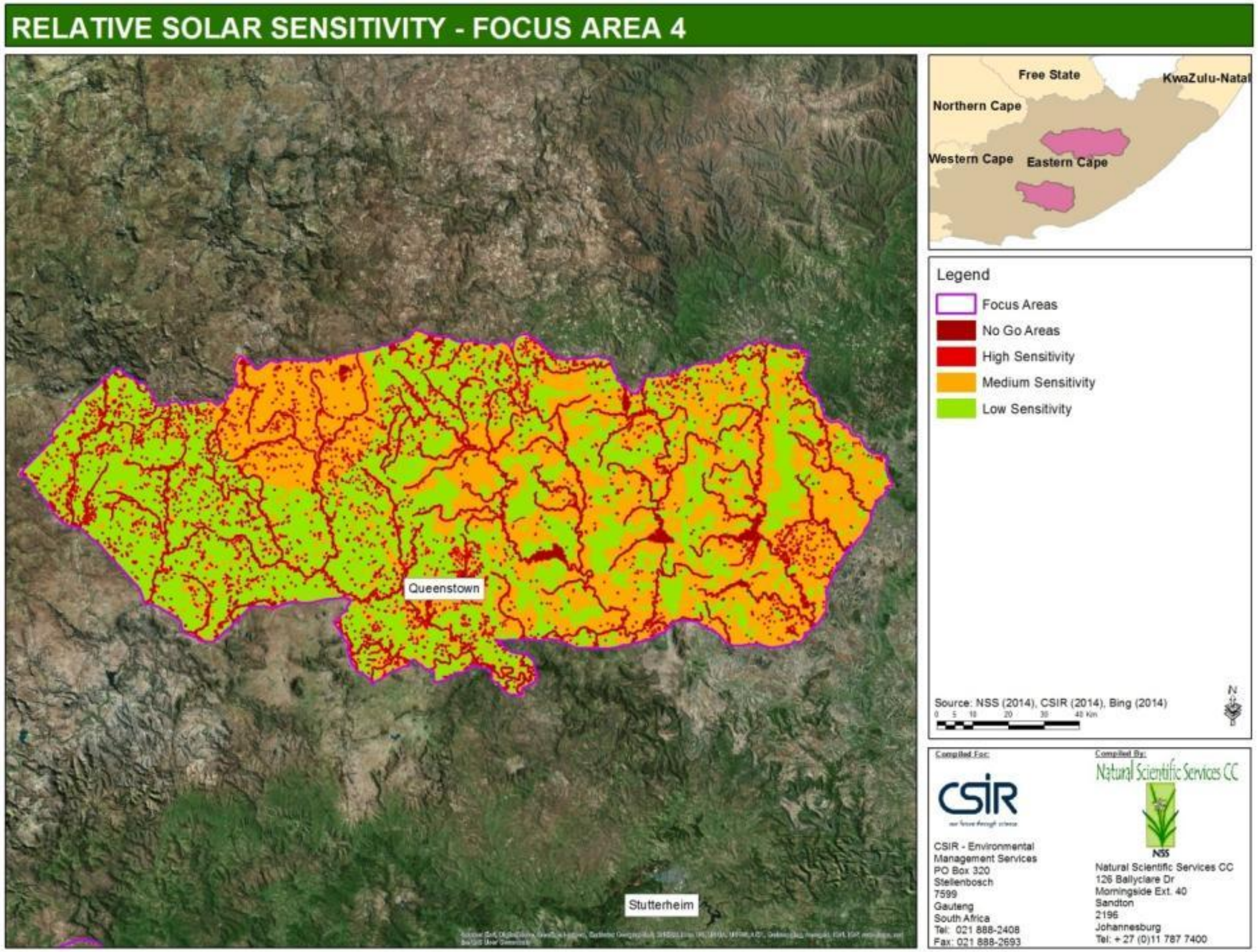
2196
Johannesburg
Tel: + 27 (0)11 787 7400

4.2.4 Stormberg FA 4




RELATIVE SOLAR SENSITIVITY - FOCUS AREA 4
Queenstown
Stutterheim
Free State
KwaZulu-Natal
Northern Cape
Western Cape
Eastern Cape
Legend
Focus Areas
No Go Areas
High Sensitivity
Medium Sensitivity
Low Sensitivity
Source: NSS (2014), CSIR (2014), Bing (2014)
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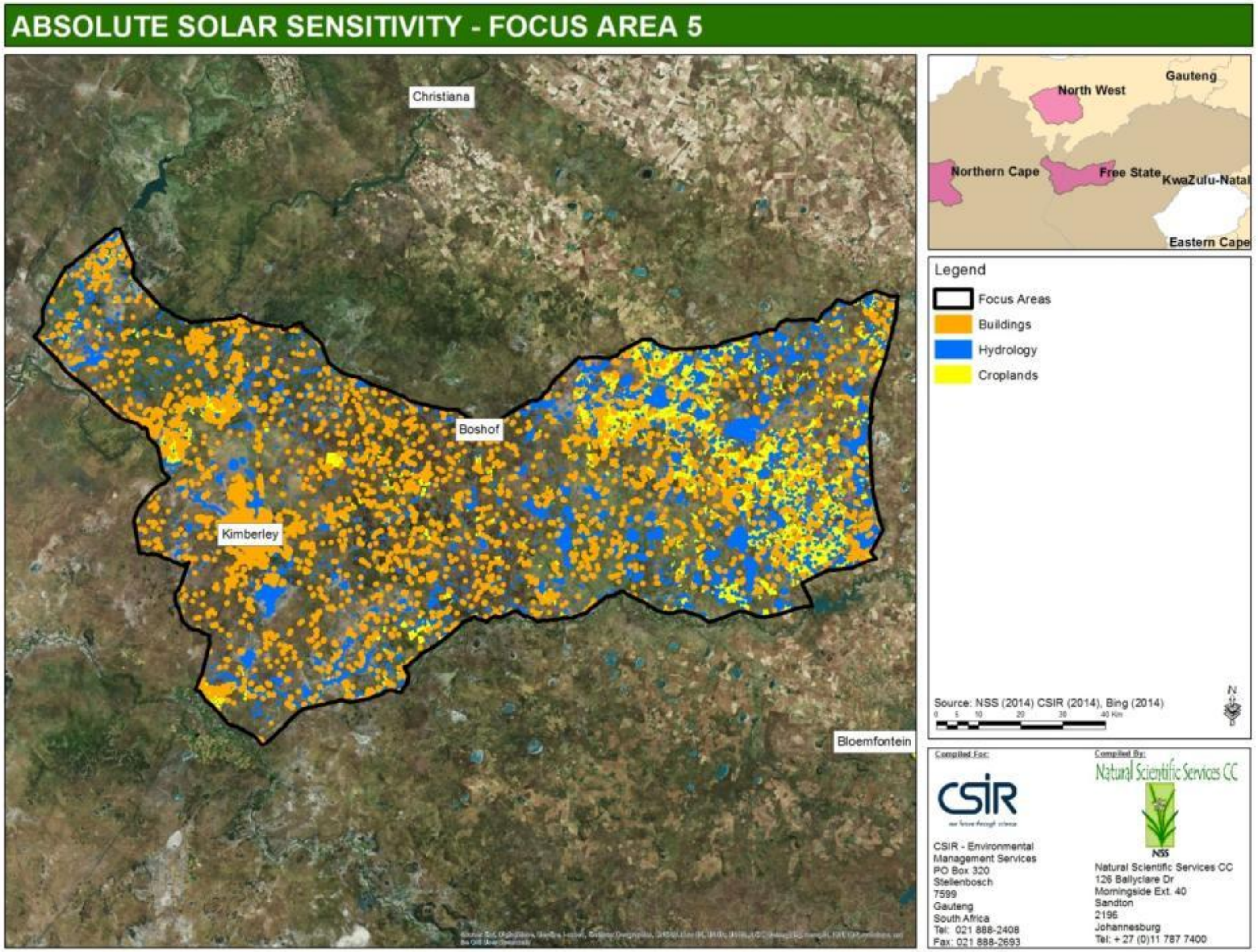
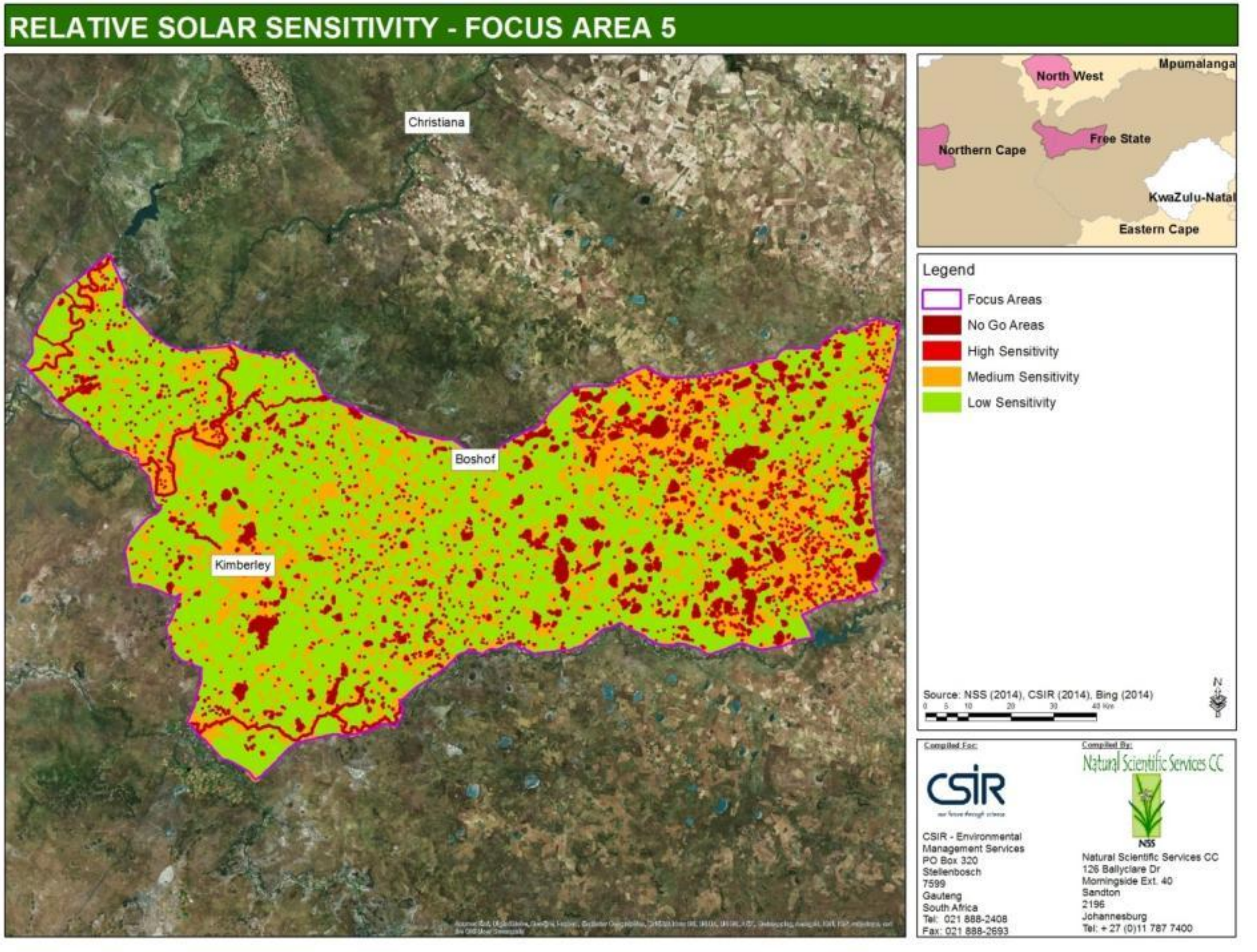
4.2.5 Kimberley FA 5




RELATIVE SOLAR SENSITIVITY - FOCUS AREA 5
Christiana
Boshof
Kimberley
North West
Mpumalanga
Northern Cape
Free State
KwaZulu-Natal
Eastern Cape
Legend
Focus Areas
No Go Areas
High Sensitivity
Medium Sensitivity
Low Sensitivity
Source: NSS (2014), CSIR (2014), Bing (2014)
Compiled For:
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South Africa
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Sandton
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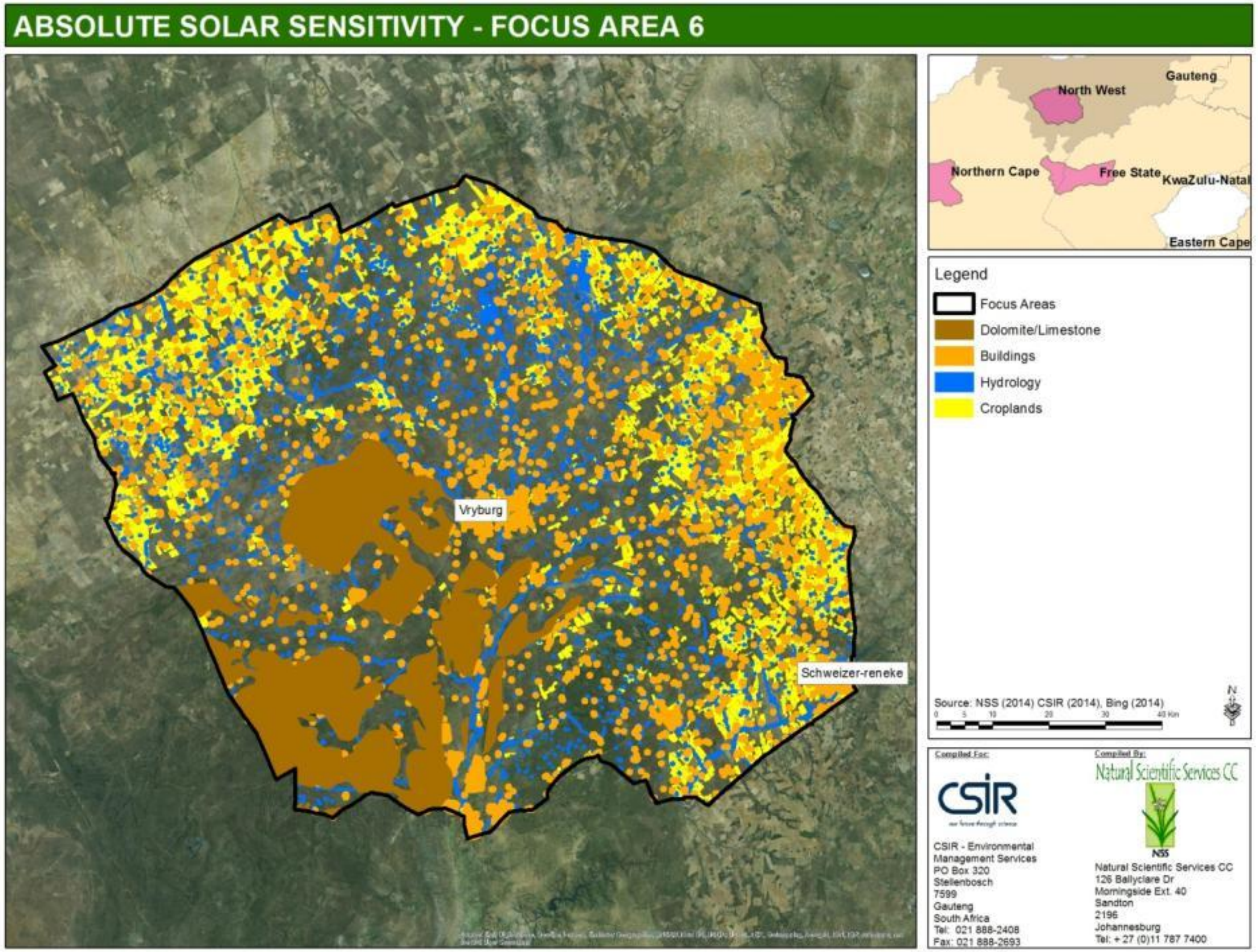
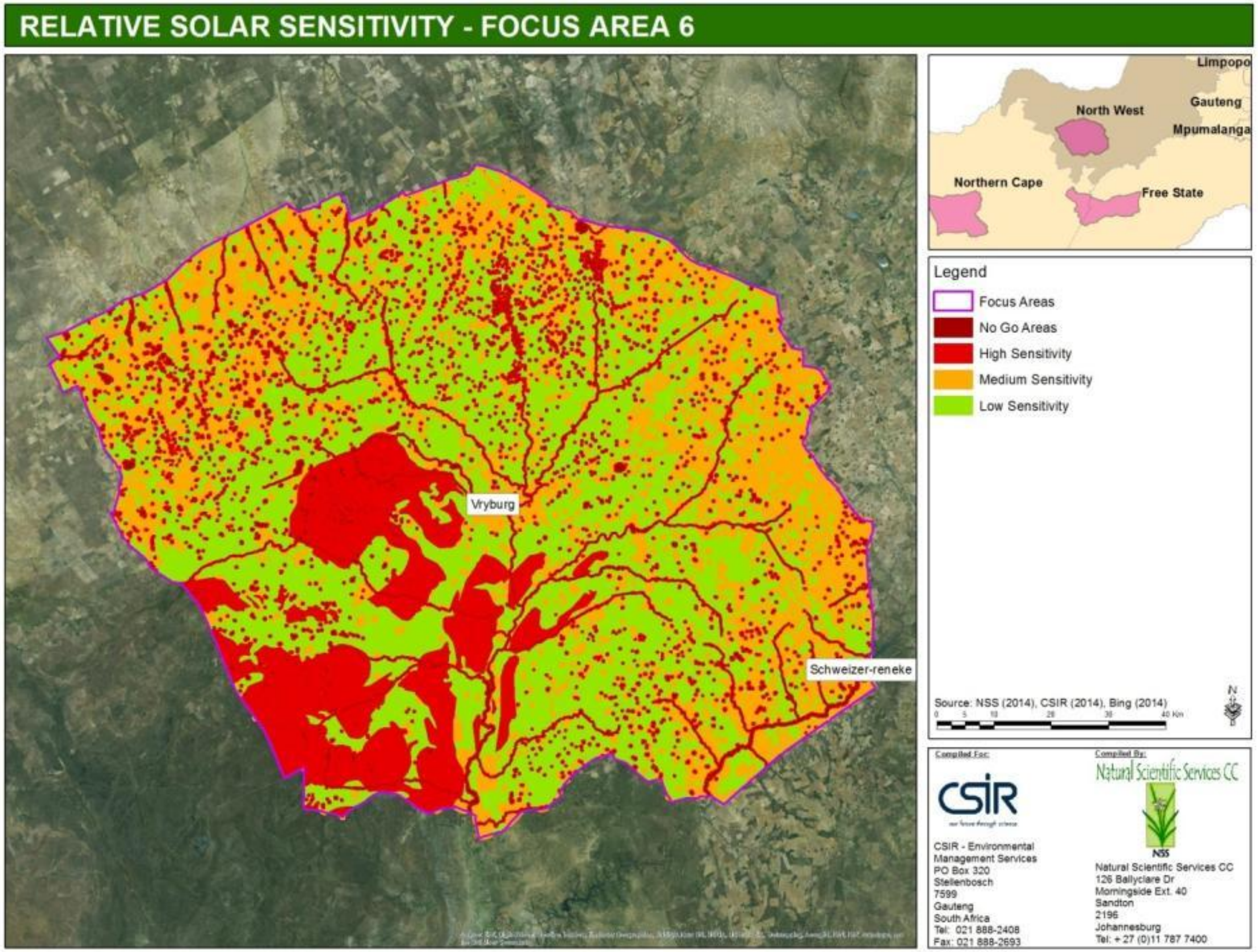
Johannesburg
Tel: + 27 (0)11 787 7400

4.2.6 Vryburg FA 6




RELATIVE SOLAR SENSITIVITY - FOCUS AREA 6
Vryburg
Schweizer-reneke
Limpopo
North West
Gauteng
Mpumalanga
Northern Cape
Free State
Legend
Focus Areas
No Go Areas
High Sensitivity
Medium Sensitivity
Low Sensitivity
Source: NSS (2014), CSIR (2014), Bing (2014)
Compiled For:
CSIR - Environmental Management Services
PO Box 320
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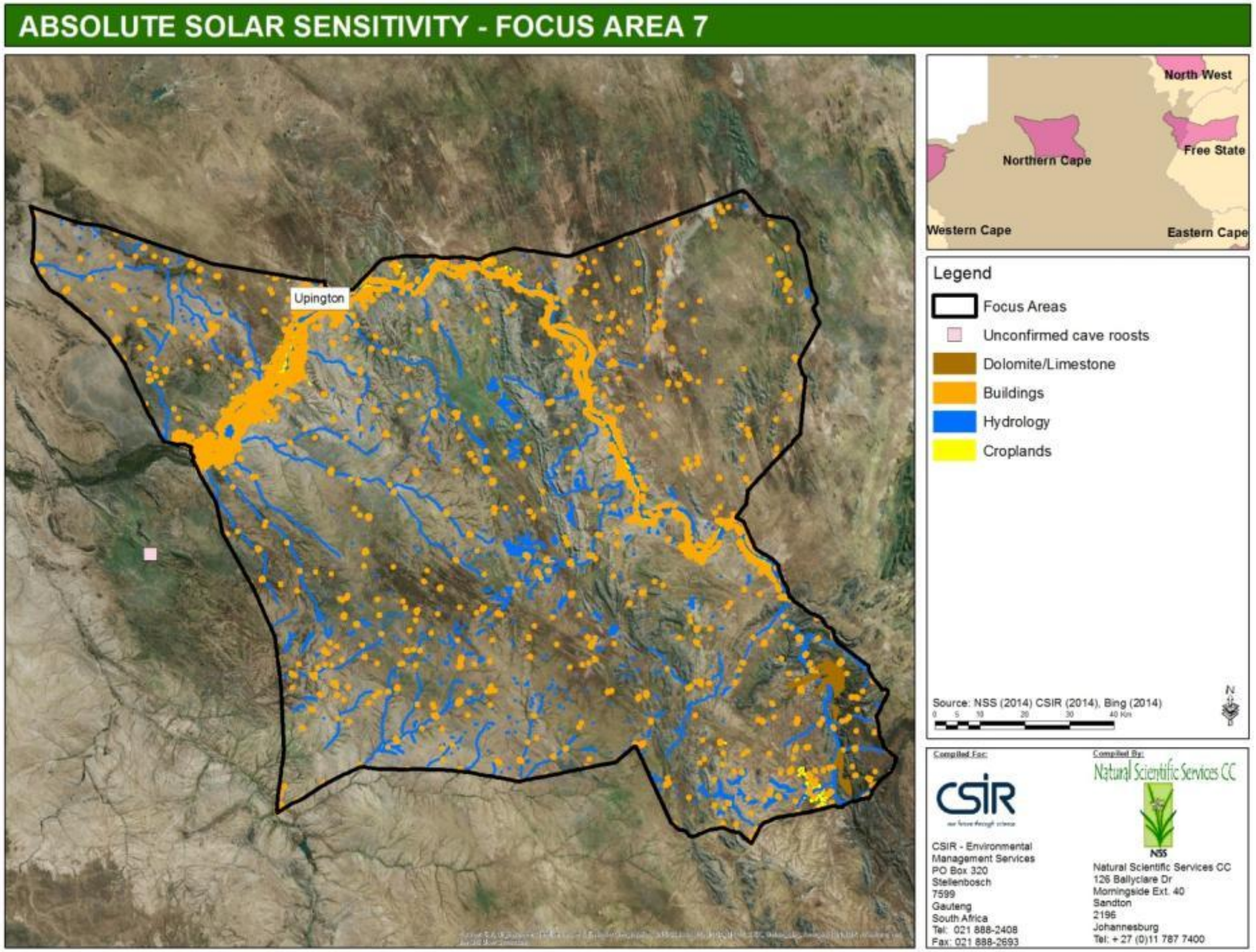
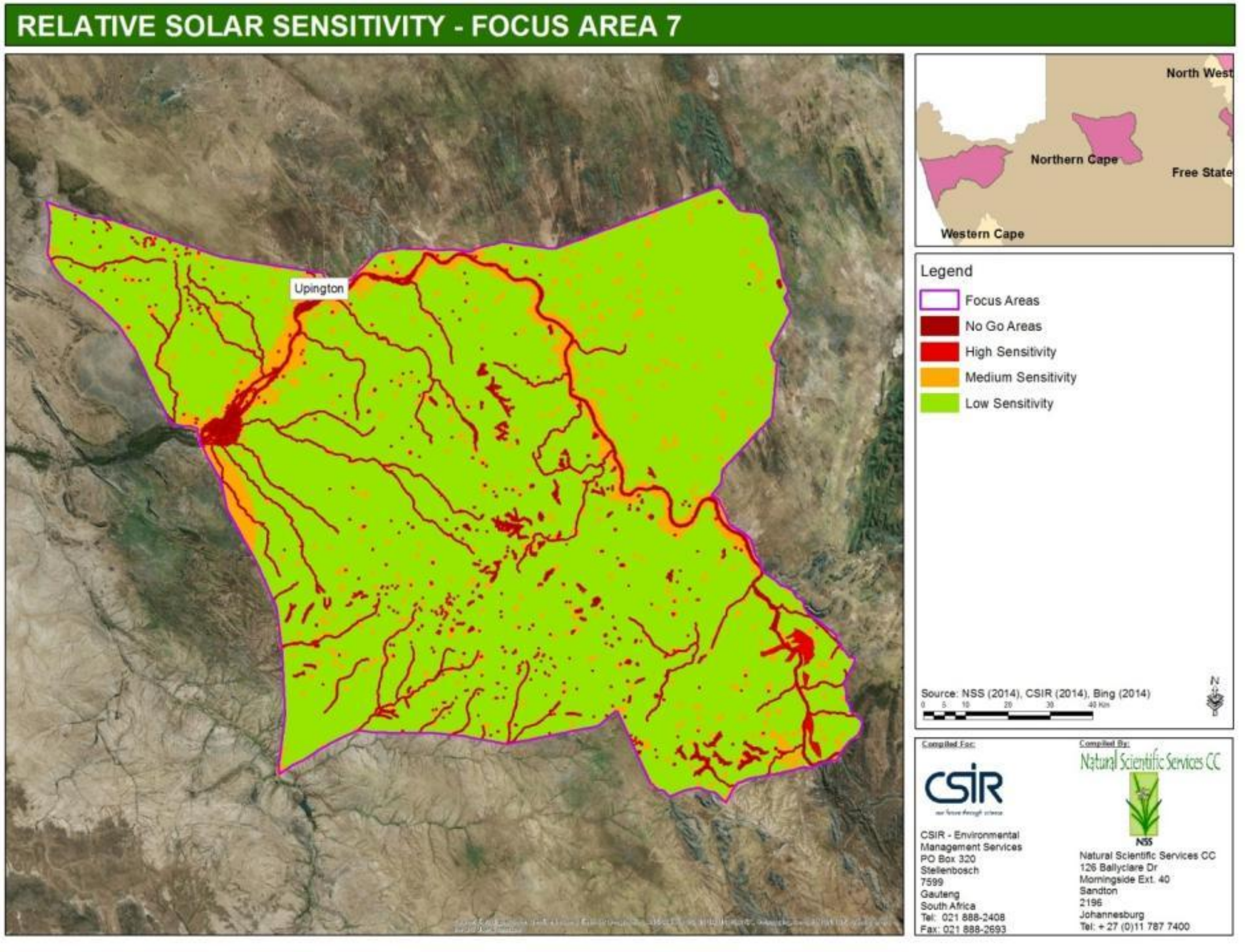
Johannesburg
Tel: + 27 (0)11 787 7400

4.2.7 Upington FA 7




RELATIVE SOLAR SENSITIVITY - FOCUS AREA 7
Upington
North West
Northern Cape
Free State
Western Cape
Legend
Focus Areas
No Go Areas
High Sensitivity
Medium Sensitivity
Low Sensitivity
Source: NSS (2014), CSIR (2014), Bing (2014)
Compiled For:
CSIR - Environmental
Management Services
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Gauteng
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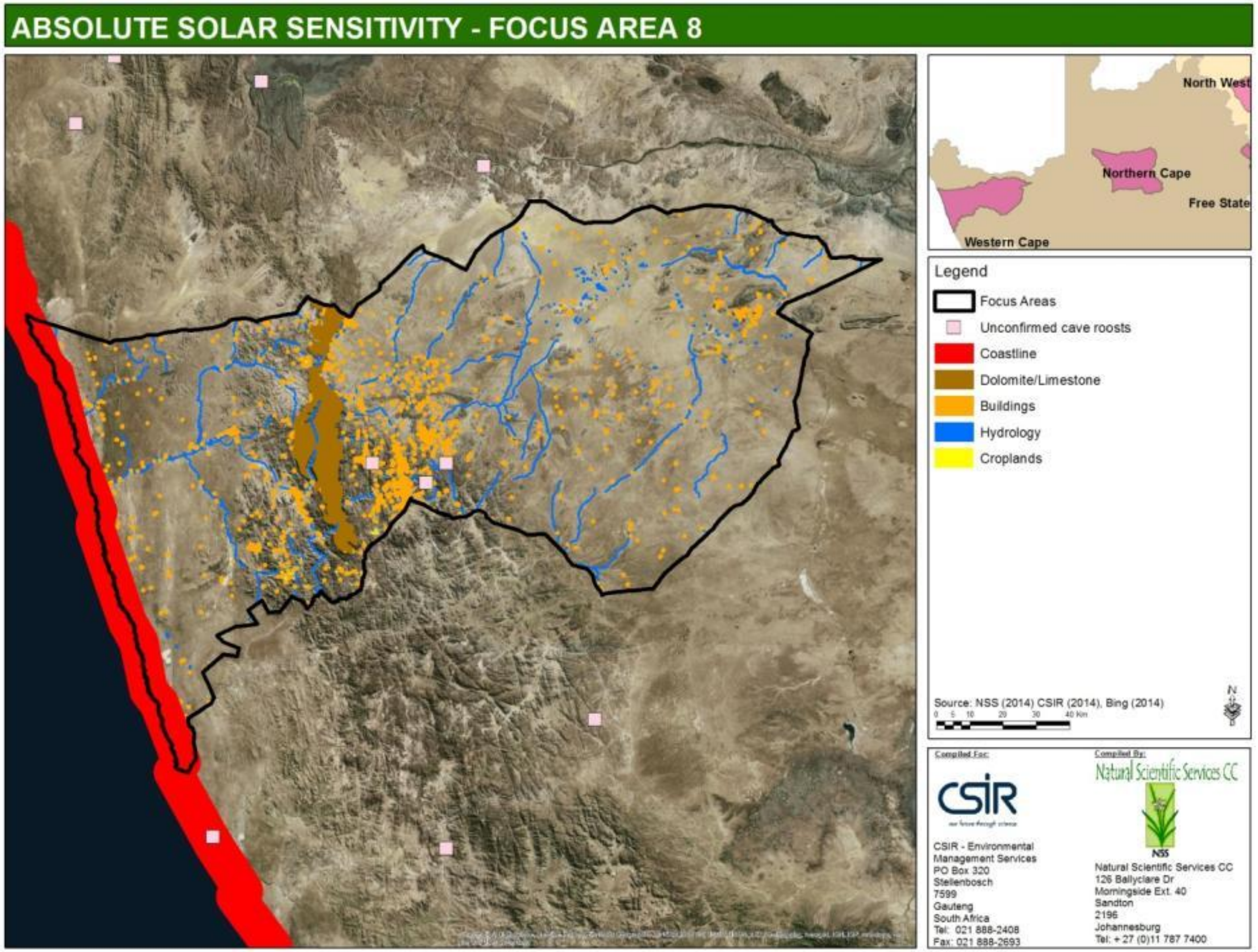
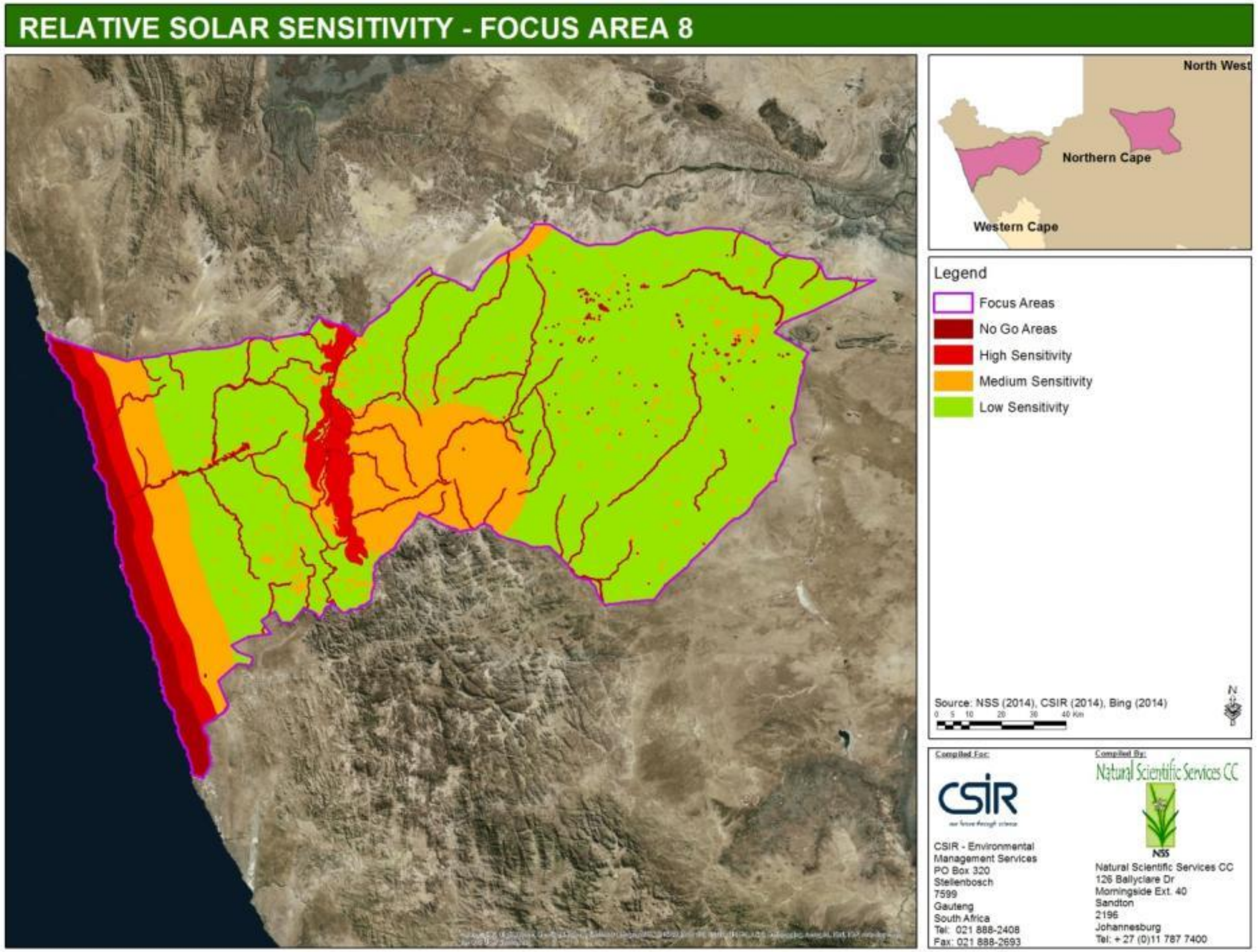
Tel: + 27 (0)11 787 7400

4.2.8 Springbok FA 8




RELATIVE SOLAR SENSITIVITY - FOCUS AREA 8
North West
Northern Cape
Western Cape
Legend
Focus Areas
No Go Areas
High Sensitivity
Medium Sensitivity
Low Sensitivity
Source: NSS (2014), CSIR (2014), Bing (2014)
Compiled For:
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4.3 Interpretation and implementation of the four tier wind map and permit requirements for each FA

A description of how to interpret the four sensitivity classes, as illustrated on the wind and solar sensitivity maps above, is provided for each technology in **Table 6** below.

Table 6: Interpretation and implementation of the four tier wind map and permit requirements for each FA

Technology	Colour	Sensitivity	Interpretation
Wind	Maroon	Very High	These areas have been identified as being potentially extremely sensitive to development from a bat perspective, either due to key roosting or foraging habitat. It is recommended that no development should take place within these areas. The risk of bat fatalities is very high. The risk of population level impacts on bats is very high. The risk of conservation important bat species being killed is very high. Developers intending on developing in these areas should prove to the DEA and SABAAP that they are not going to have a detrimental impact on bat populations, both locally and regionally. 24 months of monitoring and full assessment and recommendations by a SACNASP accredited and reputable bat specialist and according to the current best practise guidelines[93] is recommended. Peer review by SABAAP of the quarterly progress and final reports and recommendations should be budgeted for by the developer, in order for SABAAP to provide regular input into the process.
	Red	High	These areas have been identified as potentially being highly sensitive to development from a bat perspective, either due to key roosting or foraging habitat. It is recommended that the features identified as making these areas potentially highly sensitive be confirmed by a SACNASP accredited and reputable bat specialist through a short field verification process and short report. Based on the findings of the field verification, the developer must decide if they still wish to proceed. Should they still wish to proceed, 12 months of monitoring and full assessment and recommendations by a SACNASP accredited and reputable bat specialist and according to the current best practise guidelines[93] should be undertaken before development can be considered in these areas. Quarterly progress and final reports to be submitted to SABAAP. The potential for fatal flaws due to bats within these areas is high. Should development be approved, developers can expect construction and operational mitigation measures to be recommended from the commencement of construction and operation in these areas.
	Orange	Medium	There are potential roost and foraging habitat features in these areas that could make these areas sensitive to development from a bat perspective. These features should be confirmed and 12 months of monitoring and full assessment and recommendations by a SACNASP accredited and reputable bat specialist and according to the current best practise guidelines[94] should be undertaken before development can be considered in these areas.

93 Sowler, S. and Stoffberg, S. (2014) 3rd Edition of the South African Good Practice Guidelines for Surveying Bats at Wind Energy Facility Developments – Pre-construction
94 Sowler, S. and Stoffberg, S. (2014) 3rd Edition of the South African Good Practice Guidelines for Surveying Bats at Wind Energy Facility Developments – Pre-construction

Technology	Colour	Sensitivity	Interpretation
	Green	Low	There are no known roosts or foraging habitat features in these areas. However, this does not mean that unknown features exist or that an unknown migration flight path does not cross over the area. The minimum requirements within the best practise guidelines[94] must be met and appropriate recommendations be made.
Solar	Maroon	Very High	These areas have been identified as being potentially extremely sensitive to development from a bat perspective, either due to key roosting or foraging habitat. It is recommended that no development should take place within these areas. It is recommended that the features identified as making these areas extremely sensitive be confirmed by a SACNASP accredited and reputable bat specialist through a short field verification process and short report. Should they still wish to proceed, they must do so according to the recommendations made by the bat specialist in the short report.
	Red	High	These areas have been identified as potentially being highly sensitive to development from a bat perspective, either due to key roosting or foraging habitat. It is recommended that the features identified as making these areas potentially highly sensitive be confirmed by a SACNASP accredited and reputable bat specialist through a short field verification process and short report. Should they still wish to proceed, they must do so according to the recommendations made by the bat specialist in the short report.
	Orange	Medium	There are potential roost and foraging habitat features in these areas that could make these areas sensitive to development from a bat perspective. These features should be confirmed by the SACNASP accredited ecologist performing the general ecological assessment for the development. Should the development proceed, any recommendation made by the ecologist must be adhered to. Any bat fatalities during construction or operation must be reported to SABAAP.
	Green	Low	There are no known roosts or foraging habitat features in these areas. However, this does not mean that unknown features exist or that an unknown migration flight paths do not cross over the area. Bats must be considered during the general ecological assessment for development within these areas. Any recommendations made in the assessment pertaining to bats must be adhered to. Any bat fatalities during construction or operation must be reported to SABAAP.

5 GENERAL COMMENTS AND DISCUSSION

5.1 Key Potential Impacts and Mitigation – Wind

Whilst the direct impacts of wind energy on bats, such as roost and foraging habitat loss and disturbance and turbine related fatalities (**Table 7**), it is the potential indirect impact that results from these direct impacts that are of major concern. These include, but are not limited to:

- Mass loss of migrating bats.
- The cumulative impacts of mortality on affected species of bats could have long-term population effects.
- Loss of conservation important species.
- Loss of ecosystem services provided by bats.
- Economic and food security losses due to the loss of ecosystem services.
- Secondary impacts, such a predator behavioural changes.

Table 7: Key Potential Impacts and Mitigation – Wind

Site	Site-specific Potential Impacts	Mitigation
Overberg FA 1	• High potential for fatalities of resident Medium, Medium-High and High risk species. • High potential fatalities of migrant bats, such as *Miniopetrus natalensis, Myotis tricolor* and *Rosettus aegyptiaca* and potential population level impacts. • High potential for fragmentation of and re-routing of migratory routes. • High potential for loss and fragmentation of bat foraging habitat for large numbers of bats utilizing FA1 and surrounds, due the large surrounding roosts. • High potential for cumulative population level impacts on bats • Potential fatalities of lower risk, but likely to occur species, such as the Near Threatened *Rhinolophis capensis* and the Near Endemic *Laephotis namibiensis*, recorded in FA1[95], the Vulnerable *Cistugo leseueri* and the Near Threatened *Kerivula lanosa.* • During the operational phase, bats (particularly fruit bats) could potentially be negatively impacted by collision with power lines and to a lesser extent electrocution by them. • Electromagnetic radiation could have a repellent or behaviour impact on bats. The impacts suggested may be compounded if the power line is erected along bat migratory routes.	• The recommendations made in the four-tiered sensitivity mapping interpretation in **Table 6** must be adhered to. • As there are many areas of very high to medium sensitivity in FA1 and several wind turbines have already been approved for development and others are pending in FA1, any future applications and bat assessments in FA1 must seriously consider cumulative impacts in their assessment and prove that unsustainable bat population level impacts are unlikely due to further development within this FA. • Operational monitoring and fatality estimates to commence, according to the latest best practise guidelines[96], as soon as turbines start rotating. • Quarterly progress and final reports to be submitted to SABAAP. • Bat monitoring data to be shared on appropriate databases, e.g. upcoming SANBI developed bird and bat database. • Mitigation and management to continually be adapted according to the results of operational monitoring. • Power line routes to avoid bat sensitive areas as far as possible and where possible, underground power lines should be utilized.
Komsberg FA 2	• Potential loss and fragmentation of bat foraging habitat. • Potential fatalities of resident Medium, Medium-High and High risk species.	• The recommendations made in the four-tiered sensitivity mapping interpretation in **Table 6** must be adhered to. • Operational monitoring and fatality

95 Jacobs, D. (2012) Bat Echolocation Surveys at Proposed Biotherm Wind Energy Sites 2010-2011

96 Aronson, J., Richardson, E., MacEwan, K., Jacobs, D., Marais, W., Aiken, S., Taylor, P., Sowler, S. and Hein, C. (2014). 1st Edition South African Good Practice Guidelines for Operational Monitoring for Bats at Wind Energy Facilities. Produced by the South African Bat Assessment Advisory Panel (SABAAP)

Site	Site-specific Potential Impacts	Mitigation
	• Potential fatalities of migrant bats, such as *Miniopetrus natalensis.* • Electromagnetic radiation could have a repellent or behaviour impact on bats. The impacts suggested may be compounded if the power line is erected along bat migratory routes.	estimates to commence, according to the latest best practise guidelines[97], as soon as turbines start rotating. • Quarterly monitoring progress and final reports to be submitted to SABAAP. • Bat monitoring data to be shared on appropriate databases, e.g. upcoming SANBI developed bird and bat database. • Mitigation and management to continually be adapted according to the results of operational monitoring. • Power line routes to avoid bat sensitive areas as far as possible and where possible, underground power lines should be utilized.
Cookhouse FA 3	• High potential for cumulative population level impacts on bats • Potential loss and fragmentation of bat foraging habitat. • Medium-High potential for fatalities of resident Medium-High and High risk species • Potential fatalities of the migrant *Miniopterus natalensis* • Potential fragmentation of and re-routing of migratory routes. • During the operational phase, bats (particularly fruit bats) could potentially be negatively impacted by collision with power lines and to a lesser extent electrocution by them. • Electromagnetic radiation could have a repellent or behaviour impact on bats. The impacts suggested may be compounded if the power line is erected along bat migratory routes.	• The recommendations made in the four-tiered sensitivity mapping interpretation in **Table 6** must be adhered to. • As there are many areas of very high to medium sensitivity in FA3 and several wind turbines have already been approved for development and others are pending in FA3, any future applications and bat assessments in FA3 must seriously consider cumulative impacts in their assessment and prove that unsustainable population level impacts are unlikely due to further development within this FA. • Operational monitoring and fatality estimates to commence, according to the latest best practise guidelines[98], as soon as turbines start rotating. • Quarterly monitoring progress and final reports to be submitted to SABAAP. • Bat monitoring data to be shared on appropriate databases, e.g. upcoming SANBI developed bird and bat database. • Mitigation and management to continually be adapted according to the results of operational monitoring. • Power line routes to avoid bat sensitive areas as far as possible and where possible, underground power lines should be utilized.
Stormberg FA 4	• Potential loss and fragmentation of bat foraging habitat. • Potential fatalities of resident Medium, Medium-High and High risk species. • Potential fatalities of migrant bats, such as *Miniopetrus natalensis.* • Potential for cumulative impacts on bat populations. • During the operational phase, bats	• The recommendations made in the four-tiered sensitivity mapping interpretation in **Table 6** must be adhered to. • As there are several wind turbines approved and proposed for development in FA4, any future applications and bat assessments in FA4 must seriously consider cumulative impacts in their assessment and prove that unsustainable bat population level impacts

97 Aronson, J., Richardson, E., MacEwan, K., Jacobs, D., Marais, W., Aiken, S., Taylor, P., Sowler, S. and Hein, C. (2014). 1st Edition South African Good Practice Guidelines for Operational Monitoring for Bats at Wind Energy Facilities. Produced by the South African Bat Assessment Advisory Panel (SABAAP)

98 Aronson, J., Richardson, E., MacEwan, K., Jacobs, D., Marais, W., Aiken, S., Taylor, P., Sowler, S. and Hein, C. (2014). 1st Edition South African Good Practice Guidelines for Operational Monitoring for Bats at Wind Energy Facilities. Produced by the South African Bat Assessment Advisory Panel (SABAAP)

Site	Site-specific Potential Impacts	Mitigation
	(particularly fruit bats) could potentially be negatively impacted by collision with power lines and to a lesser extent electrocution by them. • Electromagnetic radiation could have a repellent or behaviour impact on bats. The impacts suggested may be compounded if the power line is erected along bat migratory routes.	are unlikely due to further development within this FA. • Operational monitoring and fatality estimates to commence, according to the latest best practise guidelines[98], as soon as turbines start rotating. • Quarterly monitoring progress and final reports to be submitted to SABAAP. • Bat monitoring data to be shared on appropriate databases, e.g. upcoming SANBI developed bird and bat database. • Mitigation and management to continually be adapted according to the results of operational monitoring. • Power line routes to avoid bat sensitive areas as far as possible and where possible, underground power lines should be utilized.
Kimberley FA 5	• Potential loss and fragmentation of bat foraging habitat. • Potential fatalities of resident Medium, Medium-High and High risk species. • Potential fatalities of migrant bats, such as *Miniopetrus natalensis.* • Electromagnetic radiation could have a repellent or behaviour impact on bats. The impacts suggested may be compounded if the power line is erected along bat migratory routes.	• The recommendations made in the four-tiered sensitivity mapping interpretation in **Table 6** must be adhered to. • Operational monitoring and fatality estimates to commence, according to the latest best practise guidelines[99], as soon as turbines start rotating. • Quarterly monitoring progress and final reports to be submitted to SABAAP. • Bat monitoring data to be shared on appropriate databases, e.g. upcoming SANBI developed bird and bat database. • Mitigation and management to continually be adapted according to the results of operational monitoring. • Power line routes to avoid bat sensitive areas as far as possible and where possible, underground power lines should be utilized.
Vryburg FA 6	• Potential loss and fragmentation of bat foraging habitat. • Potential fatalities of resident Medium, Medium-High and High risk species. • Potential fatalities of migrant bats, such as *Miniopetrus natalensis.* • Potential cross-border bat impacts with species that move to and from Botswana, e.g. *Rhinolophus denti.* • Electromagnetic radiation could have a repellent or behaviour impact on bats. The impacts suggested may be compounded if the power line is erected along bat migratory routes.	• The recommendations made in the four-tiered sensitivity mapping interpretation in **Table 6** must be adhered to. • Operational monitoring and fatality estimates to commence, according to the latest best practise guidelines[99], as soon as turbines start rotating. • Quarterly monitoring progress and final reports to be submitted to SABAAP. • Bat monitoring data to be shared on appropriate databases, e.g. upcoming SANBI developed bird and bat database. • Mitigation and management to continually be adapted according to the results of operational monitoring. • If any migratory or cross-border species are killed by turbines, cross-border research efforts funded by the wind farm owner. • Power line routes to avoid bat sensitive

99 Aronson, J., Richardson, E., MacEwan, K., Jacobs, D., Marais, W., Aiken, S., Taylor, P., Sowler, S. and Hein, C. (2014). 1st Edition South African Good Practice Guidelines for Operational Monitoring for Bats at Wind Energy Facilities. Produced by the South African Bat Assessment Advisory Panel (SABAAP)

Site	Site-specific Potential Impacts	Mitigation
		areas as far as possible and where possible, underground power lines should be utilized.
Upington FA 7	• Potential loss and fragmentation of bat foraging habitat. • Potential fatalities of resident Medium, Medium-High and High risk species. • Potential fatalities of migrant bats, such as *Miniopetrus natalensis.* • Potential cross-border bat impacts with species that move to and from Botswana, e.g. *Rhinolophus denti.* • Electromagnetic radiation could have a repellent or behaviour impact on bats. The impacts suggested may be compounded if the power line is erected along bat migratory routes.	• The recommendations made in the four-tiered sensitivity mapping interpretation in **Table 6** must be adhered to. • Operational monitoring and fatality estimates to commence, according to the latest best practise guidelines[100], as soon as turbines start rotating. • Quarterly monitoring progress and final reports to be submitted to SABAAP. • Bat monitoring data to be shared on appropriate databases, e.g. upcoming SANBI developed bird and bat database. • Mitigation and management to continually be adapted according to the results of operational monitoring. • If any migratory or cross-border species are killed by turbines, cross-border research efforts funded by the wind farm owner. • Power line routes to avoid bat sensitive areas as far as possible and where possible, underground power lines should be utilized.
Springbok FA 8	• Potential loss and fragmentation of bat foraging habitat. • Potential fatalities of resident Medium, Medium-High and High risk species. • Potential fatalities of migrant bats, such as *Miniopetrus natalensis*. • Potential cross-border bat impacts with migratory species and species that move to and from Namibia, e.g. *Miniopterus natalensis* and *Cistugo sebrae.* • Potential for cumulative impacts on bat populations. • Electromagnetic radiation could have a repellent or behaviour impact on bats. The impacts suggested may be compounded if the power line is erected along bat migratory routes.	• The recommendations made in the four-tiered sensitivity mapping interpretation in **Table 6** must be adhered to. • As there are several wind turbines approved and proposed for development in FA8, any future applications and bat assessments in FA8 must seriously consider cumulative impacts in their assessment and prove that unsustainable bat population level impacts are unlikely due to further development within this FA. • Operational monitoring and fatality estimates to commence, according to the latest best practise guidelines[100], as soon as turbines start rotating. • Quarterly monitoring progress and final reports to be submitted to SABAAP. • Bat monitoring data to be shared on appropriate databases, e.g. upcoming SANBI developed bird and bat database. • Mitigation and management to continually be adapted according to the results of operational monitoring. • If any migratory or cross-border species are killed by turbines, cross-border research efforts funded by the wind farm owner. • Power line routes to avoid bat sensitive areas as far as possible and where possible, underground power lines should be utilized.

100 Aronson, J., Richardson, E., MacEwan, K., Jacobs, D., Marais, W., Aiken, S., Taylor, P., Sowler, S. and Hein, C. (2014). 1st Edition South African Good Practice Guidelines for Operational Monitoring for Bats at Wind Energy Facilities. Produced by the South African Bat Assessment Advisory Panel (SABAAP)

5.2 Key Potential Impacts and Mitigation – Solar PV

The fact that not much is known regarding the impacts of solar energy on bats, means either that there is not a problem or that not enough research has been conducted on this. The known and anticipated potential impacts of Solar PV on bats include mainly the direct impacts of construction, with potential operational impacts. These are described in **Table 8** as being the same for all FAs due to the level of uncertainty.

Table 8: Key Potential Impacts and Mitigation – Solar

Potential Impacts	Mitigation
Clearing and sterilization of foraging habitat due to construction and operational phase. Impact will remain for the life of the SEF.	Selecting the least bat sensitive areas for development and adhering to the recommendations in **Table 6**.
Roost disturbance through the dust, noise and vibrations during construction. If the development of a SEF is constructed near to bat roosting habitat, such as trees, buildings or caves, there may be a disturbance and displacement impact.	All known roosts have been buffered on the relative sensitivity maps. These maps must be referred to when selecting a potential development site and the recommendations in **Table 6** adhered to.
During operation, the smooth solar panel surfaces may mislead bats as a potential drinking water source. The impact of this is potentially greater in the dryer parts of the country.	Selecting the least bat sensitive areas for development and adhering to the recommendations in **Table 6**.
During the operational phase, bats (particularly fruit bats) could potentially be negatively impacted by collision with power lines and to a lesser extent electrocution by them. Electromagnetic radiation could have a repellent or behaviour impact on bats. The impacts suggested may be compounded if the power line is erected along bat migratory routes.	Power line routes to avoid bat sensitive areas as far as possible and where possible, underground power lines should be utilized.

5.3 General comments

Table 9: General Comments on the Suitability of the FAs for Wind and Solar PV Development

Site	Overall Suitability	Comment
Overberg FA 1	Due to the high levels of bat sensitivity in this FA from an activity perspective, roost potential, migratory corridor and conservation important species occurrence perspective, this FA is regarded by the bat specialist as unsuitable for wind energy development, due to the high potential of fatality of medium to high risk, conservation important and migratory species. In addition, there are several approved WEFs in and around this FA. Bats do not stick to man-made boundary lines and the cumulative impacts on bats in this region of the Western Cape could be unsustainable. This needs to be seriously considered by bat specialists, EAPs, developers and government going forward. Limited solar energy development in low to medium sensitivity areas can occur on condition that the recommendations and mitigation measures in **Table 6** and **Sections 5.1** and **5.2** are adhered to.	This FA has the highest activity levels and is probably a migration corridor for thousands of conservation important bat migrants in Autumn and Spring. There are several large confirmed cave roosts surrounding this FA, with the largest bat colony in South Africa occurring less than 10km from the south east boundary of the FA. Future development applications in this vicinity should be made to prove that they will not adversely contribute to cumulative negative impacts on these populations.
Komsberg FA 2	Due to the low bat activity levels and low to moderate species richness within the FA, it is considered suitable for renewable energy development, but with conditions.	Suitable for renewable energy, on condition that the sensitivity recommendations and mitigation measures presented in **Table 6** and **Sections 5.1** and **5.2** should be adhered to.
Cookhouse FA 3	Considered low to moderately suitable for renewable energy development due to a high	The recommendations and mitigation measures presented in **Table 6** and **Sections**

Site	Overall Suitability	Comment
	species richness, low-medium activity levels and known large roosts in the vicinity. In addition, there are several turbines already approved for this FA.	**5.1** and **5.2** should be adhered to. Cumulative impacts for this FA are a serious consideration.
Stormberg FA 4	Considered low to moderately suitable for renewable energy development due to a high species richness, low-medium activity levels and known large roosts in the vicinity. In addition, there are several turbines already approved for this FA.	The recommendations and mitigation measures presented in **Table 6** and **Sections 5.1** and **5.2** should be adhered to. Cumulative impacts for this FA are a serious consideration.
Kimberley FA 5	Due to the low bat activity levels and low to moderate species richness within the FA, it is considered suitable for renewable energy development, but with conditions.	Suitable for renewable energy, on condition that the sensitivity recommendations and mitigation measures presented in **Table 6** and **Sections 5.1** and **5.2** should be adhered to.
Vryburg FA 6	Due to the low bat activity levels and low to moderate species richness within the FA, it is considered suitable for renewable energy development, but with conditions.	Suitable for renewable energy, on condition that the sensitivity recommendations and mitigation measures presented in **Table 6** and **Sections 5.1** and **5.2** should be adhered to.
Upington FA 7	Due to the low bat activity levels and low to moderate species richness within the FA, it is considered suitable for renewable energy development, but with conditions.	Suitable for renewable energy, on condition that the sensitivity recommendations and mitigation measures presented in **Table 6** and **Sections 5.1** and **5.2** should be adhered to.
Springbok FA 8	Whilst activity is low in this FA, there are some conservation important species that may be unique to this region. In addition, there are several turbines already approved for this FA. Renewable energy is only suitable outside of the High and Very High Sensitive area.	The recommendations and mitigation measures presented in **Table 6** and **Sections 5.1** and **5.2** should be adhered to. Cumulative impacts for this FA are a serious consideration.

6 CONCLUSIONS AND FURTHER RECOMMENDATIONS

The onset of renewable energy in South Africa has been a very rapid one. South Africa is in the fortunate position to have opportunities for renewable energy development. However, this comes with the responsibility of finding a balance between a reduced carbon footprint and environmental and biodiversity impacts and to learn from countries that have gone before.

There is definitely more evidence to suggest that wind turbines will potentially have a greater impact on bat populations in South Africa, compared to that of solar PV facilities. However, that is not to say that solar PV will not have any impact on bats. The current Bat Specialist Scoping Assessment provides sound guidance regarding the sensitivities of bats at a broad strategic level only and prescribes the need for site specific assessment, specifically for wind energy facilities, to ensure that significant impacts can be avoided and that proactive mitigation can be implemented. There is great value in producing such a strategic level assessment, in that developers are aware upfront and to a certain degree what the potential issues at their site will be and can plan accordingly.

The story of bats and wind turbines highlights the importance of proactive measures to ensure the health and well-being of vulnerable wildlife populations before or soon after unexpected threats arise and quickly take their toll[101]. All bats in the Western Cape are listed as Protected Wild Animals according to Schedule 2 of the Western Cape Nature Conservation Laws Amendment Act, No. 3 of 2000 and some, including species that are at High and Medium-High risk of fatality by wind turbines, are listed as Protected Species according to Schedule 2 of the Northern Cape Conservation Act, No. 9 of 2009. This is in addition to those species that are Red Listed nationally and internationally. With cross-border impacts being a potential issue that has not been seriously

101 Cryan PM. (2011). Wind turbines as landscape impediments to the migratory connectivity of bats. Environmental Law 41: 355–370.

considered, it is important to note that the migratory species *Miniopterus natalensis* and *Eidelon helvum* are listed in Appendix II of the Convention on the Conservation of Migratory Species of Wild Animals, as migratory species which have an unfavourable conservation status and which require international agreements for their conservation and management, as well as those which have a conservation status which would significantly benefit from the international cooperation that could be achieved by an international agreement.

Pre-construction monitoring for wind energy facilities, if conducted according to current best practise methodologies and principles[102], can provide information on bat spatial and temporal patterns in relation to meteorological conditions, allowing for targeted, proactive mitigation. Whilst acoustic data gathered prior to construction cannot accurately predict bat fatality, acoustic surveys still provide valuable data for understanding the timing and conditions under which bats are more or less active at a site, particularly for regions in which wind development is relatively new. Modelling bat activity or species presence using acoustic detectors as a function of time (i.e., night, season, or year) and meteorological conditions can provide powerful insight to predict when bats are most at risk, and which strategies are best suited to minimize fatalities while maximizing power production[103].

The South Africa best practise guidelines for monitoring bats at operational wind energy facilities has just been released. Mitigation measures prescribed during pre-construction monitoring needs to adapt as operational monitoring information becomes available. Bat fatality minimization is the ultimate goal of all the proposed monitoring efforts and South Africa needs to learn from research efforts in this regard internationally and apply similar principles[104].

All monitoring data from wind energy facilities should be submitted to the South African Bird and Bat Database, being developed by the South African National Biological Institute (SANBI) on mandate from the Department of Environmental Affairs (DEA). Such a database will be very valuable in determining trends and avoiding cumulative impacts in the future. Contact SABAAP to find out how to submit this data – www.sabaap.co.za

The DEA needs to be equipped to adequately assess bat impact assessments for WEFs and continue to partner with the South African National Biological Institute (SANBI) and the South African Bat Assessment Advisory Panel (SABAAP) and other key stakeholders to ensure that informed decisions are made towards avoiding large scale cumulative impacts on bat populations before it's too late.

Whilst the likelihood of direct bat fatalities due to solar PV facilities or power lines in South Africa is low, habitat disturbance and behavioural changes may have indirect impacts that need to be considered on a case by case basis.

7 SPECIALIST CV

Name:	Kate Louise MacEwan
Name of Firm:	Natural Scientific Services CC
Position:	Senior Zoologist (Member)
Date of Birth:	28 April 1975

Education

M Sc (Zoology – Bat Conservation Biology)	University of the Witwatersrand, Johannesburg (in progress)
B Sc Hons (Zoology)	University of the Witwatersrand, Johannesburg (1998)
B Sc	University of the Witwatersrand, Johannesburg (1997)

Additional Courses Completed:
2012 – Anabat Training Workshop

102 Sowler, S., & Stoffberg, S. (2014). South African Good Practice Guidelines for Surveying Bats at Wind Energy Facility Developments - Pre-construction: Third Edition: A guideline document distributed

103 Arnett, E.B., Johnson, G.D., Erickson, W.P. & Hein C.D. (2013). A synthesis of operational mitigation studies to reduce bat fatalities at wind energy facilities in North America. Prepared for The National Renewable Energy Laboratory.

104 Hein, C. (2014). Strategies to Reduce Bat Fatalities at Wind Energy Facilities. Presentation given for the US Fish & Wildlife 5th Wind Energy Broadcast.

2011 – Fall Arrest and Rescue Accredited
2005 renewed in 2008: SASS5 Accreditation with the National Department of Water Affairs and Forestry (DWAF)
2002: University of the Witwatersrand Masters Courses successfully completed: Savannah Ecology, Environmental Management, and Biogeochemistry.
2001: Foundation course in Environmental Auditing - IEMA approved

Memberships in Professional Societies

- South African Council for Natural Scientific Professions (PrSciNat) – Zoology and Environmental Science since 2005 – **SACNASP Reg No. 400123/05**
- South African Bat Assessment Advisory Panel (SABAAP)
- International Association for Impact Assessment (IAIA)
- Zoological Society of Southern Africa (ZSSA)
- Gauteng & Northern Regions Bat Interest Group (GNorBIG) Research Committee Member
- Bat Conservation International (BCI)
- Endangered Wildlife Trust (EWT)

Key Specialist Experience

- Kate has over 15 years' experience as a practicing Zoologist in the conservation and consulting industries. She has conducted numerous faunal assessments within the Gauteng, North West, Limpopo, Mpumalanga, Northern Cape, Western Cape and Eastern Cape Provinces of South Africa, with the study of Mammals and Bats (Chiroptera) being a key speciality.
- Specialist Bat Assessments for various projects, e.g.
  - Past and current short and long-term pre-construction bat monitoring projects at >20 WEF sites in South Africa.
  - Current long-term post-construction/ operational bat monitoring at a WEF site in South Africa.
  - Bat impact assessment for the development of an automobile production factory near Bon Accord, Pretoria,
  - Bat assessment for the development of a Management and Action Plan for a cave on a Driefontein Gold Mine,
  - Bat impact assessment for the mining through of old mine adits containing bats at Pilanesburg Platinum Mine, North West Province.
- She is Fall Arrest certified to climb heights over 3m.
- She has served on the Gauteng & Northern Regions Bat Interest Group (GNorBIG) executive committee for over 10 years. Her duties have included bat scientific research and educational talks to the public.
- She is the current Chairperson for the South African Bat Assessment Advisory Panel (SABAAP).
- She has hand-reared and rehabilitated over 25 individual bats over her career.

Employment Experience

Member: Natural Scientific Services, Johannesburg (October 2003-Present)
- Project management and fieldwork for numerous terrestrial and aquatic ecological assessments
- Specialist Bat Assessments for various projects
- Project management for various Environmental Impact Assessments, Environmental Programme Reports and Water Use Licence applications for the Conservation, Mining, Waste and Industrial sectors.
- Remediation audits within the industrial sector
- Tender and proposal compilation
- Administration
- Marketing
- Liaison with clients and government officials
- Environmental education

Environmental Scientist: Jones & Wagener Civil Engineers (March 2000-September 2003)
- Project management for various Environmental Impact Assessments, Environmental Programme Reports and Water Use Licence applications for the Mining, Waste and Industrial sectors
- Fieldwork for surface water quality and ecological assessments
- Tender and proposal compilation
- Liaison with clients and government officials

Area Manager (contract post): Working for Water – Kruger National Park (October 2000-January 2001)
- Management of Alien Plant Clearing operations

- Project / Financial administration
- People management

Zoo Keeper: Johannesburg Zoological Gardens (September 1998-March 2000)

- Husbandry of carnivores, pachyderms and ungulates.
- Rearing of injured or orphaned animals of all kinds.
- Environmental Education
- Waste Management
- People Management – employees and public

Publications

MacEwan, K. (2014) Bats and Wind Energy. Footprint Limited Environmental Magazine. March/ April 2014 edition

Contributing editor to the third edition South African Good Practice Guidelines for Surveying Bats in Wind Farm Developments (Sowler & Stoffberg, 2014).

Aronson, J., Richardson, E., **MacEwan, K.,** Jacobs, D., Marais, W., Aiken, S., Taylor, P., Sowler, S. and Hein, C. (2014). 1st Edition South African Good Practice Guidelines for Operational Monitoring for Bats at Wind Energy Facilities. Produced by the South African Bat Assessment Advisory Panel (SABAAP)

MacEwan K., Lötter C, Baumgartner M, Pierce M, Morgan T, Blignaut T. 2014. Bat Activity Levels in Various Terrestrial Ecoregions of South Africa (in press).

Scholes RJ, Gureja N, Giannecchinni M, Dovie D, Wilson B, Davidson N, **MacEwan** (**neē Pigott) K.,** McLoughlin C, van der Velde K, Freeman A, Bradley S, Smart R, Ndala S (2001) The Environment and Vegetation of the Flux Measurement at a Site Near Skukuza, Kruger National Park. Koedoe 44:73–83

7.1 Specialist Declaration

I, .**KATE MACEWAN**, as the appointed independent specialist hereby declare that I:

- act/ed as the independent specialist in this application;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct;
- do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed;
- have and will not have any vested interest in the proposed activity proceeding;
- have disclosed any material information that have or may have the potential to influence the objectivity of any report or decisions base thereon; and
- am aware that a false declaration is an offence in terms of regulation 71 of GN No. R. 543.

Signature of the specialist: KMacE

Name of company: **NATURAL SCIENTIFIC SERVICES CC**

Professional Registration (incl number): **SACNASP 400123/05**

Date: **18 JULY 2014**

8 APPENDIX 1 –SABAAP BAT HABITAT BUFFER RECOMMENDATIONS

The following buffers are recommended by the South African Bat Advisory Assessment Panel (SABAAP):

As an absolute minimum, a high sensitivity buffer of 200m around all potentially bat important features, e.g. delineated watercourses, i.e. from the edge of the riparian zone or from the edge of the outer wetland zone (DWAF definition), woodland vegetation (any trees or bush clumps considered important on site, including alien vegetation), outbuildings (all structures considered as potentially important for bats – water towers, farm buildings, bridges, artificial roosts, etc.), rocky outcrops and ridges.

The exception to the above distance is for confirmed or suspected roosts (permanent or seasonal roosts), where the following buffers should apply:

- 1 – 50 Least Concern Bats – 500m
- 50 – 500 Least Concern Bats – 1km
- >500 High Risk Least Concern Bats – 2.5km
- 1 – 50 Low Risk Conservation Important Bats – 500m
- 1 – 50 Med-High Risk Conservation Important Bats – 1km
- 50 - 500 Low Risk Conservation Important Bats – 1km
- 50 - 500 Med-High Risk Conservation Important Bats – 2.5km
- 500 - 2000 Low Risk Conservation Important Bats – 2.5km
- 500 - 2000 Med-High Risk Conservation Important Bats – 10km
- >2000 Bats of any status or risk level – 20km

These are minimum values and they do not exempt the developer from implementing additional mitigation measures outside of the buffer zones where bat activity levels dictate this need.

<u>Definitions:</u>

Buffer zone: Non-disturbance areas that provide a protected zone for sensitive resources such as bat foraging habitat and bat roosts. In the case of wind energy development, no part of the infrastructure, including the blade can be positioned within the buffer zone, i.e. these are No-Go development / activity zones.

Risk Categories: As per the fatality risk levels in the Sowler & Stoffberg (2012) guidelines, derived based on foraging ecology and risk of collision.

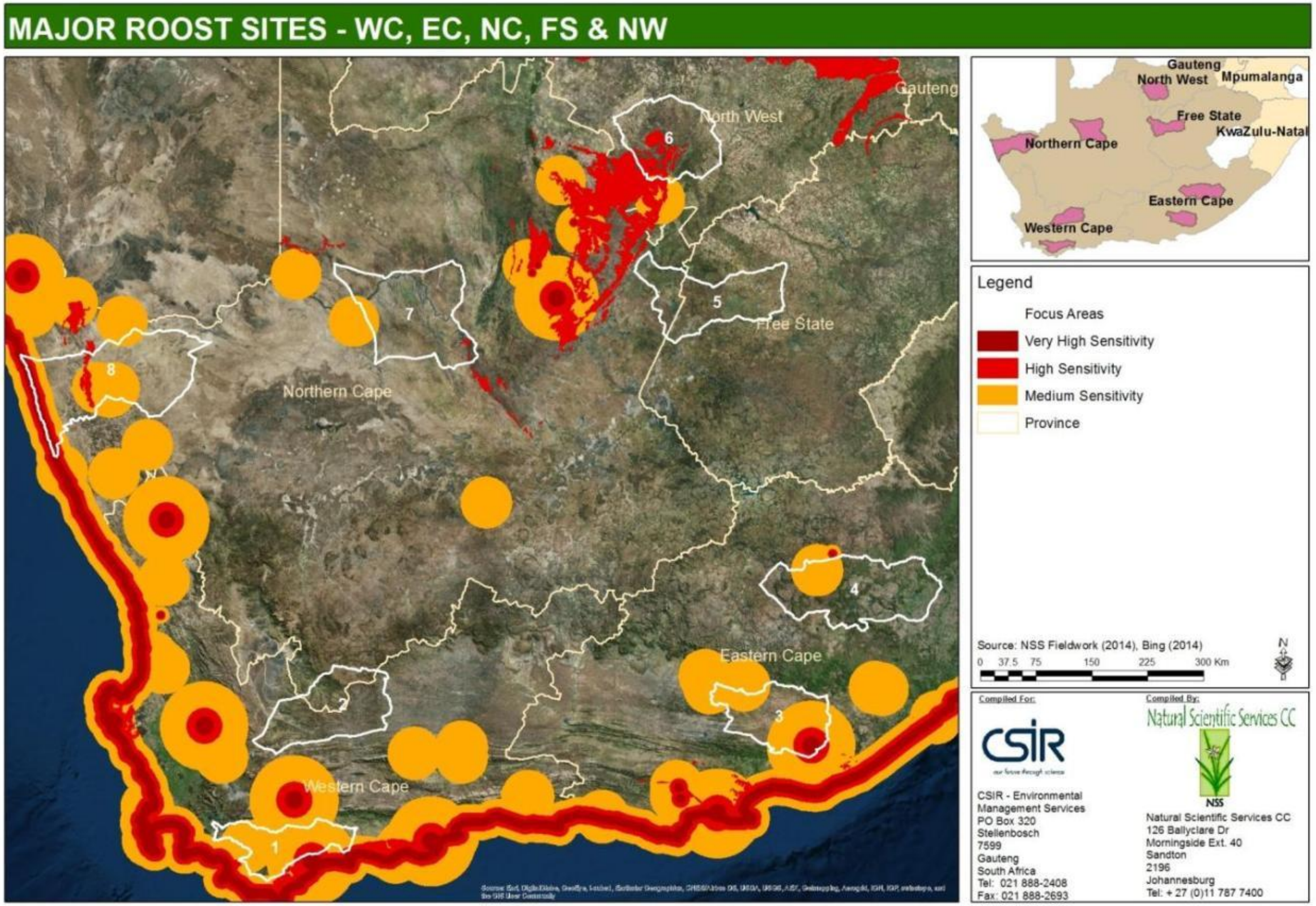
Conservation Important Species: Endemic, Near-Endemic, Threatened, Near-Threatened, Data Deficient Bats or Protected Species

Least Concern: IUCN Red Data status for a Non-threatened species

Watercourse: Definition adapted from the National Water Act, 1996 (No. 36 of 1998)

a. a river or spring;
b. a natural channel in which water flows regularly or intermittently;
c. a wetland, lake or dam into which, or from which, water flows; and
d. any collection of water, such a natural pans and farm dams.

9 APPENDIX 2 –MAJOR ROOST SITES FOR THE W. CAPE, E. CAPE, N. CAPE, FREE STATE AND NW PROVINCE



STRATEGIC ENVIRONMENTAL ASSESSMENT FOR WIND AND SOLAR PHOTOVOLTAIC ENERGY IN SOUTH AFRICA

Appendix A7

Socio-Economic Scoping Assessment Report

Specialist name:
Elena Broughton
Urban-Econ Development Economists

contents

LIST OF MAPS

ABBREVIATIONS AND ACRONYMS

CAGR	Compounded Annual Growth Rate
CSIR	Council for Scientific and Industrial Research
DM	District Municipality
DEA	Department of Environmental Affairs
DOE	Department of Energy
ED	Enterprise Development
FA	Focus Area
GDP-R	Gross domestic Product per Region
IDP	Integrated Development Plan
IPP	Independent Power Producer
LED	Local Economic Development
LM	Local Municipality
PGDS	Provincial Growth and Development Strategy
PV	Photovoltaic
REDZ	Renewable Energy Development Zone
RE IPPPP	Renewable Energy Independent Power Producer Procurement Programme
SA	South Africa
SDF	Spatial Development Framework
SEA	Strategic Environmental Assessment
SED	Socio-Economic Development
SMME	Small Medium and Micro Enterprise

1 STUDY BACKGROUND, APPROACH AND METHODOLOGY

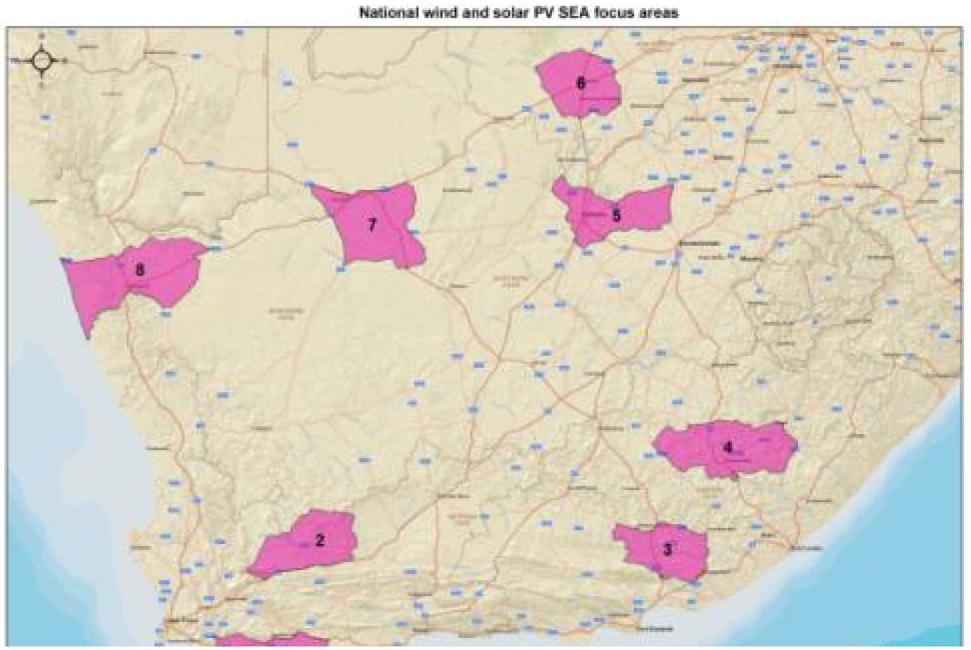
1.1 Background

In 2011, the Department of Energy (DOE) launched a Renewable Energy Independent Power Producer Procurement Programme (RE IPPPP). Since then three bid windows have been closed with 3 931.4 MW across 64 projects being approved. All renewable energy projects participating in the RE IPPPP is required to obtain numerous authorisations, licenses, permits and consents. These include Environmental Authorisations (EA) that is awarded by the national Department of Environmental Affairs (DEA).

Since the beginning of the RE IPPP, the DEA has received over half a thousand applications for EAs and in the process identified a number of weaknesses in the system. This lead to the commencement of the Strategic Environmental Assessment (SEA) process aimed at addressing the inefficiencies found in the system and streamlining the development of renewable energy projects in the country. The specific objectives of SEA include:

- Identification of geographical areas best suited for wind and Photovoltaic (PV) energy project roll-out, referred to as Renewable Energy Development Zones (REDZs).
- Provide a platform for coordination between various authorities responsible for issuing authorisations, permits and consents.
- Streamlining obtaining EAs for projects.
- Providing for more efficient planning with respect to infrastructure development necessary to support RE projects roll-out

Undertaking of the SEA was broken down into two phases. During Phase 1, eight Focus Areas (FAs) were delineated (refer to Map 1-1). The purpose of Phase 2 is to refine the FAs and complete scoping-level specialist studies to inform future development thereof. This report presents the results of the socio-economic scoping-level assessment study.



Map 1-1: National wind and solar PV SEA focus areas (CSIR, 2014)

1.2 Study methodology

The approach to the socio-economic scoping study was as follows:

1. The socio-economic team of specialists familiarised itself with the each focus area and identified its location with respect to provincial and local municipal boundaries. Furthermore, all sub-places and major towns that form part of each FA were also identified at that point.
2. All secondary data pertaining to each FA was collected:
   - Strategic documents and policy documents were sourced from the in-house databases and the internet (Spysis, government websites, town planners' websites, etc.);
   - Socio-economic data was extracted from Stats SA and Quantec databases for each FA; and
   - Land use data was mapped using available GIS information.
3. Two sets of statistics information were prepared. One referred to the FA and the other referred to all municipalities that form part of each FA. Information related to each FA was based on the data obtained from Stats SA Census 2011 by extracting statistical data for all sub-places identified to be part of that FA.
4. Data was then analysed and interpreted, which culminated in the development of baseline profiles included in this report.
5. Thereafter, a general list of socio-economic impacts associated with wind and PV projects' implementation was compiled and applicability of these separately to wind and PV project indicated.
6. Land uses were evaluated in terms of their sensitivities to socio-economic impacts that could potentially result from wind and PV project developments both directly or through secondary impacts. The focus was on land uses that are associated with some form of economic activities, i.e. used to derive value added directly or indirectly, and human settlements.
7. Land uses and their socio-economic impacts were then analysed and broad recommendations with respect to development in the specific FA were provided
8. Thereafter, each FA was analysed and assessed with respect to the potential socio-economic impacts.
9. Lastly, the overall suitability of each FA, best areas in FAs for development, and broad mitigation measures were provided.

1.3 Data Sources

The below table provides a detailed list of all data sources used in the compilation of this document.

Data title	Source and date of publication	Data Description
Focus Area Data	Stats SA Census 2011	Focus Area Population and Socio-Economic Data
Municipal Data	Stats SA Census 2011	Focus Area Population and Socio-Economic Data
Municipal Economic Data	Quantec, 2014. Standardised Regional Data	Economic Statistical Data
Land use	2009 National Land Cover	Land Cover
	SAPAD OR 2014 Q1	Nature Reserves
	SAPAD OR 2014 Q1	National Parks
	2013 National Parks Expansion	National Parks Expansion
	ECPAES Informal	Informal Conservation
	Exempt Farms	Exempt Farms
	Mining licenses	Mining Rights – lapsed and issued
	2013 Demarcation Board	Local and District Municipalities
	DAFF Data	Plantations and field crop boundaries
	DEA Data	World heritage sites, special nature reserves, protected environment, nature reserves, national parks, mountain catchment areas, forest wilderness area, forest nature reserves.
	DWAFF Data	Rivers
National Policy Review	National Energy Act (2008), The White Paper on Renewable Energy (2003), National Climate Change Response Green Paper (2010), The New Growth Path Framework (2010), The Integrated Resources Plan 2010 -2030 (2011), National Development Plan 2030	Strategic documents describing the macro-economic situation and objectives in the country
Provincial Policy Review	Provincial Growth and Development Strategies, Renewable Energy Strategies, Provincial Local Economic Development Plans, and Spatial Development Frameworks	Strategic documents describing socio-economic situation and objectives in a province and outlining its developmental priorities
Local Spatial Maps and Priorities	Spatial Development Frameworks (SDFs) developed for provinces, district and local municipalities (refer to FA sections for details)	The SDF provides a spatial illustration of land-users, priority zones and development corridors. These documents are publically available.
Local Economic Priorities and Challenges	Integrated Development Plans (refer to FA sections for details)	The IDP is an overarching development document formulated for the specific local government, with socio-economic needs of the local communities and the plans to address these. It represents a planning document for the set period. These documents are publically available.

Data title	Source and date of publication	Data Description
	Local Economic Development Plans (refer to FAs sections for details)	The LED is a development plan devised for a province or a local government. It outlines sectors that are planned to be stimulated to improve the socio-economic environment in the area and specifies projects that are envisaged to be supported to achieve the economic development goals. These documents are publically available.
Pictures collected from visits to FA	CSIR, 2014. Visits to FA taken place during March and April 2014	Pictures of Focus Areas taken during the site visits
Environmental Impact Assessment Reports	Impact Assessment Reports completed for various projects, of which location falls within the FAs analysed	Environmental Impact Assessment Reports submitted to authorities for wind and solar PV projects

1.4 Assumptions and Limitations

Limitation	Included in the scope of this study	Excluded from the scope of this study	Assumption
GIS data are not detailed or up-to-date with respect to land uses	GIS data received from the CSIR that is largely sourced from public sources	Comprehensive review of previous studies and other data sources that might provide details on land uses applicable to selected sites in each FA and including such site-specific data were excluded from the study.	Available GIS data were considered to be sufficient for the purpose of this study; where knowledge of the sensitive receptors was available but they were not reflected on the maps, it was advised that an in-depth analysis of the area was performed at project development stages
Outdated socio-economic data	Census 2011 and Quantec 2011 statistics were used as the most recent information	No projections for the current state of the FA's socio-economic environment to reflect 2014 figures were made	It was assumed that changes in the socio-economic environment of the FAs would not be so significant over a three year period that it would affect the recommendations
FA boundaries do not follow administrative boundaries of municipalities or sub-places	For demographic and labour force data, statistics provided for towns and settlements located on the outskirts or inside the FA were used (as per Census 2011)	Sub-places and wards or generally areas that might not fall under the identified towns or settlements	Data provided for towns and statements located in or on the boundaries of each FA were considered to be sufficient for representation of the FA-related demographics and labour force statistics
	For economic and access to services data information was available only at the local municipality level	FA-specific economic and service delivery stats	It was assumed that in most instances the information reflecting LMs' economic dynamics and structure, as well as levels of access to services were adequate for the understanding of the conditions in each FA; this information was augmented by review of SDFs, IDPs, and LEDs

1.5 Relevant Regulatory Instruments

This section provides a summary of the key socio-economic policies and strategic documents that affect the development in the country and that apply to all FAs under analysis. The national policy review presented in this section is also done to prevent repetition, while a cursory overview of the documentation used for provincial and local analyses are presented further in the report.

Documents reviewed	Summary
• National Energy Act (2008) • The White Paper on Renewable Energy (2003) • National Climate Change Response Green Paper (2010) • The New Growth Path Framework (2010) • The Integrated Resources Plan 2010 -2030 (2011) • National Development Plan 2030	• The New Growth Path Framework and the National Development Plan 2030 seek to stimulate annual growth of 5.4% while simultaneously creating approximately 11 million new job opportunities by 2030. Unemployment remains South Africa's largest socio-economic concern and is a central driving force behind innovation and the achievement of economic growth. • Policy priorities at national level aim to reduce unemployment and poverty by achieving the following: – Improving social protection and basic service delivery; – Agrarian reform and rural development; – Human resource development and education; – Infrastructure development; – Manufacturing diversification; and – Public sector and institutional transformation. • Apart from the priorities listed above, the national policies demarcate the renewable energy sector as imperative to growth and creation of new jobs in the country. Policy surrounding renewable resources and the green economy aim to facilitate an expansion in renewable energy sources and a reduction in carbon pollutants. • The White Paper on Renewable Energy sets an output target of 10 000 GWH of renewable energy by 2013. • The National Climate Change Response Green Paper aims to stabilise greenhouse gas emissions and manage climate change. The Paper plans to achieve these goals by: – Diversifying the energy mix; – Establishing a business environment for the renewable energy manufacturing industry; and – Improving R&D relating to renewable energies. • According to the Green Economy Accord, the signatories thereof (i.e. organised labour, businesses, communities and government) agreed to create approximately 300 000 employment opportunities in economic activities that green the economy by 2020. • The Integrated Resource Plan (IRP) 2010 stipulates that approximately 56 539 MW of additional electricity generating capacity will be required to support economic growth in South Africa over the next 20 years. The plan proposes that 9 200 MW of this will be provided by wind power facilities and a further 9 200 MW by PV by 2030. This is further affirmed in the National Development Plan (NDP) 2030 that seeks to ensure that half of all new electricity generation capacity is generated by renewables by 2030.

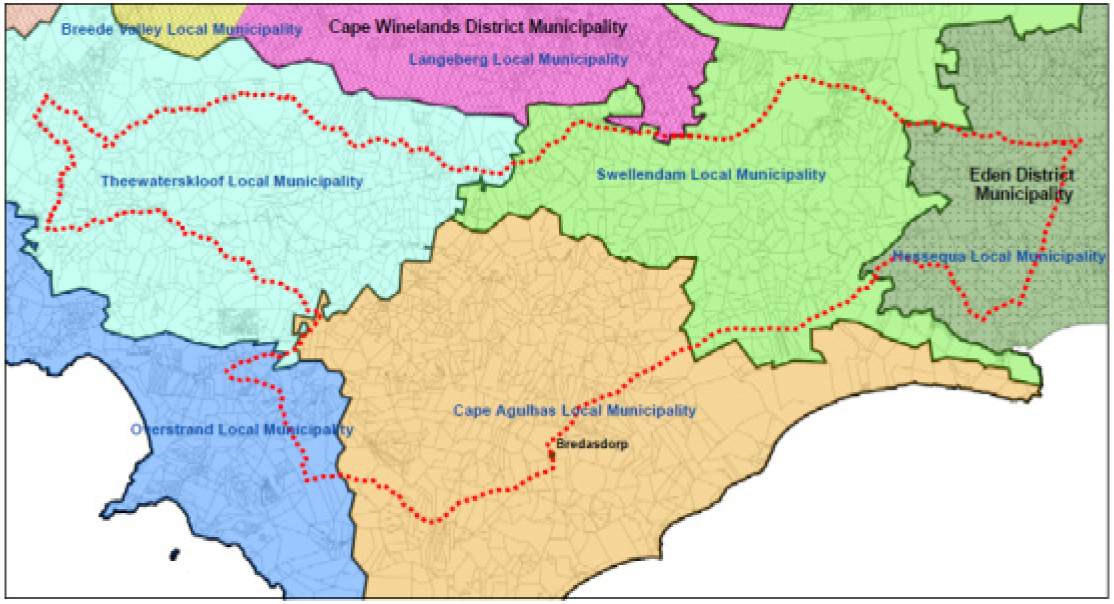
2 FOCUS AREAS' BASELINE PROFILES

2.1 Overberg Focus Area 1

2.1.1 Composition of the focus area

The Overberg FA is located in the southern region of the Western Cape Province, mainly within the Overberg District Municipality (DM) and a portion of the Eden DM. Portions of five Local Municipalities (LMs) form part of the FA, specifically, Cape Aghulas, Overstrand, Swellendam, Theewaterskloof, and Hessequa.

The major towns encompassed by the FA are Bredasdorp located in the Cape Agulhas LM and Swellendam located in the Swellendam LM. Most of the LMs that form part of the FA are associated with relatively low population densities, with the Overstrand and Theewaterskoof LMs having greater population densities than other LMs included in the FA.



Map 2-1: Overberg Focus Area

Distribution of Towns and Major Settlements within the Overberg Focus Area (Stats SA Census 2011)				
Province	District municipalities	Local Municipalities	Towns and settlements	LMs' population densities (people/ km^2)
Western Cape	Overberg DM	Cape Agulhas	• Bredasdorp (on FA's boundary) • Napier • Elim (on FA's boundary)	11.0
		Overstrand	• No towns and major settlements	37.9
		Swellendam	• Buffeljagsrivier • Swellendam (on FA's boundary)	7.9

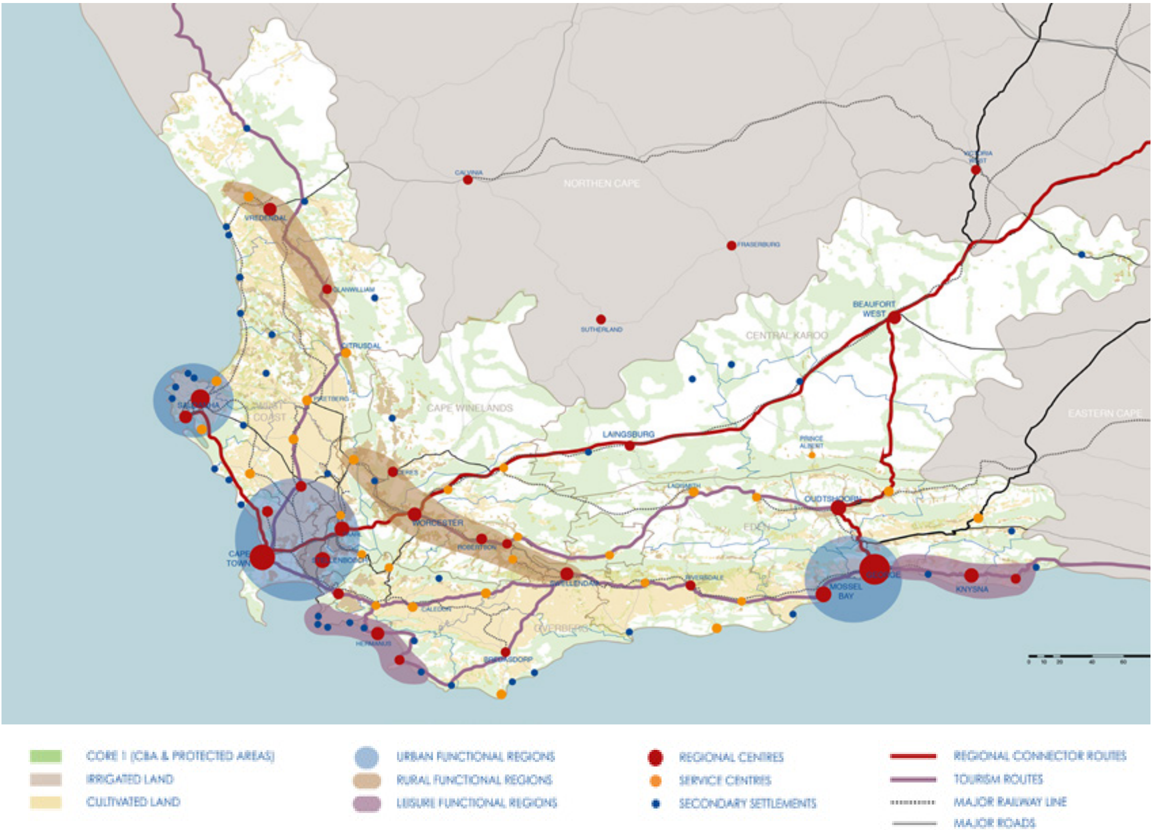
Distribution of Towns and Major Settlements within the Overberg Focus Area (Stats SA Census 2011)				
Province	District municipalities	Local Municipalities	Towns and settlements	LMs' population densities (people/ km²)
		Theewaterskloof	• Caledon (On FA's boundary) • Greyton (On FA's boundary) • Riviersonderend (on FA's boundary) • Myddleton • Genadendal (Small on FA's boundary)	27.5
	Eden DM	Hessequa	• Slangrivier	7.0

2.1.2 Policy review

a) Provincial policies and strategic documents of the Western Cape Province

Documents reviewed	Overview of Provincial Policies and Strategic Documents of the Western Cape Province

• The Western Cape Strategic Plan (Draft, 2010)
• Western Cape Provincial Spatial Development Framework (Draft , October 2013)
• The Western Cape Provincial Spatial Development Framework (2009)
• White Paper on Sustainable Energy for the Western Cape (Final Draft, 2008)
• Sustainable Energy Strategy and Programme of Action for the Western Cape (November, 2007)
	• According to the Western Cape Draft Strategic Plan of 2010, growth in the region is driven primarily by private sector businesses and the role of the state is to create and maintain an enabling environment for business. In that regard it encourages:
	  ○ Small-scale renewable energy production; and
	  ○ The creation of opportunities for growth and development in rural areas by promoting infrastructure development and service delivery.
	• The main objectives of the province's strategic plan are:
	  ○ To increase social cohesion and wellness;
	  ○ Introduce skills training programmes and create employment in the private sector; and
	  ○ Stimulate and subsidise innovation in clean and renewable technologies.
	• Western Cape provincial government, in the Sustainable Energy Strategy of 2007 and Programme of Action for the Western Cape of 2008, indicates that emergent IPPs and sustainable energy producers must be supported especially in the rural and renewable resource rich areas, in order to uplift stagnating economies. The provincial government states that 18% of the electricity consumed in the province will be from certified local renewable energy generation resources by 2020 and 30% by 2030, whereby certified renewable energy resources included wind, solar PV, solar water heaters, bio-diesel, other biomass (biomass waste from sawmills or pulp plants), hydro, pumped storage, and wave energy.
	• The Western Cape Economic Development Partnership (EDP) aims to put the regional economy on the map by focusing on:
	  ○ Economic data and intelligence;
	  ○ Shared vision, common strategy and joint plans; and
	  ○ Investment climate, business brand and performance of the delivery system.
	• In its Strategic Initiative to Introduce Commercial Land Based Wind Energy Development to the Western Cape (2006), the provincial government encourages the designation of suitable areas for wind energy project developments as it promotes efficiency in the projects implementation and

• Climate Change Strategy and Action Plan for the Western Cape (December 2008) • Growth and Development strategy. White Paper (February 2008) • Strategic Initiative to Introduce Commercial Land Based Wind Energy Development to the Western Cape (2006)	integration with other land-uses. Based on international experience urban location for wind energy project developments should be considered. • According to the Western Cape PSDF of 2013, several scenic landscapes require strategies to ensure their protection from large scale infrastructural developments, especially in the Central Karoo. In this regard government states that future power lines should be aligned within existing and proposed combined road and/or rail linkage corridors.  Map 2-2: Western Cape Spatial Development Framework Map

b) Local social and economic infrastructure development priorities, plans and potential red flag areas

Documents reviewed	Socio-Economic Development Priorities, Plans and Potential Red Flag Areas.
• Regional Development Profile Overberg District (working paper, 2013) • Overberg Integrated Development Plan (2nd Review of 2012-16 IDP) (Draft, 2014-2015) • Overberg Integrated Development Plan (2012-2016) • Cape Agulhas municipality revised IDP (Draft, 2013-2014) • Cape Agulhas Local Economic Development Strategy (Revised draft, 2013) • Langeberg MCDF (Draft, 2013) • Swellendam Municipality 3rd Generation Integrated Development Plan 2012-2017 (Adopted, May 2013) • Swellendam Municipality Local Economic Development Strategy (2008-2011) • Overberg Integrated Development Plan (Review 2014-2015) • Hessequa Integrated Development Plan (1st Review, 2013-2017) • Hessequa Local Economic Development Implementation Plan (2008) • Theewaterskloof LED Strategy, (2009) • Theewaterskloof Vision 2030 (2011)	• The Overberg DM and most of the local municipalities that fall into the FA, focus on ensuring health and safety for the people through: o Ensuring health services; o Ensuring coordination of disaster management strategies; and o Environmental management. • Agriculture is the main economic sector within the six local municipalities that are included in the Focus Area. • The local governments support development of tourism set to: o Protect the natural environment and landscape; and o Develop infrastructure for tourism purposes. • Within the Overberg DM the tourism sector is prioritised, especially in the Overstrand LM, which is the fastest growing economy in the district. • Local governments face similar challenges within the FA; especially: o Insufficient infrastructure development; o Inadequate basic service delivery; o Housing needs and spatial imbalances; o Scarce provision of water, electricity and refuse removal; o Necessity for higher order roads, access routes and public transport; and o Bulk service infrastructure, cemeteries and electricity requirements. • Local municipalities align with provincial and national policies with regard to adoption of a low carbon economy and the encouragement of alternative and resource-efficient sources of energy by: o Stimulating and subsidising innovation in clean and renewable technologies.

Theewaterskloof priorities:

- Healthy "social abric"
- Service delivery
- Development of the tourism sector
- Economic development
- Infrastructure and housing

Theewaterskoolf challenges:

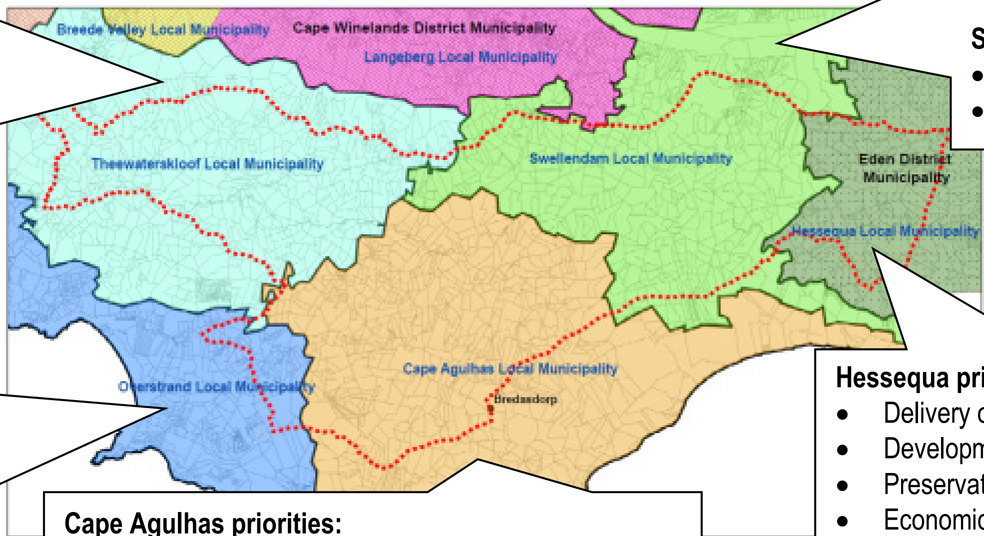
- Economic poverty
- Unemploymemt

Swellendam priorities:

- Healthy environment
- Skills development
- Protect natural environment
- Correcting spatial imbalances
- Basic services delivery
- Sustainable settlements

Swellendam challenges:

- Job losses
- Education deficiency



Overstrand priorities:

- Municipal services delivery
- Health and safety
- Promotion of tourism
- Economic and social development

Overstrand challenges:

- Housing needs

Cape Agulhas priorities:

- Development of bulk infrastructure
- Provision of basic services
- Diversification and economic development
- Develop tourism sector and create job opportunities
- Safety and livelihoods of vulnerable groups

Cape Agulhas challenges:

- Lack of transport infrastructure
- Dependency on agriculture

Hessequa priorities:

- Delivery of basic services
- Development of integrated settlements
- Preservation of natural environment
- Economic growth through tourism

Hessequa challenges:

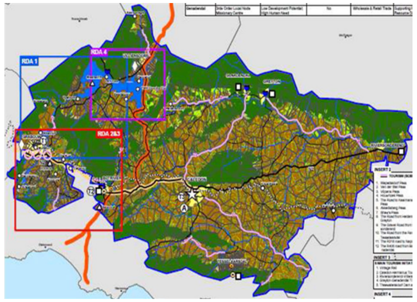
- Economic poverty
- Lack of formal dwellings
- Unemployment

c) Spatial development priorities, plans and potential red flag areas

Documents reviewed	Spatial Development Priorities and Policies Review For the Overberg Focus Area.

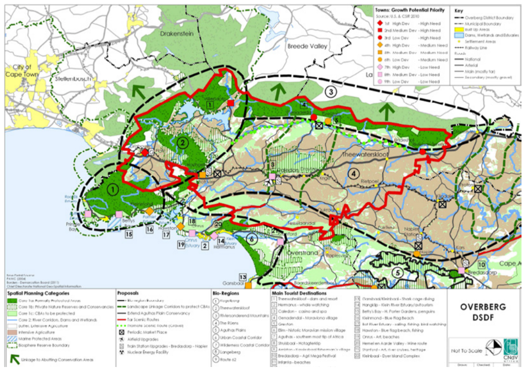
• Overberg District Municipal Spatial Development Framework (Draft, June 2013)
• Langeberg Municipal Spatial Development Framework (November, 2013)
• Hessequa Integrated Development Framework (1st Review, 2013-2017)
• Eden District Municipality: Spatial Development Framework (Review, September 2009)
• Theewaterskloof LED Strategy, (2009)
• Theewaterskloof Vision 2030 (2011)
• Swellendam Spatial Development Framework Volume II: Development Strategy (2008)
• Cape Agulhas SDF (2012)
	• Overberg district spatial development plan is in alignment with the provincial and national priorities regarding the following:
	  o Densification of urban areas;
	  o Protection of natural resources and landscapes to maintain the touristic potential; and
	  o It also proposes the extension of conservation reserves in the southern part of the FA (Agulhas plains)
	• Most of the biggest settlements are located in the periphery of the FA and the central region is mainly described as agricultural zone combined with natural conservation zones:
	  o Intensive agricultural activities are developed in the north-central and north-western parts of the FA;
	  o The south-western parts of the FA (Overstrand) is developing a regional tourism strategy for promoting tourism opportunities in the district including agri-tourism; and
	  o Spatial plans limit future developments in the area surrounding the Breede River crossing at the east part of the Focus Area (Malgas), this area is selected for conservation and touristic purposes.
	• One of the tourism corridors established by the Overberg DM falls under the FA; it encompasses the area between the Napier, Bredasdorp and Elim, i.e. towns located at the southern corner of the FA.
	• The Overberg SDF proposes a road/rail minor corridor from Bredasdorp to Cape Town, via Caledon, which would cut across the Focus Area from south-east to north-west.
	• Strategic plans set the north-central region of the FA (Riviersonderend) as the most suitable zone for wind development projects.
	• The Hessequa and Theewaterskloof municipalities encourage deployment of large-scale renewable energy projects.
	• The local government of the south-central part of the FA (Cape Alguhas) has adopted renewable energy as one of the most prominent sectors to be developed and there are plans in place to explore the possibility of utilising alternative energy sources for the affordable housing development in Napier and Bredasdorp.

- Intensive agricultural activities in the central belt
- Private Nature Reserves and Conservancies areas north of Caledon
- Formally protected areas along the northern boundary of the FA
- Scenic route along the northern boundary of the FA

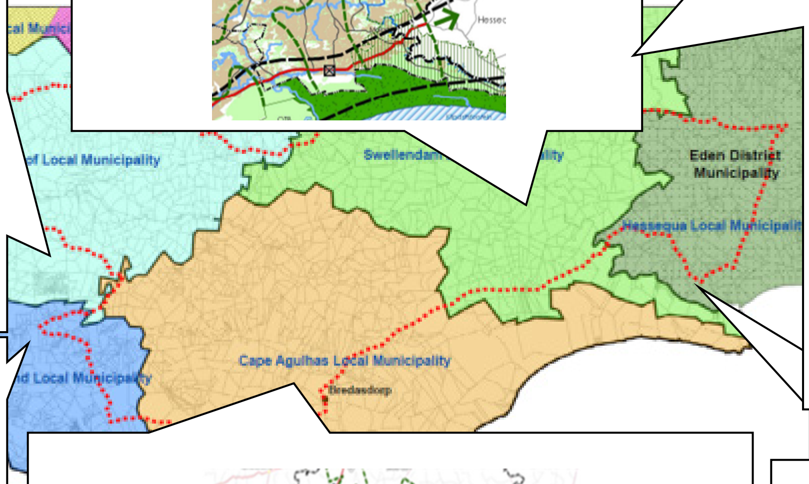


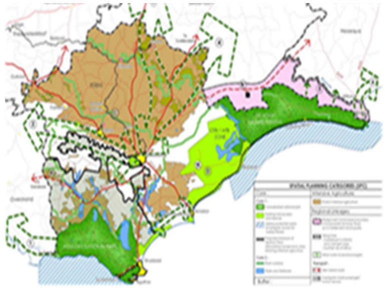
- District municipality promotes touristic projects and demarcates large portion for nature reserves and conservancies
- Salmonsdam Natural Reserve

Overberg DM SDF



- Zone of intensive agriculture
- Protected areas in the northern part of the FA

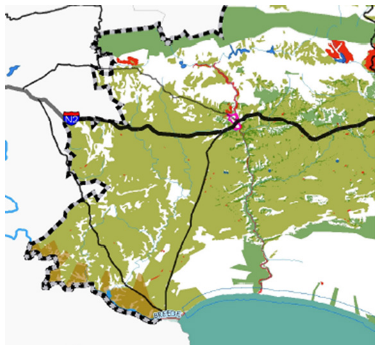




- There are three natural reserves: Sandies Glen, Jan Malherbe and Heuningberg
- Tourism corridor located between Napier, Bredasdorp and Elim
- Areas of medium wind energy potential located outside the FA

- Breede River crossing selected for conservation and touristic purposes in the east zone
- Bontebok National Park
- Conservation of natural environment and the agricultural character at Buffeljagsriver

- Areas of intensive agricultural activities



2.1.3 Socio-economic profile

The socio economic profile of the Overberg Focus Area includes demographic information of all the towns and major settlements that lie within the Focus Area. It also encompasses economic data for local municipalities.

The Langeberg (LM) is excluded for the economic analysis, because the extension of the Municipality that is encompassed by the study area is very small and the economic and social behaviour of the municipality cannot be extended to the profile of the economic situation of the Focus Area.

a) Demographic profile of the Overberg Focus Area

- The FA is populated by about 70 806 people, of which a quarter resides in the town of Swellendam.
- The majority of people above 15 years of age received some secondary education or completed secondary schooling; a small percentage (3.7%) of the population did not receive any education.
- Between 2001 and 2011 the local municipalities of the FA experienced a positive net migration of 4 418 people; however, only half of the people moved to settlements inside the FA.

Demographic data				
Demographic Profile of the Overgerb FA (Stats SA, 2014)			**Data applicable to all Local Municipalities included in the FA (Quantec, 2014)**	
Population (2011)	70 806		Population (2011)	255 386
Households (2011)	20 309		Population growth (CAGR, %) (2005-2011)	0.4%
Average monthly HH income (R, 2014 value)	9 674.9		Population growth (No.) (2005-2011)	5 588
Education:			Population density (People per km^2)	14.7
No School	1 697	3.7%	Migration:	
Complete or Some Primary	11 381	25.0%	In-migration	24 935
Complete or Some Secondary	27 533	60.5%	Out-migration	20 517
Higher	4 926	10.8%	Net migration	4 418

b) Economic structure of the Overberg Focus Area

- The LMs, of which parts are included in the FA, had a combined value of R13 279.4 million in 2011.
- The Focus Area has been characterised by relatively strong levels of economic growth in the 2005-2011 period. The CAGR of 4% exceeded the average achieved by the wider South African economy (3.2%).

- The secondary and tertiary sectors represent the driving forces behind growth in the municipalities with an overall economic structure indicative of a relatively modern economy.
- The mining and quarrying sector has a very low contribution towards the area's economy, especially in the Swellendam LM, which covers a notable portion of the FA. This sector, though, showed a decline in the period analysed
- Other industries that experienced a decrease in production include the agricultural and utilities sectors.

Size of the economies					
Indicator	Data applicable to all Local Municipalities included in Focus Area (Quantec, 2014)				
Gross Domestic Product (Current Prices) 2011 (R'm)	13 279.4				
Gross Domestic Product (Constant Prices) CAGR (2005-2011)	4.0%				
Sectoral profile (R'm, 2005 constant prices)					
Indicator	Data applicable to all Local Municipalities included in Focus Area (Quantec, 2014)				
	2005		2011		CAGR
Primary Sector	**1 158.1**	**17%**	**1 053.3**	**12%**	**-1.6%**
Agriculture, forestry and fishing	1 148.8	17%	1 045.5	12%	-1.6%
Mining and quarrying	9.3	0%	7.8	0%	-2.9%
Secondary Sector	**1 590.6**	**23%**	**2 181.7**	**25%**	**5.4%**
Manufacturing	1 033.0	15%	1 407.2	16%	5.3%
Electricity, gas and water	118.3	2%	106.8	1%	-1.7%
Construction	439.3	6%	667.7	8%	7.2%
Tertiary Sector	**4 074.5**	**60%**	**5 417.6**	**63%**	**4.9%**
Trade, catering and accommodation	1 162.4	17%	1 208.3	14%	0.6%
Transport, storage and communications	545.1	8%	675.0	8%	3.6%
Finance, insurance, real estate and business services	1 311.5	19%	2 260.7	26%	9.5%
Community, social and personal services	330.9	5%	378.1	4%	2.2%
General government	724.6	11%	895.5	10%	3.6%
Total	**6 823.2**	**100%**	**8 652.6**	**100%**	**4.0%**

c) Labour force and employment situation within the Overberg Focus Area

- In 2011, the labour force of the FA comprised of 28 558 people, of who about 16.3% were unemployed showing a much better unemployment situation than that observed in the national economy.
- The situation in the wider area, encompassing all LMs that form part of the FA, was somewhat different with about a quarter of the labour force being unemployed. Moreover, the number of people absorbed by formal economic sectors in the LMs assessed has decreased dramatically between 2005 and 2011, i.e. by more than eleven thousand people.
- The sector showing the largest number of lay-offs was the primary sector, with agriculture suffering job losses totalling 12 059 within the 2005-2011 period.
- Within the secondary sector, employment has dropped by approximately 9.5% during the period of analysis.
- The tertiary sector created 2 807 new employment opportunities with the finance and business services sub-sector creating much of this growth in employment opportunities; however, it was insufficient to offset overall job losses.

Labour force profile		
Indicator	**Focus Area (Stats SA, 2014)**	**Local Municipalities (Quantec, 2014)**
Employment	23 907	69 467
Unemployment	4 651	24 222
Unemployment %	16.3%	25.9%
Discouraged job seekers	1 865	Unavailable

Sectoral employment (Quantec, 2014)						
Indicator	**Data applicable to all Local Municipalities included in Focus Area**					
	2005		**2011**		**% Change**	**Abs Change**
Primary Sector	**24 393**	**30%**	**12 416**	**18%**	**-49.1%**	**-11 977**
Agriculture, forestry and fishing	24 344	30%	12 284	18%	-49.5%	-12 059
Mining and quarrying	49	0%	132	0%	169.0%	83
Secondary Sector	**14 353**	**18%**	**12 990**	**19%**	**-9.5%**	**-1 363**
Manufacturing	6 872	9%	6 463	9%	-6.0%	-409
Electricity, gas and water	250	0%	225	0%	-10.3%	-26
Construction	7 231	9%	6 302	9%	-12.8%	-928
Tertiary Sector	**42 093**	**52%**	**44 061**	**63%**	**4.7%**	**1 968**
Trade, catering and accommodation	12 130	15%	10 361	15%	-14.6%	-1 769
Transport, storage and communications	1 634	2%	1 465	2%	-10.4%	-169

Indicator	Data applicable to all Local Municipalities included in Focus Area					
	2005		2011		% Change	Abs Change
Finance, insurance, real estate and business services	9 931	12%	12 738	18%	28.3%	2 807
Community, social and personal services	9 888	12%	9 391	14%	-5.0%	-497
General government	8 509	11%	10 106	15%	18.8%	1 596
Total	**80 838**	**100%**	**69 467**	**100%**	**-14.1%**	**-11 371**

d) Access to basic services within the Overberg Focus Area

- Electricity infrastructure in the local municipalities included in the FA appears relatively well developed with approximately 97% of households in the LMs having access to municipal electricity supply. A number of households continue to rely on other sources of lighting such as candles, gas and paraffin.
- Although roughly 90% of households have access to flush and chemical toilet facilities, a problem of households relying on bucket latrines and other forms of sanitation facilities remain. A large number of households have no form of sanitation facility, which poses a serious task for policymakers in the municipalities involved.

Indicator	Access to Basic Services in the Settlements and Towns of the Focus Area. (Stats SA, 2014)	
	HH (No.)	HH (%)
Access to electricity		
Electricity	19 693	97.0%
Solar	57	0.3%
Other (candles, gas, paraffin)	509	2.5%
None	48	0.2%
Total	20 307	100.0%
Access to sanitation		
Flush/Chemical toilet	18 370	90.5%
Pit latrine with/without ventilation	220	1.1%
Bucket latrine	306	1.5%
Other	665	3.3%
None	746	3.7%
Total	20 307	100.0%
Access to water		
Piped water inside dwelling	16 647	82.0%
Piped water inside yard	2 163	10.7%

Indicator	Access to Basic Services in the Settlements and Towns of the Focus Area. (Stats SA, 2014)	
	HH (No.)	HH (%)
Piped water on community stand (>200mts)	1 369	6.7%
None	128	0.6%
Total	20 307	100%

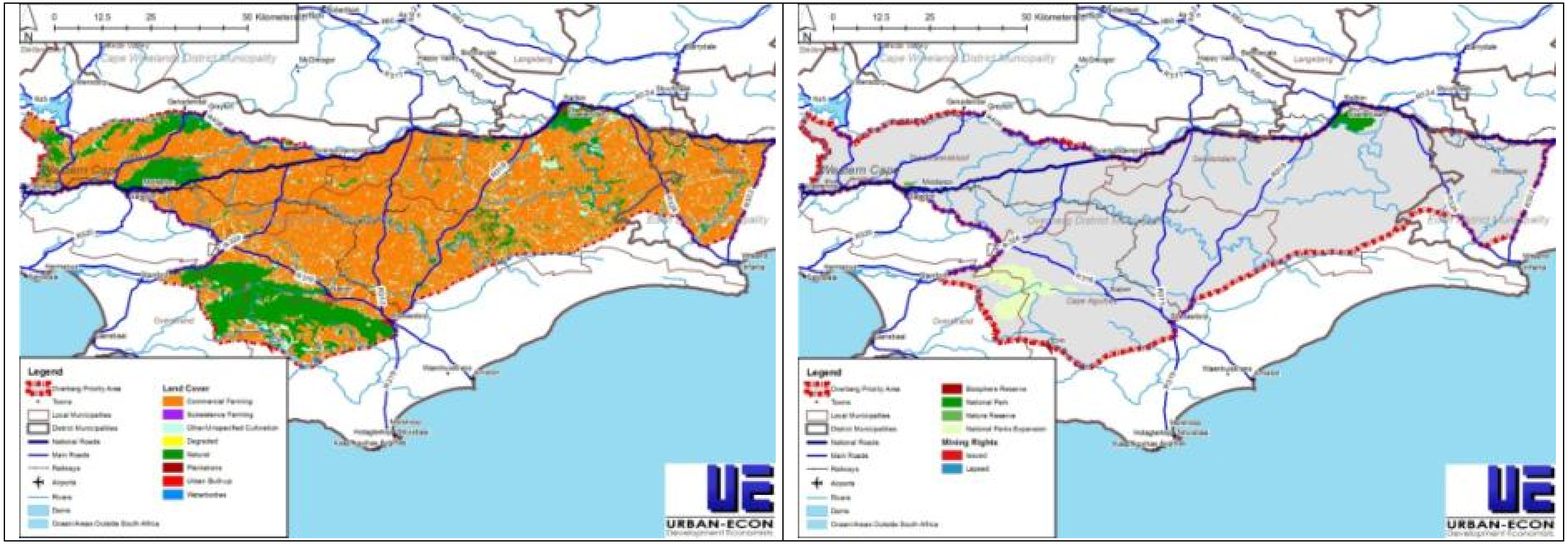
e) Level of economic infrastructure development of the Overberg Focus Area

The FA is not fully connected with the rest of the country and the local governments are facing challenges to develop the transport infrastructure.

Indicator	Transport Infrastructure Development Overview.
Airports	No airports are located within the Overberg Focus Area.
Railway Lines	Railway line connecting Bredasdorp, Napier, Caledon and Protem.
National Roads	The N2 is the north boundary of the Focus Area.
Regional Roads	Three main regional roads connect Bredasdorp in the south with the N2 and the rest of the FA.

2.1.4 Land use profile

Core land uses	Natural and mineral resources
• With the exception of Myddleton, Napier, Slangrivier and Buffeljagsrivier, the major settlements are located on the border of the FA. • The FA is characterised by the large extension of land used for commercial faming purposes. • Small areas of natural landscape are mainly located in the Overstrand and the Cape Agulhas LMs.	• National parks and nature reserves are located in the southern and western areas of the FA. Localities aim to preserve these areas for touristic purposes. • Development of tourism projects is a priority in the western half of the FA. • Tourism corridors are to be established in the southern part of the FA. • Although not indicated in the map, the northern part of the FA borders with the protected areas that have touristic value.



2.1.5 Key summary

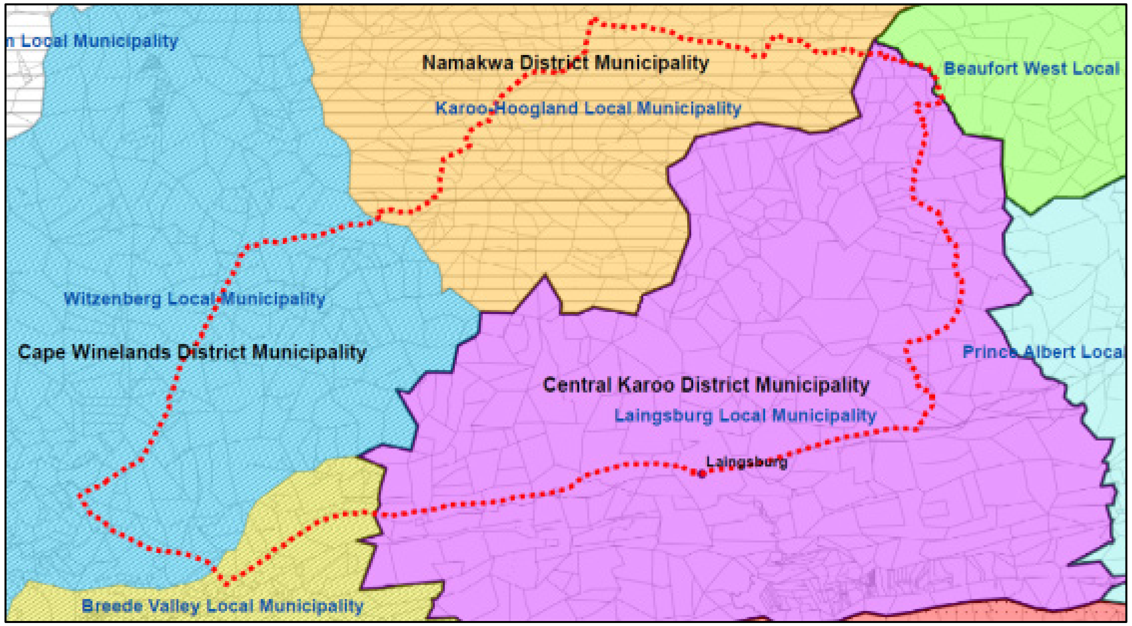
- Overberg Focus Area is characterised by its large rural areas, opportunities for tourism development and its interest in exploring the renewable energy industry.
- There was about 20 309 households and 70 806 people living inside the Overberg FA in 2011.
- In recent years the agriculture sector has faced challenges in most of the local municipalities encompassed by the FA, which resulted in significant job losses in this industry.
- The finance and business services sector is the biggest contributor to the local economy particularly in the Theewaterskloof and the Overstrand LMs
- The FA has limited infrastructural services, and some places within the FA are particularly hard to reach due to the absence of regional roads; only the main towns are connected through regional roads.

2.2 Komsberg Focus Area 2

2.2.1 Composition of the focus area

The Komsberg Focus Area covers parts of the Western Cape and the most southern part of the Northern Cape. It encompasses parts of the local municipalities of Laingsburg, Karoo Hoogland, Witzenberg and a small portion of Breede Valley.

The major settlements in the FA are situated on the border of the delineated area and include the Laingsburg Town, which forms part of the Laingbsurg LM in the Central Karoo DM and Touws River, which is situated in the Breede Valley within the jurisdiction of the Cape Winelands DM. The majority of the FA is covered by parts of the Karoo Hoogland LM and the Lainsburg LM, which have extremely small population densities of less than one person per sq.km.



Map 2-3: Komsberg Focus Area

Distribution of Towns and Major Settlements within the Komsberg Focus Area				
Province	**District Municipalities**	**Local Municipalities**	**Towns and settlements**	**LMs' population densities (people/ km²)**
Western Cape	Cape Winelands DM	Breede Valley	Touws River	10.8
		Witzenberg	No towns and major settlements	43.5
	Central Karoo DM	Laingsburg	Laingsburg	0.9
Northern Cape	Namakwa DM	Karoo Hoogland	No towns and major settlements	0.4

2.2.2 Policy review

a) Provincial policies and strategic documents

<table>
<tr><th>Documents reviewed</th><th>Overview of Provincial Policies and Strategic Documents</th></tr>
<tr><td colspan="2">Western Cape</td></tr>
<tr><td>
The Western Cape strategic plan (Draft, 2010)
Western Cape Provincial Spatial Development Framework (Draft , October 2013)
The Western Cape Provincial Spatial Development Framework (2009)
White Paper on Sustainable Energy for the Western Cape (Final Draft, 2008)
Sustainable Energy Strategy and Programme of Action for the Western Cape (November, 2007)
Climate change strategy and action plan for the Western Cape (December 2008)
Growth and Development strategy. White Paper (February 2008)
Strategic Initiative to Introduce Commercial Land Based Wind Energy Development to the Western Cape (2006)
</td><td>
According to the Western Cape Draft Strategic Plan of 2010, growth in the region is driven primarily by private sector businesses and the role of the state is to create and maintain an enabling environment for business. In that regard it encourages:
Small-scale renewable energy production; and
The creation of opportunities for growth and development in rural areas by promoting infrastructure development and service delivery.
The main objectives of the province’s strategic plan are:
To increase social cohesion and wellness;
Introduce skills training programmes and create employment in the private sector; and
Stimulate and subsidise innovation in clean and renewable technologies.
Western Cape provincial government, in the Sustainable Energy Strategy of 2007 and Programme of Action for the Western Cape of 2008, indicates that emergent IPPs and sustainable energy producers must be supported especially in the rural and renewable resource rich areas, in order to uplift stagnating economies. The provincial government states that 18% of the electricity consumed in the province will be from certified local renewable energy generation resources by 2020 and 30% by 2030, whereby certified renewable energy resources included wind, solar PV, solar water heaters, bio-diesel, other biomass (biomass waste from sawmills or pulp plants), hydro, pumped storage, and wave energy.
The Western Cape Economic Development Partnership (EDP) aims to put the regional economy on the map by focusing on:
Economic data and intelligence;
Shared vision, common strategy and joint plans; and
Investment climate, business brand and performance of the delivery system.
In its Strategic Initiative to Introduce Commercial Land Based Wind Energy Development to the Western Cape (2006), the provincial government encourages the designation of suitable areas for wind energy project developments as it promotes efficiency in the projects implementation and integration with other land-uses. Based on international experience urban location for wind energy project developments should be considered.
According to the Western Cape PSDF of 2013, several scenic landscapes require strategies to ensure their protection from large scale infrastructural developments, especially in the Central Karoo. In this regard government states that future power lines should be aligned within existing and proposed combined road and/or rail linkage corridors.
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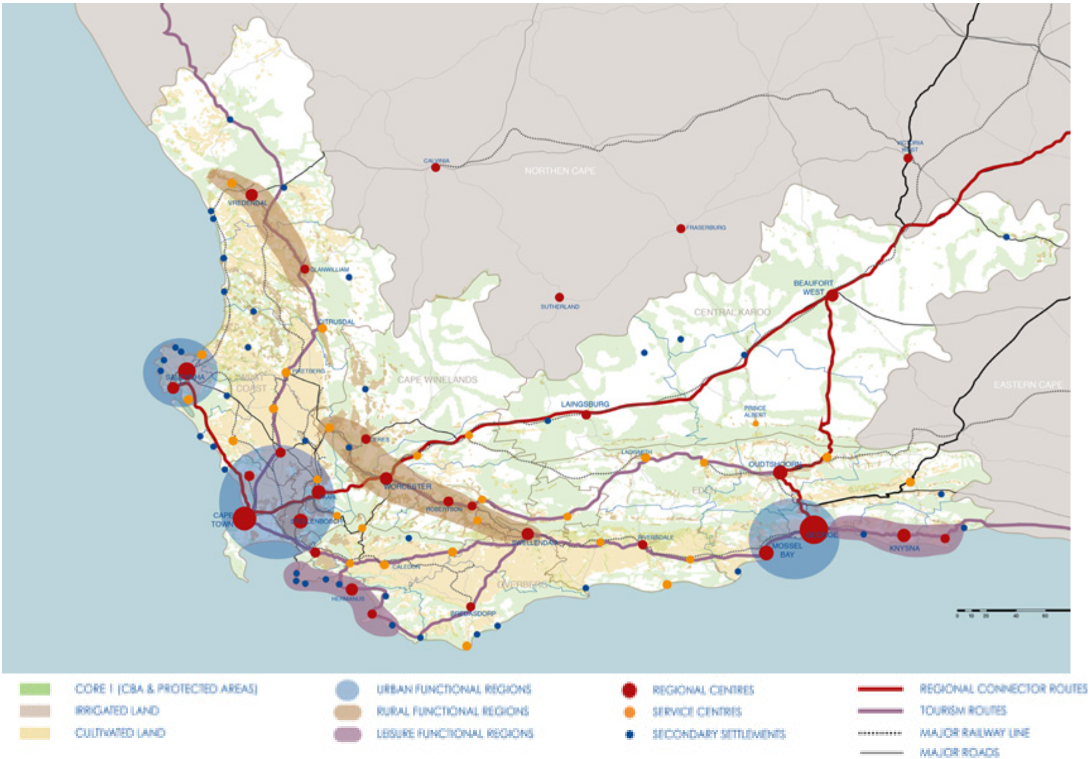
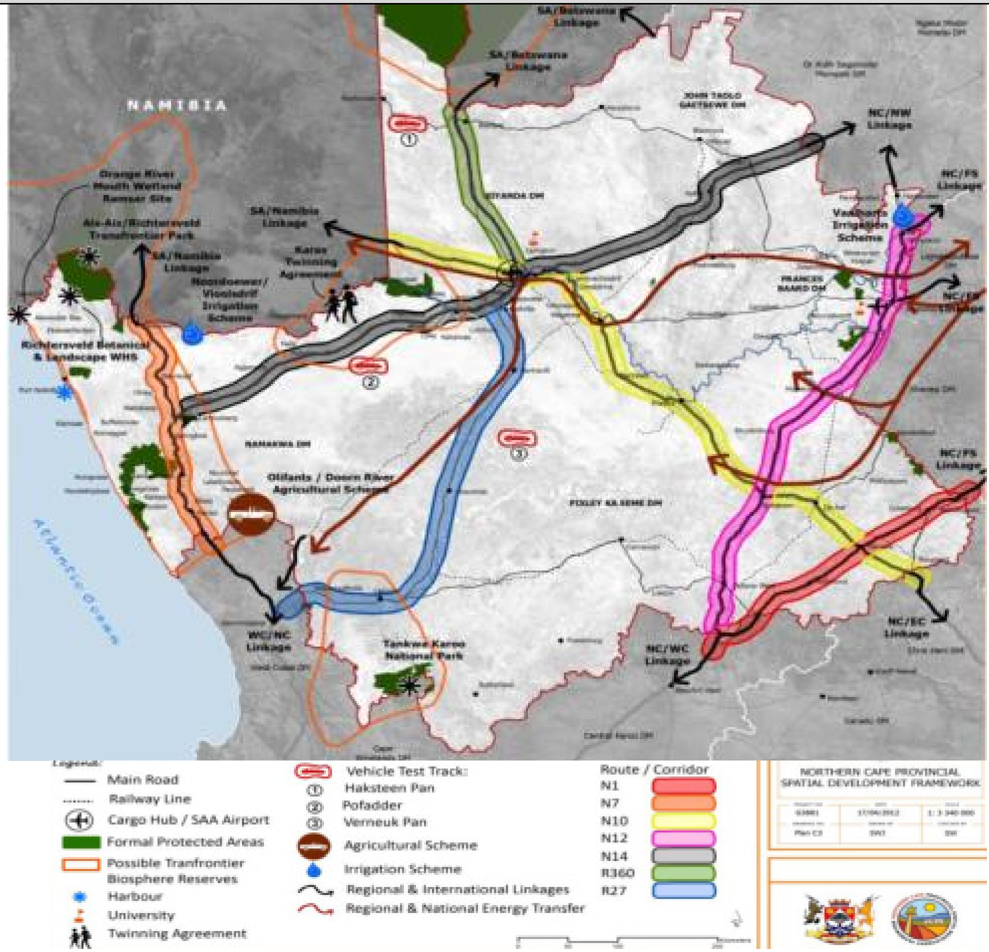
Documents reviewed	Overview of Provincial Policies and Strategic Documents
	 Map 2-4: Western Cape Spatial Development Framework Map
Northern Cape	
• The Northern Cape Municipal LED Framework (February, 2011) • Northern Cape Provincial SDF (July, 2012) • The Northern Cape province Local Economic Development Framework (February, 2011) • The Northern Cape province Local Economic	• According to the Northern Cape PSDF (2012), the overarching goal of the province is to focus on sustainable development; thus it places emphasis on the long-term sustainability and growing prosperity in the province by focusing on the following tasks: ○ Promote sustainable economic development by building on the comparative economic advantages of the province; ○ Protect and utilise the natural resource base in a sustainable manner for the benefit of all parties concerned; ○ Merge social, ecological and economic considerations in decision-making as is required by legislative instruments (NEMA);

Documents reviewed	Overview of Provincial Policies and Strategic Documents
Development Strategy (January, 2011) • The Northern Cape Provincial Growth and Development Strategy • The Northern Cape Municipal LED Framework (February, 2011) • Northern Cape Provincial SDF (July, 2012) • The Northern Cape province Local Economic Development framework (February, 2011) • The Northern Cape province Local Economic Development strategy (January, 2011) • The Northern Cape provincial Growth and Development Strategy	○ Make a meaningful and lasting contribution to eradication of poverty and inequality through the wise use of the inherent capital of the province; and ○ Create an environment that will ensure an acceptable return on capital invested by the private sector. • The Northern Cape PGDS identified the following two primary development objectives: ○ Promoting the growth, diversification and transformation of the provincial economy; and ○ Poverty reduction through social development. • The Northern Cape PSDF (2012) states that in order to take a proactive stance with regard to the promotion of economic development, the provincial government proposes to allocate resources to the identification, scoping, appraisal and investment marketing for a suite of flagship projects that can leverage associated investment and economic activity in areas of high relative economic potential. • As outlined in the Northern Cape PGDS, provincial government seeks to grow the agricultural economy and is committed to promoting transformation in agriculture. • According to the Northern Cape PSDF (2012), the Northern Cape holds a significant comparative economic advantage in a number of enterprises in the science and technology sector including: ○ Square Kilometre Array (SKA), Carnarvon in the Pixely Ka Seme DM; ○ Southern African Large Telescope (SALT); and ○ Karoo Array Telescope (MeerKAT), Carnarvon in the Pixely Ka Seme DM. • In the context of ensuring the availability of inexpensive energy and promotion of development in the province, the Northern Cape PGDS promotes the development of energy sources such as solar energy, the natural gas fields, bio-fuels, etc. • The provincial government accepts that the small-scale mining sub-sector could be the powerhouse of economic development in poor rural communities; thus, as indicated in the Northern Cape PGDS, it aims to provide assistance to as many small-scale operations to get started as possible. • Furthermore, through the Northern Cape PGDS, the provincial government proposes to use tourism as a vehicle for growth and development, which is particularly the case in remote rural areas where the aforesaid natural resources can be employed to leverage capital. • The Northern Cape PSDF (2012) proposes the creation of a solar corridor, which centres on Upington and extends from roughly Kakamas in the north to De Aar in the east.

Documents reviewed	Overview of Provincial Policies and Strategic Documents
	 Map 2-5: Northern Cape Spatial Development Framework Map

b) Social and economic infrastructure development priorities, plans and potential red flag areas

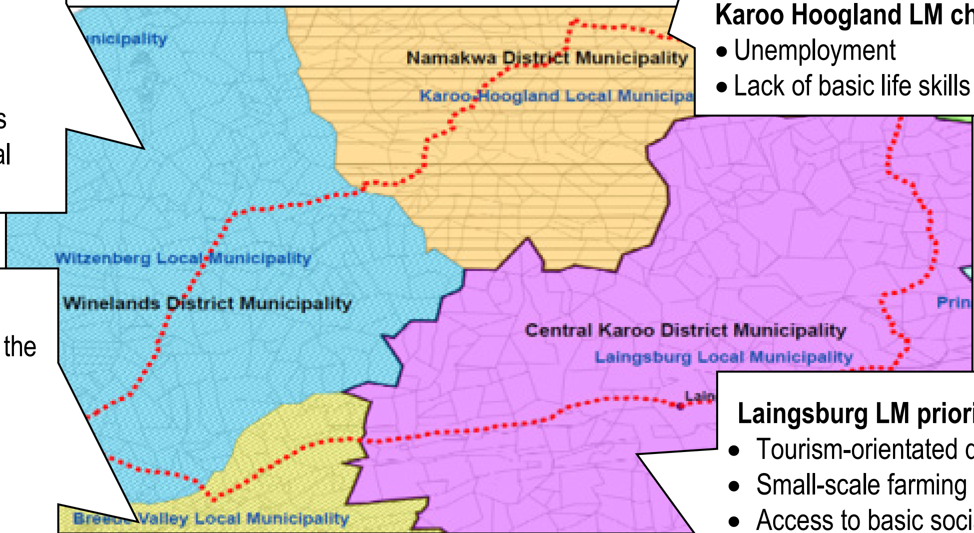
Documents reviewed	Socio-Economic Development Priorities, Plans and Potential Red Flag Areas.
• Cape Winelands District Municipality IDP (2012/13 - 2016/17) • Cape Winelands District Municipality Local Economic Development Strategy (2011) • Witzenberg Municipality IDP (2013/2014) • Witzenberg IDP (2012/17) • Breede Valley Municipality IDP (3rd Generation, 2012-2017) • Breede Valley Municipality IDP (Review, 2013 - 2017) • Breede Valley Municipality SDF (Draft, 2012) • Central Karoo District Municipality IDO(3rd Generation, 2012-2017) • Laingsburg Municipality IDP (Draft, 2012/ 2017) • Namakwa District Municipality IDP (2012-2016) • Namakwa District Municipality SDF (Draft, May 2012) • Karoo Hoogland Municipality IDP (2009-2011) • Karoo Hoogland Municipality Local Economic Development Strategy 2011	• Districts agree to <u>facilitate sustainable economic empowerment of all communities</u> through: ○ Economic, environmental and social infrastructure investment; and ○ Poverty alleviation, job creation and skills development. • Districts aim to ensure the health and safety of communities through: ○ Prevention, mitigation, identification and management of environmental health, fire and disaster risks; and ○ Ensure equitable Municipal Health Services • To support and ensure Integrated Human Settlements: ○ Increasing access to safe and efficient transport; ○ Developing integrated and sustainable human settlements; ○ Integrating service delivery for maximum impact; and ○ Creating opportunities for growth and development in rural areas. • In order to unlock employment opportunities local municipalities <u>prioritise the following sectors</u>: ○ Agriculture; ○ Manufacturing (Agro-Processing); ○ Tourism also includes ICT and BPO; and ○ Renewable Energy and Biotechnology. • Local <u>municipalities promote short term enabling programmes of renewable energy.</u> • The <u>Central Karoo Municipality encourages establishing an inclusive-tourism industry</u> through sustainable development and marketing. • The <u>Laingsburg LM identified solar and wind energy as the appropriate alternative.</u> • The <u>Namakua DM aims to explore a unique tourism opportunity</u> linked to the local facilities, i.e. ○ <u>Astro-tourism</u> taking advantage of the South African Large Telescope (SALT) at the South African Astronomical Observatory in Sutherland, and the SKA radio telescope project; and ○ <u>Energy tourism</u> taking advantage of the soon to be developed wind and solar farms.

Witzenberg LM priorities:
- Developing Integrated and Sustainable Settlements
- Bulk upgrades (Water & Sanitation)
- Attract investment
- Tourism is regarded as the means for local economic development

Witzenberg LM challenges:
- Housing need
- Unaccounted water/electricity losses
- Growing number and size of informal settlements

Karoo Hoogland LM priorities:
- To halve the unemployment rate
- To reduce the number of households living in absolute poverty
- To provide adequate infrastructure for economic growth and development

Karoo Hoogland LM challenges:
- Unemployment
- Lack of basic life skills



Breede Valley LM priorities:
- Stimulate the local economy through the development of the tourism sector
- Facilitation of job creation
- Infrastructure development
- Care to vulnerable groups
- Financial sustainability

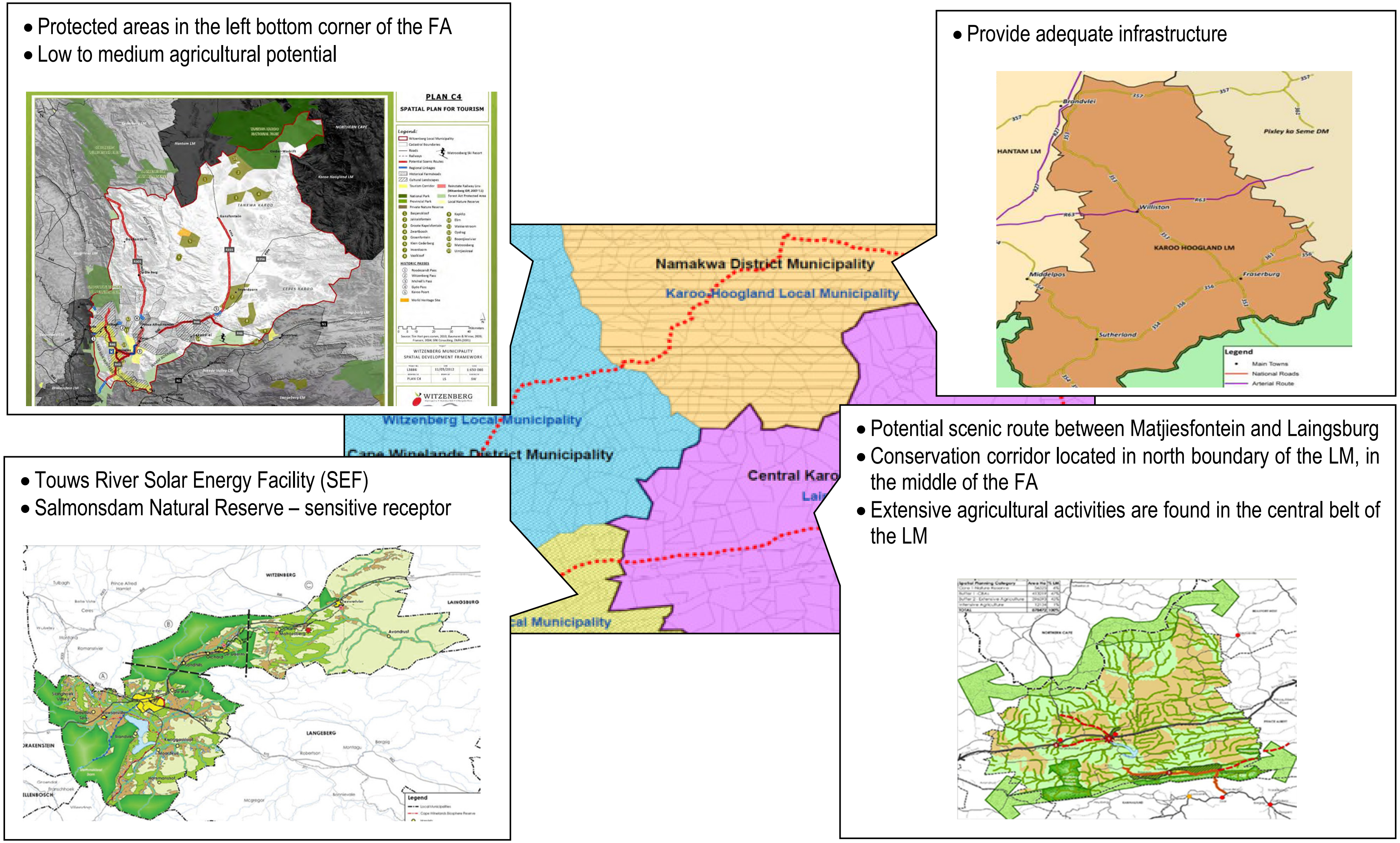
Breede Valley LM challenges:
- Uncontrollable growth in informal settlements
- Housing backlogs
- High debt exposure by the municipality
- Limited tax base

Laingsburg LM priorities:
- Tourism-orientated developments
- Small-scale farming and intensive agriculture
- Access to basic social services, educational and skills programmes
- Improving infrastructure and exploring green energy opportunities

Laingsburg LM challenges:
- Poverty
- Housing backlogs

c) Spatial development priorities, plans and potential red flag areas

Documents reviewed	Spatial Development Priorities and Policies Review For the Overberg Focus Area.
• Laingsburg Municipality IDP (First Annual Review, 2012/13) • Laingsburg Municipality IDP (Draft, 2012/ 2017) • Breede Valley Municipality SDF (Draft, 2012) • Witzenberg IDP (Review, 2013/14) • Witzenberg IDP (2012/17) • Namakwa District Municipality IDP (2012-2016) • Namakwa District Municipality SDF (Draft, May 2012) • Karoo Hoogland Municipality IDP (2009-2011)	• The eastern half of the FA aims to have a network of scenic routes some of them located within the FA: o Moordenaars Karoo; o Old road between Matjiesfontein and Laingsburg; and o Laingsburg to Prince Albert through the Klein Swartberg via a future pond over the Gamkaspoort dam. • The SDF of Laingsburg LM, which covers a big portion of the Focus Area, states: o The formation of small rural towns should be avoided; o Maintaining the rural character of non-urban areas is a must; o Areas should be provided for alternative agriculture use; o Solar energy is the appropriate alternative, which could be used locally; o Wind energy can work within certain areas within Laingsburg; and o Bio-gas is the preferred alternative energy source. • The western part of the FA is showing a growing tourism interest and possibilities are being studied. • Although not located within the FA, the Breede River valley situated to the west of the area, hosts several game reserves and should also be considered during the development of the FA. • Most of the local governments, except for Breede Valley, have not spatially planned for large scale renewable energy projects; the do however agree on the need to find new economic growth opportunities.


• Protected areas in the left bottom corner of the FA
• Low to medium agricultural potential
PLAN C4
SPATIAL PLAN FOR TOURISM
WITZENBERG
• Provide adequate infrastructure
Brandvlei
HANTAM LM
Pixley ka Seme DM
Williston
KAROO HOOGLAND LM
Middelpos
Fraserburg
Sutherland
Legend
Main Towns
National Roads
Arterial Route
Namakwa District Municipality
Karoo Hoogland Local Municipality
Witzenberg Local Municipality
Cape Winelands District Municipality
Central Karo
al Municipality
• Touws River Solar Energy Facility (SEF)
• Salmonsdam Natural Reserve – sensitive receptor
WITZENBERG
LAINGSBURG
LANGEBERG
Legend
• Potential scenic route between Matjiesfontein and Laingsburg
• Conservation corridor located in north boundary of the LM, in the middle of the FA
• Extensive agricultural activities are found in the central belt of the LM

2.2.3 Socio-economic profile

This section aims to give a general idea of the current social and economic characteristics of the zone. As noted above, only two towns are located in the FA and they are situated on the border. For the purpose of this study, they were assumed to form part of the FA. However it also means that the majority of the space covered by the FA is sparsely populated as outlined earlier.

a) Demographic profile of the Komsberg Focus Area

- Touws River is the most densely populated of the towns with 376 people per km^2, Laingsburg on the other hand has a population density of 8 people per km^2.
- The majority of the population living within the FA received some secondary education.
- Between 2005 and 2011 the population diminished in all of the four local municipalities encompassed in this FA, especially in Breede Valley.

Demographic data				
Demographic Profile of the Komsberg FA (Stats SA, 2014)			**Data applicable to all Local Municipalities included in the FA (Quantec, 2014)**	
Population (2011)	16 418		Population (2011)	233 036
Households (2011)	4 316		Population growth (CAGR, %) (2005-2011)	-0.9%
Average monthly HH income (2014 in Rands)	7 567		Population growth (No.) (2005-2011)	-13 123
Education:			Population density (People per km^2)	5.5
No School	866	8.7%	Migration:	
Complete or Some Primary	2 493	25.0%	In-migration	21 002
Complete or Some Secondary	5 962	59.8%	Out-migration	14 357
Higher	649	6.5%	Net out migration	6 645

b) Economic structure of the Komsberg Focus Area

- The combined size of the local municipalities that form part of the FA, albeit only in portion, is relatively small.
- The economic growth of the municipalities that form part of the Komsberg FA was very low during the period between 2005 and 2011. A CAGR of only 2% compared with the average achieved by the wider South African economy (3.2%) was observed.
- The secondary and tertiary sectors represent the driving forces behind the economic growth within the municipalities, which helped to offset the declining production in the primary sector.
- Primary sector's contribution has declined over the period between 2005 and 2011. The agricultural sector was the main industry experiencing a decrease in production volume.

- The mining and quarry industry do not make any contribution to the economy in the Laingsburg and Karoo Hoogland local municipalities.
- The municipalities forming part of the Komsberg FA are largely reliant on the tertiary sector which, considering their location and profile, are dependent on the local purchasing power and tourists.
- The manufacturing industry is the biggest contributor to the Breede Valley local economy.

Size of the economies					
Indicator	**Data applicable to all Local Municipalities included in Focus Area (Quantec, 2014)**				
Gross Domestic Product (Current Prices) 2011 (R'm)	7 216.13				
Gross Domestic Product (Constant Prices) CAGR (2005-2011)	2.0%				
Sectoral profile (R'm, constant 2005 prices)					
Indicator	**Data applicable to all Local Municipalities included in Focus Area (Quantec, 2014)**				
	2005		**2011**		**CAGR**
Primary Sector	**1 470.5**	**23%**	**1 393.8**	**19%**	**-0.9%**
Agriculture, forestry and fishing	1 458.6	23%	1 384.1	19%	-0.9%
Mining and quarrying	12.0	0%	9.8	0%	-3.4%
Secondary Sector	**1 295.3**	**20%**	**1 561.7**	**21%**	**3.2%**
Manufacturing	1 077.7	17%	1 286.4	18%	3.0%
Electricity, gas and water	83.5	1%	77.1	1%	-1.3%
Construction	134.1	2%	198.2	3%	6.7%
Tertiary Sector	**3 581.5**	**56%**	**4 375.7**	**60%**	**3.4%**
Trade, catering and accommodation	953.7	15%	1 016.6	14%	1.1%
Transport, storage and communications	539.8	9%	702.1	10%	4.5%
Finance, insurance, real estate and business services	891.6	14%	1 234.2	17%	5.6%
Community, social and personal services	495.3	8%	586.7	8%	2.9%
General government	701.1	11%	836.0	11%	3.0%
Total	**6 347.3**	**100%**	**7 331.3**	**100%**	**2.4%**

c) Labour force and employment situation within the Komsberg Focus Area

- The FA has a relatively small labour force, which is concentrated in the towns and specifically in Touws River.
- The unemployment rate in the Laingsburg and Touws River towns is relatively large with one out of four people in the labour force being unemployed.
- The sector showing the largest number of lay-offs is the primary sector, with agriculture being responsible for the 40% job losses in the municipalities; between 2005 and 2011 Breede Valley LM showed 7118 job losses in the agriculture industry.
- The secondary sector experienced a drastic decline in employment, with the manufacturing industry showing the largest drop in the number of jobs.

Labour force profile		
Indicator	**Focus Area (Stats SA, 2014)**	**Local Municipalities (Quantec, 2014)**
Employment	4 616	62 609
Unemployment	1 277	19 464
Unemployment %	21.7%	23.7%
Discouraged job seekers	364	Unavailable

Sectoral employment (Quantec, 2014)						
Indicator	**Data applicable to all Local Municipalities included in Focus Area**					
	2005		**2011**		**% Change**	**Abs Change**
Primary Sector	**35 089**	**44%**	**21 058**	**33%**	**-40.0%**	**-14 032**
Agriculture, forestry and fishing	35 020	44%	20 875	33%	-40.4%	-14 145
Mining and quarrying	69	0%	182	0%	164.3%	113
Secondary Sector	**8 926**	**11%**	**7 755**	**12%**	**-13.1%**	**-1 171**
Manufacturing	6 732	9%	5 920	9%	-12.1%	-813
Electricity, gas and water	159	0%	132	0%	-17.0%	-27
Construction	2 034	3%	1 703	3%	-16.3%	-331
Tertiary Sector	**35 047**	**44%**	**34 170**	**54%**	**-2.5%**	**-878**
Trade, catering and accommodation	9 787	12%	8 629	14%	-11.8%	-1 159
Transport, storage and communications	1 699	2%	1 544	2%	-9.1%	-155
Finance, insurance, real estate and business services	5 289	7%	5 338	8%	0.9%	49
Community, social and personal services	10 098	13%	9 381	15%	-7.1%	-717
General government	8 174	10%	9 278	15%	13.5%	1 104
Total	**79 062**	**100%**	**62 982**	**100%**	**-20.3%**	**-16 080**

d) Access to basic services within the Komsberg Focus Area

- Up to 83% of households in Touws River had access to piped water inside the dwelling, while in Laingsburg only 67% households had this service in 2011.
- Access to electricity in the municipalities was not universal; one out of 20 households uses solar energy and one out of ten relied on other energy sources for lighting.
- Access to sanitation is better than access to water in the areas, mainly due to the fact that many households also make use of chemical toilets rather than flush toilets that would require consistent supply of water. However, many households in the municipalities still deal with bucket systems or have no adequate sanitation at all.

Indicator	Access to Basic Services in the Settlements and Towns of the Focus Area. (Stats SA, 2014)	
	HH (No.)	HH (%)
Access to electricity (for lighting)		
Electricity	3 728	86.4%
Solar	192	4.4%
Other (candles, gas, paraffin)	378	8.8%
None	14	0.3%
Total	4 312	99.9%
Access to sanitation		
Flush/Chemical toilet	3 773	87.4%
Pit latrine with/without ventilation	229	5.3%
Bucket latrine	46	1.1%
Other	77	1.8%
None	187	4.3%
Total	4 312	99.9%
Access to water		
Piped water inside dwelling	3 181	73.7%
Piped water inside yard	1 024	23.7%
Piped water on community stand (>200mts)	50	1.2%
None	57	1.3%
Total	4312	99.9%

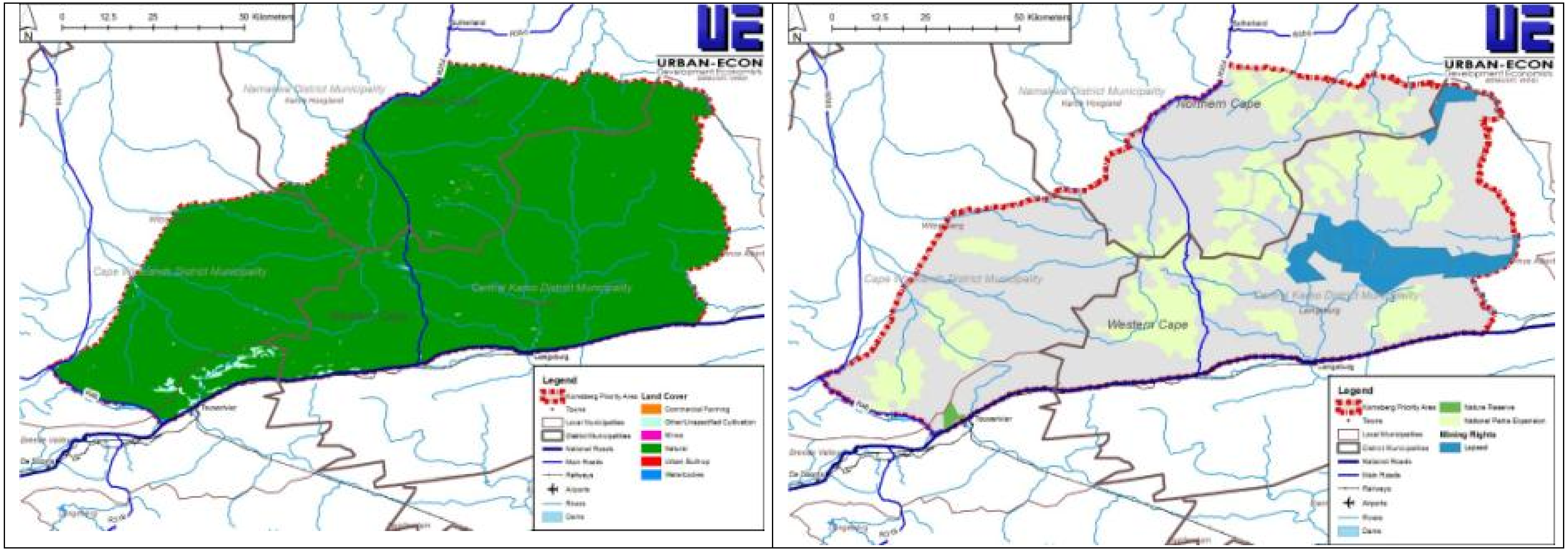
e) Level of economic infrastructure development of the Komsberg Focus Area.

Although being situated between two airports, the road connection is very poor in the FA and there are no railway lines inside the FA. It should also be noted that Sutherland is located just outside the north boundary of the FA. It houses the South African Astronomical Observatory (SAAO), which is the national centre for optical and infrared astronomy in South Africa. This highly touristic zone can be reached from Cape Town using the N1 national road and the R 354 that traverse the FA.

Indicator	Transport Infrastructure Development Overview.
Airports	Landing strip located close to Laingsburg town- Sutherland Airport located in the north of the FA.
Railway Lines	None
National Roads	The N1 is the Southern boundary of the Focus Area.
Regional Roads	FA is traversed by the R 354 and the Northern boundary is the R356

2.2.4 Land use profile

Core land uses	Natural and mineral resources
• The Komsberg Focus Area is a rural zone with very few settlements, and only one national road connecting Laingsburg and Touws River with Cape Town. • The majority of the FA is characterised by natural environment, although it is known that a notable portion of the Laingsburg LM is extensively used for commercial agricultural activities that are not reflected on the map. This could be explained by the fact that such activities predominantly involve livestock farming that does not require transformation of land compared to the crop or irrigation farming.	• The western corner of the FA, i.e. around Touws River, is characterised by a number of private and government nature reserves that are not reflected on the map but that are important to take cognisance of. • Sutherland and the South African Astronomical Observatory (SAAO) is located outside of the northern border of the Focus Area near the R354, which might be sensitive to any environmental disturbances. • Several plans for expansion of national parks are noted in the central and east zone of the FA, which again confirms the touristic value of these areas. • A conservation corridor is envisaged in the northern boundaries of the Laingsburg LM, which corresponds with the centre of the FA. • Touristic routes are to be located from the centre to the south of the Focus Area.



2.2.5 Key summary

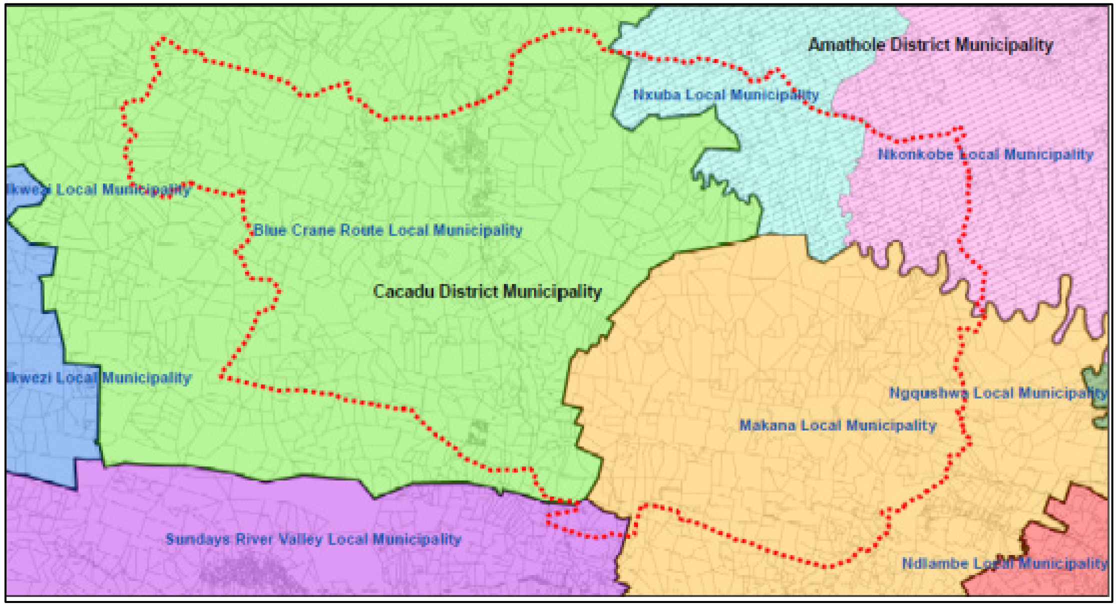
- Komsberg FA is a rural FA with very small population densities, undiversified economic base, and limited opportunities for employment.
- The population of the FA is estimated to be around 16 418 people in 2011. A portion of the population in the FA is living in small, dispersed settlements and has limited transport capacity to travel the often significant distances between urban centres. There are only two major settlements within the Komsberg FA, i.e. Touws River and Lainsburg, of which the former is the most populated one.
- Agricultural activities are the main economic activities throughout the FA. In recent years, the agricultural sector has experienced major job losses; the development of the tertiary and secondary sectors was unable to drive a sustainable growth in the economy and offset the job losses in the primary sector.
- The economy of the western area heavily relies on the tourism industry due to the presence of many private and government nature reserves. Likewise the closeness of the northern border with Sutherland should also be taken into account as the Karoo Hoogland LM envisages development of astro-tourism linked to the major astronomy facilities built in the area; however, the same municipality plans to capitalise on the wind and solar energy projects that could be established in the area.

2.3 Cookhouse Focus Area 3

2.3.1 Composition of the focus area

Cookhouse FA is located within the Eastern Cape and stretches over localities within the Cacadu and Amathole District Municipalities. Roughly half of the focus area falls within the Blue Crane Route LM and a third thereof is absorbed by the Makana LM. The Nxuba and Nkonkobe LMs share small portions in the north western allotment of the FA. The Sundays River Valley LM has an immaterial portion of the municipality within the FA. Importantly there are no towns or settlements that are located in the Sundays River Valley LM that falls within the FA, which is why this area will not be assessed in depth.

As far as population densities are concerned all of the LMs, which are covered by the FA, are characterised by very low population densities with Nxuba and Makana having the highest population densities.



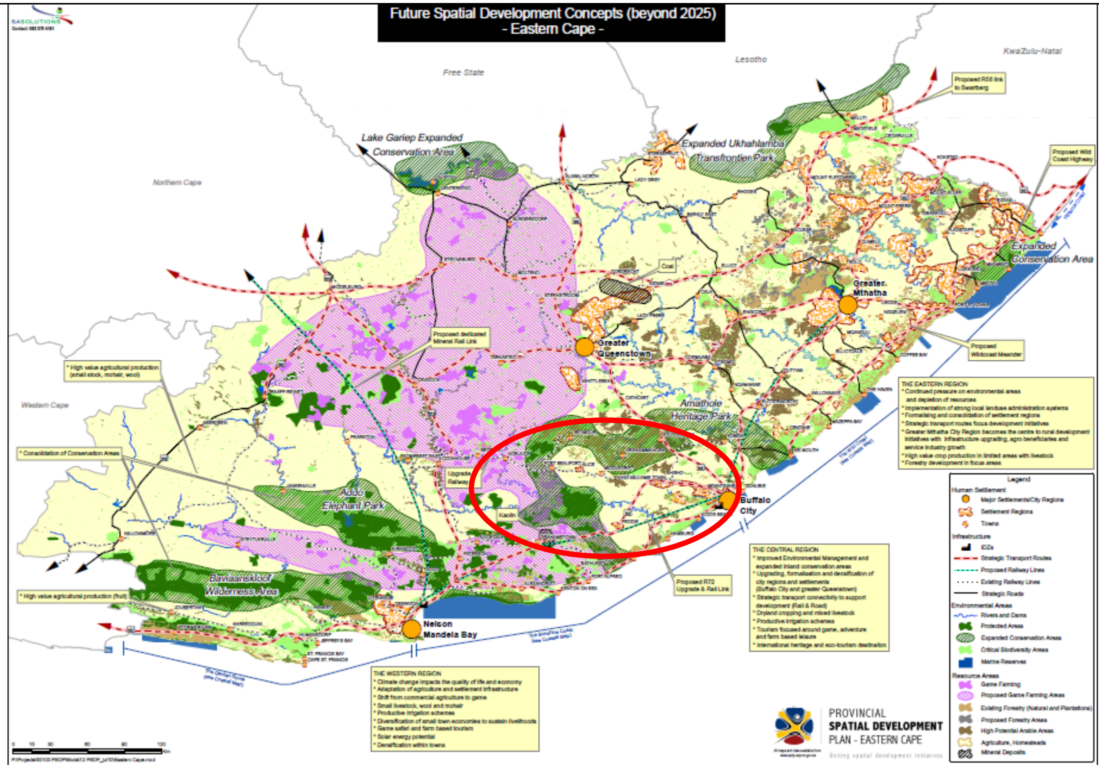
Map 2-6: Cookhouse focus area

Distribution of Towns and Major Settlements within the Cookhouse FA				
Province	**District municipalities**	**Local Municipalities**	**Towns and settlements**	**LMs' population densities (people/km^2)**
Eastern Cape	Cacadu DM	Blue Crane Route LM	• Cookhouse • Somerset East	3.3
		Makana LM	• Grahamstown • Riebeek East • Alicedale	18.4
		Sundays River LM	• N/A	9.1
	Amathole DM	Nxuba LM	• Bedford • Adelaide	35.1
		Nkonkobe LM	• N/A	8.9

2.3.2 Policy review

a) Provincial policies and strategic documents

Documents reviewed	Summary
• Eastern Cape Provincial Growth and Development Plan (2004-2014) • The Eastern Cape Industrial Development Strategy (2011) • The Eastern Cape Sustainable Energy Strategy (2012) • Eastern Cape SDF (2010)	• Easter Cape PGDS (2004) set the aim to support an annual growth rate of approximately 5% and half the poverty rate within the province by 2014. The key strategic focus areas sought to facilitate such goals are: o Transformation within the agrarian sector; o Developing and diversifying manufacturing and tourism; o Enhancing provincial infrastructure and associated backlogs; and o Encouraging growth and efficiency within the governmental sector. • The Eastern Cape Industrial Development Strategy (2011) focuses on the creation of economic growth and achievement of associated positive spin-offs by developing key industries, of which green industries are noted as pivotal to these goals. • The Eastern Cape Sustainable Energy Strategy (2012) sets out the strategic direction for the renewable energy industry in the province. The focus is to encourage sustainable, affordable and environmentally friendly energy production. This will be achieved by: o Establishing a task team to assist investors regarding information and other requirements; o Development of a provincial locational perspective for renewable energy; and o To lobby Eskom to expedite and strengthen the transmission capacity of the former Transkei area. • According to the Eastern Cape SDF (2010), the settlement characteristics of the Eastern Cape show a strong tendency towards peri-urban sprawl and informal settlement in response to the migration of people out of rural poverty areas to areas closer to economic opportunity and social facilities. • As indicated in the Eastern Cape SDF (2010), the FA covers land that is intensely populated by game farms and nature reserves. Furthermore, a significant portion of the FA has been earmarked by the provincial authorities for further development of game farms in support of the tourism industry.



Map 2-7: Eastern Cape SDF

b) Social and economic infrastructure development priorities, plans and potential red flag areas

Documents reviewed	Summary
• Amathole IDP (2012-2017) • Cacadu IDP (2012-2017) • Nkonkobe LED (2012) • Nkonkobe IDP (2012-	• The Nkonkobe LM (the north eastern area of the proposed focus area) has stated priorities including developing the agricultural sector and supporting agro-processing industries linked to this activity. Development of secondary industries will require greater electricity supply in the region. • The Nxuba LM (area north eastern to middle section of the focus area), like many other rural municipalities, focuses on basic infrastructure to assist with achieving growth and development within the area such as road building, electricity, water and sanitation service provision in poorer

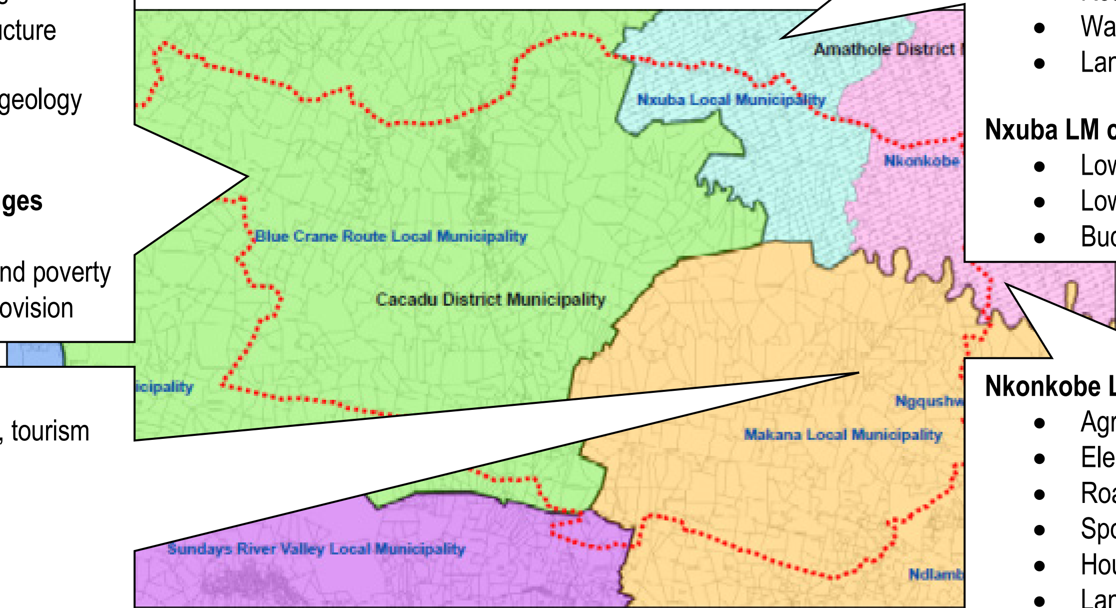
2017) • Nxuba IDP (2012-2017). • Makana IDP 2013-2014 • Blue Crane Route IDP 2013-2014	communities. Priority sectors include tourism, agriculture and SMME development. • The Makana LM (the South Eastern half of the FA) specifies the renewable energy sector as having significant potential in the municipality. Other priority areas constitute tourism and SMME growth. • The Blue Crane Route area, the western half of the focus area, has demarcated the tourism, agricultural, aerospace and industrial sectors as strategic sectors in facilitating growth and development within the municipality. Of significant interest is the establishment of the renewable energies sector as critical to achieving growth and enhancing the provision of electricity within the municipality. The focus is on hydro, wind and solar power generation. • Priority areas/sectors identified as infrastructure requiring investment and development within the municipalities included within the proposed Cookhouse focus area include: o The electrification of rural villages currently without access to basic electricity services. The Blue Crane Route and Makana LMs have made specific provision for the development and construction of renewable energy resources. Further extension regarding municipal power supply is required to meet the policy demands set out. o Many of the municipalities propose heightened investment in road construction and maintenance. Areas including the Blue Crane Route LM have existing road infrastructure that is relatively well maintained; however, those contained within the Amathole DM require upgrades to existing infrastructure. o Water supply and sanitation services are noted as problematic within the Amathole and Cacadu DMs and are therefore prioritised as critical to improving the social conditions of those living within rural communities. The objective of these schemes is to provide fresh water and functioning sanitation services to all rural communities. o Education and health in the rural communities of the associated municipalities is in dire circumstances with school and health facilities being too few and in need of repair. All municipalities in the proposed focus area state a need to focus funding on these services. o Waste management has developed into a concern for the municipalities of the proposed area – policy objectives include the eradication of illegal dumping and the expansion of town cleaning. o The backlog regarding housing is noted within all areas and is central to policy objectives among municipalities within the proposed area. The housing crisis is related to land reformation and administration where land is required for the development of future housing and community projects. • A number of challenges faced by local municipalities detract from achieving the goals and objectives sought by policy: o As with less developed areas, many of the municipalities are hindered by budgetary constraints that prevent the necessary capital investment going ahead. With low levels of funding, the municipalities are unable to implement large-scale schemes to improve education, health and infrastructure provisioning. o Projects placing greater significance on the private sector such as those generating profits for private enterprises are more likely to be realised in the short to medium term as funding is made available by such enterprises.

Blue Crane Route LM priorities

- Renewable energies sector is a growth node
- Agricultural, industry, tourism and aerospace sectors
- High levels of infrastructure provision
- Good geography and geology for agriculture

Blue Crane Route LM challenges

- Budget constraints
- High unemployment and poverty
- Basic infrastructure provision



Nxuba LM priorities

- Tourism, agriculture and SMMEs
- Electricity provision
- Solid waste removal
- Road & storm-water infrastructure
- Water & sanitation
- Land reform

Nxuba LM challenges

- Low levels of basic infrastructure
- Low levels of education
- Budget constraints

Makana LM priorities

- Renewable resources, tourism and SMME sectors
- Waste management
- Water infrastructure
- Road infrastructure

Makana LM challenges

- High unemployment
- Basic infrastructure provision
- Low education levels
- Budget constraints

Nkonkobe LM priorities

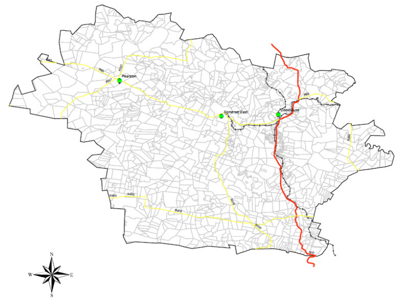
- Agriculture and food processing
- Electricity provision
- Road maintenance
- Sporting and community facilities
- Housing
- Land reform

Nkonkobe LM challenges

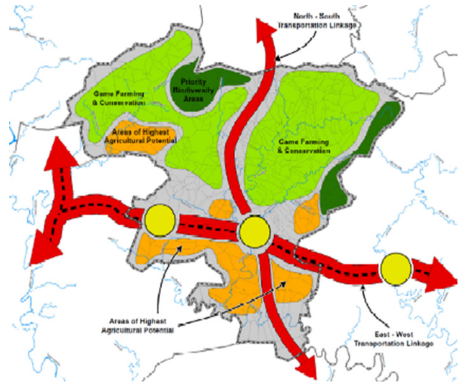
- Low levels of basic infrastructure
- Low education levels
- Budget constraints

c) Spatial development priorities, plans and potential red flag areas

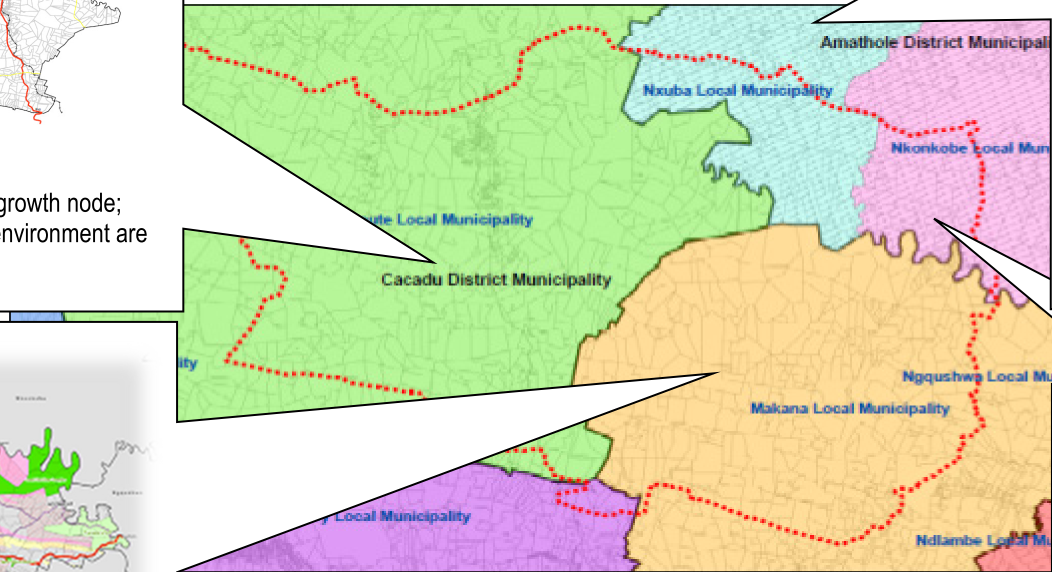
Documents reviewed	Summary
• Amathole SDF (2008) • Cacadu DM SDF (2013) • Nxuba SDF (2008) • Nkonkobe SDF (2013) • Blue Crane Route SDF (2010) • Makana SDF (2007)	• The south eastern half of the FA (Makana area) is highly concentrated with game parks and other tourism and recreational related activities. The Makana municipality focuses greatly on this sector and is therefore dedicated to protecting the natural environment, which is dense with protected and endangered areas. Furthermore, it is noted that the owners of the private game reserves are not supportive of any developments in the area that will create a visual disturbance. • The north eastern portion of the FA (Nkonkobe area) has two development corridors focusing on tourism, forestry, retail and industry, yet these do not fall within the FA. A proposal was made to establish a programme to develop renewable energy resources in the municipality; however, this is yet to be developed. There do not appear to be any conflicts within the Nkonkobe portion of the FA. • The Nxuba municipal area, which covers the north eastern to middle section of the focus area states that all industrial activities must be established within the demarcated corridors, however, these corridors are not contained within the proposed focus area. There are no conflicts identified within the Nxuba portion of the FA. • The western half of the FA (Blue Crane Route LM) prioritises agriculture and tourism and for this reason, places emphasis on maintaining the natural environment. It should be highlighted that the Addo Elephant National Park is located about 6-10 km south-west from the boundary of the FA.



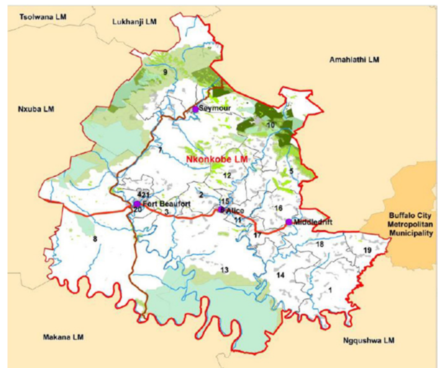
- Renewable resources is a growth node; however, tourism and the environment are to take precedence



- Tourism and agriculture priorities
- No conflicts in FA



- Numerous private game reserves
- Planned development of guidelines for establishment of wind and solar energy projects
- The southern half of the LM is demarcated as tourism focus area



- Renewable resources priority in wider municipality
- No conflicts in the FA as per the SDF

2.3.3 Socio-economic profile

The socio economic profile of the Cookhouse FA includes demographic information for the towns and major settlements that lie within the FA as well as local municipal economic data. The Sundays River Local Municipality is excluded from the economic analysis as only an immaterial portion of the municipality falls within the FA. Furthermore, there are no towns or settlements representing this municipality that fall within the FA.

a) Demographic profile of the Cookhouse FA

The next table illustrates the demographic profile of the Cookhouse FA as recorded by Stats SA Census 2011; it also includes statistics of the entire LM included in the FA.

- The area encompasses about 84 314 people and is characterised by a very low population density
- 60% of the population in the FA resides in Grahamstown
- 6.1% has received no formal education while 11.4% have received formal higher education
- The local municipalities included in the FA have experienced positive net migration into the area of roughly 2 642 individuals; however, the population declined by 4.2% (13 101) between 2005 and 2011.

Demographic data

Demographic Profile of the Cookhouse FA (Stats SA, 2014)		
Population (2011)	84 314	
Households (2011)	22 750	
Average monthly HH income (2014 in Rands)	R8 392	
Education		
No School	3 050	6.1%
Complete or Some Primary	11 369	22.9%
Complete or Some Secondary	29 544	59.5%
Higher	5 670	11.4%

Data applicable to all Local Municipalities included in FA (Quantec, 2014)	
Population (2011)	298 643
Population growth (CAGR, %) (2005-2011)	- 0.7%
Population growth (No.) (2005-2011)	- 13 101
Population density (People per km^2)	11.6
Migration	
In-migration	8 777
Out-migration	6 135
Net migration	2 642

b) Economic structure of the Cookhouse FA

The local municipalities, of which parts fall within the Focus Area, are relatively small and combined represents an economy that generates about R9.1 bn of value added. Between 2005 and 2011, they have achieved a combined growth rate of 3%. This figure is slightly below the national average achieved in the wider South African economy of 3.2%.

- The relatively heavy reliance on the tertiary sector indicates a highly modernised economy; however, the high unemployment which is tabled below tends to indicate the highly dualistic economic structure of the Cookhouse area as well as the wider South African economy in general.
- The tertiary sector, which constitutes approximately 81% of the economic activity within the municipalities assessed, represents the driving forces behind growth in the municipalities.
- Further analysis suggests that approximately 30% of the municipal economies of the area comprises of the government services sector. This factor skews the strength of the tertiary sector and is indicative of an economy that relies heavily on state funding and support. Aside from government, the financial and business services sector (19%) and the community social and personal services sector (15%) play the largest role within the municipal economies.
- The size of the agricultural sector in the assessed economies is diminishing.

Size of the economies					
Indicator	**Data applicable to all Local Municipalities included in FA (Quantec, 2014)**				
Gross Domestic Product (Current Prices) 2011 (R'm)	9 109				
Gross Domestic Product (Constant Prices) CAGR (2005-2011)	3.0%				
Sectoral profile (R'm, constant 2005 prices)					
Indicator	**Data applicable to all Local Municipalities included in FA (Quantec, 2014)**				
	2005		**2011**		**CAGR**
Primary Sector	**297.5**	**6%**	**251.8**	**4%**	**-2.7%**
Agriculture, forestry and fishing	293.9	6%	247.9	4%	-2.8%
Mining and quarrying	3.6	0%	3.9	0%	1.5%
Secondary Sector	**606.4**	**13%**	**727.2**	**13%**	**3.1%**
Manufacturing	414.8	9%	490.1	9%	2.8%
Electricity, gas and water	84.0	2%	82.1	1%	-0.4%
Construction	107.7	2%	155.1	3%	6.3%
Tertiary Sector	**3,865.4**	**81%**	**4,704.1**	**83%**	**3.3%**
Trade, catering and accommodation	636.1	13%	820.1	14%	4.3%

Sectoral profile (R'm, constant 2005 prices)					
Indicator	Data applicable to all Local Municipalities included in FA (Quantec, 2014)				
	2005		2011		CAGR
Transport, storage and communications	269.2	6%	278.8	5%	0.6%
Finance, insurance, real estate and business services	797.3	17%	1,106.9	19%	5.6%
Community, social and personal services	735.5	15%	824.5	15%	1.9%
General government	1,427.4	30%	1,673.7	29%	2.7%
Total	**4,769.3**	**100%**	**5,683.1**	**100%**	**3.0%**

c) Labour force and employment situation within the Cookhouse FA

- The FA's labour force comprises of about 27 148 people; however approximately 34.2% of these are unemployed, which is higher than the national average of 25.4% and is a considerable hindrance to social-economic cohesion in the FA.
- The agricultural sector has lost the greatest number of jobs in the period assessed. Total losses between 2005 and 2011 amount to 18 770, which reflects a 58% decline.
- Within the secondary sector, employment has dropped by approximately 15.6%, yet due to the overall decline in the employment figures its contribution towards employment in the areas increased to 8%.
- The tertiary sector provided the majority (66%) of jobs in the municipalities. Despite the decline in the number of employed in the community and personal services sector, the total employment within the tertiary sector grew by 5.8% in the period or by 1 951 individuals.
- Overall, employment with the municipalities dropped from 71 128 in 2005 to 53 577 in 2011, representing a decrease of 17 551 job opportunities (24.7%).

Labour force profile		
Indicator	**Focus Area (Stats SA, 2014)**	**Local Municipalities (Quantec, 2014)**
Employment	17 852	53 577
Unemployment	9 296	31 977
Unemployment %	34.2%	37.4%
Discouraged job seekers	3 435	Unavailable

Sectoral employment (Quantec, 2014)						
Indicator	Data applicable to all Local Municipalities included in Focus Area					
	2005		2011		% Change	Abs Change
Primary Sector	**32,403**	**46%**	**13,711**	**26%**	**-57.7%**	**-18,691**

Sectoral employment (Quantec, 2014)						
Indicator	Data applicable to all Local Municipalities included in Focus Area					
	2005		2011		% Change	Abs Change
Agriculture, forestry and fishing	32,353	45%	13,582	25%	-58.0%	-18,770
Mining and quarrying	50	0%	129	0%	158.8%	79
Secondary Sector	**5,188**	**7%**	**4,378**	**8%**	**-15.6%**	**-810**
Manufacturing	2,846	4%	2,629	5%	-7.6%	-217
Electricity, gas and water	209	0%	134	0%	-35.7%	-75
Construction	2,133	3%	1,615	3%	-24.3%	-518
Tertiary Sector	**33,537**	**47%**	**35,488**	**66%**	**5.8%**	**1,951**
Trade, catering and accommodation	6,285	9%	7,104	13%	13.0%	819
Transport, storage and communications	807	1%	833	2%	3.3%	27
Finance, insurance, real estate and business services	3,605	5%	4,515	8%	25.2%	910
Community, social and personal services	11,103	16%	9,987	19%	-10.0%	-1,116
General government	11,738	17%	13,048	24%	11.2%	1,310
Total	**71,128**	**100%**	**53,577**	**100%**	**-24.7%**	**-17,551**

d) Access to basic services within the Cookhouse FA

- Electricity infrastructure in the local municipalities included in the FA appears relatively well developed for a rural area as approximately 91.1% of households in the area have access to municipal electricity supply. The rest primarily rely on candles for lighting and a small number of households make use of gas and paraffin.
- Although roughly 81.8% of households have access to flush and chemical toilet facilities, there remains a critical problem of households relying on bucket latrines and other forms of sanitation facilities. A large number of households (405) have no form of sanitation facility which poses a serious task for policymakers and the municipalities involved.

Indicator	Access to Basic Services in the Settlements and Towns of the FA. (Stats SA, 2014)	
	HH (No.)	HH (%)
Access to electricity		
Electricity	20,723	91.1%
Solar	56	0.2%
Other (candles, gas, paraffin)	1,926	8.5%

Indicator	Access to Basic Services in the Settlements and Towns of the FA. (Stats SA, 2014)	
	HH (No.)	HH (%)
None	32	0.1%
Total	22,737	100%
Access to sanitation		
Flush/Chemical toilet	18,608	81.8%
Pit latrine with/without ventilation	2,520	11.1%
Bucket latrine	982	4.3%
Other	222	1.0%
None	405	1.8%
Total	22,737	100%
Access to water		
Piped water inside dwelling	12,386	54.4%
Piped water inside yard	8,344	36.7%
Piped water on community stand (>200mts)	1,793	7.9%
None	214	0.9%
Total	22,737	100%

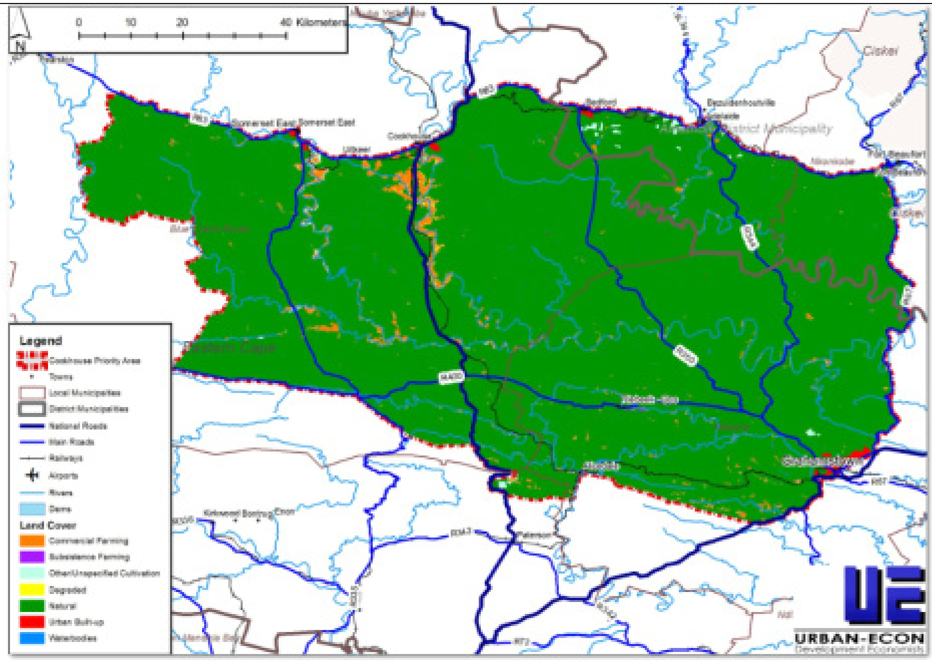
e) Level of economic infrastructure development of the Cookhouse FA

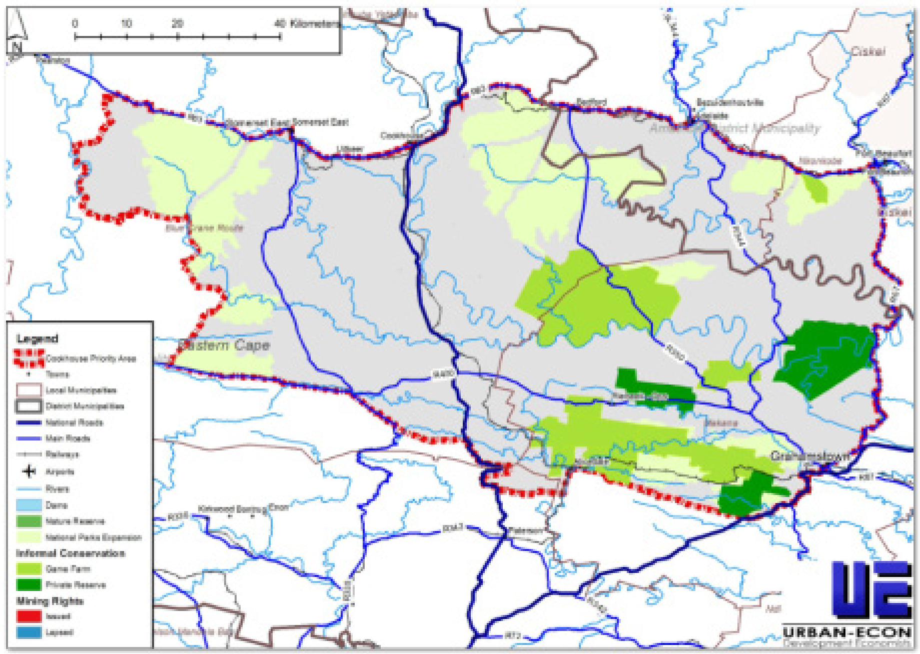
From the accessibility perspective, the FA is not fully connected with the rest of the country and the local governments are facing challenges to develop the transport infrastructure.

Indicator	Transport Infrastructure Development Overview.
Airports	An airstrip is located within Grahamstown.
Railway Lines	One railway line linking Grahamstown and Cookhouse.
National Roads	The N2 approaches Grahamstown from the east and then heads south west away from the FA.
Regional Roads	Two regional roads (R63 and R67) provide access to the towns on the perimeter of the FA while three further regional roads (R400, R350 and R344) provide access to the interior of the FA.

2.3.4 Land use profile

Core land uses	Natural and mineral resources
• As indicated, the majority of the FA consists of natural land that is not disturbed. • Urban settlements (indicated in red) are positioned on the FA's outskirts. • Commercial farming takes place in pockets close to Cookhouse and Grahamstown. The Cookhouse portion meanders in a southerly direction toward the centre of the FA that near to Grahamstown spreads out in an easterly direction. • Transport routes within the FA are well developed with five main roads linking central areas with all major towns. • A railway operates between Grahamstown and Cookhouse which runs in a north-easterly direction. • An airstrip is located in Grahamstown, however, no other air facilities are found within the FA.	• As indicated, the south eastern and central portions of the FA are populated with game farms and private reserves. • Previous studies have revealed that the game farms and private reserves are in strong opposition to the construction of solar and wind farms within the related area as they are believed to have negative impacts on the earnings of these enterprises. • Various zones have been demarcated for the future expansion of national parks and therefore represent red flag areas. These zones are coloured in a pastel colour and cover areas toward the western flank of the FA, the upper central and eastern zones. • The eastern half of the FA, falling within the Blue Crane LM stipulates priority to be given to tourism ventures; however, no specific tourism areas/corridors are demarcated.





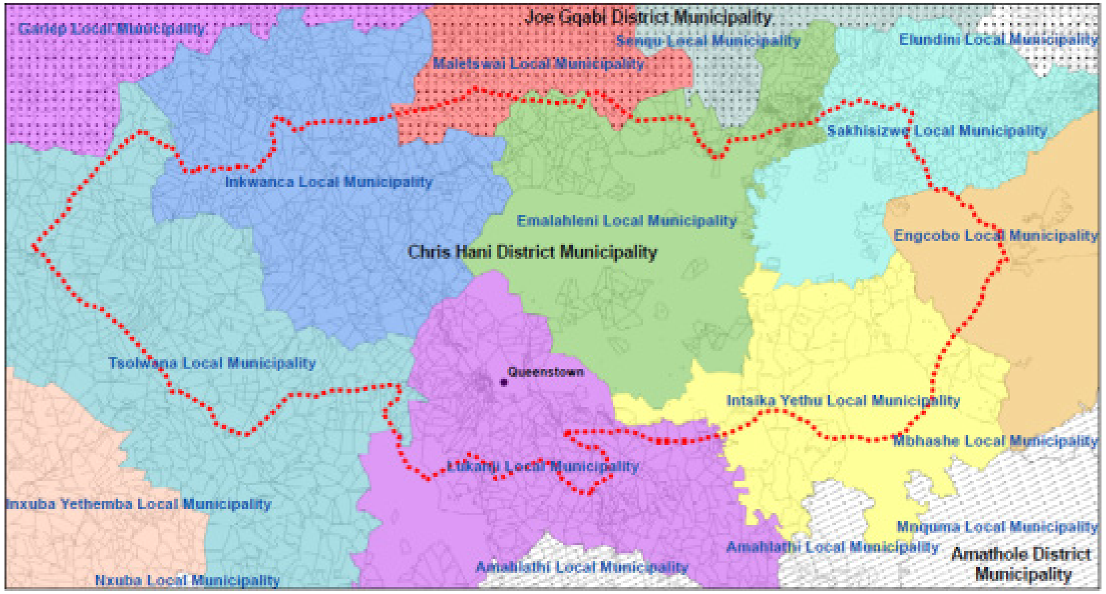
2.3.5 Key summary

- The FA contains a population of roughly 84 314 individuals; however, the area is characterised with a relatively low population density with only a few major towns encompassing the area which are situated mainly on the boundaries of the FA.
- The economies that are encompassed by the FA are primarily reliant on the tertiary sector with tourism (specifically eco-tourism and game farming) and government services playing a prominent role in its development. The agricultural sector in the assessed economies has been struggling for the past few years with its production output and subsequently number of jobs sharply declining.
- Service delivery challenges are experienced by all municipalities, which are largely related to the budgetary constraints thereof. Access to sanitation and water as well as the underdeveloped state of social infrastructure (health and education) are among the biggest impediments to ensuring good standard of living among all residents of the FA. Furthermore, road network and conditions of roads in the areas are other challenges worth noting.
- Sectoral development prioritises for the municipalities include renewable energy, agriculture and agro-processing, tourism, and SMMEs.

2.4 Stormberg Focus Area 4

2.4.1 Composition of the focus area

The Stormberg FA is located within the Eastern Cape and stretches over localities within the Chris Hani and Joe Gqabi District Municipalities. The FA is distributed among eight local municipalities. Slightly more than a half of the FA is covered by portions of three LMs, namely Emalahleni, Inkwanca, and Tsolwana. The parts of the LMs of Intsika Yethu, Lukanji, Engcobo, and Sakhisizwe share the rest of the FA, which is roughly about a third of the FA's land area. The Maletswai LM represents an insignificant claim to land in the FA. Furthermore, no towns or settlements fall within the bounds of this LM in the FA. For this reason, the assessment of the Maletswai LM will not be done in such a depth as the other LMs.



Map 2-8: Stormberg focus area

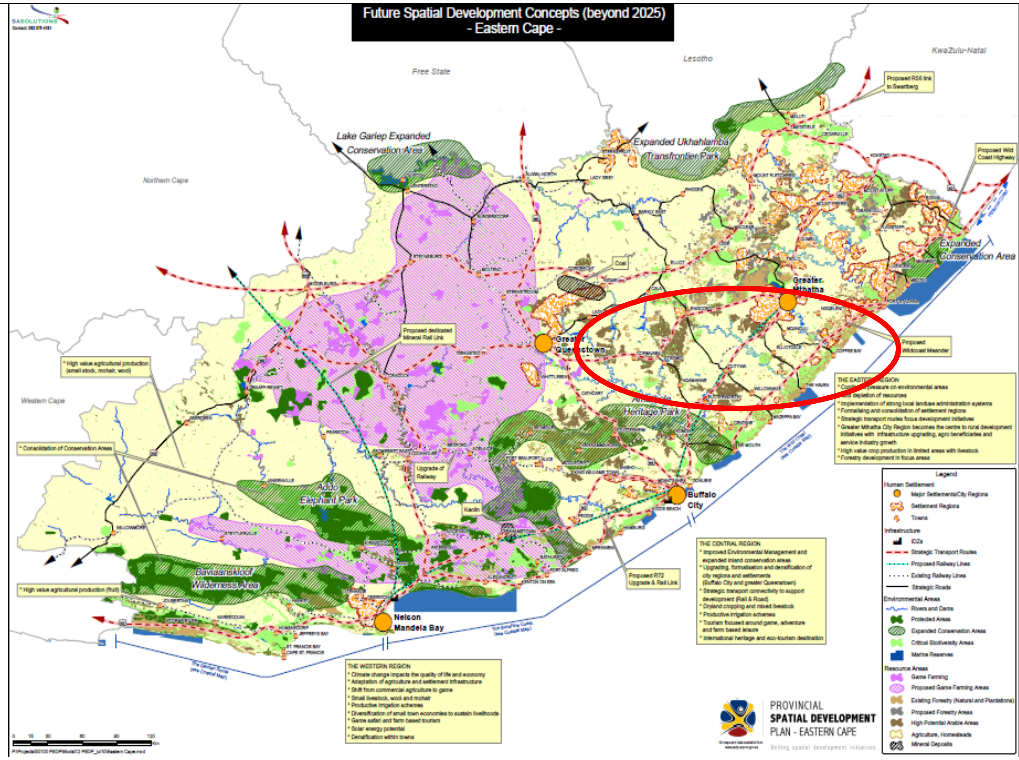
Distribution of Towns and Major Settlements within the Stormberg FA				
Province	**District municipalities**	**Local Municipalities**	**Towns and settlements within FA**	**LMs' population densities (people/km²)**
Eastern Cape	Chris Hani DM	Sakhisizwe LM	• Small communities	27.0
		Intsika Yethu LM	• Cofimvaba	53.6
		Lukhanji LM	• Queenstown • Ezibeleni • Ilinge	50.0
		Emalahleni LM	• Indwe • Dordrecht	34.7
		Engcobo LM	• Small communities	62.6
		Tsolwana LM	• Hofmeyr • Tarkastad	5.5

Distribution of Towns and Major Settlements within the Stormberg FA				
Province	**District municipalities**	**Local Municipalities**	**Towns and settlements within FA**	**LMs' population densities (people/km²)**
		Inkwanca LM	• Molteno • Sterkstroom	6.1
	Joe Gqabi DM	Maletsawai LM	• N/A	10.1

2.4.2 Policy review

a) Provincial policies and strategic documents

Documents reviewed	Summary
• Eastern Cape Provincial Growth and Development Plan (2004-2014) • The Eastern Cape Industrial Development Strategy (2011) • The Eastern Cape Sustainable Energy Strategy (2012) • Eastern Cape SDF (2010)	• Easter Cape PGDS (2004) set the aim to support an annual growth rate of approximately 5% and half the poverty rate within the province by 2014. The key strategic focus areas sought to facilitate such goals are: o Transformation within the agrarian sector; o Developing and diversifying manufacturing and tourism; o Enhancing provincial infrastructure and associated backlogs; and o Encouraging growth and efficiency within the governmental sector. • The Eastern Cape Industrial Development Strategy (2011) focuses on the creation of economic growth and achievement of associated positive spin-offs by developing key industries, of which green industries are noted as pivotal to these goals. • The Eastern Cape Sustainable Energy Strategy (2012) sets out the strategic direction for the renewable energy industry in the province. The focus is to encourage sustainable, affordable and environmentally friendly energy production. This will be achieved by: o Establishing a task team to assist investors regarding information and other requirements; o Development of a provincial locational perspective for renewable energy; and o To lobby Eskom to expedite and strengthen the transmission capacity of the former Transkei area. • According to the Eastern Cape SDF (2010), the settlement characteristics of the Eastern Cape show a strong tendency towards peri-urban sprawl and informal settlement in response to the migration of people out of rural poverty areas to areas closer to economic opportunity and social facilities. • As is indicated in the Eastern Cape SDF map, the FA covers a wide variety of demarcations. These include a demarcation of the western part as a game farming area, the central parts demarcated as settlement regions and the portion of the northern part on the western side of the FA identified as having rich mineral deposits. Parts of the eastern side of the FA are also known as high potential arable land.



Map 2-9: Eastern Cape SDF

b) Local social and economic infrastructure development priorities, plans and potential red flag areas

Documents reviewed	Summary
• Chris Hani IDP (2012-2017) • Tsolwana LED (2011) • Inkwanca IDP (2012-2017) • Intsika Yethu LED (2007) • Engcobo LED (2010)	• The Tsolwana area (south western area of the proposed FA) sets the priorities to focus its economic development efforts on developing the agricultural, tourism, manufacturing, mining and beneficiation sectors. Plans to grow and retain participants within the small business sector are central to the overall strategy to positively impact unemployment and development within the municipality. Heightened growth within these industries will draw increased electricity from the existing municipal supplies in the region. • The north western half of the focus area falls within the Inkwanca LM, which is a relatively less developed municipality in contrast to

• Emalahleni IDP (2012-2017) • Lukhanji IDP (2012-2017) • Sakhisizwe LED 2007	others in the district. Growth opportunities in this area remain a considerable challenge to the policy-makers; however, a number of priority sectors have been demarcated. These include the community services, retail, agricultural, mining and tourism sectors. • The north eastern corner of the focus area that falls under Intsika Yethu LM area has demarcated the tourism, agricultural, forestry and timber processing sectors as strategic sectors in facilitating growth and development within the municipality. Complementing these sectors is the development and support of skills and SMMEs. • The far eastern corner constituting of the Engcobo LM is a relatively less developed municipality and maintains a focus on improving the delivery of basic services and general infrastructure to permit economic growth. The main priority area is tourism, while it is noted that assistance should be provided to SMMEs when competing for tenders. Although the agricultural activities in the LM are dominated by subsistence farming, the municipality is looking to establish and develop a commercial agricultural base through training programmes. • The Emalahleni LM, which is positioned centrally within the FA, promotes growth within the following priority sectors: community services, retail, agriculture, mining, and tourism. The municipality has not stipulated the renewable energies sector as a priority; however, it notes the importance of the sector and the need to diversify away from traditional sources of electricity and lighting. • The central to southern portion of the FA that pertains to the Lukhanji LM specifies the agricultural, rural development and tourism sectors as pillars toward creating economic and job growth within the municipality. The LM does not make mention of wind or PV renewables; yet, it has implemented projects to convert waste into energy. • The north eastern portion of the FA, which relates to the Sakhisizwe LM, is a relatively undeveloped area. Very little economic activity occurs outside of the urban areas, raising concern for policy-makers. Key priorities include bolstering the manufacturing and tourism sectors, which have underperformed in recent years. • Aside from the above priorities, the following challenges are faced by the municipalities: o The electrification of rural villages currently without access to basic electricity services according the municipalities is related to Eskom projects. o Many of the municipalities propose heightened investment in road construction and maintenance. The Lukhanji LM has access to a national route; however, the municipality and those further included within the FA are relatively rural with the majority of roads outside of urban areas being gravel. o Water supply and sanitation services are noted as problematic within all the local municipalities with rural communities being most prone to low levels of water access and shortages. The objective of these schemes is to provide fresh water and functioning sanitary services to all rural communities. o Education and health in rural communities of the associated municipalities is in dire circumstances with school and health facilities being too few and in need of repair. The Sakhisizwe LM does, however, state that it provides health facilities to its people that are above and beyond national levels. o The local municipalities falling within the FA focus heavily on improving waste management services to their communities. Within many of the rural municipalities that are characterised by rural villages, these services are lacking. o The municipalities lag behind in the processing of administrative documents regarding housing. o As with other less developed areas, many of the municipalities are hindered by budgetary constraints that prevent the necessary capital investment going ahead. With low levels of funding, the municipalities are unable to implement large scale schemes to improve education, health and infrastructure provisioning.

Inkwanca LM priorities
- Agriculture
- Tourism
- Mining
- Retail
- Community services
- SMMEs

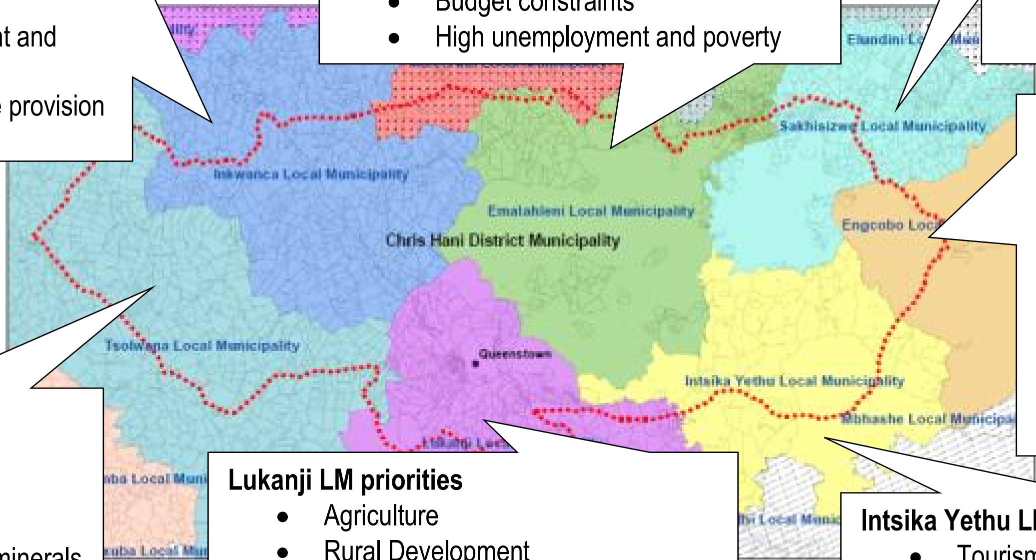
Inkwanca LM challenges
- Budget constraints
- High unemployment and poverty
- Basic infrastructure provision

Emalahleni LM priorities
- Community services
- Retail
- Agriculture
- Mining
- Tourism
- SMMEs

Emalahleni LM challenges
- Budget constraints
- High unemployment and poverty

Sakhisizwe LM priorities
- Manufacturing
- Tourism
- SMMEs

Sakhisizwe LM challenges
- Budget constraints
- High unemployment and poverty
- Basic infrastructure provision



Engcobo LM priorities
- Tourism
- SMMEs

Engcobo LM challenges
- Budget constraints
- High unemployment and poverty
- Basic infrastructure provision

Tswolana LM priorities
- Agriculture
- Mining
- Tourism
- Manufacturing and minerals beneficiation
- SMMEs

Tswolana LM challenges
- Budget constraints
- High unemployment and poverty

Lukanji LM priorities
- Agriculture
- Rural Development
- Tourism
- SMMEs

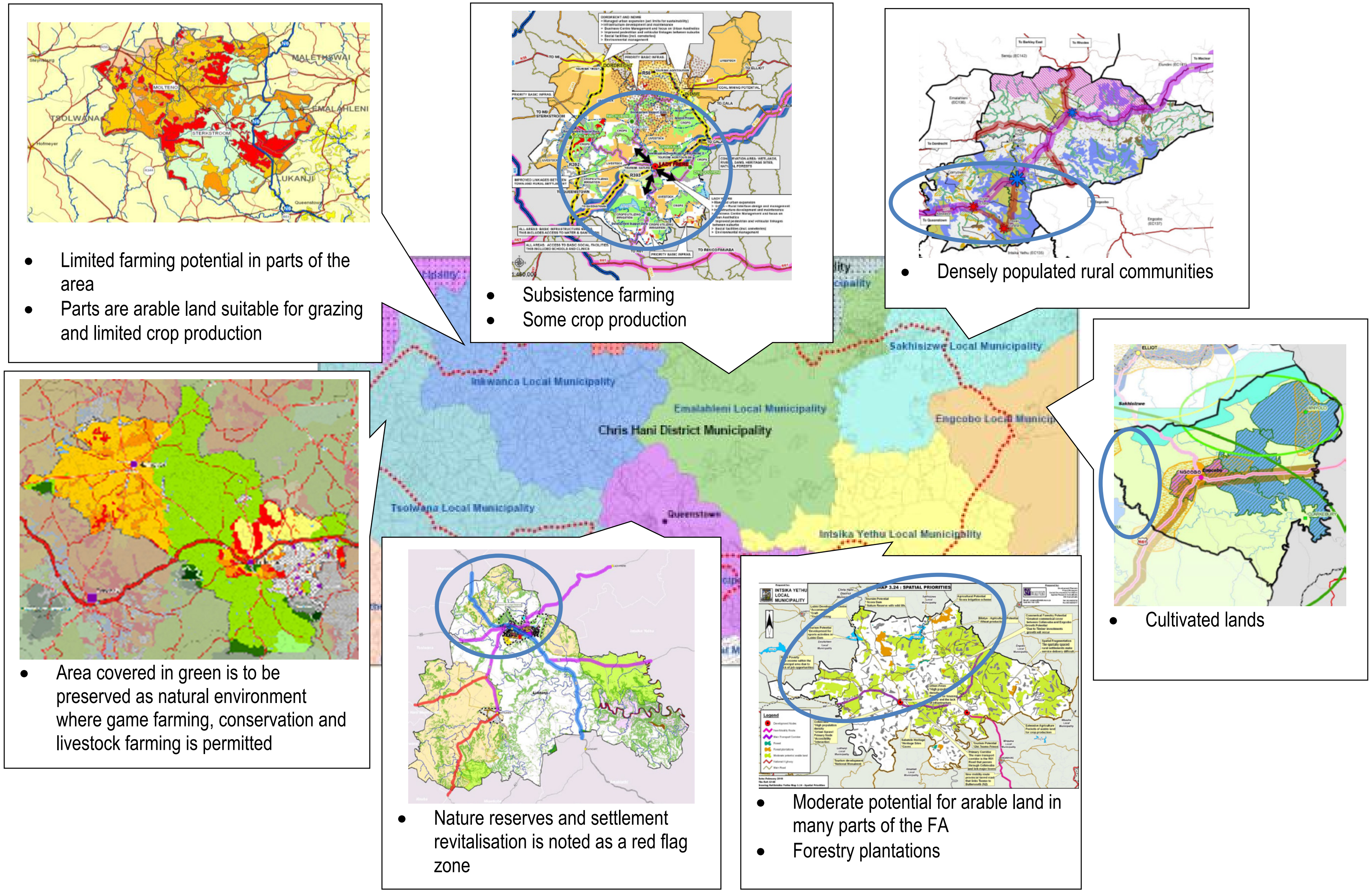
Lukanji LM challenges
- Budget constraints
- High unemployment and poverty
- Basic infrastructure provision

Intsika Yethu LM priorities
- Tourism
- Agriculture
- Forestry and Timber processing
- SMMEs

Intsika Yethu LM challenges
- Budget constraints
- High unemployment and poverty

c) Local spatial development priorities, plans and potential red flag areas

Documents reviewed	Summary
• Chris Hani SDF (2009) • Tsolwana SDF (2010) • Sakhisizwe SDF (2011) • Intsika Yethu SDF (2013) • Inkwanca SDF (2007) • Engcobo SDF (2010) • Emalahleni SDF (2010)	• The south eastern portion of the FA that encompasses parts of the Tsolwana LM area consists of land that is termed as “near-natural landscapes”. The municipality specifies that this land must be preserved thereby preventing any activities that may alter the natural environment. Activities permitted on this land include conservation, game farming and communal livestock farming. • The north eastern portion of the FA belonging to the Sakhisizwe LM is densely populated with rural settlements. Due to the focus on supplying services to these rural communities, the LM has established a first order primary node based around Cala. This node is planned to provide general services to the outlying communities. It is also noted that much of the lands near to river networks are noted as sensitive and must be preserved. The areas with tourism potential are towards the north of the LM and fall outside the scope of the FA. Generally, apart from lands noted as highly sensitive, there are no obvious red flag zones. • The Lukhanji LM, which is located in the central to southern region of the FA, contains Queenstown - the business hub of the district. A number of zones are demarcated for the revitalising of rural settlements in this area. Various nature reserves are also located within the area. • The Intsika Yethu LM, which is located in the south western corner of the FA contains various development zones. Of these, four fall within the FA: Cofimvaba - focuses on creating model settlements and town renewal; Blitaye - focuses on agriculture and irrigation; Lubisi - promotes the growth of SMMEs and the planning of settlements; Ncora - focuses on agriculture, irrigation and the formalising of settlements. • The north eastern corner of the FA, which lies within the Inkwanca LM, is heavily reliant on agriculture. Much of the land area is used for cattle and sheep farming. Other growing uses include game farming and eco-tourism; however these are sparsely distributed in the area. • Roughly 40% of the land within the Engcobo LM, which lies to the far east of the FA, is used for cultivation. The remainder is grassland, which is rural in nature with two small pockets utilised for forestry in the far western corner of the LM. The municipality further stipulates that much of the land falling within the FA be preserved as “natural” and “near-natural” landscapes, thereby preventing projects which would ultimately negatively impact the environment and sense of place. • The central northern portion of the FA, which forms part of the Emalahleni LM, has stated tourism, retail, mining, agriculture and manufacturing as its priority sectors. The part that falls under the FA is dominated by subsistence farming and has some crop production.


Limited farming potential in parts of the area
Parts are arable land suitable for grazing and limited crop production
Subsistence farming
Some crop production
Densely populated rural communities
Inkwanca Local Municipality
Emalahleni Local Municipality
Sakhisizwe Local Municipality
Engcobo Local Municip
Chris Hani District Municipality
Tsolwana Local Municipality
Queenstown
Intsika Yethu Local Municipality
Cultivated lands
Area covered in green is to be preserved as natural environment where game farming, conservation and livestock farming is permitted
Nature reserves and settlement revitalisation is noted as a red flag zone
Moderate potential for arable land in many parts of the FA
Forestry plantations

2.4.3 Socio-economic profile

The socio economic profile of the Stormberg FA includes demographic information for the towns and major settlements that lie within the FA as well as local municipal economic data. The Maletswai LM is excluded from the economic analysis as only an immaterial portion of the municipality falls within the FA. Furthermore, there are no major settlements representing the municipality that falls within the FA.

a) Demographic profile of the Stormberg FA

- The largest urban setting in the FA is Queenstown, which has a population of approximately 44 000 people. The FA consists of many small towns and settlements that contain less than 1 000 people.
- Average monthly household income is R7 226; however, the distribution of this income is highly skewed with the majority of middle to higher income earners being positioned within Queenstown.
- Almost 10% of the population living within the FA has received no formal education; the majority (55%) have received some or completed secondary schooling.
- The local municipalities of the FA have experienced positive net migration into the area of roughly 4 104 individuals; the average population growth rate in the area between 2005 and 2011, though, was quite low standing at 0.1%.

Demographic data

Demographic Profile of the Cookhouse FA (Stats SA, 2014)		
Population (2011)	175 447	
Households (2011)	48 387	
Average monthly HH income (2014 in Rands)	R7 226	
Education:		
No School	8 908	9.0%
Complete or Some Primary	23 091	23.5%
Complete or Some Secondary	54 170	55.0%
Higher	12 255	12.5%

Data applicable to all Local Municipalities included in FA (Quantec, 2014)	
Population (2011)	823 110
Population growth (CAGR, %) (2005-2011)	0.1%
Population growth (No.) (2005-2011)	2 940
Population density (People per km^2)	29.8
Migration:	
In-migration	23 929
Out-migration	19 825
Net migration	4 104

b) Economic structure of the Stormberg FA

- The size of the LMs encompassing the FA was R14 645 million in 2011, with the majority of economic base being located within or near to the urban areas. The combined economies have expanded by approximately 3.5% annually, a positive indication of heightened economic activity within the area.

- The tertiary sector contributes a relatively high 85% towards economic activity within the municipalities assessed. This clearly confirms the importance of the tertiary sector within the local economies and furthermore, illustrates the dominance of economic activity by urban areas.
- The relatively low contribution made by the primary and secondary sectors is problematic for employment creation within these localities. The majority of unemployed labour is characterised by unskilled and semi-skilled individuals that tend to find work within primary and secondary sectors. Growth within these sectors is critical to reducing unemployment within the area. Of interest is that the secondary sector has realised the highest CAGRs within the economies analysed, while the primary sector showed stagnation during the analysed period.
- Indicative of a habitually underdeveloped region exhibiting high levels of unemployment, government services represent the largest sector, contributing an estimated 29% towards local GVA.

Size of the economies	
Indicator	**Data applicable to all Local Municipalities included in FA (Quantec, 2014)**
Gross Domestic Product (Current Prices) 2011 (R'm)	R14 645
Gross Domestic Product (Constant Prices) CAGR (2005-2011)	3.5%

Sectoral profile (R'm, constant 2005 prices)					
Indicator	**Data applicable to all Local Municipalities included in FA (Quantec, 2014)**				
	2005		**2011**		**CAGR**
Primary Sector	**199.6**	**3%**	**205.8**	**2%**	**0.51%**
Agriculture, forestry and fishing	186.1	2%	197.0	2%	0.95%
Mining and quarrying	13.4	0%	8.8	0%	-6.8%
Secondary Sector	**924.0**	**12%**	**1,193.8**	**13%**	**4.4%**
Manufacturing	640.0	9%	838.5	9%	4.6%
Electricity, gas and water	109.5	1%	140.6	2%	4.2%
Construction	174.5	2%	214.8	2%	3.5%
Tertiary Sector	**6,402.7**	**85%**	**7,829.2**	**85%**	**3.4%**
Trade, catering and accommodation	1,275.6	17%	1,546.6	17%	3.3%
Transport, storage and communications	488.5	6%	635.5	7%	4.5%
Finance, insurance, real estate and business services	1,433.1	19%	1,811.0	20%	4.0%
Community, social and personal services	1,026.6	14%	1,185.9	13%	2.4%
General government	2,178.9	29%	2,650.1	29%	3.3%
Total	**7,526.3**	**100%**	**9,228.8**	**100%**	**3.5%**

c) Labour force and employment situation within the Stormberg FA

- The labour force in the FA comprised of 49 707 people in 2011. In addition, just under 8 000 people in the FA were discouraged job seekers, which shows that the area has notable challenges with respect to creating employment for its residents.
- With unemployment sitting at a high of 34.9% (higher than the national average), it should be noted that unemployment within the wider municipalities has crept northwards of 47% and represents a crisis for these localities.
- The agricultural sector has lost the greatest number of jobs in the period assessed. Total losses amount to 10 743 and is emphasised by a 46.9% decline. This trend appears to be apparent within all neighbouring districts in the Eastern Cape.
- Despite the growth in GDP-R, the secondary sector lost approximately 1 058 jobs (12.7%) thereby reducing its employment share to roughly 8% of total employment within the FA. The jobs were lost in the construction industry, while the growth of employment in the manufacturing and utilities sector partially offset the losses in the construction sector.
- The tertiary sector employed 76% of formally employed individuals within the municipalities, which equated to 59 685 jobs. Employment within the sector grew by 7.8% in the six year period, employing a further 4 313 individuals. The transport, storage and communications sector expanded the most, growing by 22.7%.
- Overall, employment with the municipalities dropped from 86 356 in 2005 to 78 964 in 2011, a drop of 7 392 for 8.6%.

Labour force profile		
Indicator	**Focus Area (Stats SA, 2014)**	**Local Municipalities (Quantec, 2014)**
Employment	32 354	78 964
Unemployment	17 353	72 268
Unemployment %	34.9%	47.8%
Discouraged job seekers	7 995	Unavailable

Sectoral employment (Quantec, 2014)						
Indicator	**Data applicable to all Local Municipalities included in Focus Area**					
	2005		**2011**		**% Change**	**Abs Change**
Primary Sector	**22,684**	**26%**	**12,037**	**15%**	**-46.9%**	**-10,647**
Agriculture, forestry and fishing	22,504	26%	11,761	15%	-47.7%	-10,743
Mining and quarrying	179	0%	276	0%	53.8%	97
Secondary Sector	**8,300**	**10%**	**7,242**	**9%**	**-12.7%**	**-1,058**
Manufacturing	4,381	5%	4,628	6%	5.6%	247
Electricity, gas and water	267	0%	228	0%	-14.4%	-38

Sectoral employment (Quantec, 2014)						
Indicator	Data applicable to all Local Municipalities included in Focus Area					
	2005		2011		% Change	Abs Change
Construction	3,652	4%	2,385	3%	-34.7%	-1,267
Tertiary Sector	**55,372**	**64%**	**59,685**	**76%**	**7.8%**	**4,313**
Trade, catering and accommodation	11,616	13%	12,710	16%	9.4%	1,094
Transport, storage and communications	1,585	2%	1,946	2%	22.7%	361
Finance, insurance, real estate and business services	5,727	7%	6,581	8%	14.9%	854
Community, social and personal services	15,819	18%	14,693	19%	-7.1%	-1,126
General government	20,625	24%	23,756	30%	15.2%	3,131
Total	**86,356**	100%	**78,964**	100%	**-8.6%**	**-7,392**

d) Access to basic services within the Stormberg FA

- Approximately 86% of households have access to electricity within the FA, while a relatively large number of households 6 702 or 13.9% still make use of candles for lighting.
- Only 62.1% of households have access to a flush/chemical toilet. Of considerable concern is the use of bucket latrines by 425 households and secondly, the use of "other" facilities and "none" by 11.8% of population within the FA.

Indicator	Access to Basic Services in the Settlements and Towns of the FA. (Stats SA, 2014)	
	HH (No.)	HH (%)
Access to electricity		
Electricity	41,514	85.8%
Solar	82	0.2%
Other (candles, gas, paraffin)	6,702	13.9%
None	71	0.1%
Total	48,369	100%
Access to sanitation		
Flush/Chemical toilet	30,062	62.1%
Pit latrine with/without ventilation	12,174	25.2%
Bucket latrine	425	0.9%
Other	963	2.0%

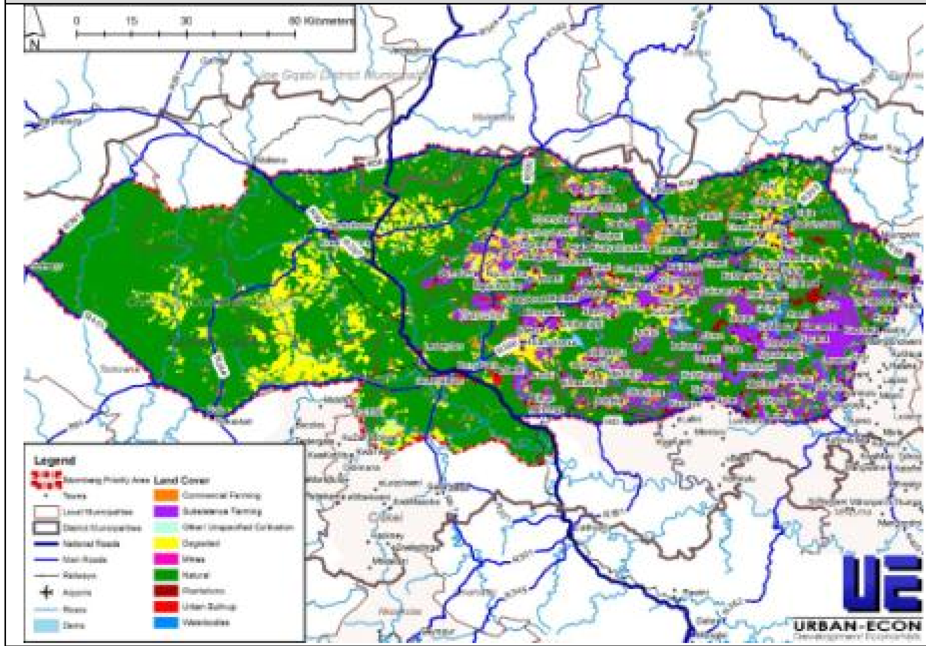
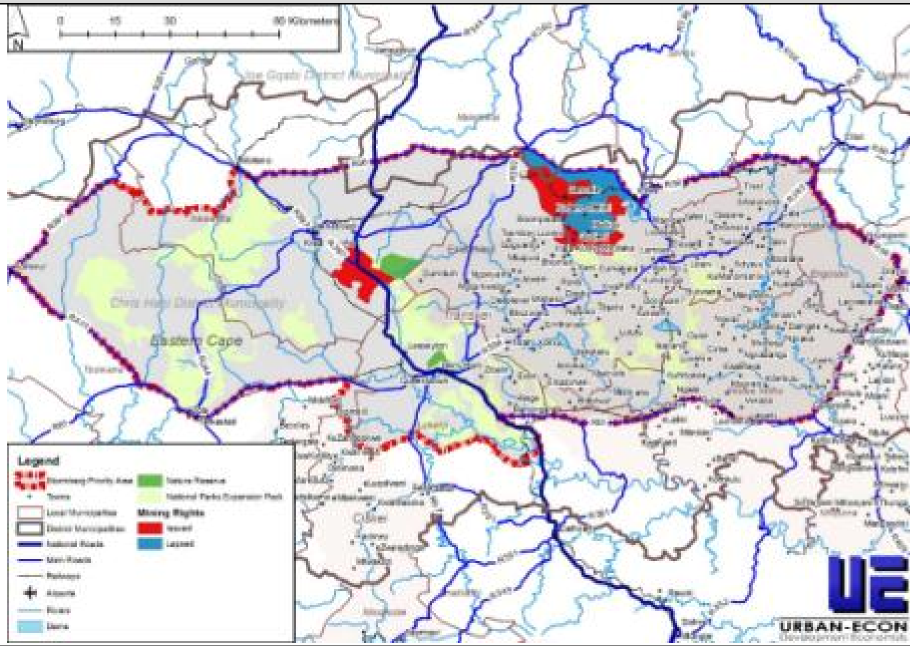
Indicator	Access to Basic Services in the Settlements and Towns of the FA. (Stats SA, 2014)	
	HH (No.)	HH (%)
None	4,745	9.8%
Total	48,369	100%
Access to water		
Piped water inside dwelling	21,504	44.4%
Piped water inside yard	13,428	27.8%
Piped water on community stand (>200mts)	11,119	23.0%
None	2,318	4.8%
Total	48,369	100%

e) Level of economic infrastructure development of the Stormberg FA

The area is relatively connected with the rest of the country. Its road networks and transport infrastructure is more developed than some FA analysed; however, some areas, especially those in the most western parts of the FA would be challenging to access.

Indicator	Transport Infrastructure Development Overview.
Airports	An airport is located in Queenstown while an airstrip is located at Tarkastad.
Railway Lines	Railway run south east from Molteno in the north to Sterkstroom and (1) heads east-west along the northern border of the FA and (2) heads south east towards Queenstown. A second railway runs eastward from Tarkastad in the south western corner toward Queenstown and (1) run east west toward eLalini and (2) heads south east toward Cathcart, south of the FA.
National Roads	The N6 runs in north westerly direction and passes through Queenstown and continues through the central regions of the FA.
Regional Roads	Nine regional roads pass through or provide transport routes to the outer extremities of the FA. Roads providing access to the interior of the FA include the R392, the R393, the R397, the R344 Roads located on the perimeter of the FA include the R61 (providing access along the southeastern border), the R56 (running east-west along the western half of the northern border), the R58 (running along the eastern half of the northern border), the R391 (running along the northwestern border), and the R401 which is located along the southwestern border of the FA.

2.4.4 Land use profile

Core land uses	Natural and mineral resources
 	
• A large number of settlements disbursed throughout the eastern half of the FA. • Linked to the above point, is the importance of subsistence farming, which is prolific within the eastern half of the FA. • In the eastern parts of the FA, numerous forestry plantations are found. • Large tracts of land, notably within the central to western and northeastern portions of the FA are degraded. • Pockets of commercial farming tend to populate areas in the northern and central reaches of the FA. • The FA has a well-developed road network with the N6 and a number of regional roads traversing the landscape.	• Areas of concern include, firstly, issued mining rights and lapsed mining rights. These are mostly located in the central northern portion of the FA. However, a zone of issued mining rights is located on either side of the N6 and R397 towards the central to eastern area of the FA. • Various zonings for the extension of national parks have been allocated within the FA. The western part of the FA has a greater coverage by this legend than the eastern part. • Two nature reserves are identified, those being located centrally within the FA.

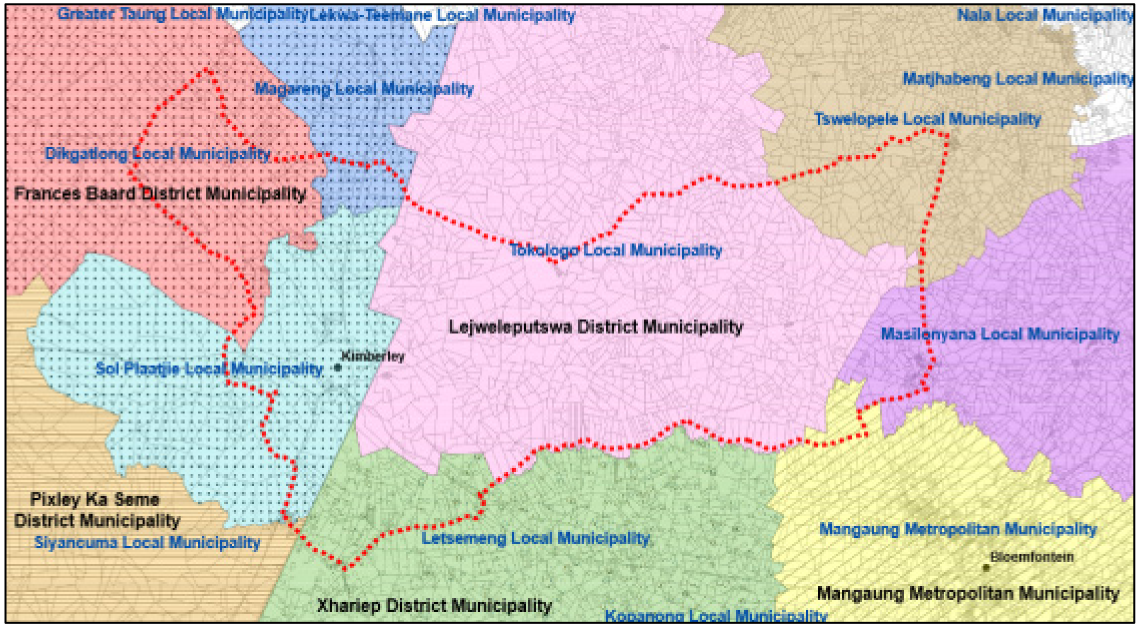
2.4.5 Key summary

- The FA contains a population of roughly 175 445 individuals.
- Monthly household income is calculated at approximately R7 226.
- Gross domestic product in 2011 totalled R14 644 million while annual growth was recorded at 3.5%.
- Municipalities associated with the FA predominantly comprise of the tertiary services sector that focuses on servicing the needs of the local communities.
- The area is troubled with a very high unemployment rate, which illustrates the limited employment absorption capacity of the LMs and challenges faced by the local economies with respect to leveraging the local comparative advantages.
- As a way to develop the local economies and create new employment opportunities, the municipalities prioritise agriculture, mining industry, and tourism - and to a smaller degree, forestry and manufacturing.
- Other priority concerns relate to basic infrastructure and road maintenance. The large number of rural communities creates a number of concerns for the municipalities of the FA as the provision of services to these communities is largely lacking. Containing the decreasing agricultural activities and the associated job numbers is a central priority to those LMs relying on agriculture.

2.5 Kimberley Focus Area 5

2.5.1 Composition of the focus area

The Kimberley focus area stretches over sections of two South African provinces that are the Free State and the Northern Cape. Almost two thirds of the FA is in the Free State. Sections of four District Municipalities and one Metropolitan Municipality make up the FA with the Lejweleputswa DM constituting the greater part. Eight LMs have some of their land making up the FA, but the local municipality contributing the most in terms of land area is Tokologo. Municipalities of Siyancuma, Mangaung Metropolitan and Magareng contribute a marginal land space towards the FA and importantly these parts do not include any major settlements; therefore, the analysis of these three municipalities will be of a lower detail compared to the other municipalities.



Map 2-10: Kimberley focus area

The majority of households residing in the FA and major economic activities characterising the FA are concentrated in Kimberley, which falls under the Sol Plaatje LM in the Northern Cape. Besides Kimberley, which is the capital of the Northern Cape and the major city in the FA, towns found in the FA include Boshof, Dealsville, Bultfontein, Ikgomotseng, Jacosdaal, Windsorton, Holpan, Barkly West, and Platfontein.

Distribution of Towns and Major Settlements within the Kimberley Focus Area				
Province	District Municipalities	Local Municipalities	Towns and settlements	LMs' population densities (people/km^2)
Free State	Lejeweleputswa	Tokologo	• Boshof • Dealesville	2.4
		Tswelopele	• Bultffontein	6.4
		Masilonyana	• Ikgomotseng	11.6
	Xhariep	Letsemeng	• Jacobsdal	3.6

Distribution of Towns and Major Settlements within the Kimberley Focus Area				
Province	**District Municipalities**	**Local Municipalities**	**Towns and settlements**	**LMs' population densities (people/km^2)**
	Mangaung Metropolitan		• No towns and major settlements	117.2
Northern Cape	Frances Baard	Dikgatlong	• Windsorton • Holpan • Barkly West	17.6
		Magareng	• No towns and major settlements	13.7
		Sol Plaatje	• Kimberly • Platfontein	130.5

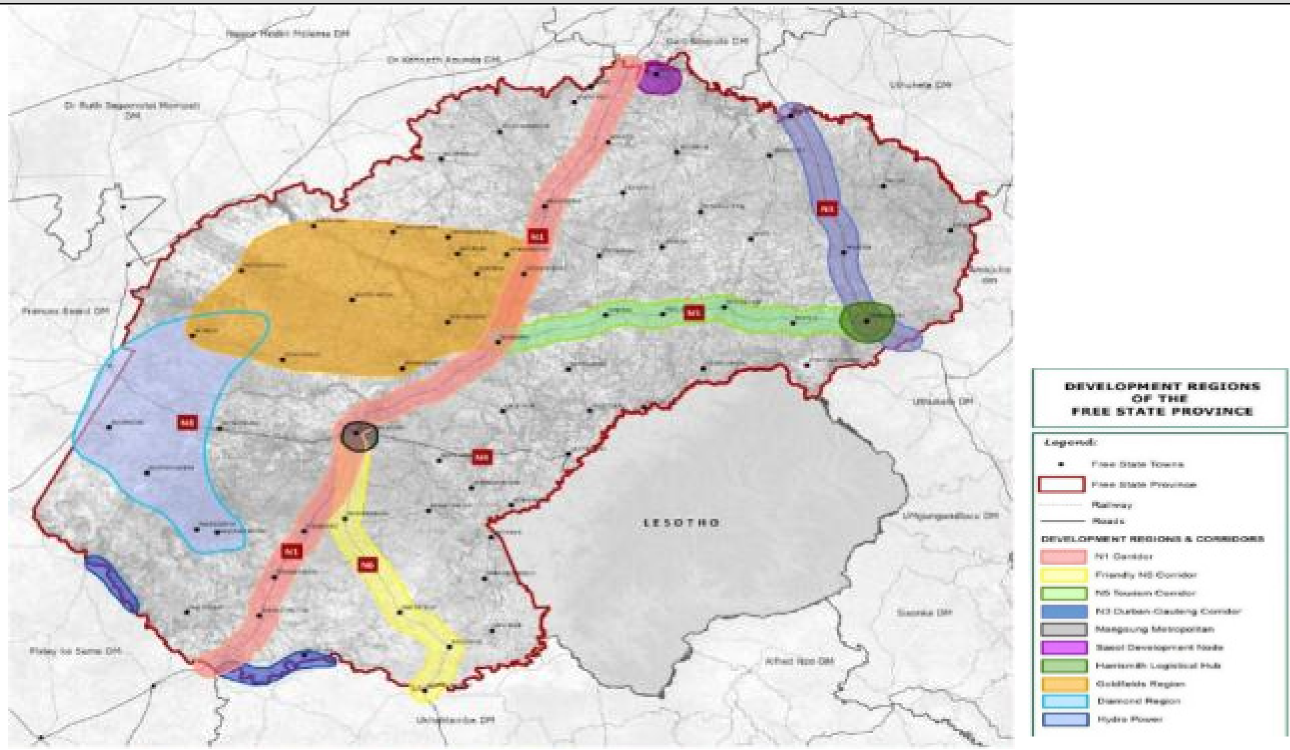
2.5.2 Policy review

a) Provincial policies and strategic documents of the Free State and Northern Cape

Documents reviewed	Overview of Provincial Policies and Strategic Documents
Free State	

• Free State Province Provincial Growth and Development Strategy (PGDS) 2005-2014
• Free State Province Provincial Spatial Development Framework (PSDF), Phase 1, Revised 25 February 2013
• Free State Province Provincial Spatial Development Framework (PSDF), Phase 2 Report, February 2013
	• According to the Free State PGDS (2005), the province is in need of an accelerating economic growth rate to meet the demand for employment, while having a good infrastructure, and a sound economic base with opportunities in tourism, agro-processing and mining.
	• Based on the social and economic development challenges of the province, Free State PGDS (2005) sets the following as primary development objectives:
	  ○ Stimulate economic development;
	  ○ Develop and enhance the infrastructure for economic growth and social development;
	  ○ Poverty alleviation through human and social development;
	  ○ Ensure a safe and secure environment for all the people of the province; and
	  ○ Promote effective and efficient governance and administration.
	• The province recently adopted a Vision 2030. The Free State Vision 2030 envisages:
	  ○ An economy that encourages the development of new growth sectors with emphasis on the knowledge-based industries and the green economy;
	  ○ By 2030, ownership and control patterns of the economy will be transformed, spatial under-development will be addressed, basic services such as healthcare, education, electricity, water and sanitation will be equitably accessed by the people of the province.

Documents reviewed	Overview of Provincial Policies and Strategic Documents
	• As part of the drivers to support the newly adopted vision and the setting up of a green economy, the following key aspects related to the development of wind and solar PV projects were also picked from the strategy document: ○ Conservation of natural resources, biodiversity and landscapes; ○ Facilitation of the use of green energy; and ○ Use of renewable resources in preference to non-renewable resources. • The Free State PSDF (2013) states that the province has a significant comparative economic advantage vested in its inherent resources (both renewable and non-renewable). It further stated that the sustainable use of such resources holds the key to long-term sustainability and growing prosperity in the province (Free State PSDF 2013). • Renewable energy is a key focus area of the Free State Development Corporation, especially when it refers to the solar energy sector. According to the Free State PSDF (2013), a number of projects are currently implemented or being investigated to support the above (for example, a gas-fired plant in Sasolburg, co-generation by Omnia, investigation into methane gas conversion by Gold Fields, 250MW solar park development in the Xhariep district, and the Letsatsi solar PV project development north of Bloemfontein). • Approximately 3.4% of the land surface of the Free State is formally conserved. There are currently 18 provincial nature reserves, which represent only 1.6% of the province's land area.

<table>
<tr><th>Documents reviewed</th><th>Overview of Provincial Policies and Strategic Documents</th></tr>
<tr><td></td><td>

Map 2-11: Free State Spatial Development Framework</td></tr>
<tr><td colspan="2">Northern Cape</td></tr>
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The Northern Cape Municipal LED Framework (February, 2011)
Northern Cape Provincial SDF (July, 2012)
The Northern Cape province Local Economic Development Framework (February, 2011)
The Northern Cape province Local Economic Development Strategy (January, 2011)

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According to the Northern Cape PSDF (2012), the overarching goal of the province is to <u>focus on sustainable development</u>; thus it places emphasis on the long-term sustainability and growing prosperity in the province by focusing on the following tasks:

Promote sustainable economic development by <u>building on the comparative economic advantages</u> of the province;
<u>Protect and utilise the natural resource base in a sustainable manner</u> for the benefit of all parties concerned;
Merge <u>social, ecological and economic considerations</u> in decision-making as is required by legislative instruments (NEMA);

</td></tr>
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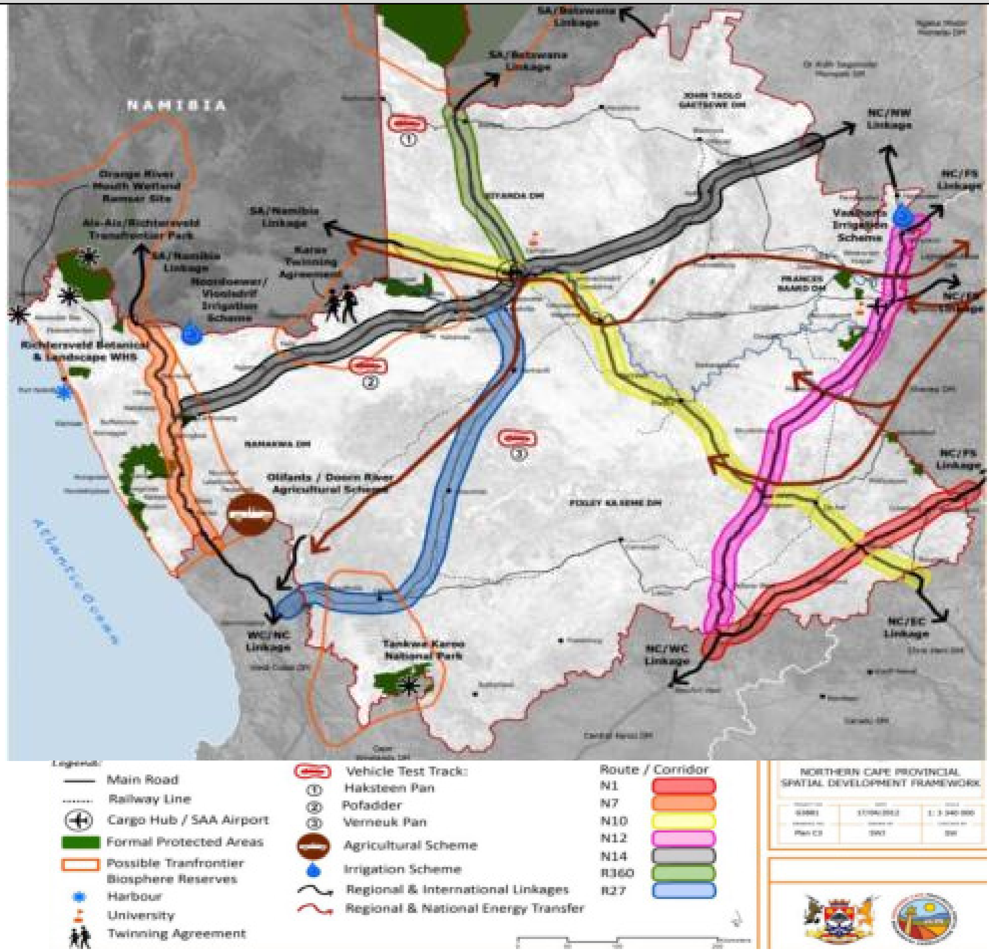
Documents reviewed	Overview of Provincial Policies and Strategic Documents
• The Northern Cape Provincial Growth and Development Strategy • The Northern Cape Municipal LED Framework (February, 2011) • Northern Cape Provincial SDF (July, 2012) • The Northern Cape province Local Economic Development framework (February, 2011) • The Northern Cape province Local Economic Development strategy (January, 2011) • The Northern Cape provincial Growth and Development Strategy	○ Make a meaningful and lasting contribution to eradication of poverty and inequality through the wise use of the inherent capital of the province; and ○ Create an environment that will ensure an acceptable return on capital invested by the private sector. • The Northern Cape PGDS identified the following two primary development objectives: ○ Promoting the growth, diversification and transformation of the provincial economy; and ○ Poverty reduction through social development. • The Northern Cape PSDF (2012) states that in order to take a proactive stance regarding the promotion of economic development, the provincial government proposes to allocate resources to the identification, scoping, appraisal and investment marketing for a suite of flagship projects that can leverage associated investment and economic activity in areas of high relative economic potential. • As outlined in the Northern Cape PGDS, provincial government seeks to grow the agricultural economy and is committed to promoting transformation in agriculture. • According to the Northern Cape PSDF (2012), the Northern Cape holds a significant comparative economic advantage in a number of enterprises in the science and technology sector including: ○ Square Kilometre Array (SKA), Carnarvon in the Pixely Ka Seme DM; ○ Southern African Large Telescope (SALT); and ○ Karoo Array Telescope (MeerKAT), Carnarvon in the Pixely Ka Seme DM. • In the context of ensuring the availability of inexpensive energy and the promotion of development in the province, the Northern Cape PGDS promotes the development of energy sources such as solar energy, the natural gas fields, bio-fuels, etc. • The provincial government accepts that the small-scale mining sub-sector could be the powerhouse of economic development in poor rural communities; thus, as indicated in the Northern Cape PGDS, it aims to provide assistance to as many small-scale operations to get started as possible. • Furthermore, through the Northern Cape PGDS, the provincial government proposes to use tourism as a vehicle for growth and development, which is particularly the case in remote rural areas where the aforesaid natural resources can be employed to leverage capital. • The Northern Cape PSDF (2012) proposes the creation of a solar corridor, which centres on Upington and extends from roughly Kakamas in the north to De Aar in the east.

Documents reviewed	Overview of Provincial Policies and Strategic Documents
	 Map 2-12: Northern Cape Spatial Development Framework Map

b) Social and economic infrastructure development priorities, plans and potential red flag areas.

Documents reviewed	Socio-Economic Development Priorities, Plans and Potential Red Flag Areas.

• Lejweleputswa DM IDP 2011/2012
• Masilonyana LM IDP 2012-2017
• Tokologo LM Draft IDP 2013-2014
• Tswelopele LM IDP 2010-2011
• Mangaung Metropolitan IDP Review 2013-2014
• Xhariep DM IDP 2010/2011
• Letsemeng LM IDP 2012/2013
• Frances Baard DM IDP 2012/12-2016/17
• Ditgatlong LM IDP Final 2013/14
• Frances Baard LED Strategy 2009
• Magareng LM IDP 2013-2014
• Sol-Plaatje LM IDP 2012/13-2016/17
• Pixley ka Seme DM IDP 2011-2016
• Siyancuma LM IDP 2012-2013
	• Most local municipalities in the FA have identified the issue of electricity reticulation as one of the major priority areas.
	• The Mangaung Metropolitan Municipality has explicitly expressed its interest of building solar farms.
	• District-wide priority issues for the Frances Baard LM includes:
	  ○ Roads and storm water;
	  ○ Land/Housing;
	  ○ Water;
	  ○ LED;
	  ○ Infrastructure development;
	  ○ Health;
	  ○ Recreational facilities;
	  ○ Electricity;
	  ○ Education;
	  ○ Sanitation;
	  ○ Safety and security;
	  ○ Refuse and waste management;
	  ○ Youth development;
	  ○ Disaster management; and
	  ○ Agriculture.
	• Poverty, low income levels, high unemployment and low literacy levels are some of the main socio-economic challenges bedevilling the people in most parts of the FA.
	• LED strategies for most of the municipalities within the FA are focused on job creation.
	• Agriculture and tourism are some of the main economic activities characterising this FA, and these also form the development priority sectors for most municipalities in the assessed area.

Dikgatlong LM Priorities:
- Housing and land
- Storm water and roads
- Water
- Sanitation
- LED/Job creation
- Early childhood development
- Parks and recreation

Dikgatlong LM Challenges:
- Poverty
- Low income levels

Magareng LM Priorities:
- Basic service provision

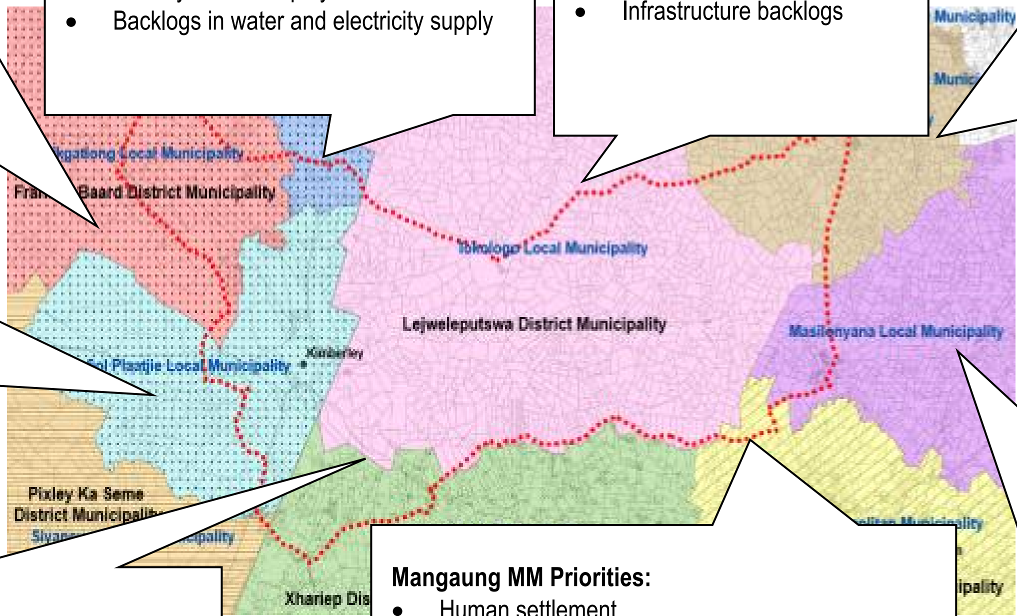
Magareng LM Challenges:
- Lower education levels
- Poverty and unemployment
- Backlogs in water and electricity supply

Tokologo LM Priorities:
- Basic service provision

Tokologo LM Challenges:
- Infrastructure backlogs

Tswelopele LM Priorities:
- Basic service provision

Tswelopele LM Challenges:
- Shortage of skills
- Housing shortages



Sol Plaatjie Priorities:
- An infrastructure-led growth path to ensure sustainable development

Sol Plaatjie Challenges:
- Household services backlog
- Access to electricity

Masilonyana LM Priorities:
- Basic service provision
- Local & rural economic development - creation of employment

Masilonyana Challenges:
- High rate of HIV/AIDS infection
- High levels of unemployment
- High illiteracy levels
- High crime rate

Letsemeng LM Priorities:
- SMME and cooperatives development
- Tourism
- Basic service delivery
- Rural development

Letsemeng LM Challenges:
- Unemployment
- Informal settlements
- Lack of water provision in some parts

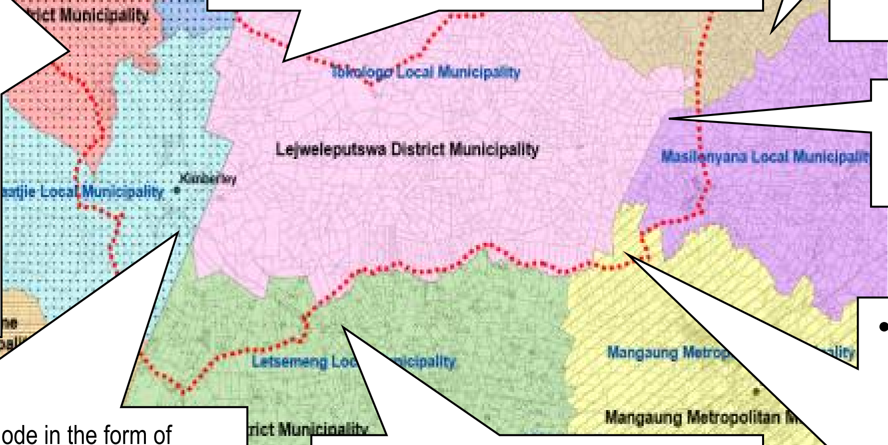
Mangaung MM Priorities:
- Human settlement
- Public transport
- Environmental management and climate change
- Social and community services

Mangaung MM Challenges:
- Huge housing backlog
- Mushrooming of informal settlements
- Youth unemployment

c) Spatial development priorities, plans and potential red flag areas

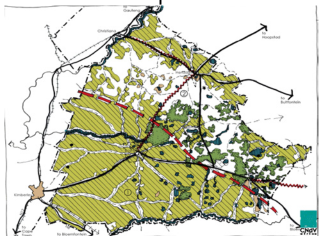
Documents reviewed	Spatial Development Priorities and Policies Review for the Kimberley Focus Area

• Tokologo LM Spatial Development Framework, 2012
• Tswelopele LM Spatial Development Framework 2008
• Mangaung MM Spatial Development Framework 2010-2011
• Xhariep DM Spatial Development Framework 2012
• Frances Baard DM Spatial Development Framework 2013
• Sol Plaatje LM Spatial Development Framework 2008
• Pixley ka Seme Spatial Development Framework 2013-2018
	• The following key economic priority sectors were identified to have potential and needing to be further developed to support objectives of economic growth and job creation in the Xhariep district:
	  ○ Agriculture & farming;
	  ○ Winery;
	  ○ Mining; and
	  ○ Tourism.
	• According to the Free State PSDF (2013), the Xhariep region has the second-best solar radiation index after Upington. It provides the opportunity to harness the natural sun power and to generate electricity. This positions Xhariep as an ideal location for the development of concentrated solar power and photovoltaic solar power generation technologies.
	• Kimberley is the most visited tourist destination area within the Frances Baard DM. Encouraging visitation to other areas of the region remains a primary challenge for tourism authorities within the region.
	• Agriculture in the Frances Baard region mainly consists of: intensive irrigation, extensive grazing and game farming
	• The following environmental conservation areas are present within the Frances Baard District:
	  ○ Benfontein near Kimberley;
	  ○ Rooipoort hunting farm;
	  ○ Kamfers Dam Flamingo Reserve; and
	  ○ Wanebaai.
	• Tourism and agriculture dominate the Kimberly Focus Area.



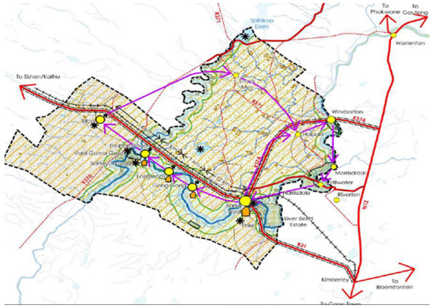
- The majority of the Magareng area can be classified as peri-urban with very low densities

- Economy rests largely on agriculture
- Game farming takes a larger portion of available land space in the area
- There are also mining deposits in the area which have not been exploited to the full



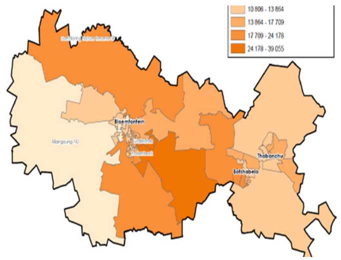
- Tswelopele consists of two urban nodes surrounded by the rural farmland
- One of the main maize producing areas in the province

- The Dikgatlong municipality also has an alluvial mining and agricultural development corridor

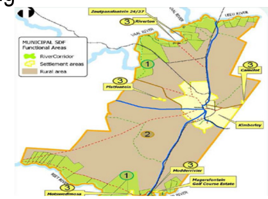


- Masilonyana LM is fundamentally rural with no major urban centres

- Mangaung comprises three prominent urban centres, which are surrounded by an extensive rural area



- The Sol Plaatje LM comprises a large urban node in the form of Kimberley, villages and farms
- The economic activities consist of several industries as well as mining and farming



- The Letsemeng municipal area which is part of the Xhariep district is dominated by agriculture
- According to the FS PSDF (2013), the Xhariep region in the southern part of the Free State has the highest solar radiation in South Africa after Upington

2.5.3 Socio-economic profile

The socio-economic profile of the Kimberley FA includes demographic information of all the towns and major settlements that lie within the FA. It also encompasses economic data for local municipalities. The Siyancuma LM is excluded from the economic analysis, because only a small and insignificant portion of the municipality is part of the wider FA.

a) Demographic profile of the Kimberley FA

- The FA encompasses about 124 840 people. The Kimberley area alone constitutes almost 78% of the total population and more than three quarters (77%) of the 31 716 households.
- There are low levels of higher education within the focus area with only 15.2% of the population believed to have some tertiary qualifications. The majority have completed or received some secondary education.
- The average monthly household income in the area (R14 705) is about 50% greater than that observed for the country.
- The municipalities covered within the focus area experienced a positive population growth of 8% between the years 2005 and 2011.
- More people have migrated into the municipal areas of the FA compared to those who have migrated to other areas. A positive net migration of 16 111 was recorded between the years 2005 and 2011. This could be as a result of economic pull factors characterising Kimberley, i.e. the main economic node in the area.

Demographic data

Demographic Profile of the Kimberley FA (Stats SA, 2014)		
Population (2011)	124 840	
Households (2011)	31 716	
Average monthly HH income (2014 in rand)	14 705	
Education:		
No School	6 307	8.4%
Complete or Some Primary	10 406	13.8%
Complete or Some Secondary	47 190	62.6%
Higher	11 434	15.2%

Data applicable to all Local Municipalities included in the FA (Quantec, 2014)	
Population (2011)	560 992
Population growth (CAGR, %) (2005-2011)	1.3%
Population growth (No.) (2005-2011)	94 498
Population density (People per km^2)	5.9
Migration:	
In-migration	63 156
Out-migration	47 045
Net migration	16 111

b) Economic structure of the Kimberley FA

- The combined size of the municipal economies included in the FA is R72 910.5 million, which is predominately attributed to the concentrated economic base in Sol Plaatje LM linked to its administrative centre of Kimberley.

- The CAGR of 3.0% recorded for the economies included in the FA is slightly below the 3.2% average achieved by the wider South African economy.
- The service sector dominates the local economy in terms of output. The tertiary sector dominates the local economies assessed with the finance and business services sector making the largest contribution towards these economies in 2011, followed by the government services sector.
- Among the primary sector, which contributed about 8% to the local economies, the production of the mining sector declined, while the production of the agricultural sector increased between 2005 and 2011.
- As far as the secondary industry is concerned, it experienced a positive growth between 2005 and 2011 with the construction sector showing an above average performance.

Size of economies					
Indicator	**Data applicable to all Local Municipalities included in FA**				
Gross Domestic Product (Current Prices) 2011 (R'm)	72 910.5				
Gross Domestic Product (Constant Prices) CAGR (2005-2011)	3.0%				
Sectoral profile (R'm, constant 2005 prices)					
Indicator	**Data applicable to all Local Municipalities included in FA**				
	2005		**2011**		**CAGR**
Primary Sector	**3 705.5**	**10%**	**3 606.2**	**8%**	-0.5%
Agriculture, forestry and fishing	836.1	2%	1 000.6	2%	3.0%
Mining and quarrying	2871.4	8%	2 605.6	6%	-1.6%
Secondary Sector	**5 348.2**	**14%**	**6 492.2**	**14%**	**3.3%**
Manufacturing	3 536.8	9%	4 296.9	10%	3.3%
Electricity, gas and water	1 183.0	3%	1 336.5	3%	2.1%
Construction	628.3	2%	858.8	2%	5.3%
Tertiary Sector	**28 533.0**	**76%**	**34 826.1**	**78%**	**3.4%**
Trade, catering and accommodation	4 248.8	11%	4 745.6	11%	1.9%
Transport, storage and communications	4 552.2	12%	5 449.3	12%	3.0%
Finance, insurance, real estate and business services	7 694.1	20%	9 719.2	22%	4.0%
Community, social and personal services	4 853.4	13%	5 799.1	13%	3.0%
General government	7 184.6	19%	9 112.9	20%	4.0%
Total	**37 588.7**	**100%**	**44 924.5**	**100%**	**3.0%**

c) Labour force and employment situation within the Kimberley FA

- The labour force in the FA comprises of about 47 306 people.
- The FA's unemployment rate is 23.7%, which is slightly lower than that of the national economy (24%).
- The tertiary sector makes the largest contribution in terms of employment in the FA's local economy. Within the tertiary sector, general government services represent the major employer within the FA.
- There was a decline in employment in the primary sector, both in the agricultural and mining industries during the period 2005 to 2011.
- There was also a decline in employment in the secondary sector with the manufacturing and construction industries being affected.
- Most jobs within the focus area were lost in the agricultural sector, followed by the trade sector and manufacturing industries.

Labour force profile		
Indicator	**FA (Stats SA, 2014)**	**Local Municipalities (Quantec, 2014)**
Employment	36 084	292 913
Unemployment	11 222	119 907
Unemployment %	23.7%	29.0%
Discouraged job seekers	3 513	Unavailable

Sectoral employment (Quantec, 2014)						
Indicator	**Data applicable to all Local Municipalities included in FA**					
	2005		**2011**		**% Change**	**Abs Change**
Primary Sector	**37 885**	**13%**	**30 685**	**10%**	**-19.0**	**-7 200**
Agriculture, forestry and fishing	22 142	8%	15 999	5%	-27.7%	-6 143
Mining and quarrying	15 743	5%	14 686	5%	-6.7%	-1 056
Secondary Sector	**38 584**	**13%**	**33 901**	**12%**	**-12.1%**	**-4 683**
Manufacturing	25 283	9%	21 145	7%	-16.4%	-4 138
Electricity, gas and water	812	0%	1 389	0%	71.0%	577
Construction	12 489	4%	11 368	4%	-9.0%	-1 121
Tertiary Sector	**215 998**	**74%**	**228 327**	**78%**	**5.7%**	**12 329**
Trade, catering and accommodation	46 322	16%	40 478	14%	-12.6%	-5 844
Transport, storage and communications	10 160	3%	10 375	4%	2.1%	215
Finance, insurance, real estate and business services	35 627	12%	38 163	13%	7.1%	2 536
Community, social and personal services	54 015	18%	50 805	17%	-5.9%	-3 210
General government	69 874	24%	88 506	30%	26.7%	18 632
Total	**292 467**	**100%**	**292 914**	**100%**	**0.2%**	**446**

d) Access to basic services within the Kimberley FA

- The majority of households in the settlements and towns within the focus area have access to electricity.
- The municipalities have made some significant strides in improving the access to sanitation for most households. Almost 85% of households have access to sanitation through the use of flush/chemical toilets. There are, however, still some service backlogs in some of the municipalities as can be revealed by the number of households without access to sanitation (3.5%), and those still relying on the bucket latrine (2.9%).
- Most of the households in the FA have access to water; however, about five out of 100 households have to walk more than 200 metres to access it or have no adequate access to water.

Indicator	Access to Basic Services in the Settlements and Towns of the FA (Stats SA, 2014)	
	HH (No.)	HH (%)
Access to electricity		
Electricity	28 664	90.4%
Solar	57	0.2%
Other (candles, gas, paraffin)	2 880	9.1%
None	118	0.4%
Total	31 719	100%
Access to sanitation		
Flush/chemical toilet	27 063	85.3%
Pit latrine with/without ventilation	1 321	4.2%
Bucket latrine	911	2.9%
Other	1 315	4.1%
None	1 109	3.5%
Total	31 719	100%
Access to water		
Piped water inside dwelling	21 325	67.2%
Piped water inside yard	8 833	27.9%
Piped water on community stand (>200m)	1 320	4.2%
None	241	0.8%
Total	31 719	100%

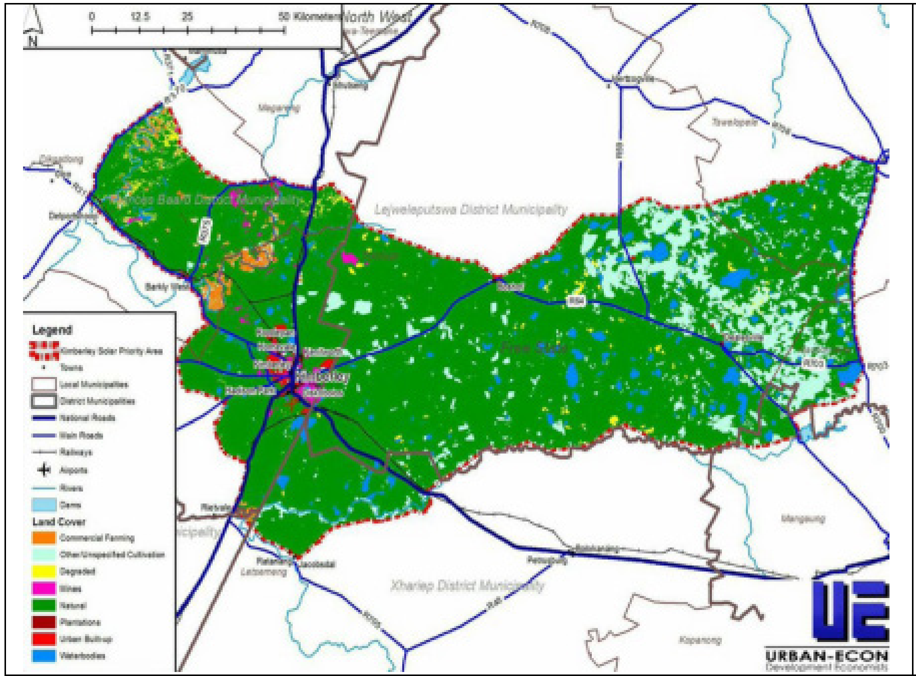
e) Level of economic infrastructure development of the Kimberley FA

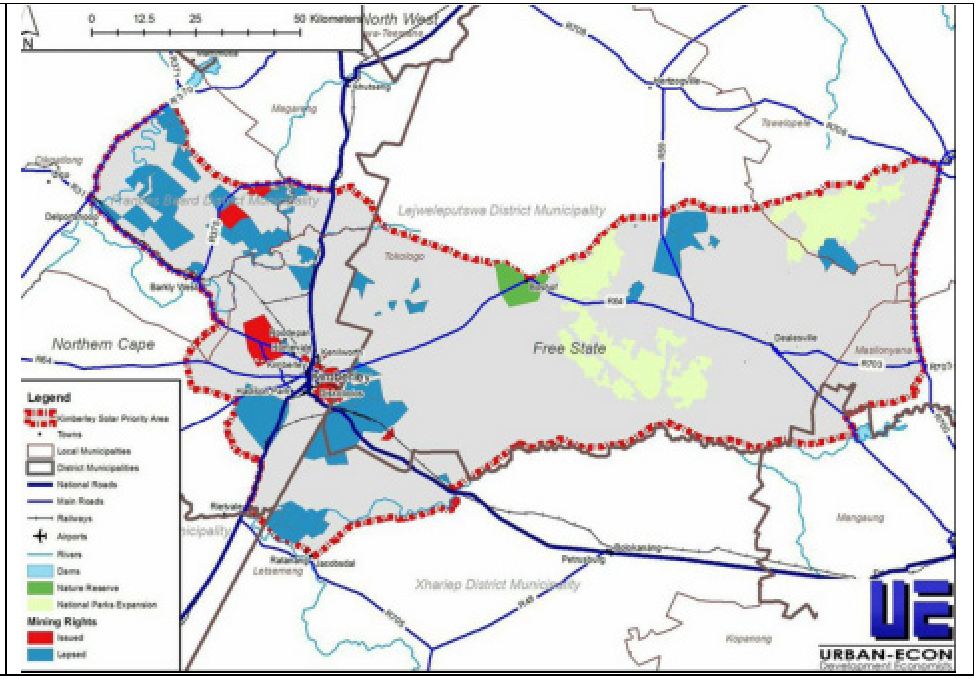
The table below shows the overall development of the FA in terms of the transport infrastructure. The western part of the FA is well connected through road networks and the airport. The other parts of the FA have a number of regional roads traversing them, but they are in many instances in dilapidated state and are in need of repair and maintenance.

Indicator	Transport Infrastructure Development Overview
Airports	Kimberley Airport
Railway lines	There are railway lines connecting Kimberley with other major cities such as Johannesburg, Cape Town and Port Elizabeth
National roads	The N8 and N12 intersect in Kimberley
Regional roads	The most notable ones include R64, R31, R703 and R375

2.5.4 Land use profile

Core land uses	Natural and mineral resources
• The eastern part of the FA is densely populated with salt pans. • Agricultural activities in the eastern part of the FA are of notable importance. • Commercial farming activities dominate the area around Barkly West in the western parts of the focus area.	• Mining activities are prevalent in the western part of the FA around the city of Kimberley and in the Dikgatlong LM where there is a predominance of alluvial mining activities. Much of the land though represents the lapsed mining rights. However, these should be taken into account nonetheless to ensure that mineral resourced areas are sterilised without due consideration. • There is an expansion of the national parks in the central parts of the focus area near the town of Boshof and on the further eastern parts of the FA. There is also a nature reserve around the Boshof area. • However, it is also known that the central part of the FA encompasses a number of private game farms that are not reflected on the map.


0 12.5 25 50 Kilometers
North West
Lejweleputswa District Municipality
Free State
Xhariep District Municipality
Legend
Kimberley Solar Priority Area
Towns
Local Municipalities
District Municipalities
National Roads
Main Roads
Railways
Airports
Rivers
Dams
Land Cover
Commercial Farming
Other/Unspecified Cultivation
Degraded
Mines
Natural
Plantations
Urban Built-up
Waterbodies
URBAN-ECON
Development Economists


0 12.5 25 50 Kilometers
North West
Lejweleputswa District Municipality
Northern Cape
Free State
Xhariep District Municipality
Legend
Kimberley Solar Priority Area
Towns
Local Municipalities
District Municipalities
National Roads
Main Roads
Railways
Airports
Rivers
Dams
Nature Reserve
National Parks Expansion
Mining Rights
Issued
Lapsed
URBAN-ECON
Development Economists

2.5.5 Key summary

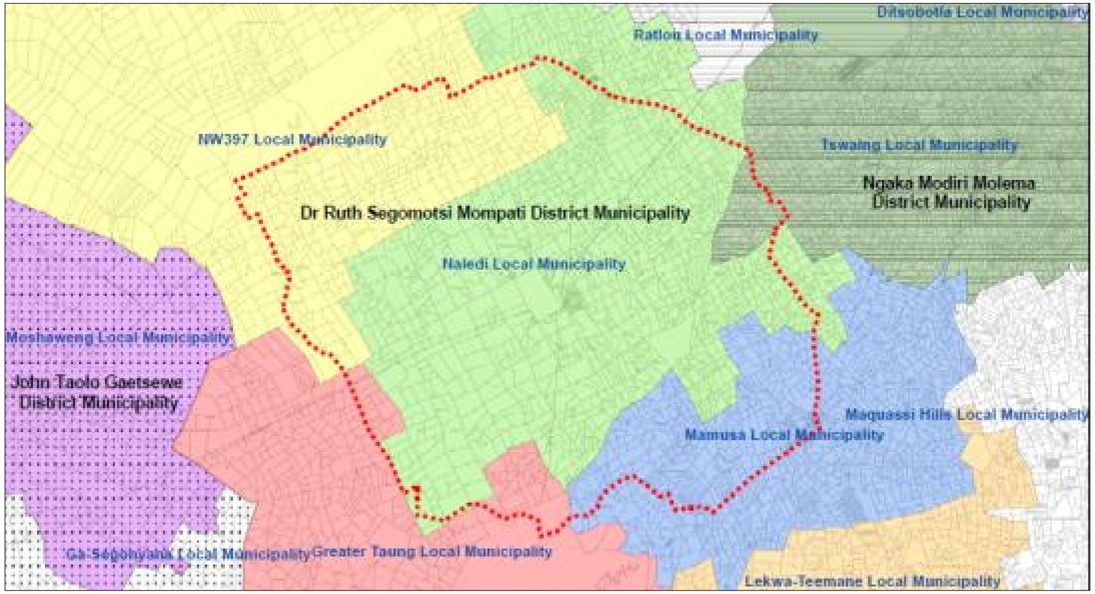
- Key characteristics of the Kimberley focus area:
  - The estimated population of the Kimberley focus area is around 125 000 with about three quarters being from the Kimberley area.
  - There is a lot of migration taking place within the Kimberley area with many people immigrating into the focus area, which is indicative of the trends observed in other parts of the country where urban areas generally experience a net increase in population while rural areas experience the opposite.
  - Skills shortage is a major challenge within the focus area with only around 15% of the active population having completed some tertiary education and about two thirds having completed secondary or received some secondary education.
- Most of the economic activity taking place within the FA is concentrated in and around Kimberley. The tertiary sector is the dominant sector in the municipalities encompassing the FA, however agriculture and mining are also to be found to make a notable contribution towards the economies of selected LMs included in the area.
- Although the assessed LMs experienced a small but positive increase in employment between 2005 and 2011, agricultural, manufacturing, and trade sectors have shown significant decline in their job absorption capacities with more than 16 000 jobs being lost among these three industries between 2005 and 2011.
- Job creation to curb rising unemployment remains one of the top priorities for most municipalities within the FA.

2.6 Vryburg Focus Area 6

2.6.1 Composition of the focus area

Vryburg FA is located in the southwestern part of the North West, mainly within the Dr Ruth Segomotsi Mompati DM and a portion of the Ngaka Modiri Molema DM. A greater part of the FA falls within the Naledi LM while the other parts are sections of the Kagisano-Molopo, Mamusa, Greater Taung and Tswaing LMs.

The major town encompassed by the FA is Vryburg, which is located in the Naledi LM area. Aside from Vryburg, the other major towns that fall within the FA include, inter alia, Stella, Amalia, Schweizer-Reneke, and Pudimoe. Most of the areas included in the FA have very low population densities, which are also smaller than that for the entire province (33.5 people/km^2) and the country (42.4 people/km^2).



Map 2-13: Vryburg Focus Area

Distribution of Towns and Major Settlements within the Vryburg FA				
Province	District Municipalities	Local Municipalities	Towns and settlements	LMS' population densities (people/km^2)
North West	Dr Ruth Segomotsi Mompati	Naledi	• Vryburg • Stella	7.8
		Kagisano-Molopo	No towns and major settlements	7.0
		Mamusa	• Amalia • Schweizer-Reneke	10.3
		Greater Taung	• Pudimoe	26.7
	Ngaka Modiri Molema	Tswaing	No towns and major settlements	14.1

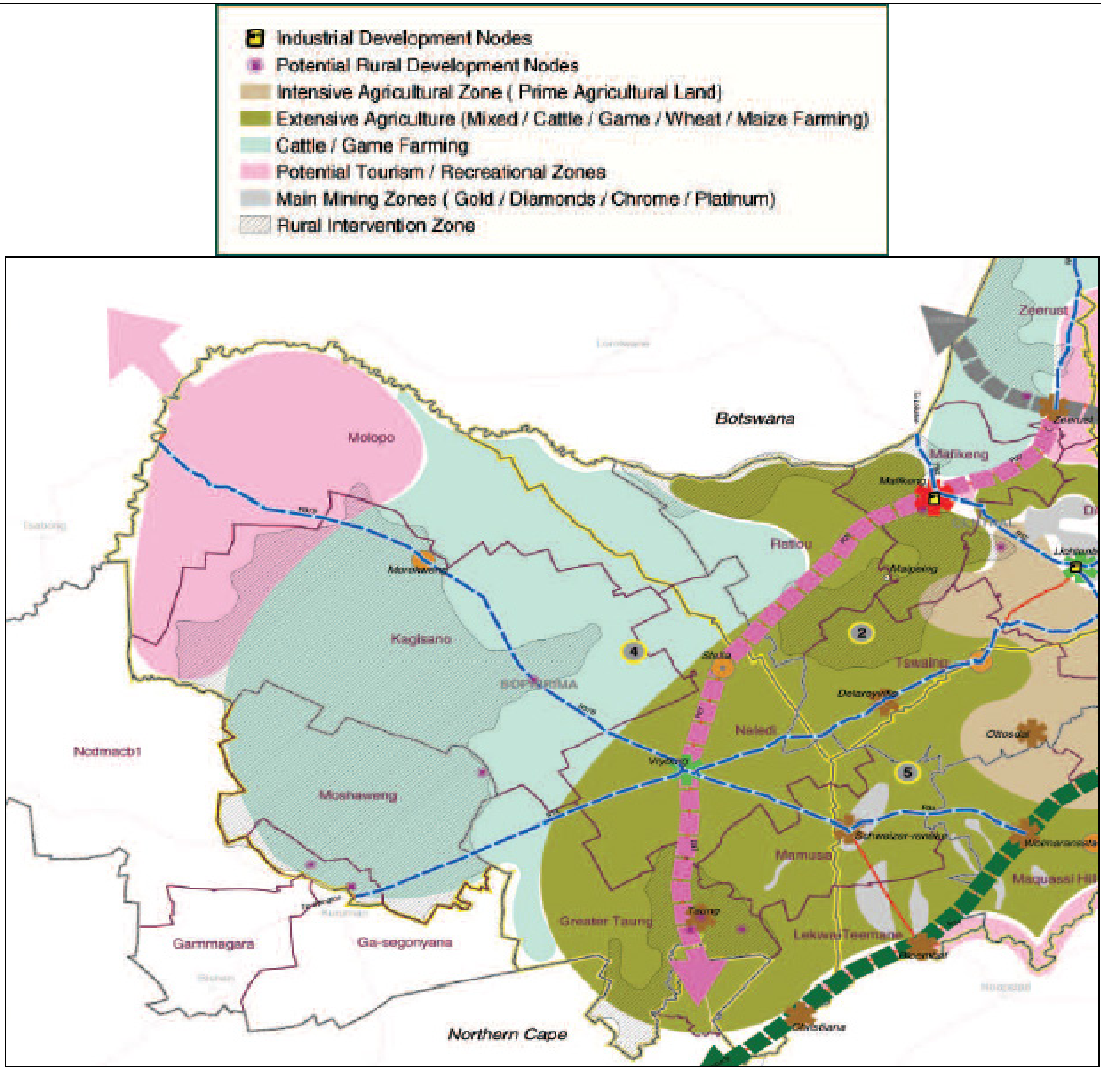
2.6.2 Policy review

a) Provincial policies and strategic documents of the North West

Documents reviewed	Overview of Provincial Policies and Strategic Documents of the North West

• North West Provincial Growth and Development Strategy, 2004 - 2014
• Provincial Spatial Development Framework and Environment Management Plan
• Renewable Energy Strategy for the North West Province. December 2012
	• The North West PGDS (2004) aims to address spatial development challenges such as <u>disparities between the eastern and western areas</u> with 60% of the population still residing mainly in rural areas. The key <u>pillars for growth and economic development</u> that were identified include:
	    ○ Agriculture and rural development;
	    ○ Mining and energy;
	    ○ Manufacturing;
	    ○ Trade and finance;
	    ○ Tourism;
	    ○ Construction and infrastructure;
	    ○ SMME; and
	    ○ Training and skills development.
	• In 2012, the province developed a Renewable Energy Strategy in response to the need for the province to participate meaningfully within the renewable energy sector of South Africa - the North West is ranked highly when it comes to electricity consumption in the country. The province is rated as the fourth largest electricity consuming province in South Africa and consumes approximately 12% of the available electricity. Such a high demand of electricity is mainly due to the mining and related industrial sector activities characterising the province, since it is estimated that approximately 63% of the electricity supplied to the North West is consumed in its mining sector.
	• The developed Renewable Energy Strategy (2012) aims to:
	    ○ Improve the province's environment;
	    ○ Reduce the province's contribution to climate change; and
	    ○ <u>Alleviate energy poverty within the province</u> while promoting economic development and job creation, and the development of a green economy.
	• According to the Renewable Energy Strategy, <u>energy sources that were identified to hold the most potential</u> and a competitive strength for the North West are solar energy (photovoltaic as well as solar water heaters), municipal solid waste, hydrogen and fuel cell technologies, bio-mass, and energy efficiency; importantly, the province's <u>competitive advantage lies in solar energy projects.</u>
	• The provincial SDF though calls for any development in the province to be undertaken <u>taking cognisance of the environmental resources</u> of the province and specifically the following:
	  ○ Formal protected areas:
	      ▪ Existing national parks and reserves managed by the North West Parks and Tourism Board. This also includes nature reserves managed by municipalities; and
	      ▪ "Protected natural environments" provided for in the old Physical Planning Act, 1967.

	○ Proposed protected areas, which include future protected areas that are currently in a planning stage with preliminary or final demarcated boundaries: ▪ Cultural and heritage sites; ▪ Conservancies; ▪ Dolomitic aquifers and dolomitic eyes; ▪ Ridges; ▪ Wetlands areas of high biodiversity; ▪ Griqualand West Centre of Endemism; and ▪ Agriculture. • Considering the Provincial SDF, areas of conservation importance are located outside the FA, i.e. to the north of the northern boundary. Nonetheless, it should be noted that the majority of the northern and western side of the FA is demarcated for <u>cattle and game farming</u>, while the central, eastern and southern parts of the FA are demarcated in the provincial SDF for <u>extensive agricultural activities</u>, inclusive of cattle, game, wheat, and maize farming.



Map 2-14: North West Spatial Development Framework Map

b) Social and economic infrastructure development priorities, plans and potential red flag areas

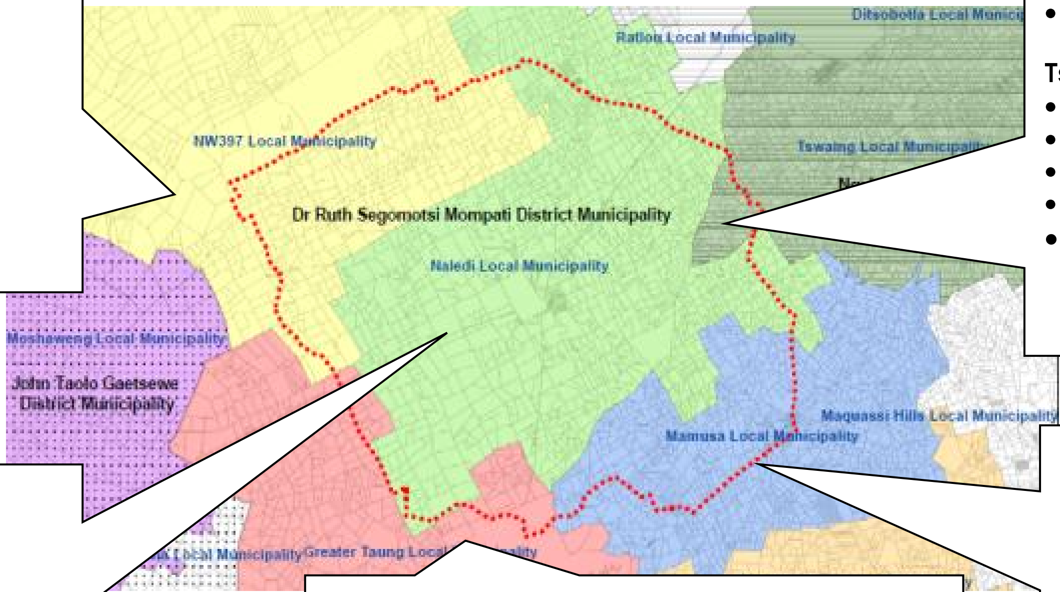
Documents reviewed	Socio-Economic Development Priorities, Plans and Potential Red Flag Areas
• Dr Ruth S Mompati District Municipality Integrated Development Planning, Third Generation, 2012-2017. (Final, May 2012) • Ngaka Modiri Molema District Municipality Integrated Development Planning (Draft), 2012-2016 • Ngaka Modiri Molema District Municipality Strategic Plan, 2011-2016 • Greater Taung Local Municipality 3rd Generation Integrated Development Plan, 2011/16, (Final, May 2011) • Naledi Local Municipality Integrated Development Plan & Budget Final Draft, 2010/11	• The consolidated socio-economic development priorities for Dr Ruth S Mompati DM include: o Water and sanitation; o Land and housing; o Job creation; o Roads and stormwater; o Electricity provision; o Recreational/social amenities; and o Refuse removal. • Agriculture is the main economic sector within the five local municipalities that are included in the FA. • Game farming and hunting is an important activity within the Dr Ruth S Mompati DM and contributes significantly to the municipality's GDP. • Separate LMs face similar challenges within the FA; especially: o Insufficient infrastructure development; o Inadequate basic service delivery; o Housing needs and spatial imbalances; o Scarce provision of water, electricity and refuse removal; and o High unemployment and poverty levels. • The Greater Taung LM has stated its interest in exploring opportunities of feeding clean energy into the national energy grid.

Kagisano-Molopo LM Priorities:
- Infrastructure development (Completion of public amenities, internal roads)
- LED & tourism
- Strengthening of community Participation

Kagisano- Molopo LM Challenges:
- High unemployment
- Bad roads

Tswaing LM Priorities:
- LED and job creation
- Environmental health management

Tswaing LM Challenges:
- Water scarcity
- Housing backlogs
- High unemployment and poverty
- Social & economic infrastructure
- Brain drain



Naledi LM Priorities:
- LED (Job creation)
- Sports & facility management

Naledi LM Challenges:
- Serious water shortages
- High unemployment
- Increase in squatters
- Poor waste management

Greater Taung LM Priorities:
- Roads, bridges
- Water

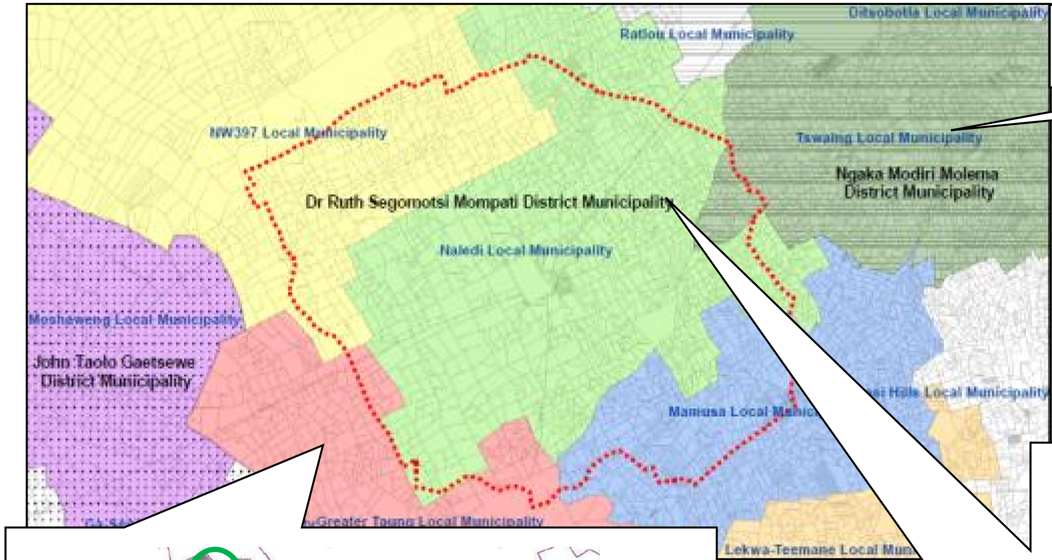
Greater Taung LM Challenges:
- Basic service delivery

Mamusa LM Priorities:
- Water & sanitation
- LED [job creation projects]

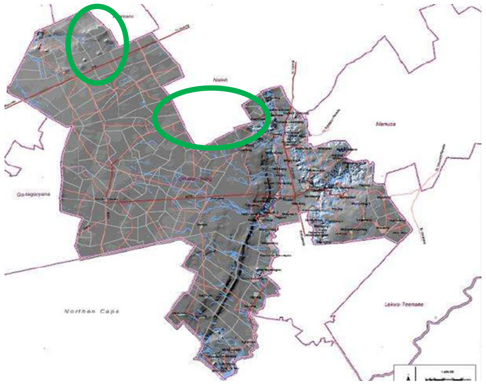
Mamusa LM Challenges:
- High unemployment
- Bad roads

c) Spatial development priorities, plans and potential red flag areas

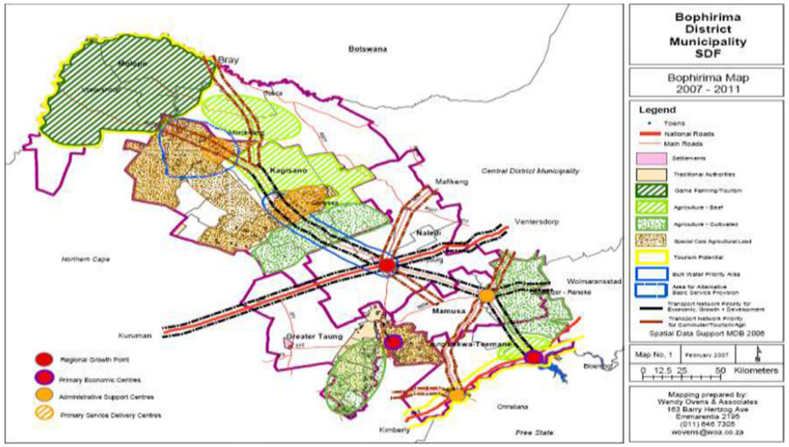
Documents reviewed	Spatial Development Priorities and Policies Review for Vryburg FA
• Naledi Spatial Development Plan 2007 • Dr Ruth S Mompati District Municipality Integrated Development Planning, Third Generation, 2012-2017. (Final, May 2012) • Ngaka Modiri Molema District Municipality Integrated Development Planning (Draft), 2012-2016 • Greater Taung Local Municipality 3rd Generation Integrated Development Plan, 2011/16, (Final, May 2011) • Bophirima District Municipality Integrated Development Plan 2007-2011, (First Review, May 2008)	• There are currently no updated or accessible SDFs for most municipalities in the FA: o A detailed spatial development framework for Dr Ruth S Mompati DM was adopted in 2007 before the municipality was renamed from Bophirima to Dr Ruth S Mompati. The spatial development framework was scheduled for review for the 2012-2013 period. o According to the Dr Ruth S Mompati DM IDP, the Naledi, Lekwa-Teemane, Greater Taung and Mamusa Local Municipalities have Town Planning Schemes, which are outdated and do not address certain issues, i.e., rural land use management, and hence are deemed ineffective. o The Ngaka Modiri Molema DM IDP identified the following challenges facing the district in terms of spatial development planning: ▪ Outdated spatial development frameworks both at district and local levels; ▪ Poor environmental management programmes; ▪ Inadequate heritage management programmes; and ▪ Local municipalities do not have integrated land use management schemes. • Part of the Dr Ruth S Mompati district lies on the eastern edge of the Griqualand West Centre of Endemism (GWC), which is on the southwestern side of the district. A centre of plant endemism is an area with a high concentration of plant species with very restrictive distributions. Although this area is not yet formally or informally protected, the municipality would like to have it conserved.



- Situated in the semi-arid area of the central plateau in South Africa and as a result water scarcity is a common problem



- About 95% of the municipal area is predominantly rural.
- The area has an interesting and ancient geological heritage that is rich in minerals and archeological artifacts.



- The SDF for the DR Ruth S Mompati (previously known as Bophirima DM) DRSM shows that the northern parts of the FA are demarcated for agricultural activities and specifically crop production (i.e. cultivation)
- Agricultural land uses are also found in the southern left corner of the FA

2.6.3 Socio-economic profile

The socio economic profile of the Vryburg FA includes demographic information for the towns and major settlements that lie within the FA as well as local municipal economic data.

a) Demographic profile of Vryburg FA

- The FA encompasses about 63 529 people. Almost 90% of the FA population resides in the towns of Schweizer-Reneke and Vryburg.
- The greater area (i.e. entire local municipalities) has very low population densities, which are four times smaller than the average for South Africa.
- About one out of five people above 15 years of age (17.7% of the population) did not receive any education; while only 9.2% proceeded further with tertiary education.
- The municipalities included within the FA experienced a negative annual population growth of 1.9% between the years 2005 and 2011.
- There have been more people coming into the municipal areas covered in the FA as compared to people migrating from the area. A positive net in-migration of 1 972 was recorded between the years 2005 and 2011.

Demographic data

Demographic Profile of the Vryburg FA (Stats SA, 2014)		
Population (2011)	63 529	
Households (2011)	16 660	
Average monthly HH income (2014 in Rands)	7 846	
Education:		
No School	6 441	17.7%
Complete or some primary	7 995	21.9%
Complete or some secondary	18 712	51.3%
Higher	3 343	9.2%

Data applicable to all Local Municipalities included in the FA (Quantec, 2014)	
Population (2011)	534 784
Absolute population growth (CAGR, %) (2005-2011)	-1.9%
Population growth (No.) (2005-2011)	-50 497
Population density (People per km^2)	11.9
Migration:	
In-migration	12 318
Out-migration	10 346
Net migration	1 972

b) Economic structure of Vryburg FA

- The combined economies of the municipalities encompassing the FA are relatively small and valued at about R10 003 million.
- The assessed economies experienced low levels of economic growth in the 2005-2011 period. The CAGR of 1.8% recorded for the economies encompassing the FA is far below the 3.2% average achieved by the wider South African economy.

- Taking the given output figures of the municipalities within the FA, it can be seen that most of the municipalities are highly dependent on the services sector for stimulating the development and creation of employment. Government services contributed the most towards the growth of these local economies during the 2005 and 20011 period.
- The primary sector is relatively small, but is greater than the secondary industries. Agricultural activities make the biggest contribution towards the primary sector's GDP-R compared to mining activities. Nonetheless, both of these industries have experienced a sharp decline in their production outputs since 2005.
- Although the secondary sector is the smallest among the sectors in terms of contribution to the local economies, it must be noted that the sector has shown a positive performance since 2005 with the manufacturing industry showing a greater increase in value added in absolute terms.

Size of economies	
Indicator	**Data applicable to all Local Municipalities included in FA**
Gross Domestic Product (Current Prices) 2011 (R'm)	10 003
Gross Domestic Product (Constant Prices) CAGR (2005-2011)	1.8%

Sectoral profile (R'm, 2005 constant prices)					
Indicator	**Data applicable to all Local Municipalities included in FA**				
	2005		**2011**		**CAGR**
Primary Sector	**909.4**	**16%**	**682.9**	**11%**	-4.66%
Agriculture, forestry and fishing	596.9	11%	505.1	8%	-2.74%
Mining and quarrying	312.5	6%	177.8	3%	-9.0%
Secondary Sector	**485.7**	**9%**	**577.5**	**9%**	**2.9%**
Manufacturing	274.5	5%	323.9	5%	2.8%
Electricity, gas and water	93.9	2%	97.9	2%	0.7%
Construction	117.3	2%	155.8	3%	4.8%
Tertiary Sector	**4 183.6**	**75%**	**4 938.1**	**80%**	**2.8%**
Trade, catering and accommodation	815.3	15%	746.6	12%	-1.5%
Transport, storage and communications	533.3	10%	661.3	11%	3.7%
Finance, insurance, real estate and business services	801.1	14%	1 013.1	16%	4.0%
Community, social and personal services	897.3	16%	1 079.5	17%	3.1%
General government	1 136.7	20%	1 437.7	23%	4.0%
Total	**5 578.6**	**100%**	**6 198.5**	**100%**	**1.8%**

c) Labour force and employment situation within the Vryburg FA

- The labour force of the FA comprises of about 20 757 people, of whom 31.8% were unemployed. The unemployment rate surpasses the national unemployment rate, which is around 24%.
- The number of jobs declined quite significantly across the primary, secondary and tertiary sectors between the years 2005 and 2011. About 12 800 jobs were lost in the FA during the period 2005 to 2011.
- The tertiary sector makes the largest contribution in terms of employment in the local economy of the FA. Community and personal services, general government, and trade industries create two thirds of the jobs in the area.
- In 2005, the agricultural sector provided the biggest number of employment opportunities for people within the FA, i.e. greater than any tertiary industry. Since then, it has shed over 10 000 jobs making it the biggest contributor to the declining employment situation in the area.
- The contribution of the secondary sector in terms of employment creation remains relatively low within the FA. The sector remained the smallest employer between the years 2005 and 2011.
- Limited employment opportunities exist within the energy and water sectors (electricity, gas and water) - an estimated 232 people were employed in this sector in the year 2011.
- The decline in the primary and secondary sectors that resulted in a sharp increase in unemployment in the area may partially explain the decline in the tertiary sector's labour absorption capacity as the former would lead to the decreasing income levels of households in the area, reducing the purchasing power thereof and demand for consumer goods and services.

Labour force profile		
Indicator	**FA (Stats SA, 2014)**	**Local Municipalities (Quantec, 2014)**
Employment	14 158	48 811
Unemployment	6 599	23 515
Unemployment %	31.8%	32.5%
Discouraged job seekers	2 294	Unavailable

Sectoral employment (Quantec, 2014)						
Indicator	**Data applicable to all Local Municipalities included in FA**					
	2005		**2011**		**% Change**	**Abs Change**
Primary Sector	**16 672**	**26%**	**6 804**	**13%**	**-59.2**	**-9 868**
Agriculture, forestry and fishing	15 226	24%	5 137	10%	-66.3%	-10 089
Mining and quarrying	1 445	2%	1 667	3%	15.3%	221
Secondary Sector	**5 228**	**8%**	**4 750**	**9%**	**-9.1%**	**-478**
Manufacturing	3 102	5%	2 534	5%	-18.3%	-568

Sectoral employment (Quantec, 2014)						
Indicator	Data applicable to all Local Municipalities included in FA					
Electricity, gas and water	188	0%	232	0%	23.2%	44
Construction	1 938	3%	1 985	4%	2.4%	47
Tertiary Sector	**41 496**	**65%**	**39 037**	**77%**	**-5.9%**	**-2 459**
Trade, catering and accommodation	9 143	14%	7 632	15%	-16.5%	-1 512
Transport, storage and communications	1 170	2%	996	2%	-14.9%	-174
Finance, insurance, real estate and business services	4 647	7%	4 679	9%	0.7%	31
Community, social and personal services	13 535	21%	12 163	24%	-10.1%	-1 373
General government	13 000	21%	13 568	27%	4.4%	569
Total	**63 396**	**100%**	**50 592**	**100%**	**-20.2%**	**-12 804**

d) Access to basic services within the Vryburg FA

- Close to 84% of the households in the settlements and towns of the FA have access to electricity.
- The municipalities have made some significant strides in improving the access to sanitation for most households. Almost 81% of the households have access to sanitation through the use of flush/chemical toilets.
- There are still some service backlogs in some of the municipalities as can be revealed by the number of households without access to sanitation and those still relying on the bucket latrine. About 3.5% of the households make use of a bucket latrine while close to 4.6% of the households have no access to sanitation at all.

Indicator	Access to Basic Services in the Settlements and Towns of the FA (Stats SA, 2014)	
	HH (No.)	HH (%)
Access to electricity		
Electricity	13 961	83.8%
Solar	45	0.3%
Other (candles, gas, paraffin)	2 595	15.5%
None	58	0.4%
Total	**16 659**	**100%**
Access to sanitation		
Flush/chemical toilet	13 492	80.9%
Pit latrine with/without ventilation	1 566	9.4%

Indicator	Access to Basic Services in the Settlements and Towns of the FA (Stats SA, 2014)	
	HH (No.)	HH (%)
Bucket latrine	584	3.5%
Other	257	1.5%
None	760	4.6%
Total	**16 659**	**100%**
Access to water		
Piped water inside dwelling	6 262	37.6%
Piped water inside yard	7 240	43.5%
Piped water on community stand (>200m)	2 728	16.4%
None	429	2.6%
Total	**16 659**	**100%**

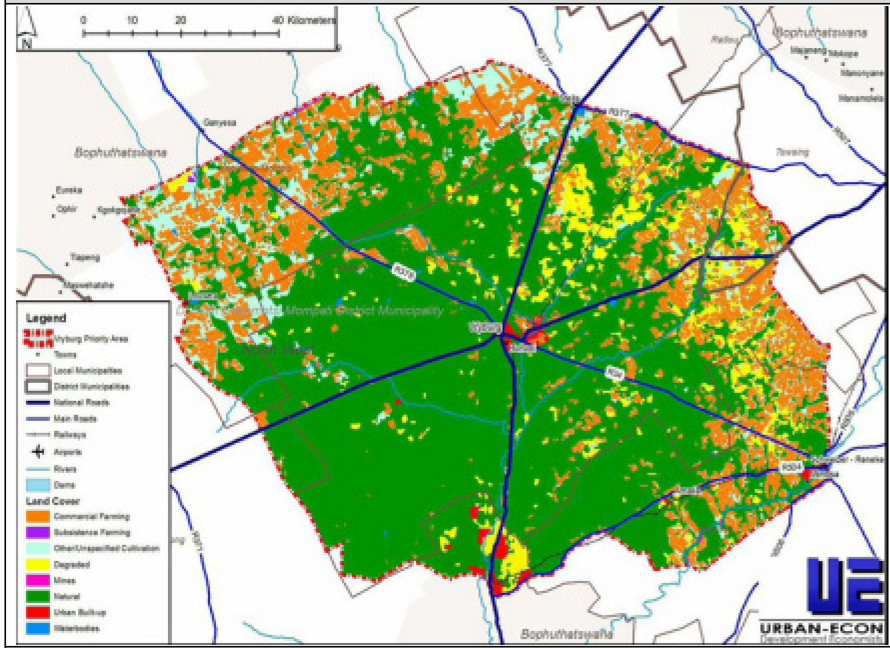
e) Level of economic infrastructure development of Vryburg FA

The FA is situated far from the major economic nodes of South Africa; nonetheless, it is well connected with the rest of the country and the region at large in terms of the available rail and road infrastructure networks. However, certain parts of the FA may be more difficult to access than others due to them being located away from regional roads.

Indicator	Transport Infrastructure Development Overview
Airports	No major airports are located within the Vryburg FA except for an air strip meant for light aircraft which is situated in Vryburg.
Railway lines	There is a railway line connecting Vryburg and Mafikeng. There is another one connecting Schweizer-Reneke with Amalia.
National roads	There is the N14 which links Vryburg with the Northern Cape. The town of Vryburg is also situated at the important junction of the N18 and N14 highways.
Regional roads	The main regional roads are: R34 connecting Vryburg and Bloemhof, R378 connecting Ganyesa and Vryburg, R377 connecting Stella with the N14, R504 connecting Pudimoe and Schweizer-Reneke, and the R47 (N18) which goes through Vryburg, Pudimoe and continues towards Kimberley.

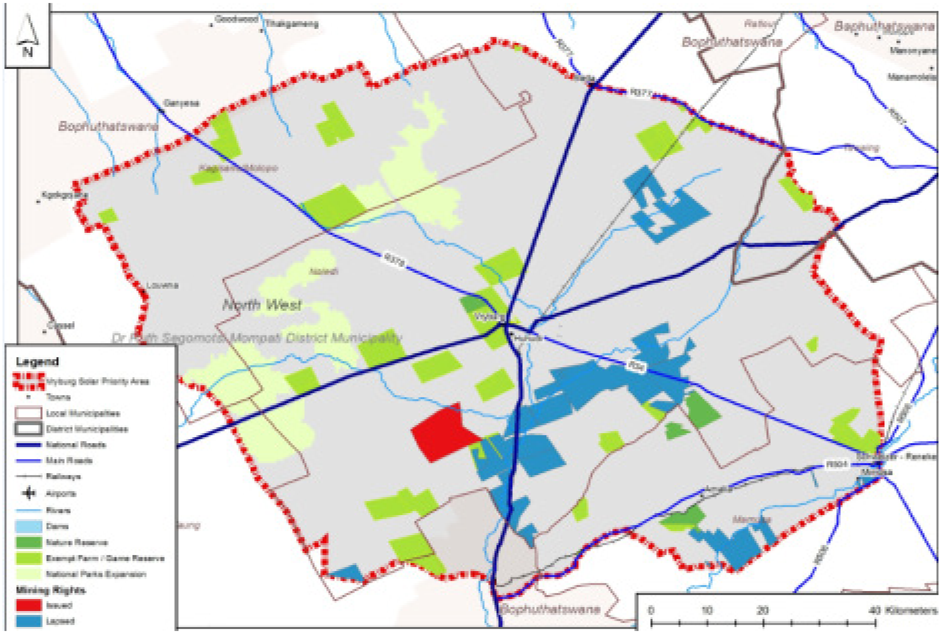
2.6.4 Land use profile

Core land uses



- Commercial farming is found in peripheral zones of the FA mainly in the northern and eastern parts of the FA.
- There are also a lot of unspecified cultivation activities taking place mostly in the northern parts of the FA.
- There is a lot of degraded land in the eastern parts of the FA.
- There are a number of towns and rural settlements located within the Vryburg FA . The town of Vryburg is situated right at the centre of the FA. The towns of Schweizer-Reneke and Stella are located on the boundary of the FA. The small town of Amalia also falls within the interior of the FA.

Natural and mineral resources



- The western part of the FA is populated with nature reserves, game reserves, and areas demarcated for the expansion of the national parks. There are also a few nature reserves in the eastern part of the FA.
- There is a mining belt stretching from the central part of the FA moving towards the southern parts. It must however be noted that most of the mining rights for that belt have lapsed and there is only a small portion with issued mining rights.

2.6.5 Key summary

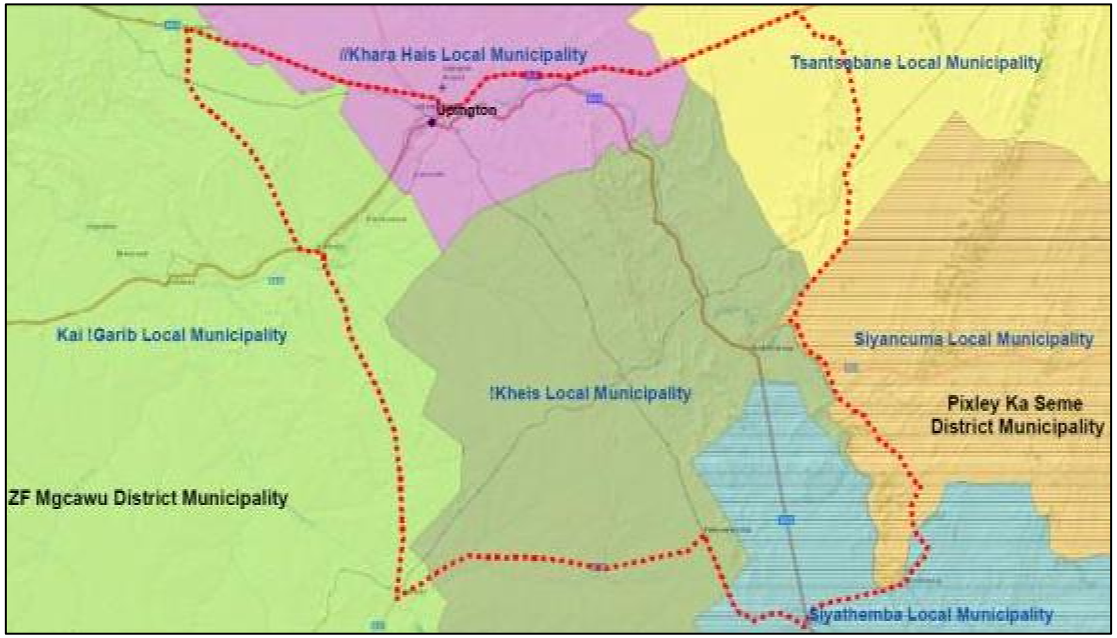
- The population of the Vryburg FA is estimated to be around 65 000. The area has a very low population density with the majority of people residing in the towns of Vryburg and Schweizer-Reneke.
- The average monthly household income for the Vryburg FA is estimated to be around R7 800, which is lower than the national average.
- The FA is characterised as a service economy with the trade, government services, and community and personal services sector being the largest contributors to the local economy.
- Levels of employment have been on a decline in the past few years resulting in an unemployment rate around 32%, which is far higher than the national unemployment rate. More than 12 000 jobs were lost in the local economies included in the FA since 2005.
- Agriculture and tourism are the major economic activities dominating the FA; however, activities in the agricultural sector have declined significantly since 2005 leading to the sector's decline in terms of contribution towards the local economic base and employment. The mining sector, albeit small, has also shown a negative performance leading to job losses and a decrease in production output.
- The majority of households in the focus area have access to electricity; however, there is still a service backlog in terms of access to acceptable levels of sanitation for some households.
- High levels of unemployment and poverty are the most developmental challenges currently bedevilling the FA and the responsible authorities have prioritised, amongst others, LED and job creation as part of the remedy.

2.7 Upington Focus Area 7

2.7.1 Composition of the focus area

Upington FA falls under the Northern Cape and stretches over localities within the Pixley Ka Seme and ZF Mgcawu DMs. It encompasses almost all of the !Kheis LM and parts of the Kai! Garib, Khara Hais, Tsantsabane, Siyathemba LMs and a small portion of the Siyancuma LMs.

Most of the settlements are located along the banks of the Orange River, which runs through the FA from the northwest to the eastern corner in the south. The major town in the FA is Upington, located in the centre of the northern boundary of the FA. Upington is also regarded as an important development centre and the link between South Africa and Namibia.



Map 2-15: Upington Focus Area

Distribution of Towns and Major Settlements within the Upington FA				
Province	**District Municipalities**	**Local Municipalities**	**Towns and settlements**	**LMs' Population densities (people/km²)**
Northern Cape	ZF Mgcawu DM	Kai !Garib LM	• Keimoes • Kenhardt	7.9
		Khara Hais LM	• Upington • Raaswater • Louisvale • Karos • Leerkrans	30.9

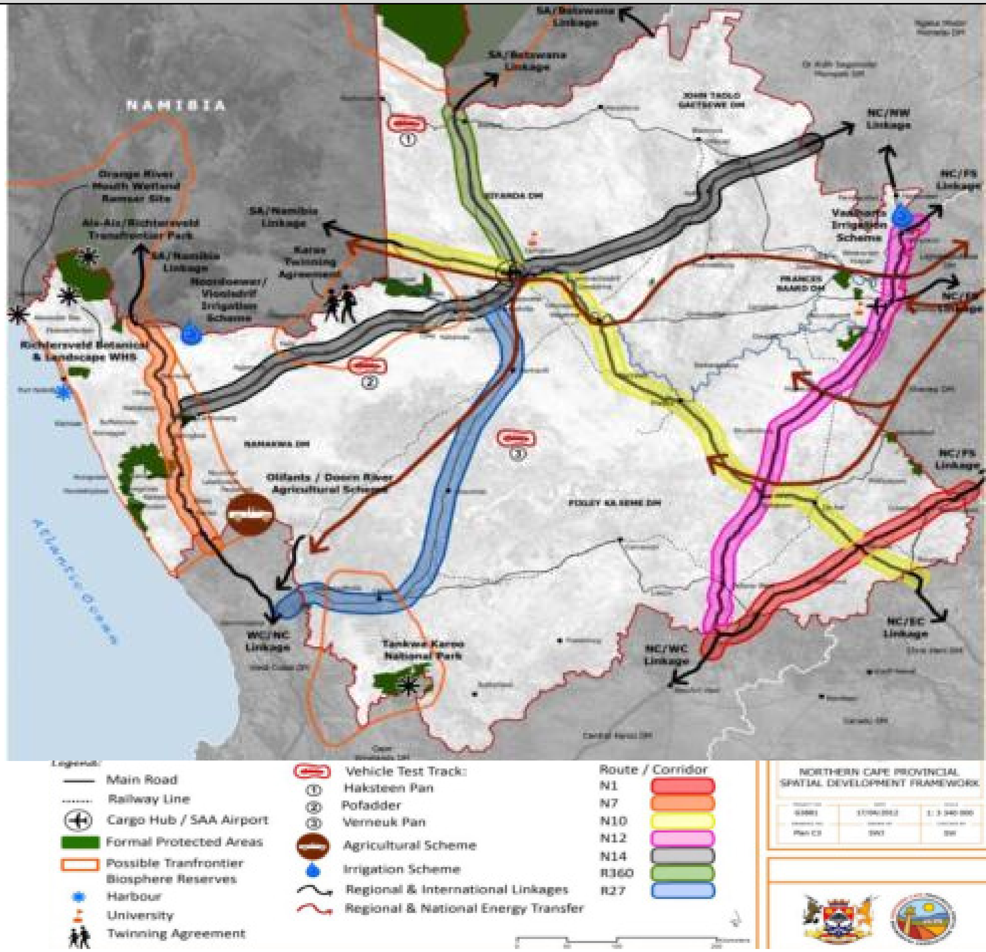
Distribution of Towns and Major Settlements within the Upington FA				
Province	**District Municipalities**	**Local Municipalities**	**Towns and settlements**	**LMs' Population densities (people/km²)**
		! Kehis LM	• Groblershoop • Grootdrink • Wegdraai	3.1
		Tsantsabane LM	No towns and major settlements	4.9
	Pixley Ka Seme DM	Siyancuma LM	No towns and major settlements	3.8
		Siyathemba LM	Marydale (on FA's boundary)	2.6

2.7.2 Policy review

a) Provincial policies and strategic documents applicable to the Northern Cape Province

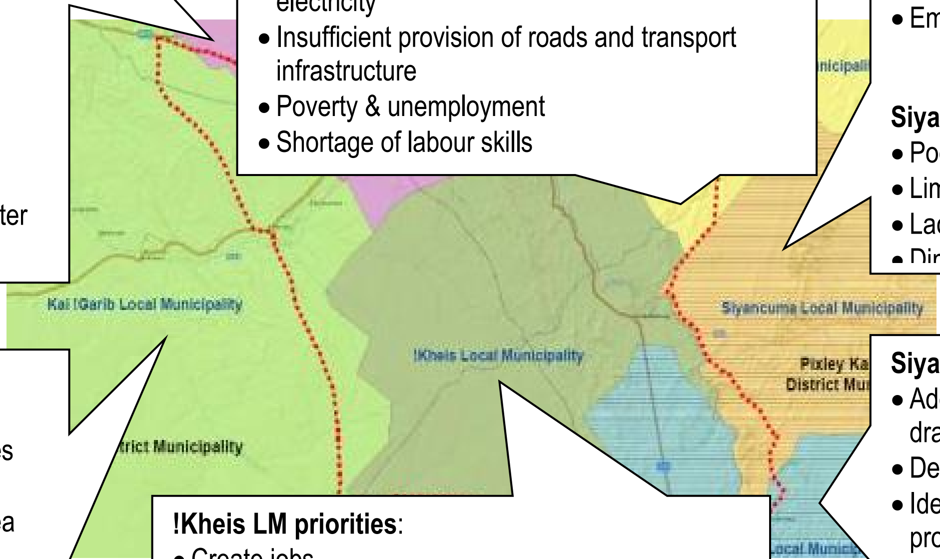
Documents reviewed	Overview of Provincial Policies and Strategic Documents
• The Northern Cape Municipal LED Framework (February, 2011) • Northern Cape Provincial SDF (July, 2012) • The Northern Cape province Local Economic Development Framework (February, 2011) • The Northern Cape province Local Economic Development Strategy (January, 2011) • The Northern Cape Provincial Growth and Development Strategy • The Northern Cape Municipal LED Framework (February, 2011) • Northern Cape Provincial SDF (July, 2012) • The Northern Cape province Local Economic Development framework (February, 2011) • The Northern Cape province Local Economic Development strategy (January, 2011) • The Northern Cape provincial Growth and Development Strategy	• According to the Northern Cape PSDF (2012), the overarching goal of the province is to <u>focus on sustainable development</u>; thus it places emphasis on the long-term sustainability and growing prosperity in the province by focusing on the following tasks: ○ Promote sustainable economic development by <u>building on the comparative economic advantages</u> of the province; ○ <u>Protect and utilise the natural resource base in a sustainable manner</u> for the benefit of all parties concerned; ○ Merge <u>social, ecological and economic considerations</u> in decision-making as is required by legislative instruments (NEMA); ○ Make a <u>meaningful and lasting contribution to eradication of poverty and inequality</u> through the wise use of the inherent capital of the province; and ○ Create an environment that will ensure an <u>acceptable return on capital</u> invested by the private sector. • The Northern Cape PGDS identified the following two primary development objectives: ○ Promoting the <u>growth, diversification and transformation of the provincial economy; and</u> ○ <u>Poverty reduction</u> through social development. • The Northern Cape PSDF (2012) states that in order to take a proactive stance with regard to the promotion of economic development, the provincial government proposes to allocate resources to the identification, scoping, appraisal and investment marketing for a suite of <u>flagship projects that can leverage associated investment and economic activity</u> in areas of high relative economic potential. • As outlined in the Northern Cape PGDS, the provincial government seeks to <u>grow the agricultural economy</u> and is committed

Documents reviewed	Overview of Provincial Policies and Strategic Documents
	to promoting transformation in agriculture. • According to the Northern Cape PSDF (2012), the Northern Cape holds a significant comparative economic advantage in a number of enterprises in the science and technology sector including: o Square Kilometre Array (SKA), Carnarvon in the Pixely Ka Seme DM; o Southern African Large Telescope (SALT); and o Karoo Array Telescope (MeerKAT), Carnarvon in the Pixely Ka Seme DM. • In the context of ensuring the availability of inexpensive energy and promotion of development in the province, the Northern Cape PGDS promotes the development of energy sources such as solar energy, the natural gas fields, bio-fuels, etc. • The provincial government accepts that the small-scale mining sub-sector could be the powerhouse of economic development in poor rural communities; thus, as indicated in the Northern Cape PGDS, it aims to provide assistance to as many small-scale operations to get started as possible. • Furthermore, through the Northern Cape PGDS, the provincial government proposes to use tourism as a vehicle for growth and development, which is particularly the case in remote rural areas where the aforesaid natural resources can be employed to leverage capital. • The Northern Cape PSDF (2012) proposes the creation of a solar corridor, which centres on Upington and extends from roughly Kakamas in the north to De Aar in the east.

Documents reviewed	Overview of Provincial Policies and Strategic Documents
	 Map 2-16: Northern Cape Spatial Development Framework Map

b) Social and economic infrastructure development priorities, plans and potential red flag areas

Documents reviewed	Socio-Economic Development Priorities, Plans and Potential Red Flag Areas
• Pixley Ka Seme District Municipality Integrated Development Plan For 2011-2016 (2011) • Integrated LED Programme Pixley Ka Seme Local Municipality • Spatial Perspective and Status Quo Volume I: Pixley Ka Seme DSDF 2013-2018 (November, 2013) • Siyancuma IDP Final Version (2012/2013) • Siyanda District Spatial development Framework 2012 • Integrated Development Plan Siyathemba Municipality (2012/13) • Siyathemba DM SDF • Kai !Garib Municipality IDP (Draft, 2013-2014) • Kai !Garib Municipality LED 2012 • Municipality //Khara Hais IDP 2012-2017(Review, 2013) • Khara Hais LM LED And Incentive Plan 2010 • !Kheis Municipality IDP (2013-2014) • Tsantsabane Local Municipality IDP 2011	• Settlements located next to the Orange River and the Vaal River are well provided with water for urban and agricultural uses. Due to the available water resources, these areas depend greatly on agriculture, which is one of the main employment sectors in the FA. • In the eastern part of the FA, local municipalities of Siyancuma and Siyathemba aim to diversify their agricultural sector through expansion of the tourism industry and agro-processing, as well as exploring aquaculture opportunities along the Orange River; they also regard Fracking to have the potential for job creation and development opportunities. • Where the agricultural sector is an integral component of the local economy, local governments set the task to utilise and further exploit opportunities in farming through research into better farming techniques, better use of water, and more suitable livestock and crop farming; • The local government of the Siyathemba LM, which covers parts in the southeast corner of the FA, has set to promote solar energy projects in its area as a means towards development of its economy. • Local governments aim to develop and expand tourism by implementing eco-tourism programmes along the Orange River. • All local governments face similar challenges with regard to high poverty levels observed in their communities; although the area has a notable agriculture potential, there is lack of a conjunct effort to develop the primary sector to its maximum potential. • The main challenges within the local municipalities of the Upington FA are: ○ Low levels of skilled people as well as high levels of poverty and unemployment; ○ Lack of proper and sufficient sanitation and sewerage systems; ○ Lack of proper and sufficient water provision; ○ Lack of proper and sufficient accommodation/ housing; ○ Lack of good quality roads infrastructure, including storm water systems as well as efficient transport system; and ○ Lack of electricity provision to all residents.



Khara Hais LM priorities:
- Agro-processing and value-adding programmes
- Revitalise the environs of the Orange River and develop outdoor nature-based attractions

Khara Hais LM challenges:
- Poverty and unemployment
- Lack of sewerage and sanitation services
- Lack of access to clean drinking water in informal settlements

Tsantsabane LM priorities:
- Mining developments
- Tourism sector can be promoted especially mining tourism

Tsantsabane LM challenges:
- Insufficient supply of bulk water, sanitation, and electricity
- Insufficient provision of roads and transport infrastructure
- Poverty & unemployment
- Shortage of labour skills

Siyancuma LM priorities:
- Expansion of the tourism industry and agro-processing
- Address housing, water & sanitation backlogs
- Employment and poverty alleviation

Siyancuma LM challenges:
- Poor levels of education
- Limited bulk water supply
- Lack of basic life skills
- Diminishing sources of income

Kai !Garib LM priorities:
- Increase and diversify farming activities
- Improving tourism profile
- To provide clean water to all in the area
- Eliminate sanitation problems
- Reduce the number of households living in absolute poverty

Kai !Garib LM challenges:
- Lack of basic services particularly water
- Unemployment

!Kheis LM priorities:
- Create jobs
- Focus on agriculture development and processing
- Tourism sites refurbishment
- Exploitation of solar project opportunities

!Kheis LM challenges:
- Lack of water provision
- Lack of housing
- Lack roads infrastructure, storm water systems
- High levels of poverty and unemployment

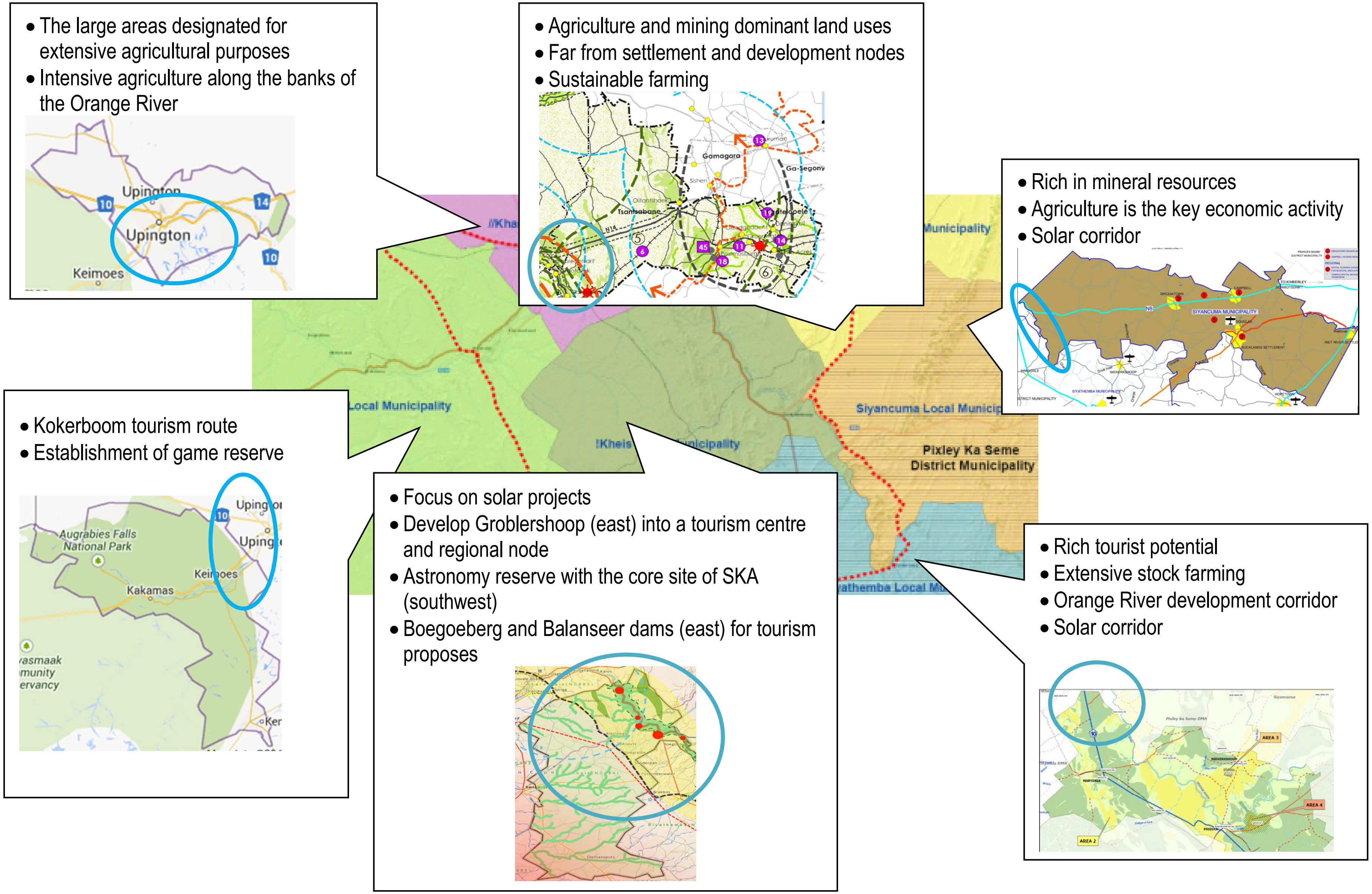
Siyathemba LM priorities:
- Address sanitation and storm water drainage backlogs
- Develop low-income housing
- Identified a solar energy incentive programme as one of their major economic activities

Siyathemba LM challenges:
- Poor provision of basic services
- High levels of unemployment and poverty
- Illiteracy and lack of skills
- Long distances between towns
- Lack of diversification of the region economy

c) Spatial development priorities, plans and potential red flag areas

Documents reviewed	Spatial Development Priorities and Policies Review For the Overberg Focus Area

• Siyanda District Spatial development Framework 2012
• Siyathemba DM SDF
• Spatial Perspective and Status Quo Volume I: Pixley Ka Seme DSDF 2013-2018 (November, 2013)
• !Kheis Municipality Rural SDF 2014
• Kai !Garib Municipality IDP (Draft, 2013-2014)
• Kai !Garib Municipality LED 2012
• Municipality //Khara Hais IDP 2012-2017(Review, 2013)
• Khara Hais LM LED And Incentive Plan 2010
• Tsantsabane Local Municipality IDP 2011
	• District and local municipalities support and aim to align with the provincial directive of developing renewable energy projects in demarcated zones, i.e. the solar corridor from Upington to De Aar that crosses the FA from north to south.
	• Local municipalities covering the western and northern parts of the FA (i.e. Kai !Garib and //Khara Hais) place emphasis on the protection of all existing and potential land suitable for intensive agriculture from conversion to other uses including conservation, which emphasises the importance of agricultural activities in these areas for sustainability of the communities.
	• The Orange River forms the foundation of the economies of all municipalities within the FA and represents a development corridor providing water for irrigation, farming and various recreational opportunities.
	• The Square Kilometre Array (SKA) designated astronomy reserve touches the southwest portion of the FA located within the !Kheis LM and the Kai !Garib LM; the benefits of the SKA include:
	  ○ Previously high-speed unconnected communities have better broadband access;
	  ○ Improving educational resources in the area; and
	  ○ Tourism opportunities.
	• Upington FA is generally well connected with the rest of the Northern Cape through several corridors, which span over all the municipalities within the FA:
	  ○ The N10 is promoted as a development corridor that borders the Orange River and along which the Northern Cape solar corridor is developed from Britstown to Namibia.
	  ○ The N14, running in an east-west direction linking FA with the Namakwa DM in the west and the North West Province in the east, forms an important link for tourists travelling between Upington and Springbok


• The large areas designated for extensive agricultural purposes
• Intensive agriculture along the banks of the Orange River
Upington
Keimoes
• Agriculture and mining dominant land uses
• Far from settlement and development nodes
• Sustainable farming
Gamagara
Ga-Segonyana
Tsantsabane
N14
• Rich in mineral resources
• Agriculture is the key economic activity
• Solar corridor
SIYANCUMA MUNICIPALITY
//Khara
Local Municipality
!Kheis Local Municipality
Municipality
Siyancuma Local Municipality
Pixley Ka Seme District Municipality
Siyathemba Local Municipality
• Kokerboom tourism route
• Establishment of game reserve
Augrabies Falls National Park
Kakamas
Keimoes
• Focus on solar projects
• Develop Groblershoop (east) into a tourism centre and regional node
• Astronomy reserve with the core site of SKA (southwest)
• Boegoeberg and Balanseer dams (east) for tourism proposes
• Rich tourist potential
• Extensive stock farming
• Orange River development corridor
• Solar corridor
AREA 2
AREA 3
AREA 4

2.7.3 Socio-economic profile

a) Demographic profile of the Upington FA

- The FA comprises of about 93 468 people. Almost 61% of the population that constitute this FA reside in Upington.
- The towns of Raaswater, Louisvale, Leerkrans and Karos have population densities above 1 500 people per km^2 with Leerkrans having the population density estimated around 2 500 people per km^2.
- The majority of the population living within the FA received some secondary education and only about 8% obtained some tertiary qualifications.
- Since 2005, the population in the local municipalities encompassed in this FA has grown at an average annual rate of 0.6%.
- Between 2005 and 2011, more people migrated to the municipalities encompassed in this FA compared to those who left the assessed LMs, resulting in a positive net immigration.

Demographic data

Demographic Profile of the Upington FA (Stats SA, 2014)		
Population (2011)	93 468	
Households (2011)	22 400	
Average monthly HH income (2014 in Rands)	10 226	
Education:		
No School	3 484	6.5%
Complete or some primary	12 208	22.7%
Complete or some secondary	33 837	62.9%
Higher	4 283	8%

Data applicable to all Local Municipalities included in the FA (Quantec, 2014)	
Population (2011)	272 413
Population growth (CAGR, %) (2005-2011)	0.6%
Population growth (No.) (2005-2011)	9 125
Population density (People per km^2)	6.4
Migration:	
In-migration	16 762
Out-migration	14 757
Net immigration	2 005

b) Economic structure of the Upington Focus Area

- The combined size of the LM that form part of the FA was R10 650 million in 2011.
- The economic growth of the municipalities assessed was very low during the period between 2005 and 2011. A CAGR of only 1.1% compared with the 3.2% average achieved by the wider South African economy was observed.
- The lower than desired performance of the economy was attributed to the decline in production of the primary sectors in the LMs assessed, trade, and business services. On the other hand, the performance of the secondary industries led to the increase in contributions by the utilities and construction sectors towards the economies of LMs assessed.

Size of the economies					
Indicator	**Data applicable to all Local Municipalities included in FA (Quantec, 2014)**				
Gross Domestic Product (Current Prices) 2011 (R'm)	10 650.69				
Gross Domestic Product (Constant Prices) CAGR (2005-2011)	1.1%				
Sectoral profile (R'm, constant 2005 prices)					
Indicator	**Data applicable to all Local Municipalities included in FA (Quantec, 2014)**				
	2005		**2011**		**CAGR**
Primary Sector	**1 572.2**	**26%**	**1 529.5**	**24%**	**-0.5%**
Agriculture, forestry and fishing	1 006.6	17%	990.2	15%	-0.3%
Mining and quarrying	565.6	9%	539.4	8%	-0.8%
Secondary Sector	**535.8**	**9%**	**677.0**	**10%**	**4.0%**
Manufacturing	277.1	5%	322.6	5%	2.6%
Electricity, gas and water	171.0	3%	236.8	4%	5.6%
Construction	87.7	1%	117.7	2%	5.0%
Tertiary Sector	**3 954.0**	**65%**	**4 270.2**	**66%**	**1.3%**
Trade, catering and accommodation	913.7	15%	834.2	13%	-1.5%
Transport, storage and communications	686.6	11%	870.6	13%	4.0%
Finance, insurance, real estate and business services	855.1	14%	723.5	11%	-2.7%
Community, social and personal services	691.5	11%	860.1	13%	3.7%
General government	807.0	13%	981.9	15%	3.3%
Total	**6 062.0**	**100%**	**6 476.7**	**100%**	**1.1%**

c) Labour force and employment situation within the Upington Focus Area

- The FA's labour force encompasses about 30 002 people, of who about one out of five does not have a job.
- Unemployment is a major challenge within the towns and settlements covered in this FA. However, the unemployment rate in the FA was lower than within the wider municipal areas, where the unemployment rate was estimated around 32.6%.
- The agricultural industry employs the highest number of people compared to any other sector in the LMs assessed.
- There was a sharp decline in employment in the primary and secondary sectors between the period 2005 and 2011, with 7 164 agricultural jobs and 774 manufacturing jobs being lost between the 2005 and 2011 period, among others.
- The tertiary sector also experienced some decline in employment, particularly sectors such as trade, transportation, as well as community and personal services; however, a sharp increase in employment by the general government sector offset the overall losses experienced in the tertiary industries.

Labour force profile		
Indicator	**Focus Area (Stats SA, 2014)**	**Local Municipalities (Quantec, 2014)**
Employment	23 120	56 363
Unemployment	6 882	27 203
Unemployment %	22.9%	32.6%
Discouraged job seekers	2 361	Unavailable

Sectoral employment (Quantec, 2014)						
Indicator	Data applicable to all Local Municipalities included in Focus Area					
	2005		2011		% Change	Abs Change
Primary Sector	**26 319**	**42%**	**19 272**	**34%**	**-26.8%**	**-7 047**
Agriculture, forestry and fishing	24 358	39%	17 194	31%	-29.4%	-7 164
Mining and quarrying	1 961	3%	2 078	4%	6.0%	117
Secondary Sector	**5 270**	**8%**	**4 515**	**8%**	**-14.3%**	**-755**
Manufacturing	3 009	5%	2 235	4%	-25.7%	-774
Electricity, gas and water	206	0%	508	1%	146.8%	302
Construction	2 056	3%	1 772	3%	-13.8%	-283
Tertiary Sector	**30 819**	**49%**	**32 575**	**58%**	**5.7%**	**1 756**
Trade, catering and accommodation	8 830	14%	6 959	12%	-21.2%	-1 871
Transport, storage and communications	1 518	2%	1 407	2%	-7.3%	-111
Finance, insurance, real estate and business services	3 925	6%	4 557	8%	16.1%	632
Community, social and personal services	8 055	13%	7 993	14%	-0.8%	-62
General government	8 492	14%	11 659	21%	37.3%	3 167
Total	**62 408**	**100%**	**56 363**	**100%**	**-9.7%**	**-6 046**

d) Access to basic services within the Upington Focus Area

- The majority of households within the FA have access to electricity; however, one out of ten households still rely on candles, gas and paraffin for lighting.
- Although 75% of the households in this focus area have access to sanitation through the use of flush/chemical toilets, there is still a significant percentage of households without appropriate access to sanitation.
- The majority of households do have access to piped water either in their dwellings or in their yards, one out of ten households though experience difficulties in accessing it.

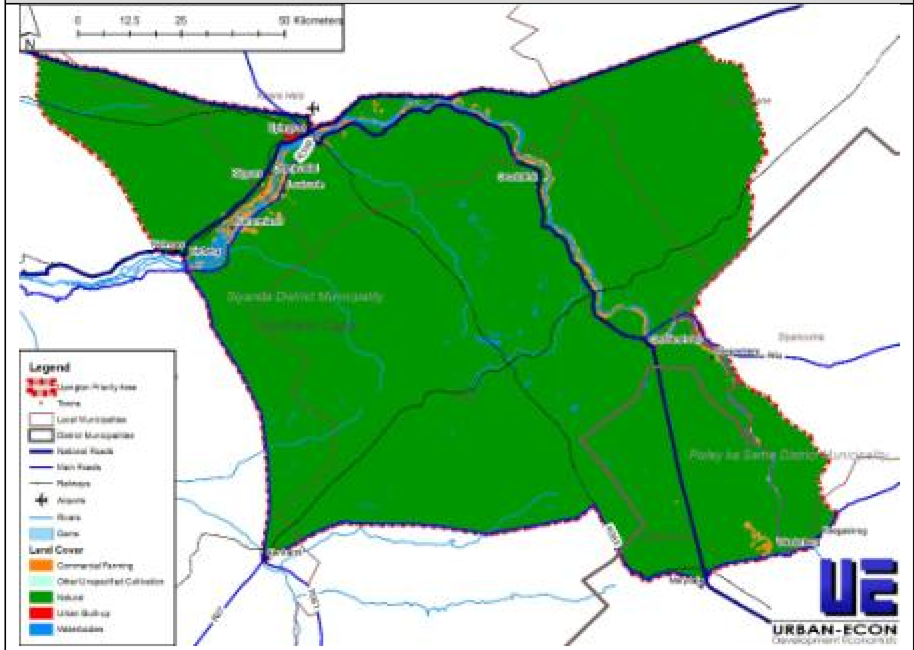
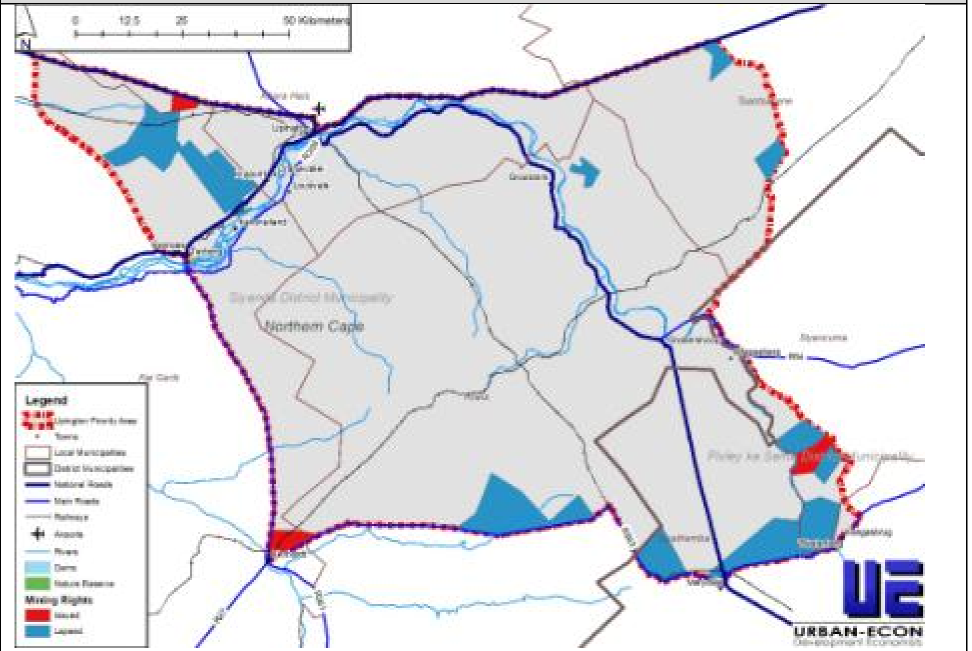
Indicator	Access to Basic Services in the Settlements and Towns of the Focus Area. (Stats SA, 2014)	
	HH (No.)	HH (%)
Access to electricity (for lighting)		
Electricity	20 253	90.4%
Solar	41	0.2%
Other (candles, gas, paraffin)	2 037	9.1%
None	68	0.3%
Total	22 399	100%
Access to sanitation		
Flush/chemical toilet	16 978	75.8%
Pit latrine with/without ventilation	2 293	10.2%
Bucket latrine	1 930	8.6%
Other	140	0.6%
None	1 058	4.7%
Total	22 399	99.9%
Access to water		
Piped water inside dwelling	13 246	59.1%
Piped water inside yard	6 956	31.1%
Piped water on community stand (>200m)	1 702	7.6%
None	495	2.2%
Total	22 399	100%

e) Level of economic infrastructure development of the Upington Focus Area.

The towns and settlements within the focus area are well connected in terms of economic infrastructure such as road and rail. The area also has access to the international airport located in Upington.

Indicator	Transport Infrastructure Development Overview.
Airports	There is one airport in the Upington area, which has international status.
Railway lines	The focus area is rich in terms of rail network. There is a railway line that stretches from Marydale to Upington and another one connecting Kenhardt with the eastern parts of the focus area. These two railway lines intersect at the central part of the focus area.
National roads	There is the N14 connecting Keimoes and Upington and also the N10 connecting Upington with Grootdrink, Groblershoop and Marydale.
Regional roads	There is the R383 in the southern parts of the focus area that connects Knehardt with Marydale, Westerbergand, and Koegasbrug which are all towns within the focus area. There is also the R359 in the northwestern parts of the focus area.

2.7.4 Land use profile

Core land uses	Natural and mineral resources
	
• The majority of Upington FA is characterised by natural environment. • There is a belt of commercial farming activities along the Orange River stretching from the northwestern part of the focus area going towards the northern and eastern parts of the FA. • There are also other commercial farming activities taking place around Westerberg in the southeastern part of the FA • Most of the settlements and important development nodes are located along the Orange River.	• The Orange River is an important feature mainly because most of the towns and major road networks were built along the course of this river. • Considering the issued mining and quarrying licenses in the area, mining activities are limited to the parts of the northwestern corner, southeastern corner and southwestern corner of the FA. However, a number of mining rights have lapsed that could potential be reinstated in the future and that should be taken into account as they may refer to available mineral deposits. • Although not indicated on the map, Google Maps suggests that the FA hosts a commercial game farm (i.e. FM Safaris) in the northeastern corner of the FA.

2.7.5 Key summary

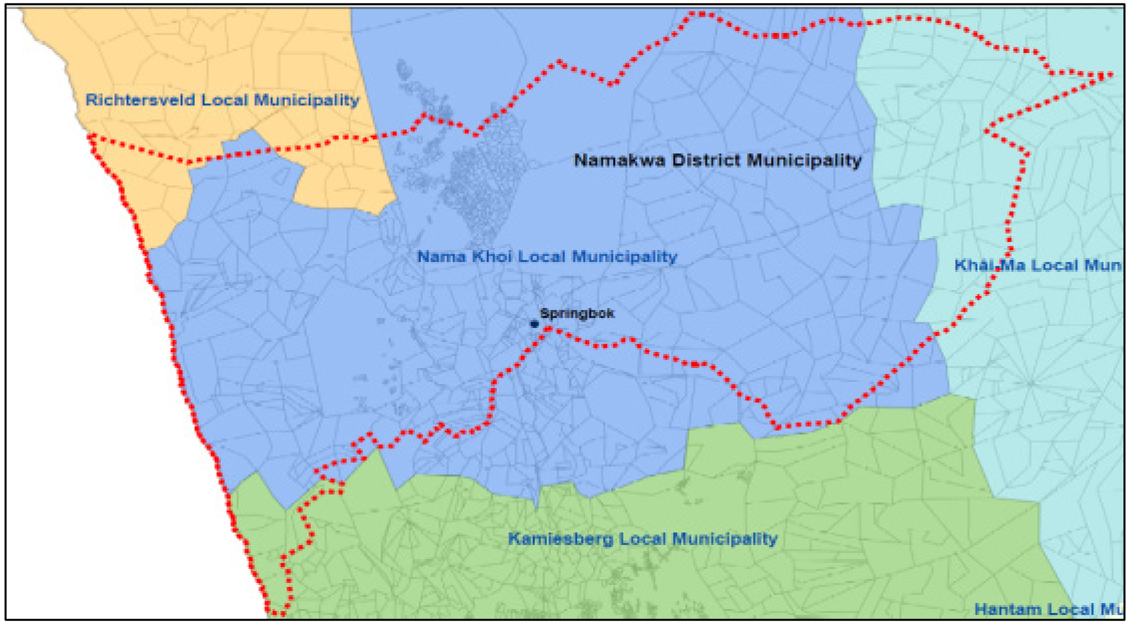
- The main characteristic of the Upington FA is the presence of the Orange River that drives the development growth of the area and stimulates the agricultural and tourism industries in the area. The FA is also characterised by good road connectivity among the settlements and with the main development nodes of the Northern Cape and North West.
- Almost the entire population (92%) of the FA lives around the Orange River, only two towns are located outside of the river banks, i.e. Kenhardt (Kai !Garib LM) located in the southwestern corner and Marydale (Siyathemba LM) in the southeastern corner of the FA.
- The economic development of the FA is almost entirely dependent on the agricultural sector and supporting tertiary services. The former has shown poor performance in recent years with more than 7 000 jobs being lost between 2005 and 2011. The tourism sector is not well developed outside the town of Upington.
- All local municipalities face challenges with regard to bulk infrastructure provision.
- Local municipalities fully support the provincial policy regarding the creation of a solar corridor within the FA; however, this corridor stretches along the Orange River and the N10, where agricultural land uses are prioritised above other land uses.
- !Kheis, Siyacuma, Siyathemba LMs encourage PV development in their areas of jurisdiction; the !Kheis LM particularly emphasises the need to provide support to enhance the trade, catering and accommodation industry during the stages of construction and operation of such projects.

2.8 Springbok Focus Area 8

2.8.1 Composition of the focus area

The Springbok FA starts at the coast of the Atlantic Ocean in the Northern Cape and stretches inland encompassing parts of four local municipalities of the Namakwa DM. The majority of the FA falls within the jurisdiction of the Nama Khoi LM and covers small portions of the Khai-Ma, Richtersveld, and Kamiesberg LMs

This area encompasses 13 towns and major settlements. Springbok is the biggest town in the FA, which is also the principal town of the Namakwa (DM). It is located in the centre just outside the southern border of the FA. The majority of other towns located in the FA are also situated in the Nama Khoi LM.



Map 2-17: Springbok Focus Area

Distribution of Towns and Major Settlements within the Overberg Focus Area				
Province	District Municipalities	Local Municipalities	Towns and settlements	LMS' population densities (people/km^2)
Northern Cape	Namakwa DM	Kamiesberg	• Koingnaas • Hondeklip bay (small portion)	1.1
		Khâi-Ma	• Aggeneys	1.6
		Nama Khoi	• Kleinsee • Komaggas • Concordia • Carolusberg • Bulletrap • O'kiep	3.9

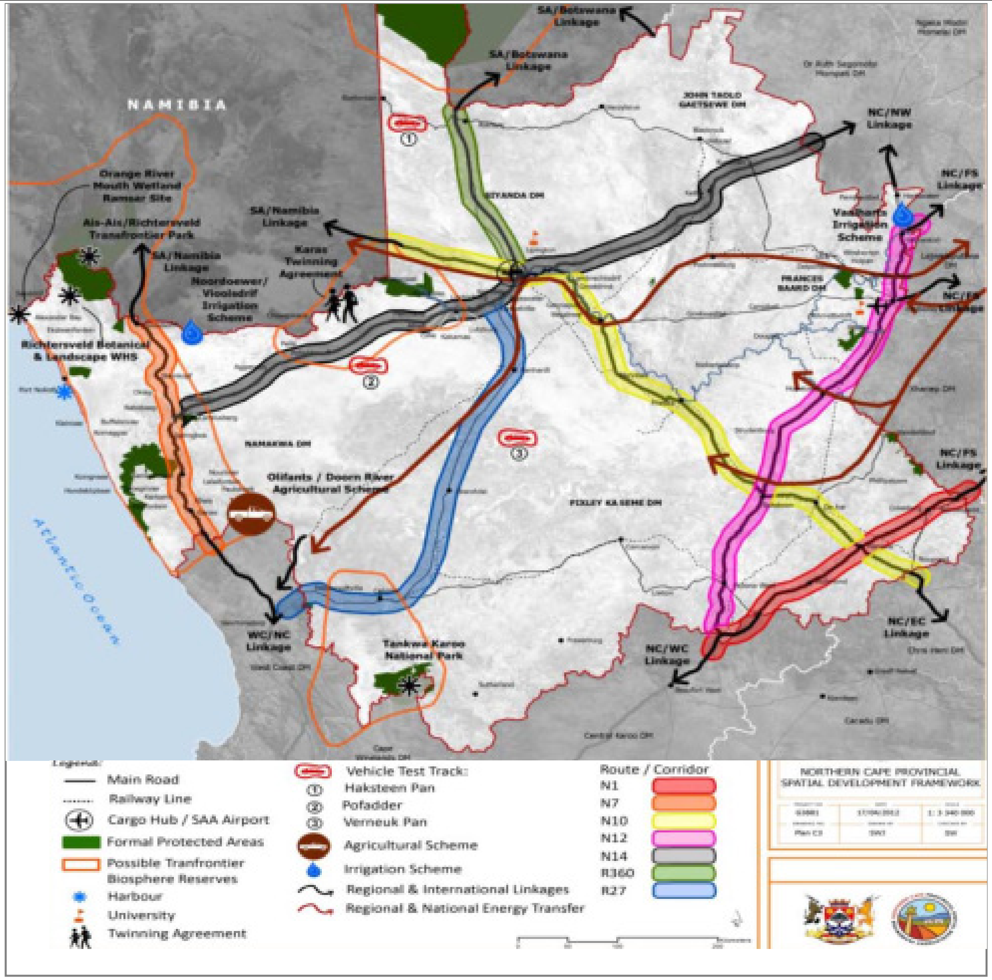
Distribution of Towns and Major Settlements within the Overberg Focus Area				
Province	District Municipalities	Local Municipalities	Towns and settlements	LMS' population densities (people/km^2)
			• Nababeep • Springbok • Steinkopf	
		Richtersveld	• Port Nolloth	1.6

2.8.2 Policy review

a) Provincial policies and strategic documents of the Northern Cape Province

Documents reviewed	Overview of Provincial Policies and Strategic Documents
• The Northern Cape Municipal LED Framework (February, 2011) • Northern Cape Provincial SDF (July, 2012) • The Northern Cape province Local Economic Development Framework (February, 2011) • The Northern Cape province Local Economic Development Strategy (January, 2011) • The Northern Cape Provincial Growth and Development Strategy • The Northern Cape Municipal LED Framework (February, 2011) • Northern Cape Provincial SDF (July, 2012) • The Northern Cape province Local Economic Development framework (February, 2011) • The Northern Cape province Local Economic Development strategy (January, 2011) • The Northern Cape provincial Growth and Development Strategy	• According to the Northern Cape PSDF (2012), the overarching goal of the province is to <u>focus on sustainable development</u>; thus it places emphasis on the long-term sustainability and growing prosperity in the province by focusing on the following tasks: ○ Promote sustainable economic development by <u>building on the comparative economic advantages</u> of the province; ○ <u>Protect and utilise the natural resource base in a sustainable manner</u> for the benefit of all parties concerned; ○ Merge <u>social, ecological and economic considerations</u> in decision-making as is required by legislative instruments (NEMA); ○ Make a <u>meaningful and lasting contribution to eradication of poverty and inequality</u> through the wise use of the inherent capital of the province; and ○ Create an environment that will ensure an <u>acceptable return on capital</u> invested by the private sector. • The Northern Cape PGDS identified the following two primary development objectives: ○ Promoting the <u>growth, diversification and transformation of the provincial economy; and</u> ○ <u>Poverty reduction</u> through social development. • The Northern Cape PSDF (2012) states that in order to take a proactive stance with regard to the promotion of economic development, the provincial government proposes to allocate resources to the identification, scoping, appraisal and investment marketing for a suite of <u>flagship projects that can leverage associated investment and economic activity</u> in areas of high relative economic potential. • As outlined in the Northern Cape PGDS, the provincial government seeks to <u>grow the agricultural economy</u> and is committed to promoting transformation in agriculture. • According to the Northern Cape PSDF (2012), the Northern Cape holds a significant comparative economic advantage in a number of enterprises in the <u>science and technology sector</u> including: ○ Square Kilometre Array (SKA), Carnarvon in the Pixely Ka Seme DM;

Documents reviewed	Overview of Provincial Policies and Strategic Documents
	○ Southern African Large Telescope (SALT); and ○ Karoo Array Telescope (MeerKAT), Carnarvon in the Pixely Ka Seme DM. • In the context of ensuring the availability of inexpensive energy and promotion of development in the province, the Northern Cape PGDS promotes the development of energy sources such as solar energy, the natural gas fields, bio-fuels, etc. • The provincial government accepts that the small-scale mining sub-sector could be the powerhouse of economic development in poor rural communities; thus, as indicated in the Northern Cape PGDS, it aims to provide assistance to as many small-scale operations to get started as possible. • Furthermore, through the Northern Cape PGDS, the provincial government proposes to use tourism as a vehicle for growth and development, which is particularly the case in remote rural areas where the aforesaid natural resources can be employed to leverage capital. • The Northern Cape PSDF (2012) proposes the creation of a solar corridor, which centres on Upington and extends from roughly Kakamas in the north to De Aar in the east.

Documents reviewed	Overview of Provincial Policies and Strategic Documents
	 Map 2-18: Northern Cape Spatial Development Framework Map

b) Social and economic infrastructure development priorities, plans and potential red flag areas

Documents reviewed	Socio-Economic Development Priorities, Plans and Potential Red Flag Areas.
• Nama Khoi Municipality IDP (2012-2017) • Nama Khoi Municipality IDP 2012/2017 First Revision (2013/2014) • Nama Khoi Municipality LED 2011 • Nama Khoi Municipality IDP 2012/2017 (Draft -Second Revision, 2014/2015) • Kamiesberg Municipality Integrated Development Plan (Draft, 2011-2012) • Kamiesberg Municipality LEDS 2011 • Kamiesberg Local Municipality Spatial Development Framework Land Development Plan (2010 – 2015) • Richtersveld Municipality IDP 2013 • Richtersveld Municipality LEDS 2011 • Richtersveld Municipality LEDS (2012-2016) • Khai Ma Municipality Rural Spatial Development Framework/Land Development Plan 2010 • Namakwa District Municipality IDP (2012-2016) • Namakwa District Municipality SDF (Draft, May 2012)	• Local municipalities within the Springbok FA face similar socio-economic developmental challenges including: ○ Undiversified economy; ○ Over-dependence on mining and government services sectors; ○ Virtually non-existent manufacturing industry; and ○ Low income levels and low spending capabilities. • Economic sectors that are prioritised in different parts of the FA by respective LMs include: ○ Livestock grazing; ○ Mining; ○ Tourism; ○ Aquaculture; ○ Conservation and ecological restoration; ○ Mariculture; and ○ Alternative energy as an industry. • High levels of poverty are present in the communities of the FA. This is particularly applicable to the Khâi Ma LM, which indicated that over three quarters of its households were considered indigent and received subsidies for basic services. • Communities within the FA are much dispersed and have very poor communication and transportation infrastructure to link the development centres with the rest of the settlements. • The Richtersveld LM government stated that each connection to the conventional electrical grid should be supplemented with alternative energy sources *inter alia*, solar, gas, wind and hydro. • Local governments are concerned about the scaling-down of the mining sector in their areas; although some municipalities still envision the realisation of new mining opportunities. Nonetheless, the majority of the local governments aim to support other economic sectors including the renewable energy industry.

Richtersveld LM Priorities:

- Address the backlog in the provision of basic services such as water, sanitation, electricity, roads and housing
- Effective public transport systems need to be implemented
- Potential for alternative/renewable energy resources
- Exploit the opportunities of a mariculture and tourism development

Richtersveld LM Challenges:

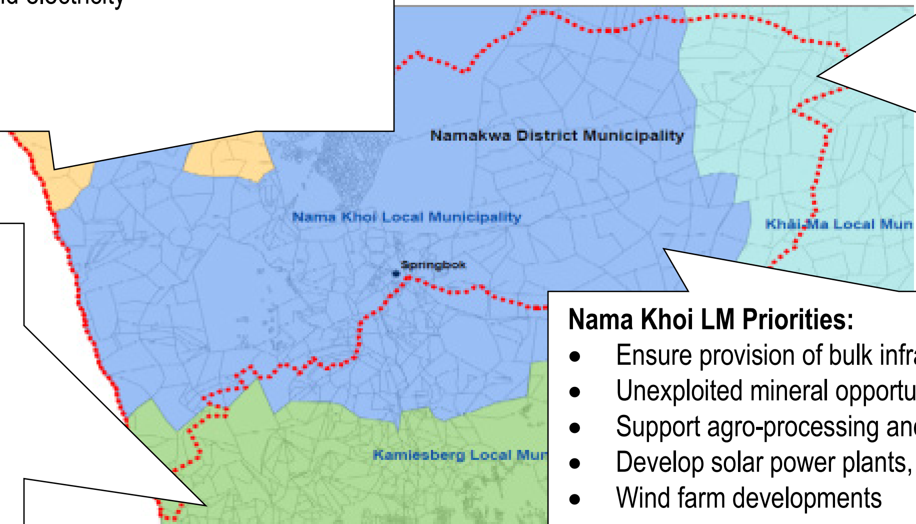
- Limited availability of bulk water and electricity
- Low levels of income
- Economic dependence on mining
- High poverty levels

Khâi Ma LM Priorities:

- Promotion of local tourism
- Protect environmental conservation corridors
- Ensure economic development

Khâi Ma LM Challenges:

- Limited farming opportunities
- Insufficient engineering and social infrastructure development
- High levels of poverty



Kamiesberg LM Priorities:

- Job creation
- Livestock grazing, mining and tourism economic growth potential
- Provide housing, services and infrastructure
- Conservation and ecological restoration

Kamiesberg LM Challenges:

- Water scarcity
- Poor transport infrastructure
- Almost all roads in the area are gravel
- Mining industry downscaling

Nama Khoi LM Priorities:

- Ensure provision of bulk infrastructure
- Unexploited mineral opportunities
- Support agro-processing and mariculture
- Develop solar power plants, especially towards Vioolsdrif
- Wind farm developments

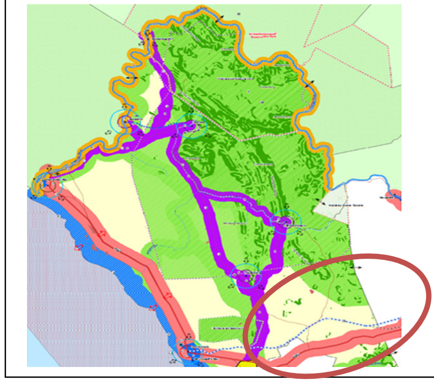
Nama Khoi LM Challenges:

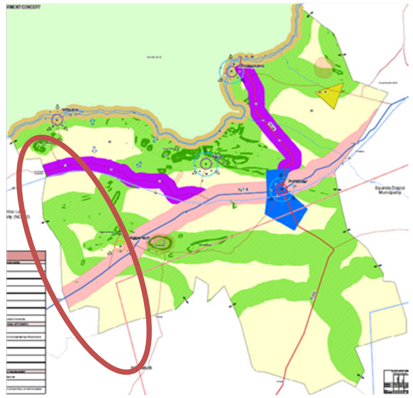
- Climate change will impact on water resources and agricultural activities
- Water supply and quality
- Low income levels
- Over-dependence on mining and government services sectors
- Lack of jobs and economic development
- Municipal owned land is not being used for its best strategic uses

c) Spatial development priorities, plans and potentia red flag areas

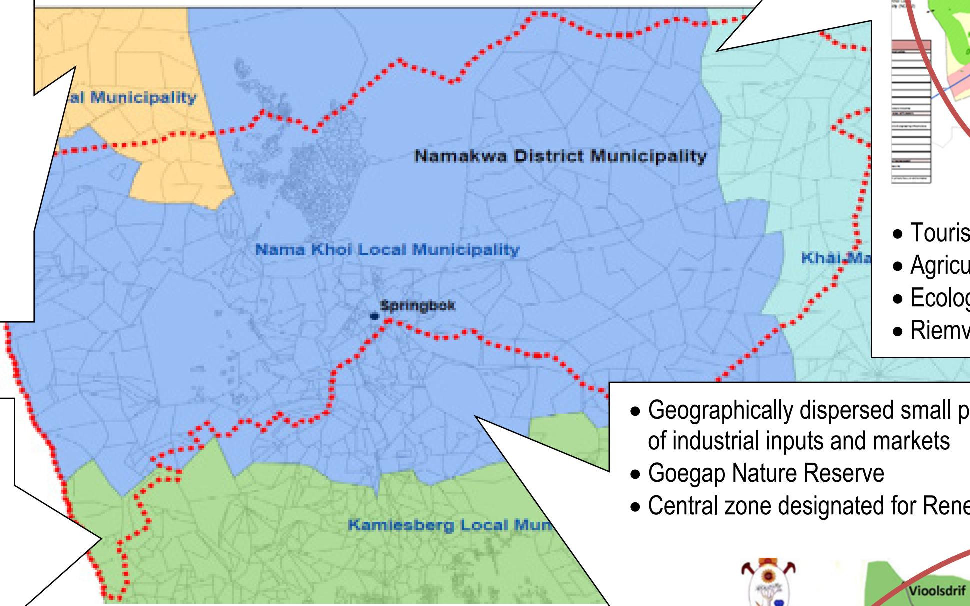
Documents reviewed	Spatial Development Priorities and Policies Review For the Overberg Focus Area
• Kamiesberg Local Municipality Spatial Development Framework Land Development Plan (2010 – 2015) • Richtersveld Local Municipality Rural Spatial Development Framework/Land Development Plan 2010 • Richtersveld Municipality IDP 2013 • Nama Khoi Municipality IDP 2012/2017 (Draft -Second Revision, 2014/2015) • Kamiesberg Municipality Integrated Development Plan (Draft, 2011-2012) • Khai Ma Municipality Rural Spatial Development Framework/Land Development Plan 2010	• The majority of local governments envisioned the growth of tourism taking advantage of the position of the N7, which is the national road that connects Cape Town with Namibia, as well as the local natural resources. • The Nama Khoi LM, which accounts for the biggest share of the FA in terms of land area, aims to embark on the government solar water heating and renewable energy programme particularly in the towns of: o Komaggas; o Buffelsrivier; and o Bulletrap. • In the southwestern part, FA borders with the Namakwa National Park and The Living Edge of Africa Project (LEAP), which supports numerous policies including: 1. The need to stimulate economic development and create employment; 2. Strong focus on mariculture, tourism, and alternative energy generation; 3. The need to protect valuable biodiversity resources; 4. The important role of the mining sector; and 5. The issue of water scarcity. • Local Government of the Richtersveld LM located in the northwest corner of the FA promotes alternative energy (wind) to be considered close to the industrial zones of Port Nolloth & Alexander Bay.

- Kannikwa Vlakte wind farm
- Agricultural and ecologic conservation
- Richtersveld National Park



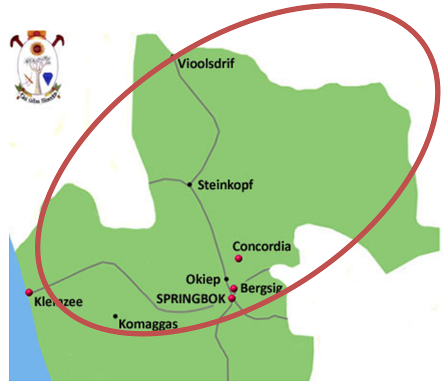


- Tourism corridor
- Agricultural land
- Ecological conservation
- Riemvasmaak conservancy area



- Area is not suitable for agriculture
- Mining areas
- Borders with Namakwa National Park
- The Living Edge of Africa Project

- Geographically dispersed small population and far from sources of industrial inputs and markets
- Goegap Nature Reserve
- Central zone designated for Renewable Energy projects



2.8.3 Socio-economic profile

a) Demographic profile of the Springbok Focus Area

- The FA encompasses about 51 166 people, of which roughly 58% resided in the Nama Khoi LM.
- The town of Springbok is the most populated town in the FA as it accounts for a quarter of the FA's population, followed by Steinkopf (15% of the FA's population).
- Education levels in the FA mirror that of many other FA analysed with the majority of people receiving some secondary or completing secondary schooling. Bulletrap is the town with lowest education levels within the FA; while Koingnaas had the biggest percentage of people with access to higher education (10%).
- The population growth was considerable in the Richtersveld LM, however in Kamiesberg and Khai Ma LMs the population decreased during the period between 2005 and 2011. Overall, the municipalities included in the FA experienced a positive annual growth rate of about 0.5% and a net migration into the area.

Demographic data

Demographic Profile of the Springbok FA (Stats SA, 2014)		
Population (2011)	51 166	
Households (2011)	13 863	
Average monthly HH income (2014 in Rands)	9 307.2	
Education:		
No School	630	2.0%
Complete or some primary	7 609	23.6%
Complete or some secondary	21 288	65.9%
Higher	2 770	8.6%

Data applicable to all Local Municipalities included in the FA (Quantec, 2014)	
Population (2011)	99 578
Population growth (CAGR, %) (2005-2011)	0.5%
Population growth (No.) (2005-2011)	3 072
Population density (People per km^2)	2.2
Migration:	
In-migration	4 346
Out-migration	3 928
Net migration	418

b) Economic structure of the Springbok FA

- The combined economies of the LMs that encompass the FA were valued at R8 545.5 million in 2011. They were predominantly based on the utilisation of mineral resources and servicing of the local population. Agricultural activities in the combined economies of the assessed LMs make a small contribution towards their value add due to various climatic and soil conditions that make such activities unfavourable in the area.
- The mining industry has shown a decline in production between 2005 and 2011, which, considering its contribution to the LMs economies, presented a major developmental challenge for the areas. With a 3.3% decline on an annual basis, its economic contribution also dropped from 53% in 2005 to 44% in 2011.

- The contribution of the secondary sectors in the LMs assessed is very low, which, considering the size of the mining sector, means that the local economies feature very little in beneficiation of minerals extracted from its reserves.
- Half of the combined economies' production were generated by the tertiary industries. These are relatively diversified in the area, and besides some businesses that focus on tourists they mainly service the needs of the assessed LMs' communities.

Size of the economies					
Indicator	**Data applicable to all Local Municipalities included in Focus Area (Quantec, 2014)**				
Gross Domestic Product (Current Prices) 2011 (R'm)	8 546.5				
Gross Domestic Product (Constant Prices) CAGR (2005-2011)	0.6%				
Sectoral profile (R'm, 2005 constant prices)					
Indicator	**Data applicable to all Local Municipalities included in Focus Area (Quantec, 2014)**				
	2005		**2011**		**CAGR**
Primary Sector	**2 415.8**	**56%**	**1 994.8**	**44%**	**-3.1%**
Agriculture, forestry and fishing	123.2	3%	120.0	3%	-0.4%
Mining and quarrying	2 292.6	53%	1 874.8	42%	-3.3%
Secondary Sector	**179.9**	**4%**	**218.4**	**5%**	**3.3%**
Manufacturing	72.6	2%	85.3	2%	2.7%
Electricity, gas and water	39.7	1%	36.3	1%	-1.5%
Construction	67.6	2%	96.8	2%	6.2%
Tertiary Sector	**1 745.5**	**40%**	**2 299.5**	**51%**	**4.7%**
Trade, catering and accommodation	400.3	9%	436.5	10%	1.5%
Transport, storage and communications	290.1	7%	448.4	10%	7.5%
Finance, insurance, real estate and business services	358.5	8%	448.8	10%	3.8%
Community, social and personal services	340.7	8%	451.1	10%	4.8%
General government	355.9	8%	514.7	11%	6.3%
Total	**4 341.2**	**100%**	**4 512.7**	**100%**	**0.6%**

c) Labour force and employment situation within the Springbok Focus Area

- The labour force in the FA comprised about 18 168 people; of these about one out of five were unemployed (22.4%) showing a lower than the national average unemployment rate of 24%. In addition, the area encompassed about 1 967 discouraged job seekers, which is significantly less than that observed in some other FAs.

- Between 2005 and 2011, the employment in the combined LMs grew by 3 872 people with at least half of economic sectors creating new jobs during that period. Industries such as agriculture, trade, construction and manufacturing were the sectors that experienced a decline in employment. Agriculture and trade shed the most jobs during the period between 2005 and 2011.
- The majority of the people in the municipalities accessed work in the mining and general government services sectors. During the analysed periods, both of these industries showed an increase in employment figures, which to some degree assisted in offsetting the decline in employment in other sectors in the municipalities.

Labour force profile		
Indicator	**Focus Area (Stats SA, 2014)**	**Local Municipalities (Quantec, 2014)**
Employment	14 090	30 366
Unemployment	4 078	7 395
Unemployment %	22.4%	19.6%
Discouraged job seekers	1 967	Unavailable

Sectoral employment (Quantec, 2014)						
Indicator	**Data applicable to all Local Municipalities included in Focus Area**					
	2005		**2011**		**% Change**	**Abs Change**
Primary Sector	**11 273**	**43%**	**11 098**	**37%**	**-1.6%**	**-176**
Agriculture, forestry and fishing	3 340	13%	2 213	7%	-33.7%	-1 126
Mining and quarrying	7 934	30%	8 885	29%	12.0%	951
Secondary Sector	**2 005**	**8%**	**1 757**	**6%**	**-12.3%**	**-248**
Manufacturing	821	3%	592	2%	-27.9%	-229
Electricity, gas and water	54	0%	83	0%	53.3%	29
Construction	1 130	4%	1 082	4%	-4.2%	-48
Tertiary Sector	**13 216**	**50%**	**17 512**	**58%**	**32.5%**	**4 295**
Trade, catering and accommodation	4 015	15%	3 181	10%	-20.8%	-834
Transport, storage and communications	611	2%	798	3%	30.6%	187
Finance, insurance, real estate and business services	1 541	6%	2 279	8%	47.9%	738
Community, social and personal services	3 274	12%	4 132	14%	26.2%	859
General government	3 775	14%	7 121	23%	88.6%	3 346
Total	**26 494**	**100%**	**30 366**	**100%**	**14.6%**	**3 872**

d) Access to basic services within the Springbok Focus Area

- The majority of households in the FA have access to electricity and access to water with a fraction of households suffering from lack of bulk connections.
- Access to adequate sanitation is among the bigger concerns in the area; households with access to flush sanitation system in Komaggas, Concordia and Hondeklip Bay were fewer than 45% in 2011.

Indicator	Access to Basic Services in the Settlements and Towns of the Focus Area (Stats SA, 2014)	
	HH (No.)	HH (%)
Access to electricity (for lighting)		
Electricity	13 503	97.4%
Solar	30	0.2%
Other (candles, gas, paraffin)	286	2.1%
None	46	0.3%
Total	**13 865**	**100.0%**
Access to sanitation		
Flush/chemical toilet	11 516	83.1%
Pit latrine with/without ventilation	1 848	13.3%
Bucket latrine	102	0.7%
Other	81	0.6%
None	318	2.3%
Total	**13 865**	**100.0%**
Access to water		
Piped water inside dwelling	11 087	80.0%
Piped water inside yard	2 548	18.4%
Piped water on community stand (>200m)	86	0.6%
None	144	1.0%
Total	**13865**	**100.0%**

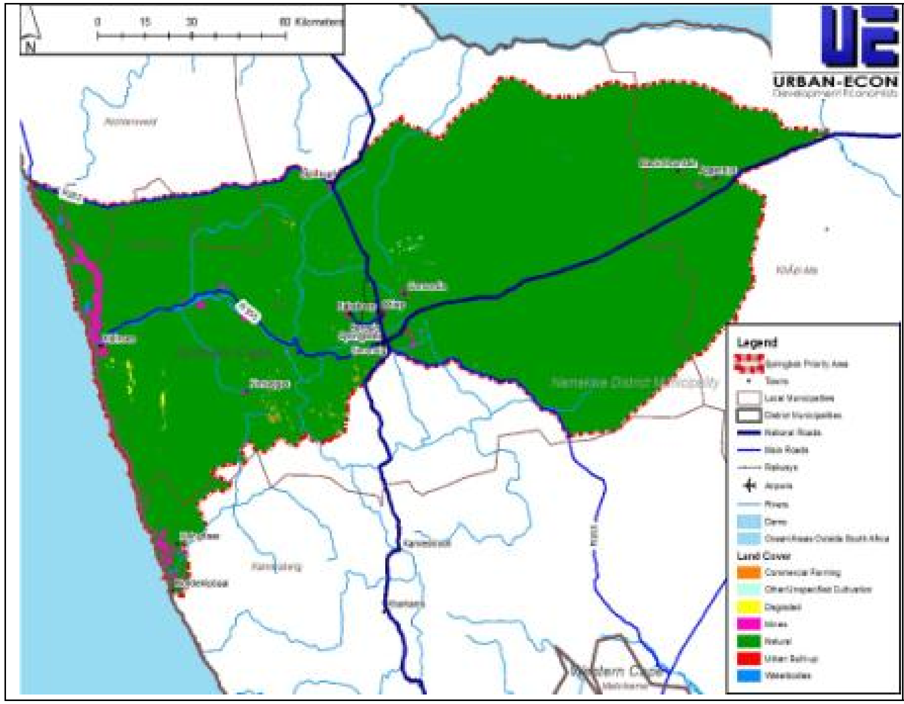
e) Level of economic infrastructure development of the Springbok Focus Area.

Two national roads connect this area with the development centres of the country. However, due to the distance of the towns located in the FA relative to the major centre such as Cape Town, Johannesburg, and even Kimberley, the area boasts four airports, which are situated mainly in the borders of the FA. No railway lines connect the towns located in the FA with other centres in the country; however, plans are in place to develop a railway line to link the northern part of the Northern Cape with Namibia.

Indicator	Transport Infrastructure Development Overview
Airports	Koingnaas Airport and Kleinzee Airport are located at the West Coast, Springbok Aerodrome in the central zone and Aggeneys Airport in the east of the FA
Railway lines	None
National roads	N7 national road, which runs in a north-south direction connecting Cape Town to Namibia and traverses the FA in the middle, and the N14, which runs from Springbok in an easterly direction to Upington
Regional roads	R 382 limits the north-east zone and the northern boundary is the R356

2.8.4 Land use profile

Core land uses	Natural and mineral resources
• There are vast extensions of land not suitable for agriculture purposes and that maintain their natural character; some local governments aim to protect these areas and explore tourism opportunities. • The regions within the FA most suited for livestock are concentrated along the western side of the N7, in Buffelsrivier, Komaggas, Springbok, Nababeep and Bulletrap. Farming in the area includes sheep, goats, and, to a limited extent, cattle. • The Namaqualand coast of the Northern Cape lies adjacent to one of the richest and most prolific marine eco-systems in the world. There is potential for mariculture production that can then be linked to Hondeklipbaai and Port Nolloth.	• Several settlements that lie within this zone were created as mining towns and continue to depend on these activities. These are predominantly concentrated in the western and northeastern parts of the FA. • Certain areas are designated for national parks expansion, inclusive of that in the southeastern part of the FA related to the Riemvasmaak conservancy area and in the southwestern part that is linked to the Namakwa National Park.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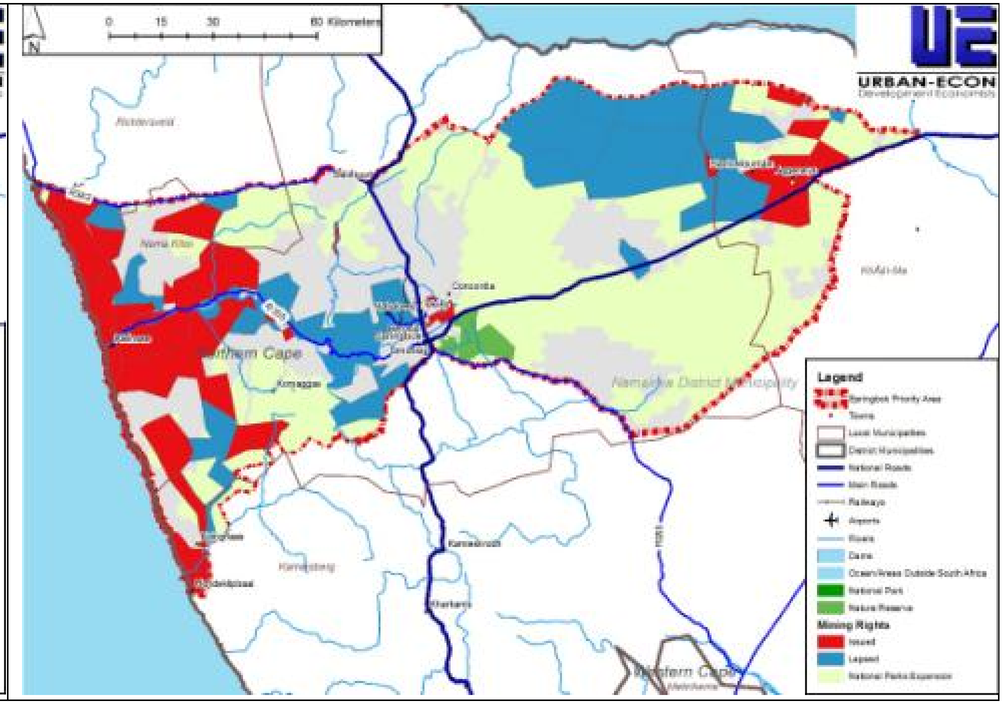
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Concordia
Legend
Mining Rights

2.8.5 Key summary

- The population of the FA is estimated to be around 51 166 people, most of whom live in Springbok and the rest being dispersed in the area and in the other 12 towns and major settlements.
- The Springbok Focus Area is scarcely populated except for the main towns of Springbok and Steinkopf. The area is situated far from the major centres; therefore, local municipalities have to rely on their own comparative advantages to create employment for their residents.
- The main characteristic of the economy is that it depends almost entirely on mining-related activities; there is very low development in the secondary and tertiary sector and very little opportunities in the agriculture sector.
- The dry weather and poor agricultural potential of the land, together with the decay in mining activities on which the economy of the region relies, are the main factors for the limited economic growth exhibited in the period between 2005 and 2011.
- Local governments are focusing on finding new approaches for the agriculture sector exploring non-traditional practices and mariculture opportunities.
- Local governments aim to develop tourism along the N7, which connects the country with Namibia.
- One of the main concerns of the local governments is the need to provide basic services and bulk infrastructure for their communities; however many do not have the financial resources to address the backlogs. There is an urgent need to generate income in order to improve the standards of living in the area.
- Several areas of the FA are already designated by local governments to be the best choices for renewable developments, particularly in the centre of the Nama Khoi LM.

3 SOCIO-ECONOMIC IMPACT ANALYSIS

3.1 General impacts associated with development of wind and PV projects

The establishment of renewable energy projects, regardless of the technology, is associated with a number of both positive and negative environmental impacts during various stages of these projects' lives. Such projects also affect the well-being of communities as well as the structure and dynamics of the related economies and generate both positive and negative socio-economic impacts. The general socio-economic impacts that can be observed during construction and operational phases of the wind and PV project are outlined in the following table. It outlines the general impacts, beneficiaries and sensitive receptors, the cause of the impact, and the potential sensitivity of the impact considering different renewable energy technologies.

Impact	Beneficiary/sensitive receptor	Cause	Effect	Sensitivity of beneficiary/receptor	
				Wind	PV
Positive impacts					
Improved energy security and efficiency of the national grid	Country in general and users of electricity	Establishment of additional electricity generating capacities using renewable energy sources in areas outside existing electricity generating regions	Contribution towards government developmental and energy security objectives; improved investment environment; carbon emission savings; long-term energy cost savings; development of the regions that had limited electricity supply	Highly beneficial when established	Highly beneficial when established
Stimulation of the local and national economy as a result of investment into project development and operational expenditure	Local and national economies	Capital investment and operating expenses that create direct and multiplier effects, i.e. production and consumption induced impacts	Businesses affected by the project directly or through multiply effect experience an increase in demand, which stimulates their production and grows their revenue	Highly beneficial, particularly during construction	Highly beneficial, particularly during construction
Creation of temporary and permanent employment opportunities in various economic sectors in the local communities and nationwide through direct and multiplier effects	Local and national economies	Capital investment and operating expenses that create direct and multiplier effects, i.e. production and consumption induced impacts	Businesses that experience an increase in production could experience the need to employ more people or increase utilisation of existing human resources	Highly beneficial, particularly during construction	Highly beneficial, particularly during construction
Skills development due to the creation of new employment opportunities or sustaining of	Local and to a smaller degree national economy	Construction and operational activities that create potential for knowledge sharing and skills	Workers benefiting directly and to some degree indirectly from the project may acquire new skills or advance their	Beneficial	Beneficial

Impact	Beneficiary/sensitive receptor	Cause	Effect	Sensitivity of beneficiary/receptor	
				Wind	PV
existing jobs for a longer period		development through learnerships	knowledge		
Temporary or sustainable improvement of standard of living of households directly or indirectly benefiting from created employment opportunities	Local and national economies	Capital investment and operating expenses that lead to job creation through direct and multiplier effects, which in turn increases HH income	Increase in income will increase the purchasing power of the benefiting households, which will lead to them being able to improve their standard of living by affording them to pay for services and address their needs	Highly beneficial, particularly during construction	Highly beneficial, particularly during construction
Increase in government revenue due to investment and revenue generated	Local, provincial and national government	Capital investment and revenue generation during operations through payment of rates and taxes, company taxes, and income taxes	Greater government revenue allows for re-investment of these funds in the communities and on other pubic necessities	Highly beneficial, particularly during construction	Highly beneficial, particularly during construction
Investment in the local community and economic development projects as part of a Socio-Economic Development and Enterprise Development plan	Local communities	Revenue generation during operations and the regulatory requirement to spend certain percentages on Socio-Economic Development and Enterprise Development initiatives	Improved living conditions of the beneficiary communities and stimulation of local small business sector leading to job creation	Highly beneficial	Highly beneficial
Improved economic value derived from land as a factor of production due to change in land use	Non-arable or degraded land not used for any commercial activity or used for grazing	Change in land use leading to a more productive use of land, i.e. derivation of greater value added and job creation	Creation of new employment opportunities, increase in local and national government revenue streams, stimulation of the economy	Beneficial during operations	Highly beneficial during operations
Impact on property and land values in the surrounding area	Various land uses, but especially agricultural land uses	Increasing demand for properties due to the resource, environmental, physical, and infrastructural suitability of the area for RE projects	Increase in property prices, specifically land	Highly beneficial	Highly beneficial
Negative impacts					
Altered sense of place and deterioration of living and working conditions due to various environmental impacts	Local communities; people living, working and visiting the area	Environmental impacts created during construction and operation, including increase in traffic, visual impacts, noise impacts, and air pollution	Areas become more industrialised and perceptions about the local environment among the residents and visitors change; daily lives of people are being affected due to created disturbances and added	Highly sensitive	Highly sensitive

Impact	Beneficiary/sensitive receptor	Cause	Effect	Sensitivity of beneficiary/receptor	
				Wind	PV
		impacts	pressure on social and economic infrastructure		
Economic and job losses in the local area in sectors that are negatively affected by the development due to change in the land use	Commercial agricultural activities (incl. game farming) and subsistence farming affected by the footprint	Sterilisation of land affected by the project's footprint	Loss of revenue generated from commercial or subsistence farming that further results in job losses and affects the local residents due to the loss of sustainable income and jeopardises food security in the country	Limited sensitivity – limited footprint	High sensitivity - large footprint
Economic and job losses in the local area in sectors that are negatively affected by exerted negative environmental impacts on the surrounding environment sensitive to changes in the sense of place	Leisure tourism including eco-tourism and commercial game hunting activities that are in the zone of influence of these environmental impacts	Environmental impacts created during construction and operation that negatively affect sense of place	Decline in attractiveness of the area among domestic and international tourists interested in leisure tourism, eco-tourism and/or game hunting, leading to the loss of revenue among affected tourism and commercial game farming activities, which further leads to closure or downscaling of businesses resulting in losses of jobs and sustainable income in the area	Highly sensitive	Highly sensitive
Change in demographics of the areas due to influx of workers and job seekers	Local communities located in proximity to the sites where projects are implemented	Construction projects tend to attract people in search of employment to the area; limited labour force composition in the area and general influx of job seekers looking for work	Increase in male population in the area and the number of one-person households in the area, as job seekers and workers tend to migrate on their own in search of work, leaving families behind	Sensitive	Sensitive
Increase in social pathologies associated with influx of migrant labourers and job seekers to the area (health, crime, prostitution, xenophobia, etc.)	Local communities located in proximity to the sites where projects are implemented; nearby farms	Limited labour force composition in the area and general influx of job seekers looking for work	Influx of people from outside the community increases tension and conflict between local residents seeking employment and migrants also seeking employment; job seekers who cannot find employment opportunities tend to resort to violent protests and crime in the area; increase in male population in the area generally leads to spike in prostitution and health diseases	Sensitive	Sensitive
Added pressure on basic	Local communities located	Increased demand for local	Without appropriate planning, the area may	Sensitive	Sensitive

Impact	Beneficiary/sensitive receptor	Cause	Effect	Sensitivity of beneficiary/receptor	
				Wind	PV
services and social and economic infrastructure	in proximity to the sites where projects are implemented	basic services and economic infrastructure due to increase in development in the area and temporary increase in local population due to migrant workers and job seekers	experience significant service delivery backlogs and deterioration of existing social and economic infrastructure leading to decreased standards of living and dissatisfaction of residents with local government and other stakeholders		
Impact on property and land values in the surrounding area	Properties used or that have the potential for leisure tourism that are in the zone of influence of the impacts	Environmental impacts created during construction and operation leading to the change in the sense of place and land use	Reduced attractiveness of the land for selected economic activities, specifically tourism and game farming, that will lead to reduced property prices	Highly sensitive	Highly sensitive

The spatial extent, duration and magnitude of the above-mentioned differ depending on the project phase, socio-economic environment of the area where a project is implemented, and to a smaller degree technology involved. The majority of impacts during construction are of a temporary nature; however, due to the nature of the technologies and investment required, they tend to be associated with a greater concentration of positive and negative effects than those observed during operation. However, impacts that ensue during operations are long term and as far as positive effects are concerned are more sustainable, albeit they might be of a lower magnitude than those observed during construction.

From a project perspective, certain impacts that are created by renewable energy projects, inclusive of PV and wind projects, would be of the same magnitude when considering their nationwide effect. However, the socio-economic characteristics of an area inclusive of the demographic profile, local economic base, labour force profile, infrastructural development, and land uses would differentiate each project in terms of the significance of impacts exerted on the local areas. Given the scope of the this study, it is thus important to focus on those positive and negative socio-economic impacts that would first and foremost assist in further decision making with respect to future project roll-out in each focus area and inform recommendations with regard to more detailed socio-economic impact assessment studies that will need to be undertaken at project level. Considering the sensitivity of various impacts highlighted, further analysis of the nature of potential impacts that could ensue in the focus areas needs to focus on the most sensitive receptors or beneficiaries, which are defined as follows[1]:

- Local economy and specifically the current economic base and its ability to provide employment opportunities for the local labour force;
- Existing labour force and its ability to satisfy the potential demand for skills and labour;
- Land uses in the focus area and associated commercial activities that could potentially be affected either due to sterilisation of land where facilities are built or environmental impacts; and

[1] The impacts associated with SED and ED initiatives, as well as property values are commented on in the next chapter.

- Local communities that may experience change in the demographics and increase in social pathologies due to influx of migrant workers and job seekers, as well as deterioration of living and working conditions

Given the above sensitive receptors and beneficiaries, the following sections examines each focus area from the perspective of the sensitive receptors and the nature of the potential impacts that could ensue in the areas. These sections first provide the map of the receptors sensitive to certain impacts, which assist in assessing the magnitude of the potential effects and provides recommendations on the need for future assessments. Mitigation measures specific to each FA are provided at the end of the each section together with the notes on the overall suitability of each FA.

3.2 Focus Area 1: Overberg Focus Area potential impacts

Considering the socio-economic profile presented earlier for Overberg FA, a number of sensitive receptors can be identified among which are commercial agriculture, the tourism industry, and communities. Considering the sensitivities of these receptors to wind and PV projects, as well as the socio-economic environment of the Focus Area described earlier in the report, the following tables describes the potential socio-economic impacts that could ensue in the area.

Beneficiary/sensitive receptor	Potential impacts experienced	FA specific description
Local economy	• Growth of the local economy during construction and operational phases • Increase in government revenue	• Any renewable energy project is supported and promoted by the provincial policies, especially those that will aid in growth and development of rural areas. • Construction and operation of wind or PV projects would be associated with the injection into the local economic base, which will lead to the diversification of the local economy and stimulate its development. • It will create a new sector and will diversify the economic activities in rural areas, diminishing the dependencies on the agricultural sector, which has been showing poor performance in the past few years. • Renewable energy projects could potentially attract tourists to the area, which will stimulate the local economy further. However, it will be integral to ensure that development of the tourism industry based on the renewable energy projects located in the area does not come at a cost of an established eco-tourism industry that attracts tourists interested in scenery and natural beauty, which will require appropriate spatial planning.
Local labour force	• Development of temporary and permanent employment positions in the local communities • Development of skills, particularly in	• The employment in the local municipalities that are covered by the FA has declined sharply in the last few years with the majority of jobs being lost in the agricultural, manufacturing and construction industries. • The Focus Area's unemployment rate of 16.3% could be reduced significantly, if projects are

Beneficiary/sensitive receptor	Potential impacts experienced	FA specific description
	construction and renewable energy generation industries	implemented providing job opportunities in the construction (temporary basis) and utility sectors (permanent basis). • Since most of the jobs are semi-skilled and unskilled, i.e. the same as in the agricultural sector, these projects could offset the increasing trend in agricultural sector's employment decline.
Commercial agricultural activities	• Economic and job losses in the local agricultural sector due to land sterilisation	• Commercial agriculture, and specifically intensive agricultural activities, dominates land uses in the FA making a prominent contribution towards the economies of the LMs and job creation in the communities. • This impact will be more applicable to the development of PV projects, as they are associated with a notable footprint. Although, there are numerous examples globally where solar PV projects are co-located with livestock or crop production, such practices can be associated with greater construction and/or operating expenses and are yet to be adopted in South Africa. • Due to the land sterilisation associated with the establishment of PV facilities, PV projects will be in direct competition for land with the agricultural sector. As a result a large roll out of PV projects in the area may come at a cost to the agricultural sector. • Increasing loss of productive agricultural land in the area to PV facilities will further reduce the size and labour absorption capacity of the local agricultural sector, which may destabilise the local economy further unless these are adequately offset by the value added and employment created from established PV projects.
Leisure tourism and commercial game farming	• Economic and job losses in the local tourism industry as a result of the changes in the sense of place	• The FA and specifically the western and southern parts thereof either already attract domestic and international tourists or have been identified to have notable potential for future tourism growth. • Development of wind or PV projects would most probably change the natural attractiveness of the area that is currently not associated with notable industrial activities or urban sprawl. • A single and more specifically a large roll-out of either PV or wind projects will lead to the change in the sense of place. Depending on the location of the projects relative to tourism hotspots, this may lead to the decline in the number of domestic and international tourists visiting tourist attractions in the FA and thus the decline in the tourism industry in the area.
Local communities	• Altered sense of place and deterioration of living and working conditions due to various environmental impacts • Change in demographics of the areas due to influx of workers and job seekers • Increase in social pathologies	• The area is sparsely populated with major urban settlements being located on the outskirts of the Focus Area. The development of projects may require establishment of construction camps, depending on how far the location of the selected projects are relative to the closest communities that could host migrant workers. • Movement of workers and jobs seekers may be experienced within the FA, as well as from outside the FA, which may cause unrest and increase social pathologies. • The more concentrated the development is in one particular area, the greater the influx of people may be experienced. This means that the significance of impacts associated with change in demographics,

Beneficiary/sensitive receptor	Potential impacts experienced	FA specific description
	associated with influx of migrant labourers and job seekers to the area (health, crime, prostitution, xenophobia, etc.) • Added pressure on basic services and social and economic infrastructure • Improved access to social facilities and infrastructure during operations	increase in social pathologies and added pressure on service delivery could be considerably greater if projects are clustered in one specific area than if they are distributed over a larger spatial extent. Timing of project development would play an important role in this case. The greater the number of projects being implemented in one period of time, the greater the magnitude of the impact will be on the community. • Local communities have notable changes with respect to basic service delivery and housing. Furthermore, due to a sparse population in the FA, certain social and economic infrastructural elements are not well developed. The situation may be exacerbated if projects are developed without adequately addressing the road network, health facility, and accommodation needs. • Development of RE projects, though, could assist in improving the access to social facilities and services in the area through the efficient and effective spend of SED and ED commitments during operations of the RE projects. The projects will also create additional revenue for the local government that could be directed towards addressing service delivery challenges. However, to ensure fair contribution by RE projects towards local government fiscus, this may require review of the zoning schemes and applicable policies and regulations whereby land owners would be required to apply for consent use (i.e. additional rights) that would allow local authorities to charge greater rates and taxes on land (mainly zoned for agriculture) where RE projects are located.

Based on the above, the following can be concluded:

Key questions	Comments/ responses
Overall suitability for wind and PV project development	• From a socio-economic perspective the Focus Area is generally suitable for renewable energy project development. • The Focus Area has a number of hot spots that relate to areas of touristic value, which will need to be avoided and development around which will need to be done following the other specialists guidelines with respect to buffer zones.
Where in the FA is development better suited?	• The development should first focus on the central and eastern parts of the FA, except for the area surrounding Swellendam that hosts the Bontebok National Park. These parts of the FA are associated with a lower concentration of tourism-related activities. In this instance, they may become the destination for tourists interested in viewing RE projects, which in turn may stimulate the growth of the existing tourism industry in the other parts of the FA. • Projects should ideally be spread over a bigger spatial extent than be clustered around a specific community to reduce the potential negative impact on one community and to spread the economic and job creation benefits over a wider territory. However, such developments should be planned accordingly to prevent development of informal settlements and spread of associated negative socio-economic impacts.

Key questions	Comments/ responses
FA specific mitigation measures	• Areas of high touristic value that directly or indirectly generate revenue for the local tourism industry should be considered and developments around these should be done outside the buffer zone delineated by other specialists. • Areas of intensive agricultural activities should be avoided for solar PV project deployment, but can be considered for wind project developments. • Planning for a possible sharp increase in population in the area and specifically in and around the existing settlements and towns will need to be done accordingly; provision of accommodation, social services and basic services will need to be planned for in advance to ensure the standards of services are retained as a minimum. • A socio-economic impact assessment study considering impacts that could be exerted on the local tourism industry will need to be undertaken for each proposed wind project. • Cumulative impact on agriculture that could ensue from a large roll-out of PV projects in the area will need to be determined and include quantification of the agricultural sector opportunity costs associated with this a large roll-out of PV projects and identification of the threshold levels for land sterilisation in the FA.

3.3 Focus Area 2: Komsberg Focus Area potential impacts

Given the socio-economic profile presented earlier for Komsberg FA, a number of sensitive receptors can be identified among which are eco-tourism and commercial game farming, leisure tourism, commercial agriculture, and communities. Proximity of the northern border of the FA with respect to Sutherland, where astro-tourism is planned to be developed should also be take due cognisance. Considering the sensitivities of these receptors to wind and PV projects, as well as the socio-economic environment of the Focus Area described earlier in the report, the following table describes the potential socio-economic impacts that could ensue in the area.

Beneficiary/sensitive receptor	Potential impacts experienced	FA specific description
Local economy	• Growth of the local economy during construction and operational phases • Increase in government revenue	• The area has a small economic base, but also a very small labour force due to low population densities. The agricultural sector is the dominant economic activity outside a few urban areas located in the FA; however, it has experienced significant decline in the past few years. • Construction and operation of wind or PV projects would be associated with the injection into the local economic base, which will lead to the diversification of the local economy and stimulate its development. • Careful placement of wind and PV projects can complement the tourism activities and stimulate economic growth in the zone. Development of tourism on the backbone of renewable energy projects has already been identified by the Karoo Hoogland LM as one of the means to stimulate its economy.
Local labour force	• Development of temporary and permanent employment positions in	• In recent years the number of employed dropped by 20.3% in the FA, which was mainly attributed to shedding of jobs by the agricultural sector; since most of the jobs are semi-skilled and unskilled, i.e.

Beneficiary/sensitive receptor	Potential impacts experienced	FA specific description
	the local communities • Development of skills, particularly in construction and renewable energy generation industries	the same as in the agricultural sector, these projects could offset the increasing trend in agricultural sector's employment decline. • Due to low population densities and a limited number of settlements observed in the FA, finding a workforce to support construction and operations could be problematic, particularly if projects are to be located far away from the exiting towns and settlements. This will most likely mean that much of the workforce may need to come from the areas outside the FA; it also means that on-site construction camps will need to be developed.
Non-arable or degraded land not used for any commercial activity or used for grazing	• Improved economic value derived from land as a factor of production due to change in land use • Offset of declining employment trends in the agricultural sector	• Grazing is a dominant land use in the FA. On a hectare basis, such projects are associated with a much lower added value and job creation potential than solar PV projects, for example. • Considering that the local agricultural sector has experienced a sharp decline in the production output and labour absorption capacity, the development of renewable energy projects and particularly solar PV projects in the area could lead to the derivation of greater economic value from the land parcels that are either not suitable or associated with low productivity levels when it comes to commercial agricultural land uses.
Commercial agricultural activities	• Economic and job losses in the local livestock farming community due to land sterilisation	• As mentioned earlier, local agricultural activities are predominantly dominated by livestock grazing, although there are pockets of intensive agricultural activities that can be found in certain parts of the FA. • Development of PV projects is associated with a notable footprint that does not generally allow for continuation of agricultural activities within the footprint area. Although there are numerous examples globally where solar PV projects are co-located with livestock or crop production, such practices can be associated with greater construction and/or operating expenses and are yet to be tested and adopted in South Africa. • Although the impact of one solar PV project on the land used for grazing may result in a positive net socio-economic effect, a large roll-out of PV projects could have a negative cumulative impact on livestock farming in the area that may lead to negative multiplier effects on other industries; thus this should not be ignored. Furthermore, development of solar PV projects in areas characterised by high productive agricultural land could have a negative impact on agricultural activities and raise concern over food security; thus such areas should be avoided or undergo project-specific socio-economic impact studies.
Leisure tourism and commercial game farming	• Economic and job losses in the local tourism industry as a result of the changes in the sense of place	• The western area is noted for its tourism value associated with the established private and government nature reserves; this area is a clear no-go zone particularly for wind projects. However, any project developed in the western corner of the FA should be accompanied by a comprehensive socio-economic impact study focusing on the local tourism activities. • New touristic projects aimed for the Laingsburg LM should be carefully studied before placing any

Beneficiary/sensitive receptor	Potential impacts experienced	FA specific description
		kind of renewable energy project in the municipality. • The location of Sutherland and the SAAO outside of the northern boundary of the FA implies an influx of tourist crossing the FA from Cape Town to reach this hotspot. For some, passing through the area containing wind or solar PV projects could be a deterrent during their next trip; however, other tourists may find such changes to landscapes of interest particularly if they only pass though the area and not stay in the area.
Local communities	• Altered sense of place and deterioration of living and working conditions due to various environmental impacts • Change in demographics of the areas due to influx of workers and job seekers • Increase in social pathologies associated with the influx of migrant labourers and job seekers to the area (health, crime, prostitution, xenophobia, etc.) • Added pressure on basic services and social and economic infrastructure • Improved access to social facilities and infrastructure during operations	• The FA is associated with very low population densities. The FA has only two major settlements located on the southern border and is characterised by a limited road network traversing the area. • The FA is rural and has not experienced any major changes to its natural environment aside from a few areas where urban settlements or road networks are found. Any development of the nature analysed in this study will bring about the change in the sense of place, alternating the living conditions. • As with any major development, a large roll-out of projects will most likely also lead to an influx of job seekers into the area. Considering that the FA is sparsely populated and experiences certain service delivery challenges, it is most likely that the local area will not be able to cope with a sudden increase in population due to migrating workers and job seekers. More specifically, this could lead to further growth of informal settlements and the establishment of new informal settlements; reduce the ability of the existing social facilities to provide adequate services to the population; increase social pathologies; and generally divide the population leading to their unhappiness and dissatisfaction with living conditions. • During operations though, the funds allocated for SED and ED could be directed towards addressing the weaknesses in the social infrastructure. The projects will also create additional revenue for the local government that could be directed towards addressing service delivery challenges. This could ultimately improve the standard of living in the FA, provided the funds are spent effectively and efficiently. However, to ensure fair contribution by RE projects towards local government fiscus, this may require review of the zoning schemes and applicable policies and regulations whereby land owners would be required to apply for consent use (i.e. additional rights) that would allow local authorities to charge greater rates and taxes on land (mainly zoned for agriculture) where RE projects are located.

Based on the above, the following can be concluded:

Key questions	Comments/responses
Overall suitability for wind and PV project development	• From a socio-economic perspective the FA is generally suitable for renewable energy project development; however, inherent socio-economic conditions may create major difficulty in implementing the projects particularly if they are located further away from major roads and settlements. • The FA has a number of hot spots that relate to areas of touristic value; development around these will need to be done following the other specialist guidelines with respect to buffer zones.
Where in the FA is development better suited?	• From a socio-economic perspective, developments should ideally first be rolled-out in the north-central and north-western parts of the FA; however, other parts except for the western corner of the FA could be suitable but will need to be investigated on a project by project basis. • Due to the population densities applicable to the FA, it would be advisable that projects are clustered together rather than spread over a bigger territory. This would assist with appropriate planning for accommodation, services, and general logistics, and could minimise the negative impacts in the area associated with the influx of job seekers and workers.
FA specific mitigation measures	• Considering the population densities in the area and the location of service centres and economic activities, the roll-out of projects should ideally be done following a clustering approach, where certain areas are chosen first for development of wind or PV projects, instead of projects being spread throughout the entire FA. • Planning for a sharp increase in population in the area and specifically in and around the existing settlements will need to be done; provision of accommodation, social and basic services will need to be planned accordingly to ensure the standards of services are retained. • Areas of high touristic value, i.e. private and government nature reserves, should be avoided. This specifically refers to the westerner corner of the FA. • Development of wind projects at the northern boundary of the FA, which is close to Sutherland, should also be accompanied by a comprehensive socio-economic study to determine whether such projects could potentially have a negative impact on the government's vision to develop astro-tourism in the area • Development of wind projects in the western corner of the FA should be subjected to a socio-economic impact assessment to investigate the potential impact on local tourism. • Where PV projects are to be developed on land currently used for agricultural activities, the possibility for co-location of the plant and livestock or crop production should be examined and, where feasible, implemented.

3.4 Focus Area 3: Cookhouse Focus Area potential impacts

With reference to the strategic policies review and socio-economic profile presented earlier for Cookhouse FA, sensitive receptors in this FA include the tourism industry reliant on the aesthetics and natural beauty of the area, communities and the agricultural sector. Considering the sensitivities of these receptors to wind and PV projects, as well as the socio-economic environment of the Focus Area described earlier in the report, the following table describes the potential socio-economic impacts that could ensue in the area.

Beneficiary/sensitive receptor	Potential impacts experienced	FA specific description
Local economy	• Growth of the local economy during construction and operational phases • Increase in government revenue	• The local municipalities' economy is relatively dependent on the tourism sector that will be sensitive to any change in the sense of place; furthermore, the municipalities are experiencing significant budgetary constraints, which means that any decline in local economic activity leads to the decline in the revenue stream for these local economies. • Construction and operation of wind or PV projects would be associated with the injection into the local economic base, which will lead to the diversification of the local economy and provide additional revenue for government to enable it to address the needs of the communities and improve their standard of living.
Local labour force	• Development of temporary and permanent employment positions in the local communities • Development of skills, particularly in construction and renewable energy generation industries	• Employment in the local municipalities that are covered by the FA declined sharply (24.7%) in the 2005-2011 period with approximately 18 770 jobs being lost in the agricultural sector alone. The secondary sector lost roughly 810 jobs with the manufacturing and construction sectors experiencing the majority of these layoffs. • Development of wind and PV projects is associated with a notable increase in employment opportunities during construction and a small increase in job creation during operations. Since the jobs lost and the jobs to be created by the construction and operation of the projects are of similar skills profile, jobs created through the construction of new projects as well as those maintained through operations will partially offset the job losses experienced in the past and would provide the communities in the FA with an additional income stream.
Non-arable or degraded land not used for any commercial activity or used for grazing	• Improved economic value derived from land as a factor of production due to change in land use • Offset of declining employment trends in the agricultural sector	• Local agricultural activities include both livestock grazing and pockets of intensive crop production. Grazing is the dominant land use in the FA. Although commercial farming is not the mainstay of economic activity within the FA, the agricultural sector has come under immense strain with a large number of layoffs. • As mentioned earlier, on a hectare basis, solar PV projects tend to create a bigger added value and more jobs than commercial livestock farming. Considering that the sector has also experienced significant job losses in the past few years, development of solar PV projects in the area could offset these negative trends, particularly considering the fact that the labour pool used by livestock farming and solar PV projects is largely the same and comprises unskilled and semi-skilled people.
Commercial agricultural activities	• Economic and job losses in the local agricultural sector due to land sterilisation	• The FA has pockets of intensive crop production, which are mainly situated along the rivers south of Cookhouse and Bedford. Any development that may sterilise these land parcels will negatively impact on the agricultural sector in the area, have the potential to affect food security and could worsen the employment situation in the agricultural sector that has been on the decline. • As mentioned earlier, co-location of solar PV projects with livestock grazing and some crop production is practiced in other parts of the world. However, such practices are yet to be implemented in South

Beneficiary/sensitive receptor	Potential impacts experienced	FA specific description
		Africa. Some barriers for their implementation can be associated with greater construction (need for higher mounting structures and improved protection of cables) and/or operating expenses (i.e. additional ground maintenance). • Until co-location of solar PV plants and livestock and crop production is integrated in land use practices in the country, large roll-out of solar PV projects will have the risk of creating negative impacts on the livestock farming or commercial crop production industry in the area, which may lead not only to the decline in the sector's output but also job losses.
Leisure tourism and commercial game farming	• Economic and job losses in the local tourism industry as a result of the changes in the sense of place	• Certain sections within the FA have been demarcated to have potential for tourism development and growth; furthermore a number of areas, notably within the Makana area, are heavily reliant upon tourism earnings. The entire south-eastern portion of the FA is also dependent on the earnings and jobs created by private game farms and reserves. • The development of wind or PV projects would undoubtedly change the natural attractiveness of the area and may lead to the decline in the domestic and international tourists visiting the area, which may negatively impact the local tourism industry. • The feedback received from the affected parties shows that the local game farming industry is against any development in the area that may impact on their revenue and job creation. Aside from these negative impacts, having the local stakeholders opposing projects may jeopardise the roll-out of projects and considering that the concerns raised by potentially affected parties are valid, buffer zones proposed by other specialists should be adhered to and development of wind or PV projects should be done outside thereof.
Local communities	• Altered sense of place and deterioration of living and working conditions due to various environmental impacts • Change in demographics of the areas due to influx of workers and job seekers • Increase in social pathologies associated with influx of migrant labourers and job seekers to the area (health, crime, prostitution, xenophobia, etc.) • Added pressure on basic services and social and economic infrastructure	• The area is sparsely populated with major urban settlements being located on the outskirts of the FA. However, such areas are located in different parts of the FA, which allows for a greater distribution of projects spatially to disperse the potential negative impacts. The development of projects may require the establishment of construction camps, depending on how far the location of the selected projects are relative to the closest communities that could host migrant workers. • Movement of workers and job seekers may be experienced within the FA, as well as from outside the FA, which may cause unrest and increase social pathologies. • Local communities may encounter challenges with respect to basic service delivery and housing. Furthermore, due to the sparsely populated nature of the FA, certain social and economic infrastructural elements are not well developed. The situation may be exacerbated for projects that are developed without adequately addressing the condition of road networks, capacity of health facilities, and availability of affordable accommodation. • Considering the SED and ED commitments applicable to all RE projects that form part of the RE IPPPP, the funds allocated for SED and ED during the operational stage of the projects could be

Beneficiary/sensitive receptor	Potential impacts experienced	FA specific description
	• Improved access to social facilities and infrastructure during operations	directed towards addressing the gaps in service delivery and social infrastructure in the area. This could ultimately improve the standard of living in the FA, provided the funds are spent effectively and efficiently. The projects will also create additional revenue for the local government that could be directed towards addressing service delivery challenges. However, to ensure fair contribution by RE projects towards local government fiscus, this may require review of the zoning schemes and applicable policies and regulations whereby land owners would be required to apply for consent use (i.e. additional rights) that would allow local authorities to charge greater rates and taxes on land (mainly zoned for agriculture) where RE projects are located.

Based on the above, the following can be concluded:

Key questions	Comments/ responses
Overall suitability for wind and PV project development	• From a socio-economic perspective the FA is generally suitable for renewable energy project development as large tracts of non-sensitive land exist in the FA; however, due to the nature of economic activities found in the area and the development plans, the eastern portion of the FA is less suitable for deployment of RE projects than the western portion.
Where in the FA is development better suited and should it be clustered or spread?	• From a socio-economic perspective, development should first focus on the central to western parts of the FA – these areas are free of tourism hot spots and are characterised as low sensitivity areas - where the eastern part of the FA has been demarcated as a tourism focus area. Although the areas currently demarcated for the extension of national parks (notably within the Blue Crane, Nxuba and Nkonkobe LMs) will require consideration at the time of the development of projects. • Projects should ideally be spread over a bigger spatial extent than be clustered around a specific community to reduce the potential negative impact on one community and to spread the economic and job creation benefits over a wider territory. At the same time, development of projects would need to be done in such a way as to avoid congesting roads that are frequently used by tourists as this may also deter them from visiting the area in the future.
FA specific mitigation measures	• The development of wind or PV facilities near to the hot spots (i.e. touristic value areas) would be required to adhere to buffer zones developed for wind and PV projects, and meet the requirements specified by environmental specialists. • A socio-economic impact assessment study focusing on the negative impacts that could be exerted on the local tourism industry will need to be undertaken for each renewable energy project suggested to ensure that it does not negatively impact on the tourism sector or the potential for its further development. It will be imperative for such a study to consider the cumulative impact of all projects already located or planned to be located in the area. • The development of PV projects should avoid productive agricultural land. Solar PV projects should be prioritised for development in areas of low to medium agricultural potential that are not yet utilised for any commercial activities or are used for livestock farming only. However, care will need to be taken to ensure that the cumulative impact on commercial livestock farming in the area does not become significant and lead to the notable

Key questions	Comments/ responses
	multiplier effects; in such cases, co-location of solar PV projects with commercial grazing activities should be considered. • Appropriate planning for the provision of adequate basic and social services will need to be undertaken in light of the potential influx of people to the area. • The road network and the conditions of the local roads will need to be addressed to eliminate further impact living conditions in the area. • Logistics associated with delivery of materials/workers to the sites will need to be planned in such a way as to reduce traffic congestion of routes frequented by tourists.

3.5 Focus Area 4: Stormberg Focus Area potential impacts

Considering the use and socio-economic profile created for Stromberg FA, agriculture, mining, and households populating the eastern side of the FA, which forms part of the former homeland, are among the most sensitive receptors in this FA. Considering the sensitivities of these receptors to wind and PV projects, as well as the socio-economic environment of the Focus Area described earlier in the report, the following table describes the potential socio-economic impacts that could ensue in the area.

Beneficiary/sensitive receptor	Potential impacts experienced	FA specific description
Local economy	• Growth of the local economy during construction and operational phases • Increase in government revenue	• The development of rural communities to improve their standard of living is on the agenda of all municipalities. • Although local governments do not state the development of renewables to be among the priority sectors, the need to diversify the economic base of the assessed municipalities and offset the decline in the agricultural sector is significant. • Construction and operation of wind or PV projects would be associated with the injection into the local economic base, which will lead to the diversification of the local economies and stimulate their development. • It will create a new sector and will diversify the economic activities in rural areas diminishing the dependencies on the agricultural sector which has experienced large job losses.
Local labour force	• Development of temporary and permanent employment positions in the local communities • Development of skills, particularly in construction and renewable energy generation industries	• The employment in the local municipalities that are covered by the FA has declined sharply in the last few years with the majority of jobs being lost in the agricultural and construction sectors. • The FA's considerable high unemployment rate could be reduced significantly if projects were implemented providing job opportunities in the construction (temporary basis) and utility sectors (permanent basis). • Since most of the jobs created through the development of wind or PV projects are semi-skilled and

Beneficiary/sensitive receptor	Potential impacts experienced	FA specific description
		unskilled, i.e. the same as in the agricultural and construction industries, these projects could offset the increasing trend in employment decline in the respective sectors, providing new sources of income for the affected households.
Commercial mining activities	• Sterilisation of land from mining activities	• The FA has some parcels of land suitable for mining considering the mineral resources. • Development of wind or solar PV projects could potentially sterilise this land from mining activities, which may be associated with large opportunity costs. Therefore, any development in the zones of mineral rights, either lapsed or existing, will need to be done following a proper assessment to ensure that the proposed RE project does not prevent from mining activities to be expanded or initiated in the respective areas anytime during construction or operation of the RE projects.
Non-arable or degraded land not used for any commercial activity or used for grazing	• Improved economic value derived from land as a factor of production due to change in land use • Offset of declining employment trends in the agricultural sector	• Much of the land in the FA has moderate agricultural potential and is used for commercial agricultural activities. There are also vast tracks of land that are degraded and land that is used for grazing. • Development of solar PV projects that generally require access to large parcels of land may increase the productivity of these parcels of land, leading to a greater value and employment generated from it compared to the current uses. This will assist in offsetting a rapid decline in the number of jobs created by the local agricultural sector.
Commercial agricultural activities	• Economic and job losses in the local agricultural sector due to land sterilisation	• This impact will be more applicable to the development of PV projects. These projects are associated with a notable footprint and current practices that exclude co-location of solar PV projects with livestock or crop production imply that development thereof would sterilise land from agricultural activities practiced on it at the moment. • The FA has vast pockets of land used for commercial crop production and even plantations. The eastern part of the FA also has moderate potential arable land. Establishment of solar PV projects in these areas, without allowing for integration of agricultural and solar PV projects, would most likely lead to the sterilisation of productive agricultural land that will further reduce the size and labour absorption capacity of the local agricultural sector. This may destabilise the local economy, although development of solar PV projects could potentially offset some of the negative impacts; however, such a trade-off is not desirable in the context of the local economy.
Leisure tourism and commercial game farming	• Economic and job losses in the local tourism industry as a result of the changes in the sense of place	• The FA has very little tourism attraction with few tourists visiting the area annually. • Development of wind or PV projects would not have a considerable impact on tourism earnings in the FA.
Local communities	• Loss of sustainable income or decline in food security derived from subsistence farming • Altered sense of place and deterioration of living and working	• The area is populated with major urban settlements on the outskirts of the FA, however, the largest urban area (Queenstown) is located within the borders of the FA. A larger number of smaller settlements and communities populate the eastern half of the FA and would be positively or negatively impacted depending on the nature of the effects. • Establishment of PV projects that could lead to sterilisation of land may lead to the loss of land used

Beneficiary/sensitive receptor	Potential impacts experienced	FA specific description
	conditions due to various environmental impacts • Change in demographics of the areas due to influx of workers and job seekers • Increase in social pathologies associated with influx of migrant labourers and job seekers to the area (health, crime, prostitution, xenophobia, etc.) • Added pressure on basic services and social and economic infrastructure (during construction) • Improved access to social facilities and infrastructure (during operations)	for subsistence farming. This is particularly applicable to the central and southern parts of the eastern side of the FA. This would be detrimental to the households dependent on this activity as a supplement to their other income sources, unless these households become direct beneficiaries of the established projects and thus are allowed to substitute their losses with rental income derived from land leasing agreements. • The particularly densely populated eastern side of the FA may be self-sufficient in providing the majority of the workforce required for the construction and later for operation of wind and PV projects considering the need for semi-skilled and unskilled workers. This could somewhat reduce the potential magnitude of influx of people to the area. Nonetheless, some movement of workers and job seekers may be experienced within the FA, as well as from outside the FA, which may cause unrest and increase social pathologies. The western side of the FA may experience greater challenges in this respect than the eastern side. • Local communities face notable challenges with respect to basic service delivery and housing. Furthermore, due to the relatively rural nature of the FA, certain social and economic infrastructural elements are not well developed. The situation may be exasperated if projects are developed without adequately addressing the road network, health facility, and accommodation needs. The western side of the FA may experience greater challenges in this respect than the eastern side. • Considering the SED and ED commitments applicable to all RE projects that form part of the RE IPPPP, the funds allocated for SED and ED during the operational stage of the projects could be directed towards addressing the pertinent needs of the local communities. This could ultimately improve the standard of living in the FA, provided the funds are spent effectively and efficiently. The projects will also create additional revenue for the local government that could be directed towards addressing service delivery challenges. However, to ensure fair contribution by RE projects towards local government fiscus, this may require review of the zoning schemes and applicable policies and regulations whereby land owners would be required to apply for consent use (i.e. additional rights) that would allow local authorities to charge greater rates and taxes on land (mainly zoned for agriculture) where RE projects are located.

Based on the above, the following can be concluded:

Key questions	Comments/ responses
Overall suitability for wind and PV project development	• From a socio-economic perspective the FA is generally suitable for renewable energy project development; however, it can be argued that it is more fitting for wind rather than PV projects. • The FA has various hot spots that relate to areas of mining, nature reserves and farming (i.e. commercial and subsistence) which will need to be avoided.
Where in the FA is development better suited?	• The development should first focus on the central to northern part of the FA, which is associated with greater tracts of low sensitivity areas from a socio-economic perspective. However, existing mining, tourism and agricultural activities should be avoided or considered during project design and deployment, and any impact on these activities avoided or minimised. • Areas on the eastern side are more suitable for wind projects than for PV projects due to the nature of activities and the footprint of infrastructure associated with proposed projects.
FA specific mitigation measures	• The development of wind or PV facilities near the existing tourist attractions would be required to adhere to a buffer zone and meet the requirements specified by environmental specialists. Furthermore, areas identified for the potential expansion of national parks should be considered in any future project development in case their status changes by the time the development takes place. • The development of PV projects should avoid high-potential commercial agricultural land or co-location practices of solar PV projects, and agricultural activities should be considered for implementation. • Development in areas used for subsistence farming could be considered for solar PV projects, particularly if integration of agricultural practices and these projects could be allowed. This though may be difficult considering the nature of subsistence farming and the need to ensure security and guarantees of such projects. In instances where co-location cannot be allowed for practical reasons, it would be imperative to ensure that the affected households are not put in a worse position and that their losses from subsistence farming are adequately substituted by income derived from leasing of land for RE projects. • Development of both wind and PV projects should take into considering areas zoned for mining activities or areas that are inherent with mineral resources. Development in these areas should either be avoided or follow a proper assessment and project design that would ensure that they do not prevent the mineral resources from being extracted in the future. • Development in the densely populated areas, i.e. the eastern side of the FA, should ideally be spread over a larger territory to benefit a larger population; while development in the areas that are sparsely populated, i.e. the western side the FA, should be clustered in one area to optimise the use of resources and minimise the negative social impacts that could ensue.

3.6 Focus Area 5: Kimberley Focus Area potential impacts

The following table describes the potential socio-economic impacts that could ensue in the area, considering the socio-economic profile and land uses in the area.

Beneficiary/sensitive receptor	Potential impacts experienced	FA specific description
Local economy	• Growth of the local economy during construction and operational phases • Increase in government revenue	• The provincial policies of both the Northern Cape and the Free State explicitly support the development of renewable energy projects, especially those that will aid in growth and development of local economies. • The development of the wind and solar PV projects will further boost the focus area's secondary sector, which has experienced some steady increases in the levels of output in the past few years; importantly it will increase the local economic base and assist in diversifying local activities. • The development of wind and solar PV projects will aid in revenue generation for some predominantly rural municipalities in the focus area, which have been struggling financially.
Local labour force	• Development of temporary and permanent employment positions in the local communities • Development of skills, particularly in construction and renewable energy generation industries	• The municipalities that are part of the FA have experienced some excessive decline in the levels of employment mainly in the agricultural, trade, and manufacturing sectors. Employment has also been on the decline within the mining sector as more mines continue to close due to extinction of minerals or financial unavailability of further mining. • The FA's unemployment rate of 23.7% could be reduced significantly, if projects were implemented providing job opportunities in the construction (temporary basis) and utility sectors (permanent basis), as well as other supporting industries such as trade and services. • Since most of the jobs required to build and maintain the renewable projects are semi-skilled and unskilled, i.e. the same as in the agricultural, construction, and mining sectors, these projects could offset the increasing trend in agricultural, construction, and mining sectors' employment decline.
Non-arable or degraded land not used for any commercial activity or used for grazing	• Improved economic value derived from land as a factor of production due to change in land use • Offset of declining employment trends in the agricultural sector	• From a land use perspective, the FA is dominated by agricultural activities and primarily livestock farming. Agriculture made a notable contribution towards job creation in the past; however, due to continuous decline in its labour absorption capacity, thousands of people have lost jobs in the sector between 2005 and 2011. • Grazing activities though are associated with a lower positive socio-economic impact than solar PV projects, for example. Therefore, substitution of existing livestock farming with solar PV projects could lead to a more productive use of land that is otherwise not suitable for intensive agricultural activities or for development of other economic activities due to location or other factors. This would translate into creating an additional value add in the local economies, new streams of government revenue and importantly, job creation.
Commercial agricultural activities	• Economic and job losses in the local agricultural sector due to land	• Commercial agriculture dominates land uses in the western parts of the focus area around Barkley West. There are also a lot of agricultural activities taking place in the eastern parts of the focus area

Beneficiary/sensitive receptor	Potential impacts experienced	FA specific description
	sterilisation	with Tswelopele LM being the major producer of maize in the whole of the Free State. • Since integration of crop production and solar PV projects has not yet been seen in South Africa, development of these projects may result in sterilisation of these parcels of land, which may further exacerbate the performance of the agricultural sector and lead to greater job losses in the industry. This could also have some negative impacts on food security.
Commercial mining	• Opportunity costs assisted with the loss of potential income and job creation from exploitation of mineral deposits	• There are a lot of mining activities taking place especially in the western parts of the focus area within the Northern Cape. • The SDF for the Tokologo LM explicitly states that there are a lot of mineral deposits within the area, most of which have not yet been fully exploited. • The development of the wind and PV projects, which could lead to sterilisation of mineral deposits, would mean foregoing potential benefits from mining activities in some parts of the focus area.
Leisure tourism and commercial game farming	• Economic and job losses in the local tourism industry as a result of the changes in the sense of place	• Tourism activities are prominent in the areas around Kimberley and in the Tokologo LM. • Development of wind or PV projects could change the natural attractiveness of the area. • A single or large roll-out of either PV or wind projects will lead to the change in the sense of place and, depending on the location of the projects relative to tourism hotspots, may lead to the decline in the number of domestic and international tourists visiting the sites in the focus area and thus the decline in the tourism industry in the area.
Local communities	• Altered sense of place and deterioration of living and working conditions due to various environmental impacts • Change in demographics of the areas due to influx of workers and job seekers • Increase in social pathologies associated with influx of migrant labourers and job seekers to the area (health, crime, prostitution, xenophobia, etc.) • Added pressure on basic services and social and economic infrastructure (during construction) • Improved access to social facilities and infrastructure (during operations)	• The FA is characterised by an increasing population growth coupled with an influx of labour migrants scouting for economic opportunities. As a result most municipalities, especially the Sol Plaatjie LM, are faced with basic services backlogs and adequate social infrastructure provision. • The development of wind and solar PV projects will further attract more migrants, hence adding pressure on service delivery in some parts of the FA during the time when projects are being developed. • The continued influx of migrant labourers and job seekers might also result in social unrest and this is especially true considering the high rate of unemployment and low levels of education applicable in most parts of the FA. • During operations, the commitments to SED and ED could potentially address some of the challenges in the FA with respect to access to social facilities. The projects will also create additional revenue for the local government that could be directed towards addressing service delivery challenges. However, to ensure fair contribution by RE projects towards local government revenue, this may require review of the zoning schemes and applicable policies and regulations whereby land owners would be required to apply for consent use (i.e. additional rights) that would allow local authorities to charge greater rates and taxes on land (mainly zoned for agriculture) where RE projects are located.

Based on the above, the following can be concluded:

Key questions	Comments/ responses
Overall suitability for wind and PV project development	• From a socio-economic perspective the Focus Area is generally suitable for renewable energy project development. The area has already been scouted by many developers to establish solar PV projects and at least one project, i.e. Letsatsi Solar PV project, has already been built in the FA.
Where in the FA is development better suited and should it be clustered or spread?	• From a socio-economic perspective, the development should firstly focus on the central parts of the FA, which are associated with a lower concentration of agricultural, mining and tourism-related activities. • However, other parts of the FA are also suitable and development in these parts should proceed mindful of the on-site or nearby activities, such as agriculture, tourism, and mining. • Considering the population densities of the areas outside the Kimberley regions, clustering of projects in close proximity could be the preferred choice as it may assist in better mitigation of the potential impacts on the local communities than if the projects were to spread over a larger area.
FA specific mitigation measures	• High potential and productive commercial farmland should be avoided from development of PV projects as far as possible. • Co-location of solar PV projects and livestock farming should be promoted as far as possible. • Economic activities sensitive to visual impacts (i.e. tourist value spots such as nature reserves and game farms) should be avoided and developments in their proximity should be done following other specialist guidelines. Areas identified for the potential expansion of national parks should be considered in any future project development in case their status changes by the time RE projects are planned to be developed. • Areas that have mineral deposits should be considered before development proceeds to sterilised mineral resources.

3.7 Focus Area 6: Vryburg Focus Area potential impacts

Human settlements, game reserves, nature reserves and mining activities are scattered throughout the FA and are thus among the most sensitive receptors in the FA to from the socio-economic perspective. The following paragraphs outline the potential impacts that could ensue as a result of wind and PV projects development in the area considering the land uses and socio-economic profile of Vryburg FA.

Beneficiary/sensitive receptor	Potential impacts experienced	FA specific description
Local economy	• Growth of the local economy during construction and operational phases • Increase in government revenue	• The municipalities that are part of the FA have a limited economic base and are characterised by having a low economic growth rate of 1.8%, which is below the national average of 4%. • Growth within the FA is public sector-led growth. • Construction and operation of wind or PV projects would be associated with the injection into the local economic base, which will lead to the diversification of the local economy and stimulate its development.

Beneficiary/sensitive receptor	Potential impacts experienced	FA specific description
		• It will create a new sector and will diversify the economic activities in rural areas, diminishing the dependencies on the agricultural sector, which has been showing poor performance in the past few years both in terms of output and employment capacity, and on the tertiary sector that is dependent on the local purchasing power.
Local labour force	• Development of temporary and permanent employment positions in the local communities • Development of skills, particularly in construction and renewable energy generation industries	• The employment in the local municipalities that are covered by the FA has declined sharply in the last few years with the agricultural industry losing more than 10 000 jobs, followed by a declining labour absorption capacity of selected services industries. • The local economy is characterised by a small secondary sector that has limited capacity to produce and create more jobs for the locals. • The Focus Area's unemployment rate of 32.5% could be reduced significantly if projects are implemented providing job opportunities in the construction (temporary basis) and utility sectors (permanent basis), as well as services sector. • Since most of the jobs created during construction and operation of wind and solar PV projects are semi-skilled and unskilled, these projects could absorb most of the unemployed locals since almost 18% of the active population in the FA has no schooling at all while the other 22% only received some primary education. • The development of the projects could offset the increasing trend in agricultural and tertiary sectors' employment decline.
Non-arable or degraded land not used for any commercial activity or used for grazing	• Improved economic value derived from land as a factor of production due to change in land use • Offset of declining employment trends in the agricultural sector	• The FA has vast tracks of degraded land and land used for livestock farming. • Considering that solar PV projects have greater socio-economic benefits in terms of value add and job creation per hectare than livestock farming in areas of limited grazing potential, development of solar PV projects in some parts of the FA could lead to a more productive use of land. This could in turn create greater revenue for the local municipality and provide much needed employment to the local unskilled and semi-skilled labour force.
Commercial agricultural activities	• Economic and job losses in the local agricultural sector due to land sterilisation	• The FA includes large parcels of land used for intensive agricultural activities. And as has been described earlier in the report, the economy of the FA is highly dependent on commercial agriculture for job creation and rural development. The sectoral trends have been negative in the period between 2005 and 2011 suggesting that all efforts need to be made to ensure that no further losses in the sector occur. • Commercial farming activities, mainly along the peripheral zones of the FA in the western, northern and eastern parts of the FA, will be sensitive towards the development of solar PV projects since the adoption of PV projects could impact on high potential and productive agricultural land. Increasing loss of high potential and productive agricultural land in the area to PV facilities, unless as mentioned earlier it is integrated with existing agricultural activities, will further reduce the size and labour

Beneficiary/sensitive receptor	Potential impacts experienced	FA specific description
		absorption capacity of the local agricultural sector, which may further negatively affect the local economy leading to greater employment losses and decline on the sector's contribution towards the local economy. • Since crop cultivation can also be found in the FA, a large roll-out of wind energy projects in the high potential and producing agricultural land in the FA may lead to a significant negative cumulative socio-economic effect on the agricultural sector too.
Leisure tourism and commercial game farming	• Economic and job losses in the local tourism industry as a result of the changes in the sense of place	• Leisure and hunting tourism is one of the major economic activities characterising the FA due to the concentration of private game farms and nature reserves in the FA. These are largely concentrated in the central and southern parts of the FA. • Development of wind or PV projects could change the natural attractiveness and biodiversity of the area that is currently not associated with notable industrial activities or urban sprawl. • A single or large roll out of either PV or wind projects will lead to the change in the sense of place and depending on the location of the projects relative to tourism hotspots, may lead to the decline in the number of domestic and international tourists visiting the sites in the FA and thus the decline in the tourism industry in the area.
Mining sector	• Opportunity costs resulting in the loss of economic value added and employment associated with sterilisation of mineral deposits	• The eastern part of the FA and specifically the southern portion thereof is associated with a number of lapsed mining rights. These could still reflect the value of the land from a mineral perspective. Any development of such land could lead to notable opportunity costs as it could sterilise the area from the extraction of minerals and generation of value added from such activities.
Local communities	• Altered sense of place and deterioration of living and working conditions due to various environmental impacts • Change in demographics of the areas due to influx of workers and job seekers • Increase in social pathologies associated with influx of migrant labourers and job seekers to the area (health, crime, prostitution, xenophobia, etc.) • Added pressure on basic services and social and economic infrastructure (During construction)	• The area is sparsely populated with the two major urban settlements, Vryburg and Schweizer-Reneke, situated in the centre and south-eastern parts of the FA. Other settlements are found on the outskirts of the FA. The development of projects further away from these settlements and towns may require establishment of construction camps. • Movement of workers and jobs seekers may be experienced within the FA, as well as from outside the FA, which may cause unrest and increase social pathologies. • The more concentrated the development is in one particularly area, the greater the influx of people may be experienced. This means that the significant impacts associated with change in demographics, increase in social pathologies and added pressure on service delivery could be considerably greater if projects are clustered in one specific area than are distributed over a larger spatial extent. Timing of project development would though play an important role in this case. The greater the number of projects being implemented in one period of time, the greater the magnitude of the impact will be on the community. • Local communities have notable challenges with respect to basic service delivery and housing. Furthermore, due to the sparsely populated nature of the FA, certain social and economic

Beneficiary/sensitive receptor	Potential impacts experienced	FA specific description
	• Improved access to social facilities and infrastructure (during operations)	infrastructural elements are not well developed. The situation may be exasperated if projects are developed without adequately addressing basic service delivery challenges and increasing capacities of the existing social infrastructure. • Deployment of RE projects in the area will create an additional economic base and provide a new revenue stream for the local government that can be used to address some of the service delivery challenges. Furthermore, through the SED and ED commitments, these projects will most likely lead to improved access and quality of social services and economic infrastructure. However, to ensure fair contribution by RE projects towards local government revenue, this may require review of the zoning schemes and applicable policies and regulations whereby land owners would be required to apply for consent use (i.e. additional rights) that would allow local authorities to charge greater rates and taxes on land (mainly zoned for agriculture) where RE projects are located.

Based on the above, the following can be concluded:

Key questions	Comments/ responses
Overall suitability for wind and PV project development	• The Focus Area is generally suitable for renewable energy project development; however, the FA has a number of hot spots that relate to areas of touristic value which will need to be avoided and development around which will need to be done following the other specialist guidelines with respect to buffer zones, as well as areas of extensive agricultural and mining activities that would need to be avoided to ensure that projects do not contribute to decline of these sectors.
Where in the FA is development better suited and should it be clustered or spread?	• From a socio-economic perspective the development of wind projects should first focus on the eastern and northern parts of the FA, which are associated with lower mining and tourism-related activities. • Solar PV projects would be better suited in the south-western parts of the FA, which are associated with lower agricultural, mining and tourism-related activities. They may also be clustered in the central and eastern parts of the FA that is currently not used for any high productivity commercial activity or associated with touristic value. • Overall, though, deployment of RE projects should be spread throughout the area with the preference given to projects located closer to urban areas or projects scattered throughout the FA.
FA specific mitigation measures	• The development of solar PV projects should ideally not be concentrated in the northern and eastern peripheral zones of the FA due to high concentration of commercial farming activities taking place in those areas. If projects are developed on land currently used to derive economic value from agriculture, integration of the activities should be investigated and implemented as far as possible. • If there are any solar PV projects to be developed in the eastern parts, then these need to be situated on degraded land where they will not disturb high potential and productive agricultural activities dominant in that part of the FA. • Areas sensitive to visual impacts (i.e. tourist value spots such as nature reserves and game farms) should be avoided and developments

Key questions	Comments/ responses
	in their proximity should be done following other specialist guidelines. Areas identified for the potential extension for national parks should be considered in any future project development in case their status changes by the time RE projects are planned to be developed. • Areas that have mineral deposits should be avoided from development of any renewable energy project altogether. However, where it is clear that a project built on a piece of land that is zoned for mining would not prevent it from any future mineral deposits extraction, such projects could be considered.

3.8 Focus Area 7: Upington Focus Area potential impacts

Intensive agricultural activities and existing eco-tourism based on water-related activities along the Orange River, game farming activities, and residential areas are some of the sensitive receptors that can be found in the FA. The following table describes the potential impacts that could be expected to ensue from development of wind and solar PV projects in the area, considering the above sensitive receptors as well as other characteristics of the socio-economic environment applicable to the FA.

Beneficiary/sensitive receptor	Potential impacts experienced	FA specific description
Local economy	• Growth of the local economy during construction and operational phases • Increase in government revenue	• The local economy is highly dependent on the agricultural and tertiary services sectors with the former losing thousands of jobs in the past few years. • Development of renewable energy projects would diversify and revitalise the economies in the FA, provided they do not interfere with the spatial development plans of the municipalities and do not affect the performance of existing businesses, particularly in the agricultural and tourism industries.
Local labour force	• Development of temporary and permanent employment positions in the local communities • Development of skills, particularly in construction and renewable energy generation industries	• The FA has a lower unemployment rate than that of the assessed economies, however, one out of five people in the labour force is still unemployed. The problem is exacerbated by the declining labour absorption capacity of the agricultural sector that in the past created almost four out of ten jobs in the assessed economies. • The development of renewable energy projects in the area will positively impact on the employment situation and offset some of the job losses experienced in the past due to the nature of skills required during construction and operations. • A large deployment of renewables in the area will also lead to skills development.
Non-arable or degraded land not used for any commercial activity or	• Improved economic value derived from land as a factor of production due to change in land use	• Most of the FA comprises of grazing land with intensive agricultural activities being concentrated along the Orange River. • Development of RE projects and specifically solar PV projects that requite vast tracks of land in areas

Beneficiary/sensitive receptor	Potential impacts experienced	FA specific description
used for grazing	• Offset of declining employment trends in the agricultural sector	of limited agricultural productivity will create an opportunity for improving the value added and job creation potential derived from these parcels of land. This will particularly be the case if renewable energy projects are co-located with existing agricultural activities, which has yet to be implemented in South Africa.
Commercial agricultural activities	• Economic and job losses in the local agricultural sector due to land sterilisation	• The areas along the banks of the Orange River can be considered to be a backbone of the local economy in the FA due to high productive agricultural land located in these areas. • Any developments, but more so for solar PV than wind, has the potential to impact on productive agricultural land for the duration of the project. Unless the deployment of solar PV and wind projects is done following a co-location approach, such projects will sterilise the affected parcels of land. • If co-location is not pursued, this could lead to a further decline of the agricultural sector and its employment, which would not only affect local households but households in other parts of the country, whose jobs rely on the agricultural produce derived from the region. However, as mentioned earlier, the FA area has vast parcels of land located outside the immediate vicinity of the Orange River and should therefore be prioritised for project development.
Leisure tourism and commercial game farming	• Economic and job losses in the local tourism industry as a result of the changes in the sense of place	• The FA encompasses a demarcated tourism corridor along the Orange River and the N14. The areas along the banks of the Orange River are associated with high touristic value associated with the existing grape farms and natural scenery. Some areas are already capitalising on this comparative advantage, while others are yet to develop to its full potential. • Development of any renewable energy project in proximity of these areas or inside these areas would lead to a change in the aesthetics of the area and could potentially reduce the touristic value thereof. This could result in the loss of revenue by the existing tourism establishments or the opportunity costs related to the unrealised tourism potential.
Local communities	• Altered sense of place and deterioration of living and working conditions due to various environmental impacts • Change in demographics of the areas due to influx of workers and job seekers • Increase in social pathologies associated with influx of migrant labourers and job seekers to the area (health, crime, prostitution, xenophobia, etc.)	• The FA encompasses a number of towns, which are primarily located on its boundaries or along the Orange River. The other parts of the FA are sparsely populated as they are dominated by farms. • Since the majority of the FA is associated with natural beauty, development of renewable energy projects could lead to the notable change in the sense of place particularly in those areas that are remotely located from towns and settlements. • A few solar projects are already constructed in the area with some to come online in the next year or two. The area, and specifically Upington, has already seen some challenges with respect to the provision of adequate services and accommodation to address the increase in population due to the influx of job seekers and contractors. • Further development of the FA with respect to renewable energy projects will continue to put pressure on the local government and other stakeholders to maintain a good standard of service delivery and successfully manage social pathologies.

Beneficiary/sensitive receptor	Potential impacts experienced	FA specific description
	• Added pressure on basic services and social and economic infrastructure (during construction) • Improved access to social facilities and infrastructure (during operations)	• Overall, the towns in the FA can be expected to continue experiencing a positive net migration trend, which would increase the demand for social and economic infrastructure particularly during the construction phases of the projects. • During operations, revenue derived by the local government from the established new economic activities and SED and ED commitments will most likely assist in maintaining good service delivery and addressing some of the weaknesses in the existing social and economic infrastructure. However, to ensure fair contribution by RE projects towards local government revenue, this may require review of the zoning schemes and applicable policies and regulations whereby land owners would be required to apply for consent use (i.e. additional rights) that would allow local authorities to charge greater rates and taxes on land (mainly zoned for agriculture) where RE projects are located.

Based on the above, the following can be concluded:

Key questions	Comments/ responses
Overall suitability for wind and PV project development	• The FA is generally suitable for development of renewables; however, areas of touristic value and high productive agricultural land along the banks of the Orange River should be avoided.
Where in the FA is development better suited and should it be clustered or spread?	• Most of the FA is suitable for deployment of renewable energy projects; however, the south-western part of the FA, considering the distance from settlements and the fact that not many tourism projects are developed in this area, may be more preferred for project development than the other parts of the FA. • Clustering of projects far away from the nearby towns should ideally be avoided to prevent development of informal settlements in these areas. Projects could be spread either throughout the FA or developed in clusters around the towns.
FA specific mitigation measures	• Although some PV projects are currently developed in the area and even along the Orange River, it should be done in such a way as to avoid sterilisation of productive agricultural land or areas that could be converted into productive agricultural land by extending irrigation systems bringing water from the river to the farms. Considering the presence of the tourism industry being reliant on the Orange River, it would be advisable to avoid developing both wind and solar PV projects too close to the banks of the Orange River to prevent negative impacts on the local agricultural and tourism activities. • The development objective associated with the deployment of PV projects should focus on complementing the agricultural sector, rather than substituting the agricultural activity with solar PV projects. Therefore, co-location of solar PV projects with any agricultural activity on the parcel of land where a project is planned to be developed should be investigated and where feasible implemented. • Development of projects in the areas of issued and lapsed mining rights should be done following an investigation into viability and absence of the impact on sterilisation of mineral deposits.

Key questions	Comments/ responses
	• Local government and other stakeholders will need to plan accordingly for a possible sharp increase in population in the towns located in the FA; provision of accommodation, social services and basic services will need to be planned for in advance to ensure the standards of services are retained as a minimum.

3.9 Focus Area 8: Springbok Focus Area potential impacts

Mining and tourism are the core activities in the FA. Considering these sensitive receptors and other socio-economic characteristics of the FA, the following table outlines the potential socio-economic impacts that could ensue from development of wind and solar PV projects in the area.

Beneficiary/sensitive receptor	Potential impacts experienced	FA specific description
Local economy	• Growth of the local economy during construction and operational phases • Increase in government revenue	• The economy of the LMs, which form part of the FA, are stagnant. • The mining sector is the dominant economic activity in the FA; however, in recent years this activity has been declining in the LMs encompassing the FA. • Construction and operation of wind or solar PV projects would be associated with the injection into the local economic base, which will lead to the diversification of the local economy and stimulate its development. • Careful placement of wind and PV projects can complement the tourism, agricultural and mining activities and stimulate economic growth in the FA.
Local labour force	• Development of temporary and permanent employment positions in the local communities • Development of skills, particularly in construction and renewable energy generation industries	• The LMs, whose portions form part of the FA, have experienced a positive trend with respect to employment between 2005 and 2011. However, agricultural and trade sectors have lost more than 2 000 jobs in the period analysed. • Since most of the jobs for renewable projects are semi-skilled and unskilled, i.e. the same as in the agricultural and trade industries, development of renewables in the area offset the declining employment in the above-mentioned sectors.
Non-arable or degraded land not used for any commercial activity or used for grazing	• Improved economic value derived from land as a factor of production due to change in land use • Offset of declining employment trends in the agricultural sector	• Aside from mining, grazing is among the most common land uses in the FA. However, due to the limited potential of the land in the area, most of the agricultural activities in the FA are limited to livestock farming. • Establishment of solar PV projects in areas of limited agricultural productivity and even grazing capacity could present the opportunity to improve the value added derived from that land and the potential for employment creation. Since the LMs encompassing the FA have experienced a sharp decline in the agricultural sectors' employment between 2005 and 2011, such projects create the

Beneficiary/sensitive receptor	Potential impacts experienced	FA specific description
		opportunity for offsetting this trend as mentioned previously.
Commercial agricultural activities	• Economic and job losses in the local agricultural sector due to land sterilisation	• The area is largely associated with low productivity levels of agricultural land. Nonetheless, the agricultural sector is still a notable contributor to job creation in the municipalities encompassing the FA. • Although development of a solar PV project that may sterilise land - unless the co-location of a solar PV project and livestock farming is implemented - the impact of one solar PV project may not be notable and may actually be associated with a net positive effect. However, a large roll-out of solar PV projects that may take out vast tracks of land currently used for grazing may have a more substantial negative effect that can lead to the losses along the upstream and downstream activities. Therefore, it would be advisable to consider integration of solar PV projects with livestock farming where feasible.
Leisure tourism and commercial game farming	• Economic and job losses in the local tourism industry as a result of the changes in the sense of place	• The FA is known for its natural beauty and encompasses a number of spaces of touristic value. Tourism-related projects along the N7 and N14 are of great importance for the diversification of the economy in the FA. Furthermore, much of the FA has been demarcated for the potential expansion for the national parks. • Establishment of wind or PV projects on the sites of existing of future touristic value or in their proximity could either result in the decline of the existing tourism industry or lead to notable opportunity costs. Both of these could be detrimental to the sustainability of the local economies.
Mining sector	• Opportunity costs resulting in the loss of economic value added and employment associated with sterilisation of mineral deposits	• The area has a large mining sector, whose presence extends to the western and the north-eastern part of the FA. Much of this land is lapsed mining rights areas that could still be associated with potential mineral deposits and therefore economic value and job creation potential. Any development of these portions of land could lead to notable opportunity costs as it could sterilise the area from extraction of minerals and generation of added value from such activities.
Local communities	• Altered sense of place and deterioration of living and working conditions due to various environmental impacts • Change in demographics of the areas due to influx of workers and job seekers • Increase in social pathologies associated with influx of migrant labourers and job seekers to the area (health, crime, prostitution,	• The FA encompasses three towns and a number of major settlements mainly located in the western and central parts thereof; however, most of these towns are very small and have low population densities. • Although the extensive mining activities in the FA have already disturbed the surrounding environment, there are still parcels of land that are void of any industrial or human intervention. Any development in these areas would lead to the change in the sense of place affecting the standard of living of households and tourists' perceptions. • As any major development, a large roll-out of projects will most likely also lead to the influx of job seekers into the area. Considering that the area is sparsely populated and experiences certain service delivery challenges, it is most likely that the local area will not be able to cope with a sudden increase in population due to migrating workers and job seekers. More specifically, this could lead to further

Beneficiary/sensitive receptor	Potential impacts experienced	FA specific description
	xenophobia, etc.) • Added pressure on basic services and social and economic infrastructure (during construction) • Improved access to social facilities and infrastructure (during operations)	growth of informal settlements and establishment of new informal settlements; reduce the ability of the existing social facilities to provide adequate services to the population; increase social pathologies; and generally divide the population leading to their unhappiness and dissatisfaction with the living conditions. • During operations, revenue derived by the local government from the established new economic activities and SED and ED commitments will most likely assist in maintaining good service delivery and addressing some of the weaknesses in the existing social and economic infrastructure. However, to ensure fair contribution by RE projects towards local government revenue, this may require review of the zoning schemes and applicable policies and regulations whereby land owners would be required to apply for consent use (i.e. additional rights) that would allow local authorities to charge greater rates and taxes on land (mainly zoned for agriculture) where RE projects are located.

Based on the above, the following can be concluded:

Key questions	Comments/ responses
Overall suitability for wind and PV project development	• Due to mining activities and mineral resources, as well as areas of high touristic value, large parts of the FA are not suitable for renewable energy project development from a socio-economic perspective as their development may come at a significant opportunity cost. Nonetheless, the other areas would still allow for deployment of a large number of wind or solar PV projects.
Where in the FA is development better suited and should it be clustered or spread?	• The developments should ideally be fist clustered in the central parts of the FA, south-eastern parts and some areas of the western part of the FA; however, other parts of the FA could be suitable.
FA specific mitigation measures	• Areas of high touristic value, i.e. private and government nature reserves, should be avoided and development in their proximity should follow guidelines suggested by other specialists. • Areas endowed with mineral resources should ideally be avoided altogether to ensure that projects do not sterilise mineral deposits; however, project-by-project investigations can be undertaken to determine the economic feasibility of establishing such projects in areas of exiting or lapsed mining rights. • Development of solar PV projects on parcels of land used for livestock farming should be done considering the potential for co-location of these projects with such activities. • Planning for a possible sharp increase in population in the area and specifically in and around the existing settlements (specifically Springbok and Steinkopf) will need to be done accordingly; provision of accommodation, social services and basic services will need to be planned for in advance to ensure the standards of services are retained as a minimum.

4 BROADER ISSUES

4.1 Question 1: Considering the demographics (e.g. population densities) of the FA, is the current renewable energy IPP social spend sustainable?

The reviewed FAs, which will be referred to as REDZ once gazetted, differ in terms of land cover and importantly in terms of socio-economic characteristics. As indicated in the table below, the populations of the FAs range between 16 000 and 175 000 people with Komsberg FA being the smallest and Cookhouse FA being the largest in terms of population. The majority of FAs though have populations measuring between 50 000 and 100 0000 people. Most of the people in the reviewed FAs live in towns with the exception of the Stromberg FA, where a notable number of people reside in small settlements scattered over the eastern part of that FA. Furthermore, the towns within the delineated FAs are generally located on the boundaries thereof with few exceptions where major towns are positioned inside the FA (for example, Vryburg and Kimberley FAs).

Population and major towns in Focus Areas (Stats SA Census 2011)						
Focus area	**Number of people**	**Number of HHs**	**Spatial population distribution**	**Major towns and their population**		
Overberg	70 806	20 315	11 towns; most settlements are located on the border of the FA	Swellendam: 17 538	Bredasdorp: 15 526	Caledon: 13 021
Komsberg	16 418	4 316	Only two towns on the southern border; very sparsely populated	Touws Rivier: 8 128	Laingsburg: 5 671	
Stormberg	84 314	22 750	Ten towns; the eastern part is scattered with small settlements	Grahamstown: 50 213	Adelaide:6 123	Bedford: 5 972
Cookhouse	175 447	48 387	Seven towns located on the border of the FA; no major settlements inside the FA	Queenstown: 43 975	Ilinge:10 688	Cofimvaba: 8 784
Kimberley	124 840	31 716	Ten towns, some located inside the FA; vast areas of low population densities	Kimberley: 96 982	Barkly West: 8 258	
Vryburg	63 529	15 709	Five towns with Vryburg located in the centre; sparsely populated	Vryburg: 21 183	Schweizer Reneke: 41 228	
Springbok	51 166	13 863	13 towns with vast areas of very low population densities	Springbok: 12 791	Steinkopf: 7 841	Port Nolloth: 6 090
Upington	93 468	22 400	Ten towns mostly located on the boundaries of the FA, vast areas of very low population densities	Upington: 57 216	Keimoes: 12 001	

The greater the population of the area, the greater the demand for social and economic infrastructure including basic services, health facilities, educational facilities, recreational facilities, care facilities, roads, etc. Therefore, it is safe to assume that an FA with a greater population would have greater socio-economic needs than an FA with a lower population. This means that in general, an FA with a greater population would require a bigger annual investment into maintenance or expansion of the existing infrastructural elements in the communities or creation of new facilities and infrastructure. However, measurement of the needs in quantitative terms does not offer a full picture of the plight and actual needs of the community. Therefore, it cannot always reflect the actual investment required to ensure adequate standard of living of the local population from a household and community perspective. Other aspects that as a minimum need to be taken into consideration include (a) the extent to which the existing needs are met by the local government and other stakeholders in the area and (b) the concentration of the population in one specific area:

- Provision of socio-economic needs mentioned above is the responsibility of various spheres of government, and to a large degree local government. Depending on the financial health of the local municipality, as well as its planning, administrative, and management capabilities and capacities, the ability of the local government to address the needs of the communities located within their areas of jurisdiction differs from one municipality to another. Most rural municipalities in the country, including those reviewed under FAs, experience budgetary constraints that limit their abilities to adequately address the socio-economic needs of the communities. As a result, it is often observed that much of the social and economic infrastructure is not maintained up to standard. Where facilities are not the direct responsibility of the local government but of the provincial or national government, the conditions and quality of services offered are not always up to standard (for example, Early Childhood Development centres). Therefore, an area that is serviced by an inefficient and constrained local government that has smaller population numbers might experience a greater need for support than an area that encompasses a larger population group and local government is more capable of delivering services.
- Service delivery requirements are usually calculated on the basis of specific standards that outline the minimum number of selected facilities per population size. The greater the dispersion of the population, the lower the opportunities for the establishment of certain facilities. This particularly refers to health and education facilities, but also applies to social care facilities such as old age homes, facilities for orphaned children, etc. Application of standard is not always the ideal way to determine the actual needs and gaps in the communities, but considering they are developed to ensure a minimum standard of living, they could be a good means to investigate the overall needs of the community and identify the gaps in addressing these needs.

From the above it is clear that the size of an FA in terms of population and its dispersion in the area, as well as the ability of the local government and other spheres of government to adequately address the needs of the communities situated in the FA, are some of the criteria that will affect the total social spend required in each FA in addition to what is provided by government spheres and other stakeholders. This in turn means that the sustainability of the renewable energy IPP social spend will also depend on the above factors, as they would determine the total socio-economic requirements and the investment gaps in one specific area.

Experience shows that most of the communities in the country require additional injection into their social and economic infrastructure to improve the standard and quality of services provided, including fixed assets (i.e. roads, buildings, basic services, playgrounds, etc.), movable assets (i.e. equipment and machinery), and even consumables. Most of these refer to once-off investments or investments that would be required once in a medium to long-term. The greater the concentration of renewable energy IPPs in one area, the greater the amount of social investment can be envisaged to be available for support of the local communities. This could be beneficial to a community as it would most likely imply that their socio-economic needs are addressed at a faster rate than if they were to be supported by a smaller number of projects. However, it also means that once such needs are fully addressed, the range of socio-economic initiatives that could be implemented to improve the livelihoods of the people living in selected communities would expire and would most probably necessitate the investigation into the needs of other communities that might not be located within the FAs. This means that in the medium to long-term, most of the social spend committed by renewable energy IPPs will likely be directed into areas that do not form part of FAs. The timeframe within which such a situation will occur will to a larger degree be dependent on the factors such as:

- Total population of the area and the number of settlements or concentration of households in one specific area that determine the demand for social and economic infrastructure;
- Current state of social and economic infrastructure reflecting the ability of government (local and other spheres) to address the needs;
- Number of renewable energy projects to be developed in an area; and
- The location of renewable energy projects and the overlap among targeted communities.

In situations where projects are developed within a proximity of the major towns located in the FA, the needs will be greater and therefore the opportunities for social spend will be bigger than in situations where projects fall in areas of sparsely populated regions with a limited number of settlements. For example, opportunities for social spend in Overberg FA will be bigger considering that it encompasses 11 towns, albeit on the border of the FA, compared to the opportunities for social spend in Komsberg FA, where there are only two major towns and the population is about 4.5 times less than in the Overberg FA. It is likely that initiatives for social spend in Komsberg FA will expire faster than that in Overberg FA provided the renewable energy projects in these FAs are developed at the same rate.

It is clear that the opportunities for social spend discussed above will be subject to a number of factors. However, the experience in devising practicable and implementable plans to meet the commitments made by IPPs shows that the greatest issue that renewable energy IPPs will face with respect to Socio-Economic Development (SED) and Enterprise Development (ED) spend will relate to the identification of enterprise development opportunities to support and invest into the socio-economic development initiatives. It is expected that this situation will apply to all FAs, although some will face greater challenges than others. This is due to the following factors that come into play:

- FAs analysed largely comprise rural economies, which had small economic bases made up mainly of the tertiary sectors that provide services to the local communities. In most of the FAs, the agricultural sector played a notable role in creating employment opportunities, although it made relatively small contributions towards the size of the economies themselves. A few had mining industries that contributed towards development. Many also relied on the tourism sector to create existing employment and to expand the economy in the future. Importantly, some of the economies reviewed were stagnating while others were growing just below or at the pace as the national economy. Many though experienced a sharp decline in the employment opportunities in their areas mainly due to the loss of agricultural jobs. All of the above suggests that finding Exempted Micro Enterprises (EMEs) (less than R5 million of annual revenue) and Qualified Small Enterprises (QSEs) (between R5 million and R35 million in annual revenue) to support as well as identifying new business opportunities that could be feasible to implement could be very challenging. In FAs with a small economic base (for example, Komsberg FA) such a task would be more difficult than in FAs that have a more diversified and bigger economic base (for example, Kimberley FA).
- The investment risks associated with enterprise development opportunities are far greater than investment risks associated with initiatives aimed at addressing socio-economic needs. Whether investing in a new business or assisting the existing business to transform or expand its market base, such investment first of all usually benefits a smaller group of people, i.e. owners and employees, than when compared to the initiatives aimed at addressing socio-economic needs of the communities. Most importantly though is the fact that the assessment of whether such investment resulted in the desired outcome, i.e. job creation and improved sustainability of the business, can only be done months and most likely years after the investment is made. Failure

to change the business or to start a new enterprise is a high possibility, which means that this coupled with the limited number of enterprise development opportunities that are generally associated with rural communities will become a greater sustainability challenge for IPPs than that associated with the socio-economic spend.

It is clear from the above that the size of the FA, the population densities, established economic base, and financial health of the local government will be among some of the factors that will determine the opportunities for SED and ED initiatives in each FA. Areas with greater population numbers and higher population densities will most likely have a greater number/bigger value of SED opportunities than those characterised by low population densities and lower population numbers. Nonetheless, considering the socio-economic profiles of the FAs, it is envisaged that devising SED programmes will be easier than formulating practical and sustainable solutions for ED.

The biggest challenge, however, will be in ensuring that SED and ED commitments are directed towards projects that will have a real impact on the lives of people in the area and that would result in the development of sustainable and independent communities rather than communities continuously reliant on the support of third parties. Therefore, sustainability of SED and ED spend will also be reliant on the quality of that spend, which in turn is subject to adequate planning and implementation of the programmes. If devised projects are successfully implemented, the range of SED and ED initiatives with the increase in the number of RE projects and subsequently SED and ED funds directed at their implementation will decline. In this instance, the search for SED and ED opportunities may need to be diverted to communities located outside the FA, which means that the benefits of RE projects will most likely spread beyond the boundaries of the FA in the long-term. However, poor planning and implementation of SED and ED initiatives will lead to wasteful expenditure that would not contribute to the development of sustainable communities, which emphasises the importance of such programmes being devised following an integrated approach to planning, which is not possible to achieve if IPPs work independently of each other and compete for SED and ED projects – the issue that is discussed in greater detail later in the chapter.

Last but not least is the issue of the income derived by local government from RE projects through rates and taxes. Although this aspect is not directly related to the sustainability of SED and ED spend, it does impact on the ability of the local government to provide adequate services to the communities and businesses. This in turn has an indirect effect on the needs of the communities that may be designated for SED and ED spend. Development of wind and solar PV projects do not require re-zoning; therefore, when these projects are operational, the rates and taxes paid by the land owners where these projects are located will be the same as those paid before these developments (in most cases – rates and taxes applicable to agricultural land). However, this may be unfair to the local municipalities that still have to service the land, but now needs to provide additional or bigger value of services than before. Therefore, it would be advisable that discussion with stakeholders also include possible approaches to increasing the revenue derived by local government from RE projects. As mentioned earlier, this could be done by reviewing the zoning scheme and applicable policies and, for example, enforcing land owners where projects are built to apply for consent use, which would demand payment of higher rates and taxes on portions of land where RE projects are located.

4.2 Question 2: Considering the concentration of social spend in REDZs, how could the social spend be better managed?

The first renewable energy projects approved under the first Bid Window have already come online and started generating revenue. Although the project owners will be required to report on their SED and ED commitments only later in the year, the preparation for these have already highlighted major problems in the areas that jeopardise the cost-effectiveness and benefit of the entire programme with respect to the SED and ED investments. This specifically refers to the areas where more than one IPP project is established, which means that such problems could also be faced in the REDZs unless they are adequately addressed. The major problems experienced include, inter alia:

- Competition for the SED and ED initiatives due to the projects being located in an area that has a very small communality within a 50km radius, whose needs and business opportunities are limited;
- Identification of the same type of SED and ED initiatives to be supported and invested into by IPPs and reluctance to share knowledge and align the initiatives with other IPPs in the area due to competition; this may in the future result in community dissatisfaction and/or greater corruption in the area;
- Increase in overall administrative expenses carried by IPPs due to the need by each IPP to develop investment plans either by themselves using internal capacitates or by contracting consultants to do this task, hosting of local offices, employ a staff to manage SED and ED activities, and a need to employ an implementing agent to roll out projects on behalf of the IPP;
- Communities get exposed to different people and consultants, which confuses them and which may in the future lead to misunderstandings; and
- Raising of expectations among community members that may be difficult to manage in the future, particularly if messages delivered by different IPPs contradict each other or communication by parties is done so poorly that it creates rumours and subsequently expectations that can never be matched by IPPs. This is especially true during the EIA consultation process when expectations are raised with local communities without them understanding that the realisation of the commitments are subject to the project being selected as a preferred bidder. Considering that over 500 applications have been submitted to the DEA for EA of RE projects, there are hundreds of communities in South Africa that anticipate developments in their areas. As time passes and projects initially planned to be established in these areas are not selected as preferred bidders, the tension in these communities increases as they feel that promises made to them have not been met, making approaching them for other developments more challenging.

In addition to the above, although not related to the concentration of IPPs but linked to the actual reporting requirements, is the limited amount of funds that can potentially be spent by a project towards the SED and ED commitments during a reporting period of one quarter. On average, about 1.0% and 0.6% of revenue generated by RE projects are to be spent on SED and ED initiatives on an annual basis, respectively. Depending on the size of the project and the technology, these translate from a few hundred thousand rand to about three quarters of a million that can be spent on SED and ED initiatives on a quarterly basis. Some of the community projects that require investment in new facilities or upgrade of facilities are associated with greater expenses than the above-motioned quarterly allocations of IPPs towards SED and ED commitments. The same applies to new business enterprises that could potentially be developed. Although it appears that there are means to overcome the hurdle of matching the need to produce quarterly reports and the need to allocate a greater amount towards a specific initiative, this can become an administrative hurdle for both IPPs and the Department of Energy in case of multi-million projects identified for the area.

Furthermore is the issue associated with the enforcement on IPPs to also become pioneers in community development, which is not their core business and which is not their core business objective. Although it differs from IPP to IPP, it can be argued that some renewable energy IPPs view the need to invest in the SED and ED initiatives purely as a compliance issue that allows them to continue with their core business. Such an approach is not necessarily universal among IPPs and many IPPs do acknowledge the importance of receiving a social license to operate in their communities by means of giving back through SED and ED spend. Regardless of the approach by IPPs towards SED and ED, the fact that development of communities and SMMEs is not their primary business, it does not necessarily mean that they can successfully implement the tasks of developing communities and local enterprises. Whether this is done by subcontracting the activities to consultants experienced in implementing SED and ED initiatives or internally, the results will vary and may be riddled with both success and failures, which ultimately affect people's lives one way or another.

Last but not least is the aspect of managing the community expectations and their satisfaction or dissatisfaction as a result of perceived promises made. If the IPP gets involved in community projects either by its own means or through an implementing agent or sub-consultant, there are risks that the delivery of either of these parties with respect to the SED and ED initiatives might not be to the communities' satisfaction. Managing the communication and implementation channels might be the most difficult task that IPPs may face as any mistake that raises the levels of unhappiness among the communities towards the owners/operators of the renewable energy facility in general may become an operation risk for these projects.

The above shows that the current approach to SED and ED under the RE IPPPP is riddled with challenges that may lead to inefficient and ineffective spend by IPPs. Managing SED and ED spend, and optimisation thereof, is ultimately a complex issue that needs to be further investigated and debated to find the most optimal framework. It is however already clear that in order to address the known weaknesses in the design and implementation of the SED and ED component of the RE IPPPP, any further discussion needs to distinguish between two key phases, i.e. project planning and project implementation. Such discussions should also involve project developers, relevant government departments, and experts in planning and implementation of socio-economic development and enterprise development initiatives. It should ideally start with undertaking case studies on those projects and areas where it has been implemented and where problems have been experienced (e.g. De Aar) as well as other industries where these issues have been dealt with for years (e.g. the mining industry). From such case studies, lessons learnt and key successes can be drawn to more accurately identify the problems faced and inform the required changes to the current programme.

Given the knowledge of the existing weaknesses in the system, the following aspects should form part of further discussions:

- Devising the most optimal framework that would promote collaboration among IPPs with respect to information sharing, community engagement, project identification, and implementation;
- Investigating the most efficient system for identification of practicable, sustainable, and adequate SED and ED opportunities in each REDZ and debating whether it should, for example, be outsourced to a third party (e.g. an agency responsible for project identification in the entire REDZ and financier through SED and ED allocations), be done internally by the Department of Energy (e.g. the department takes the responsibility for consultation with the local stakeholders, identification of projects within the REDZ and outside the area, and allocation thereof to IPPs), or following another approach;
- Development of a framework to govern suitable spending that would assist in equitable and balanced implementation of projects by IPPs in terms of spatial extent;

- Establishment of a centralised implementation office, which could reduce the operational risks and administrative burden of IPPs with respect to implementation of projects and initiatives, lead to a more optimal utilisation of existing resources directed at SED and ED initiatives, as well as assist in managing expectations of the communities by means of communicating information with respect to the SED and ED programmes, its objectives, approach to its implementation, decision-making concerning the priorities, etc.; and
- Provision for the pooling of funds to allow investment into larger projects that IPPs cannot support on their own and could become major employment creation initiatives in REDZs.

4.3 Question 3: Is there potential for the establishment of local renewable energy specific service providers in REDZs and if so, how could this be facilitated and incentivised?

Construction and operation of wind and solar PV projects, like any other greenfields or brownfields development, is associated with an increase in demand for selected goods and services. Due to the nature of these projects, though, requirements for inputs during construction are far greater than requirements for inputs during the operational stage.

Since construction of wind and solar PV projects is generally limited to six months to one and a half years, depending on the size of the project, any demand created during that period is not sustainable unless a continuous roll out of renewable energy projects can be assured. Although the promulgation of REDZs may lead to a more concentrated development of wind and solar PV projects in specific areas, the potential for establishing new business along its backward linkages will ultimately depend on a number of factors, including the assurance given by government with respect to future roll-out of wind and solar PV projects.
Since the inception of the RE IPPPP in the country, notable strides have been made with respect to localising activities along the renewables value chain. These include, for example, establishing the local wind turbine manufacturer, setting up assembly plants for solar PV panels, establishing local inverter manufacturing capability, creating new businesses producing solar PV structures, etc. Currently, though, the market still faces uncertainly with regard to the future annual allocations of wind and solar PV capacities, which restrains investment into the value chains of the wind and solar PV projects by domestic and international businesses above the ones that have already been made. Moreover, such manufacturing capabilities generally require large orders that may not make their location in each REDZ to be financially feasible. Nonetheless, from a REDZ perspective, the deployment of wind or solar PV projects in one REDZ would most definitely create demand for a variety of services needed for construction or required by the employees of the construction companies, who would move into the area - albeit for a temporary period. Such services would include transportation, accommodation, training, trade, business services, insurance, rentals, personal services, etc. The successful realisation of the opportunities brought by this demand that would result in the establishment of sustainable small businesses in the REDZs will only be possible if the roll-out of projects in these areas is done on a continuous basis for a prolonged period. This means that projects will need to be rolled out at a specific frequency per annum (i.e. one in the 1st quarter of year 1, second in the 3rd quarter of year 1, third in the 1st quarter of year 2, etc.) and such roll-out will need to be assured for at least five years to ensure that such opportunities are not seen as temporary that would attract foot loose companies to the area but are developed as sustainable businesses in these localities. Planning for such a roll-out of projects will need to be done at two levels:

- Firstly, national government will need to make a long-term commitment to allocation of projects in REDZ. This implies appropriate future allocation of electricity generation capacities to wind and PV projects at a national level (i.e. as part of the Integrated Resource Plan); commitment to run at least one bid window on an annual basis; gazetting of REDZs; and giving priority approval to those projects that are proposed to be located in REDZs.
- Secondly, some form of a project level roll-out planning for REDZs will need to be undertaken. This will be required to ensure that projects are deployed in such a way as to minimise or completely eliminate the lag between the completion of one project and the start of another project in the same REDZ. This will be required to ensure sustainability of the established businesses in REDZs as such planning will lead to creation of a continuous demand for their services and goods.

During operations, some opportunities for businesses providing supporting services could also be created and could also be localised in REDZs. Such businesses again could be investigated and linked with the ED initiatives provided that the established projects create sufficient demand to justify the establishment of these businesses.

To conclude, government is already facilitating and incentivising the project developers to procure from local businesses and increase their expenditure during construction and operation in the communities located within a 50km radius. Although this does stimulate some activities in the area, albeit for a temporary period, they are not coordinated by the IPPs among themselves and this leads to the establishment of many new opportunistic start-ups that may not be capable of delivering quality services, ultimately leading to poor leverage of available opportunities.

To inform any changes to the current programme will, again, require further studies, but a possible solution might be linked to centralising the development of the businesses on the backbone of the rolled-out renewable energy projects in such a way that would ensure that jobs created by these businesses are filled by the local labour force and that services rendered by these businesses are of the quality required by the IPPs during construction or operation. It should be noted though that following such an approach would create a risk of such businesses being entirely dependent on the future roll-out of the RE IPPPP and specifically the deployment of projects in each REDZ, which creates the issue of self-sufficiency and sustainability for such businesses.

4.4 Question 4: What is the risk of an escalation in land prices in REDZs and how could this be managed?

Land prices are subject to demand and supply forces, where many externalities and characteristics of the land itself come into play. Development of utility-scale projects under RE IPPP is guided by the Integrated Resource Plan. According to IRP 2010, 16 800MW of wind and solar PV projects were to be established in South Africa by 2030. Of these, 3 467MW has already been allocated to preferred bidders of wind and solar PV projects under Bid Window 1, 2 and 3. This means unless the allocations for wind and solar PV projects changes once the IRP 2010 is revised, about 6 516MW of solar PV projects and 6 417MW of wind projects are yet to be awarded by 2030. During the first three bid windows, an average of 500MW to 600MW was allocated to wind and solar PV projects per annum with the majority of projects being between 50MW and 100MW. The IRP 2010, though, envisages allocation of between 300MW and 400 MW of projects on an annual basis. Given the above, it can be estimated that between 600MW and 1 200MW of solar and wind projects could be allocated on an annual basis in the future, which will translate into about eight to 16 wind and solar PV projects combined. Considering that the number of REDZ planned to be established, it is envisaged that on average one to two projects could be approved for development in each REDZ on an annual basis. The number of projects developed in REDZ on an annual basis however could be smaller as projects outside of REDZ could also be awarded. The above though suggests that over a 15-year period, i.e. until 2030, between 15 and 30 wind and solar projects could be clustered in each REDZ.

The combined land cover of all eight REDZs is about 80 000km^2. For the purpose of this exercise, assuming that half of the projects developed in REDZs will be solar PV projects and on average each solar PV project will require about 400ha, a total of 480km^2 will be required to accommodate these projects (the area required for wind projects will be smaller due to the footprint of wind turbines). This represents about 0.6% of the total land area encompassing REDsZ. Furthermore, even if only half of area delineated for REDZs will be suitable for deployment of solar PV projects, the required land will still be small relative to the total size of REDZs. This suggests that the supply of land suitable for development of solar PV projects and wind projects, considering the lower land requirement of the latter, will unlikely be exhausted until 2030, i.e. the IRP planning horizon, which means that maintaining free market environment should be sufficient to prevent land prices from escalation in the long term.

Having said, some increase in land prices can be expected prior to the promulgation of the REDZs or just after its promulgation. Such increases will be driven by speculators bidding up the price of land. Given the nature of land, i.e. being a limited commodity that cannot be produced, increase in prices raises expectation on further price increases, which ultimately could create a self-inflating speculative bubble. Such price increases are not sustainable; however, it may take time before the market stabilises. In the mean time, greater prices would mean greater capital investment required, leading to greater interest and greater tariffs, which, considering the nature of projects, will need to be paid by the public. Therefore, curbing speculative price increases will be imperative to ensure that one individual does not benefit from the project at the cost of other South African citizens. This can be achieved by ensuring that the developers, the land owners, the local municipalities, and other stakeholders have access to a complete set of information regarding REDZs, the development approach outside REDZ, and the RE IPPPP.

There is also a possibility that prices of land in some areas of REDZ could actually drop with the development of wind or solar PV projects. This scenario will apply to all the areas and land parcels that are situated in picturesque areas and are currently deriving their income from eco-tourism and hunting. Establishment of wind or solar PV projects in areas that may affect the landscape and aesthetics of the environment that is used to generate revenue from tourists will negatively impact the attractiveness of the area. As a result, the area might no longer be suitable for tourism-related activities or the revenue that could be generated from such activities would be significantly reduced. Since land values are linked to future economic value of revenue that could be derived from it, decline in tourism numbers completely or partially will lead to a decline in revenue, which subsequently results in the decrease of business value and land that is used to derive the revenue. In order to mitigate the potential decline in land prices in selected areas, wind and solar PV projects should not be developed on land parcels that derive their income from eco-tourism or commercial game hunting and within the buffer zones of these sites.

4.5 Question 5: What are the potential costs and benefits related to focusing renewable energy investment and development in REDZs rather than distributing it evenly across the country?

Concentrating the development of wind and solar PV projects in REDZs versus continuing with the current approach and allowing the projects to be spread over a greater territory is associated with the following opportunity costs and benefits:

- Benefits:
  - Increases the concentration of projects in one area that allows reducing project development costs as far as provision of required service and infrastructure is concerned. This in turn translates into lower electricity prices applicable to these projects.
  - Provides for an opportunity to make a notable difference to the communities in the REDZs leading to a greater local impact in terms of job creation, diversification of the economic base, as well as improvement in standards of living through increase in household income and investments in SED and ED initiatives;
  - Increases the economies of scale from deployed projects, which may create sufficient demand to establish new businesses in the area stimulating economic growth and development;
  - Creates opportunity for devising a more integrated approach to implementation of SED and ED initiatives, as well as accessing a greater pool of funds for these projects, which may lead to a more optimised, efficient, and effective spending of SED and ED allocations by IPPs;
  - Allows the local government to appropriately plan for the potential influx of people to the area and other risks that may be faced during development stages;
  - Improves access of the area to economic infrastructure as far as road networks and power lines are concerned;
  - Provides for a more efficient use of resources, leading to the optimisation of cost-effectiveness of the entire RE IPPPP.
- Costs:
  - May lead to the local government in the respective REDZs abandoning or reducing their efforts towards service delivery and economic development;
  - Greater burden on local municipalities to provide services and infrastructure in the area without receiving adequate revenue from renewable energy projects through rates and taxes due to the current zoning schemes
  - May result in a sharp increase in population due to the influx of job seekers, which if not appropriately addressed would lead to growth of informal settlements in the area, increase in magnitude and severity of social pathologies in the area, and reduce the standard of living among the existing households;
  - Excludes other rural areas, which are also faced with the challenges of high unemployment, poverty, underdeveloped infrastructure and poor economic growth that could benefit from deployment of renewable energy projects.

5 CONCLUSIONS AND FURTHER RECOMMENDATIONS

The review of the socio-economic conditions of the delineated FAs and the potential socio-economic impacts that could be associated with the deployment of wind and/or PV projects in these areas revealed that they are suitable for development of these projects. It was also clear that development of wind and solar PV projects in REDZs would largely be guided by the concentration and spatial distribution of agricultural, tourism, and mining activities since wind and solar PV projects would tend to compete with these activities for land use and could significantly affect the development of these sectors either through direct or indirect impacts. However, some of these land conflicts could be successfully addressed if projects are allowed to be co-located with existing land use practices, for example livestock farming or crop production and solar PV projects. Such practices have already been implemented in other parts of the world and will need to be investigated and promoted in South Africa too.

Development of projects would also need to be mindful of the distribution of settlements and towns in REDZ as they would represent the core labour sending areas during construction and to a lesser degree during operations. Clustering of projects in closer proximity to towns and settlements might be a preferred choice in most instances; however, this could lead to a sharp increase in migrants in the area that could lead to a variety of notable negative socio-economic impacts that might be difficult to mitigate over the short-term. Preventative measures such as appropriate planning for potential change in demographics, increase in demand for social and economic infrastructure and other measures would need to be implemented to reduce the probability and severity of negative impacts that could occur. In some REDZs, distribution of projects over a wider territory might also be a solution to curbing negative social impacts.

Importantly, however, considering the socio-economic environment and development trends of the analysed, it is clear that deployment of solar and wind projects in REDZs will be associated with much-needed investment that could positively impact the lives of the people in these areas. REDZs primarily encompass rural economies that are characterised by a limited economic base and scarce opportunities for growth. Development of solar PV and wind energy projects would revitalise some of these economies and provide sustainable income for local households. Importantly, most economies where REDZs are to be located have shown a sharp decline in employment in the agricultural sector. Considering that most of the job opportunities created by solar PV and wind projects are in unskilled and semi-skilled positions, the roll-out of solar and wind projects could offset the negative employment trends observed in these areas' agricultural sectors.

Overall, promulgation of REDZs would be associated with both positive and negative socio-economic impacts. However much of the negative effects can be mitigated. This, however, would necessitate proper management of the roll-out of projects in each REDZs that would allow to predict, prevent, and possibly eliminate negative impacts while enhancing positive effects for local communities brought by deployment of projects. The positive direct and spin-off effects of project development in REDZ, however, are expected to exceed the negative impact ultimately leading to a net positive effect on the local economies and communities.

6 SPECIALIST SHORT CV

EK BROUGHTON

Personal Details

Surname	:	Broughton
Names	:	Elena
Date of Birth	:	11 September 1980
Nationality	:	Russian
Residency	:	RSA Permanent Resident
Profession	:	Unit Manager/Senior Development Economist

Key Qualifications

Elena Broughton completed her BCom (Hon) in Economics in Russia, at Nizhny Novgorod State University in 2002 specialising in regional economics. At the same time, she completed an additional degree as Translator/Interpreter in Professional Orientated Communication. After completion of her Honours degree in Economics, Elena has moved to the USA and stayed there for 1.5 years. During her stay in the USA, she completed a number of Accounting and Business courses at Parkland College, Illinois. In 2007, she obtained her BSc (Hon) in Technology Management (Cum Laude) at the University of Pretoria and later received her MSC in Technology Management (2011) from the same university.

Elena Broughton is a senior professional at Urban-Econ and has an extensive knowledge in various fields of economic development, including impact assessments, investment strategy formulation, strategic decision analysis, and monitoring and evaluation. She is experienced in developing input-output and SAM-based models, as well as development and application of other econometric techniques. Elena has a special interest in project evaluation and decision-making framework, with the latter being the focus of her Master's dissertation. Over the past few years, she was able to extend her experience in these fields working on projects for both government and the private sector.

Academic Qualifications

Institution (Date from – Date to)	Degree(s) or Diploma(s) obtained:
2008-2011	MSc in Technology Management
2006 - 2007	BSc (Hon) in Technology Management
2002, Nizhny Novogorod University, Russia	BCom (Hon) in Economics

Employment Record

2004: Urban-Econ: Development Economist
Position: Manager/Specialist

Projects Undertaken

- **Saldanha Bay Separation Plant Economic Impact Assessment**: The project involved undertaking an economic impact assessment study for the proposed construction and operation of a Rare Earth Elements (REE) Separation Plant on Portion 6 of the Farm Langeberg 188 in Saldanha, in the Western Cape. The study formed part of the Environmental Impact Assessment process as prescribed in the National Environmental Management Act (NEMA) of 1998 and its subsequent amendments.
- **Zandkopsdrift Rare Earth Elements (REE) Project Economic Impact Assessment**: The project involved undertaking a socio-economic impact assessment study for the proposed the Zandkopsdrift Rare Earth Elements (REEs) Project near Garies in the Northern Cape Province of South Africa. The study formed part of the Environmental Impact Assessment process as prescribed in the National Environmental Management Act (NEMA) of 1998 and its subsequent amendments.

- **Northern Cape Renewable Energy Strategy:** Urban-Econ Development Economists with support from EScience Associates and Centre for Renewable and Sustainable Energy Studies (CRSES) was appointed to develop a renewable energy strategy for the Northern Cape. The objective of the study was to undertake a situational assessment of the Northern Cape economy to identify the opportunities and constraints with respect to renewable energy development, and accordingly to formulate a plan to unlock the existing potential of the province to harness renewable energy to the benefit of its communities and economy and to position the province to attract a maximum share of investment under the IRP2010 Renewable Energy Target and beyond.
- **The localisation potential of Photovoltaics and a strategy to support large scale roll-out in South Africa:** A consortium comprising of EScience Associates, Urban-Econ Development Economists and Chris Ahlfeldt, the project team was appointed to undertake the study on the localisation potential of solar PV. The specific objectives of the study included profiling of the industry, analysis of the PV industry value chain, and development of the strategy for the future roll-out of the industry in the country.
- **Eskom CSP Macro-Economic Impact Assessment:** Eskom CSP (Solar 1) Macroeconomic Impact Assessment: The study involved the identification of potential localisation opportunities for various components of the project and modelling of the socio-economic impacts**.**
- **Proposed Exxaro IPP Coal-Powered Power Station near Lephalale, Limpopo Scoping Inputs:** Urban-Econ Development Economists was appointed to undertake a socio-economic scoping study and land use impact study for the proposed Exxaro coal-powered power station near the town of Lephalale, in Limpopo.
- **Mafube Nooitgedacht and Wildfontein EIA/EMP Sustainable Development Investigation Study**: Urban-Econ Development Economist was appointed to undertake an investigation into sustainable development options associated with the proposed project. The results of this study aimed at informing the decision makers of socio-economic trade-offs related to each option analysed and the most preferred alternative.
- **Thabametsi Sustainable Development Investigation Study:** The objective of the Thabametsi Project is to mine coal via opencast and underground mining methods for supply to the Independent Power Producer (IPP) coal-fired power station, to be developed by Exxaro north of the proposed Thabametsi project. Urban-Econ Development Economists provided a specialist input into the sustainable development investigation that aimed to quantify and assess various options associated with the development and post-mining land uses that formed part of an input into the EIA report.
- **Eskom Sere Wind (WEF1) Macro-Economic Impact Assessment:** The project entailed the strategic assessment of the proposed facility on the macroeconomic situation with respect to the impact on the balance of payments, supply of energy, demand for water, and achievement of strategic government objectives. It also entailed the assessment of the proposed project on the regional and local economies.
- **Socio-Economic and Economic Impact Assessment Studies for Renewable Energy Projects** conducted as part of the Environmental Impact Assessment Processes
    - Arriesfontein Solar Energy Park near Danielskuil in the Northern Cape (100 MW CSP-Tower facility and 225 MW PV solar facility)
    - Humansrus Solar Energy Facility near Postmasburg in the Northern Cape (100 MW CSP-Tower facility)
    - Rooipunt Solar Energy Park near Upington in the Northern Cape (100 MW CSP-Tower facility and 215 MW PV solar facility)
    - Farm 198 PV Solar Energy Facility north of Kimberley in the Northern Cape (210 MW PV solar facility)
    - Wag'nbiekiespan PV Solar Energy Facility near Boshof, Free State (75 MW PV solar facility)
- **Lesedi and Letsatsi Community Needs Assessment Studies**: The two studies involved the assessment of the local socio-economic development needs and enterprise development opportunities using primary data and to a lesser degree secondary information. The project prioritised the initiatives and created an investment plan for the project owners to follow to meet their commitments made to the Department of Energy and ensure improvement of socio-economic conditions in the local communities.

6.1 Specialist Declaration

I, Elena Konstantinovna Broughton, as the appointed independent specialist hereby declare that I:

- act/ed as the independent specialist in this application;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct;
- do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed;
- have and will not have any vested interest in the proposed activity proceeding;
- have disclosed any material information that have or may have the potential to influence the objectivity of any report or decisions base thereon; and
- am aware that a false declaration is an offence in terms of regulation 71 of GN No. R. 543.

Name of company:	Urban-Econ Development Economists
Professional Registration (incl number):	N/A
Date:	4 June 2014