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

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Strategic Environmental Assessment for wind and solar photovoltaic energy in South Africa

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Vision and Mission

Vision

Large scale wind and solar photovoltaic projects that contribute to the National Development Plan are supported by strategic planning, endorsed by government, embraced by stakeholders, and attractive to investors.

Mission

To identify Renewable Energy Development Zones (REDZs) that are of strategic importance for large scale wind and solar photovoltaic development in terms of Strategic Integrated Project 8, and in which significant negative impacts on the natural environment are limited and socio-economic benefits to the country are enhanced.

SUMMARY

National Planning Context

In 2012, the South African Government adopted the National Development Plan (NDP) as the long term strategy to address economic growth and broaden socio-economic transformation in the country. The National Infrastructure Plan (NIP) which is fully aligned with the NDP initiated a process of accelerated infrastructure development to enable economic growth and job creation in South Africa. The Presidential Infrastructure Coordination Commission (PICC), as the coordinator and facilitator of the NIP, subsequently identified 18 Strategic Integrated Projects (SIPs) which are large-scale infrastructure projects of national importance aimed at unlocking development potential in the country.

The Department of Environmental Affairs (DEA) is committed to the implementation of the NDP and NIP. It is in terms of this commitment that DEA is currently undertaking several Strategic Environmental Assessments (SEAs) to identify adaptive processes that streamline the regulatory environmental requirements for SIPs, while also safeguarding the environment. The wind and solar photovoltaic (PV) SEA was the first to be commissioned by DEA in support of SIP 8, which aims to facilitate the implementation of sustainable green energy initiatives. This SEA identifies areas where large scale wind and solar PV energy facilities can be developed in terms of SIP 8 and in a manner that limits significant negative impacts on the natural environment, while yielding the highest possible socio-economic benefits to the country. These areas are referred to as Renewable Energy Development Zones (REDZs).

REDZs Benefits

The implementation of REDZs will streamline the planning, approval and implementation processes associated with appropriate large scale wind and solar PV development in South Africa. The streamlining of environmental authorisation processes will be achieved by DEA through the utilisation of relevant provisions in the National Environmental Management Act (NEMA) (Act 107 of 1998). Further streamlining in terms of cooperative governance and the proactive development of supporting infrastructure, which is particularly necessary to unlock essential investment in the electricity grid, can be achieved by the PICC adopting REDZs as areas associated with SIP 8 in terms of the Infrastructure Development Act (Act 23 of 2014). The adoption of the REDZs by the PICC will allow for policy and planning alignment between national, provincial and local authorities. Such alignment is supported by, among others, the Spatial Planning and Land Use Management Act (SPLUMA) (Act 16 of 2013). It is thus intended for the proposed REDZs to be presented to Cabinet by mid-2015 and subsequently gazetted by DEA as geographical areas with streamlined environmental authorisation processes in terms of NEMA, as well as by the PICC as areas associated with the SIP programme in terms of the Infrastructure Development Act.

The REDZs represent priority areas for investment into the electricity grid. Currently, one of the greatest challenges for the continued success of the renewable energy industry in South Africa is the depletion of existing grid infrastructure in high resource areas and the hurdles in upgrading and expanding the grid. Proactive investment in grid infrastructure is thus likely to be the most important factor determining the success of REDZs and the renewable energy industry in South Africa. It must be noted that although it is intended for the SEA to prioritise proactive grid investment in REDZs, such investment should not be limited to these areas. Suitable wind and solar PV development is still promoted across the country and any proposed development must be considered on its own merits.

SEA Scope

The wind assessment domain for this first iteration of the SEA is based on the Wind Atlas for South Africa (WASA) coverage available at the time of commencing the SEA (i.e. parts of Northern Cape, Western Cape and Eastern Cape provinces). The solar PV assessment domain was informed by the location of the majority of existing solar PV project applications at the commencement of the SEA and includes the five provinces of Northern Cape, Western Cape, Eastern Cape, Free State, and North West. The SEA process is intended to be iterative, with the study being expanded to redefine and identify additional REDZs as new data and learnings become available. Such updates should be undertaken at intervals less than five years to prevent the study and its finding from becoming outdated.

It is through integrated spatial analyses and wide stakeholder consultation that the proposed REDZs have been identified. As illustrated in Figure 1, the proposed REDZs were identified by firstly considering wind and solar resource data. Development potentials were then determined by adjusting the resource data with key pull factors such as social development needs as determined in consultation with provincial governments. Priority areas applicable to renewable energy development, such as Special Economic Zones (SEZs) and major ports with Industrial Development Zones (IDZs), as well as available transmission infrastructure and the national transmission losses, were also taken into account when determining development potentials. To meet the socio-political, technical and environmental need to spatially spread development, the highest development potential areas per province were then selected and subsequently overlaid with environmental and land-use constraints to identify study areas. Industry then provided additional inputs in terms of where they consider development prioritisation to be required in the next five years, and based thereon the eight proposed REDZs were identified (see Figure 2).

REDZs Generation Capacity

The eight proposed REDZs have a combined size of approximately 80 000 km^2 and comprise about 17 000 farm portions. In addition to the 11 preferred bidder projects (6 wind and 5 solar PV) selected up to round 3 of the Renewable Energy Independent Power Producer Procurement Programme (REI4P), more than 100 projects (approximately 32 wind projects representing 6 844 MW generation capacity, and 72 solar PV projects representing 5 971 MW generation capacity) are also proposed in the vicinity of the REDZs. The proposed REDZs are estimated to have a combined installed generation development capacity of approximately 15.5 GW wind and 166 GW solar PV. The available transmission level evacuation capacity in these areas after round 3 of the REI4P is approximately 2.3 GW, with an additional 17.5 GW which could potentially be unlocked within the next 3 to 10 years. The realisation of the additional evacuation capacity in the REDZs is largely dependent on the appropriate prioritisation of these areas in terms of SIP 8. The streamlining of additional transmission infrastructure development to unlock evacuation capacity in the REDZs is allowed for by of the Electrical Grid Infrastructure (EGI) SEA, commissioned by the DEA in support of SIP 10 (see Figure 3). As is the intention of the SIP programme, exemplary integrated strategic planning between the SEAs for SIP 8 and SP 10 is facilitating efficient and effective infrastructure development in South Africa.

Environmental Authorisation Streamlining

To allow for DEA to utilise provisions in the NEMA to streamline environmental authorisation processes in pre-assessed geographical areas, scoping level assessments of the biophysical and social environments have been undertaken as part of the SEA to produce sensitivity maps for the proposed REDZs. The sensitivity maps are based on the best available data, but are not sufficiently detailed to support project level decision-making in terms of the NEMA. The maps instead identify potential sensitivities to inform environmental assessment at a project level. Environmental Authorisation in terms of the NEMA will thus be based on the outcomes of a project level environmental assessment and not the outputs of this SEA. However, given the level of pre-assessment undertaken within the proposed REDZs and the strategic nature of these areas, all wind and solar PV projects in REDZs with their associated infrastructure that require environmental authorisation will be required to follow a streamlined project level environmental assessment process in the form of a Basic Assessment (BA). The scope of the project level BA in REDZs will be informed by the protocols developed as part of the SEA. The project level BA process will also include the associated public participation process.

The protocols prepared as part of this SEA also address the involvement of other authorities with authorisation mandates relevant to wind and solar PV development in the BA process. If the REDZs and their associated protocols are agreed to by the relevant authorities through a legal PICC adoption process, it would facilitate integrated environmental authorisation.

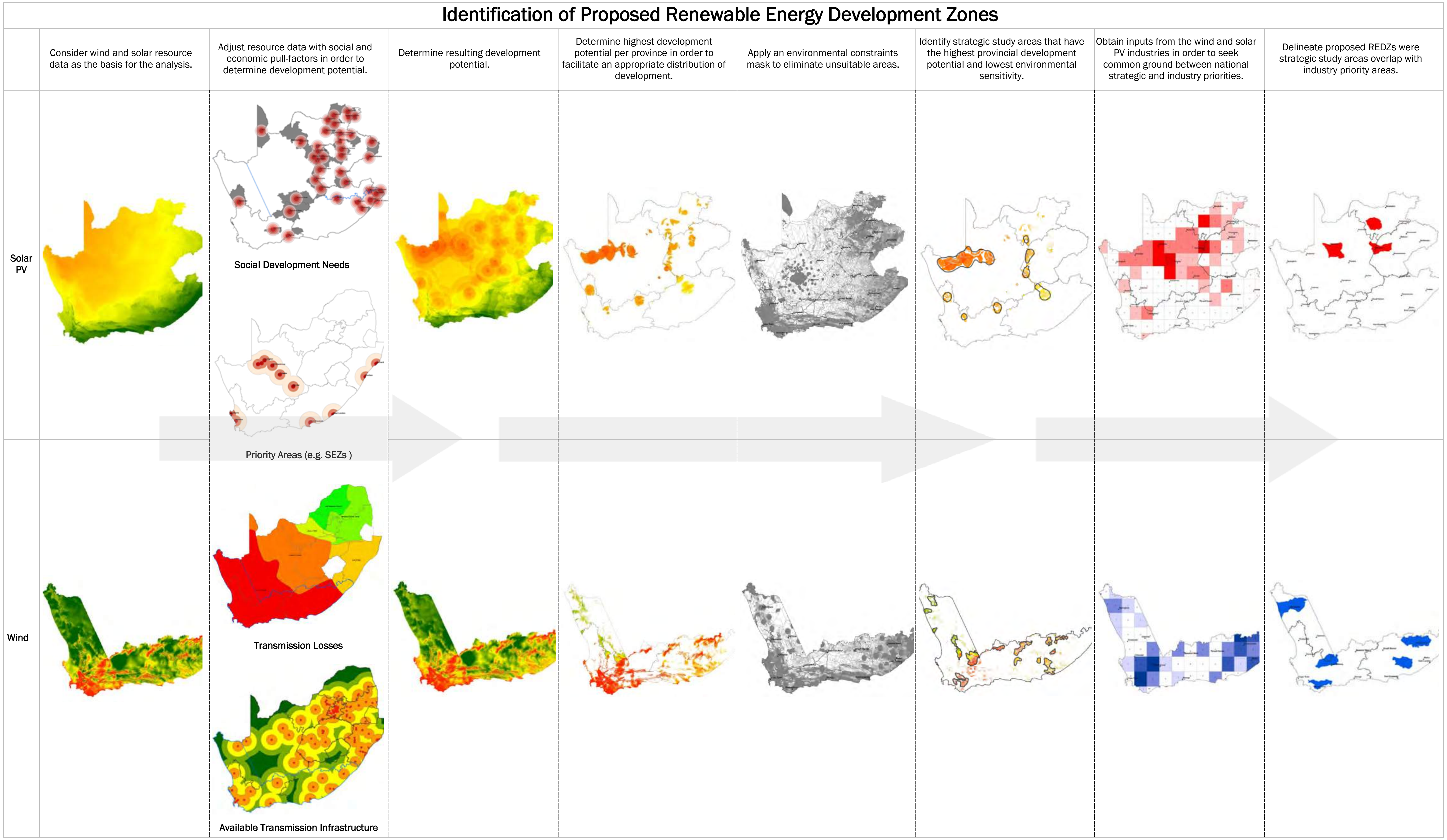

Figure 1: Illustration of REDZs identification process

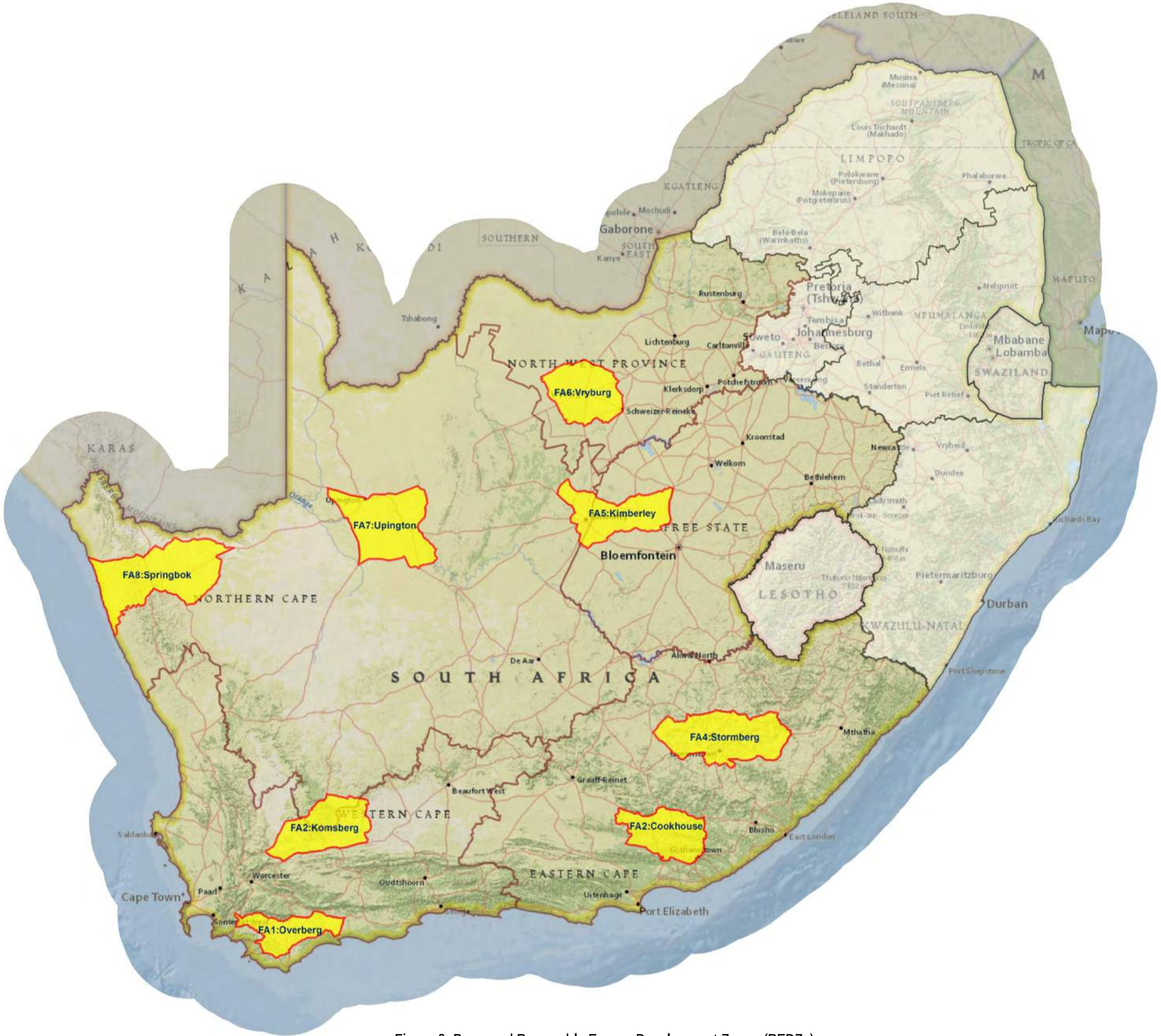

Figure 2: Proposed Renewable Energy Development Zones (REDZs)

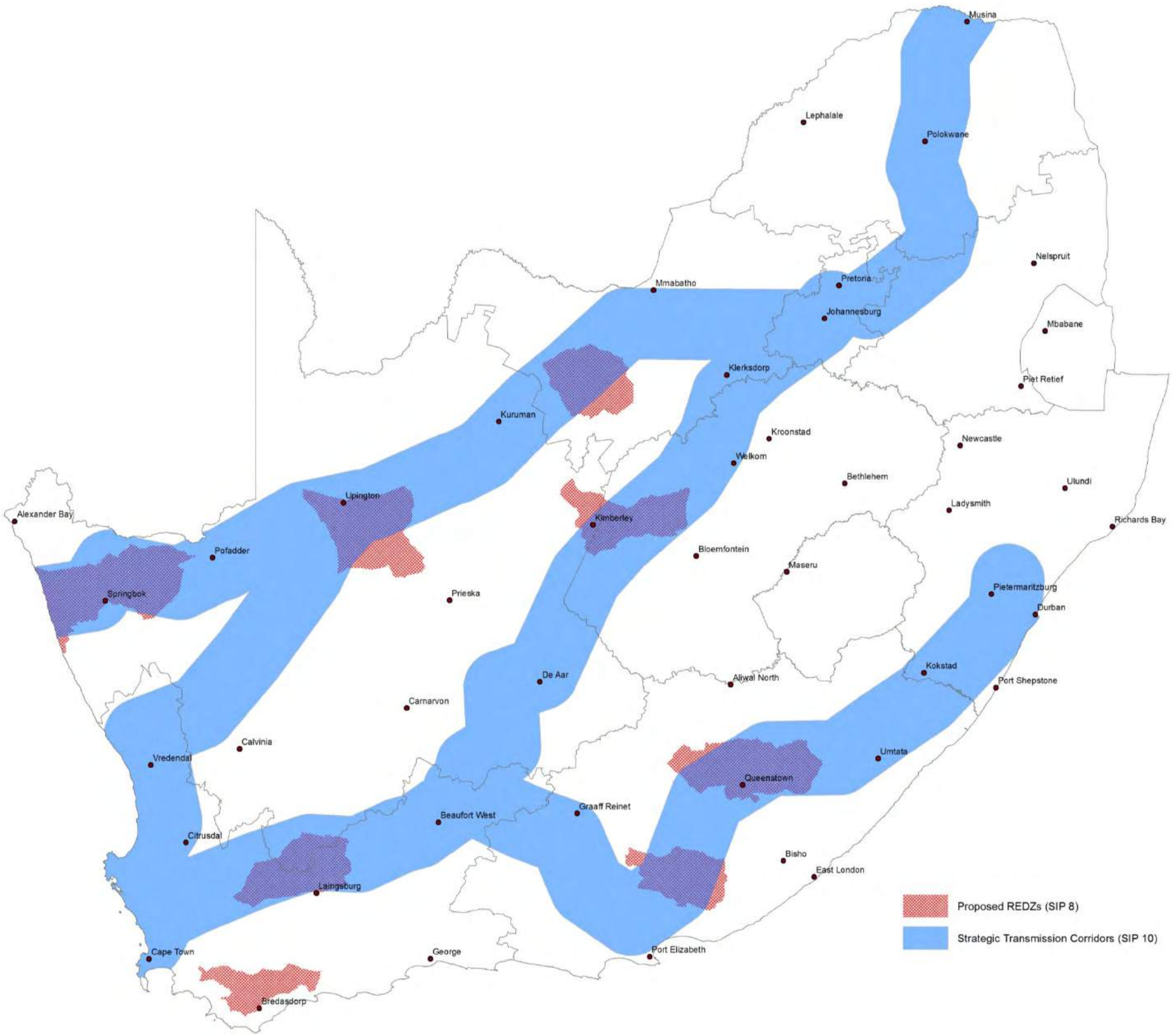

Figure 3: Integration of strategic infrastructure planning in terms of SIP 8 (REDZs) and SIP 10 (Strategic Transmission Corridors)

REPORT CONTENT

Abbreviations and Acronyms

ADU	Animal Demography Unit	NASA	National Aeronautics and Space Administration
AIA	Archaeological Impact Assessment	NBA	National Biodiversity Assessment
AM	Amplitude Modulation	NCOP	National Council of Provinces
ATNS	Air Traffic and Navigation Control Service	NDP	National Development Plan
BA	Basic Assessment	NEMA	National Environmental Management Act
BAWESG	Birds and Wind Energy Specialist Group	NEMBA	National Environmental Management: Biodiversity Act
BID	Background Information Document	NERSA	National Energy Regulator of South Africa
BLSA	Birdlife South Africa	NFEPA	National Freshwater Ecosystem Priority Area
BRICS	Major emerging national economies of Brazil, Russia, India, China, and South Africa	NGO	Non-Governmental Organization
CBA	Critical Biodiversity Areas	NHRA	National Heritage Resources AcT
C-BASS	C-Band All Sky Survey	NID	Notification of Intent to Develop
CD-NGI	Chief Directorate: National Geographic Information	NIP	National Infrastructure Plan
CEF	Central Energy Fund	NPAES	National Protected Areas Expansion Strategy
CGS	Council for Geoscience	NSDP	National Spatial Development Perspective
CoGHSTA	Department of Co-operative Governance, Human Settlements and Traditional Affairs	NWA	National Water Act
CRSES	Centre for Renewable and Sustainable Energy Studies	OEC	Obstacle Evaluation Committee
CSIR	Council for Scientific and Industrial Research	PAPER	Precision Array for Probing the Epoch of Re-ionisation
CWAC	Coordinated Waterbird Counts	PES	Present Ecological State
DAFF	Department of Agriculture, Fisheries and Forestry	PIA	Paleontological Impact Assessment
dB(A)	A-weighted Decibels	PICC	Presidential Infrastructure Coordination Committee
DEA	Department of Environmental Affairs	POI	Points of Interest
DEADP	Western Cape Department of Environmental Affairs and Development Planning	PPA	Power Purchase Agreement
DEDEAT	Eastern Cape Department of Economic Development, Environmental Affairs and Tourism	PPP	Public Participation Process
DEDECT	North West Department of Economic Development, Environment, Conservation and Tourism	PSC	Project Steering Committee
DEM	Digital Elevation Model	PV	Photovoltaic
DENC	Northern Cape Department of Environmental Affairs and Nature Conservation	RDB	Red Data Book
DM	District Municipality	REDZ	Renewable Energy Development Zone
DMR	Department of Mineral Resources	REFIT	Renewable Energy Feed-In Tariff
DoD	Department of Defence	REI4P (or REIPPPP)	Renewable Energy Independent Power Producer Procurement Programme
DoE	Department of Energy	RFI	Radio Frequency Interference
DoT	Department of Transport	S&EIA	Scoping and Environmental Impact Assessment
DRDLR	Department of Rural Development and Land Reform	SAA	South African Army
DST	Department of Sciences and Technology	SAAF	South African Air Force
DTEEA	Free State Department of Tourism, Environmental and Economic Affairs	SABAAP	South African Bat Assessment Advisory Panel
DWS	Department of Water and Sanitation	SABAP	South African Bird Atlas Project
EA	Environmental Authorisation	SABC	South African Broadcasting Corporation
EAP	Environmental Assessment Practitioners	SACAA	South African Civil Aviation Authority
EAPASA	Environmental Assessment Practitioners Association of South Africa	SACAR	South African Civil Aviation Regulation
ED	Enterprise Development	SACATS	South African Civil Aviation Technical Standard
EGI	Electrical Grid Infrastructure	SACNASP	South African Council for Natural Scientific Professionals
EIA	Environmental Impact Assessment	SAHRA	South African Heritage Resources Agency

EIS	Ecological Importance and Sensitivity	SAHRIS	South African Heritage Resources Information System
EMI	Electromagnetic Interference	SALA	Subdivision of Agricultural Land Act
EMPr	Environmental Management Programme	SALGA	South African Local Government Association
ERG	Expert Reference Group	SALT	South African Large Telescope
ESA	Ecological Support Areas	SAMHS	South African Military Health Services
ESMAP	World Bank Energy Sector Management Assistance Program	SANBI	South African National Biodiversity Institute
eTOD	Electronic Terrain and Obstacle Database	SANDF	South African National Defence Force
EWT	Endangered Wildlife Trust	SANEDI	South African National Energy Development Institute
Exco	Executive Committee	SANParks	South African National Parks
FA	Focus Area	SANS	South African National Standards
FAQ	Frequently Asked Question	SAPAD	South African Protected Areas Database
FM	Frequency Modulation	SAPVIA	South African Photovoltaic Industry Association
GA	General Authorisation	SAREC	South African Renewable Energy Council
GCCA-2016	Generation Connection Capacity Assessment of the 2016 Transmission Network	SARPs	Standards and Recommended Practices
GDP	Gross Domestic Product	SASTELA	Southern Africa Solar Thermal and Electricity Association
GG	Government Gazette	SAWEA	South African Wind Energy Association
GHI	Global Horizontal Irradiation	SAWS	South African Weather Services
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit / German Federal Enterprise for International Cooperation	SDF	Spatial Development Framework
GN	Government Notice	SEA	Strategic Environmental Assessment
GW	Gigawatt	SED	Socio-Economic Development
ha	Hectare	SEF	Solar Energy Facility
HIA	Heritage Impact Assessment	SEZ	Special Economic Zone
I&AP	Interested and Affected Party	SIP	Strategic Integrated Project
IAIA	International Association for Impact Assessment	SKA	Square Kilometre Array
IBA	Important Bird Areas	SKEP	Succulent-Karoo Ecosystem Programme
ICAO	International Civil Aviation Organisation	SMME	Small, Medium and Micro Enterprise
IDC	Industrial Development Corporation	SOE	State Owned Enterprise
IDP	Integrated Development Plan	SPLUMA	Spatial Planning and Land Use Management Act
IDZ	Industrial Development Zone	SRTM	Shuttle Radar Topographic Mission
IPP	Independent Power Producer	TV	Television
IRP	Integrated Resource Plan	UCT	University of Cape Town
J OP HQ	Joint Operational Headquarters	USA	United States of America
KCAAA	Karoo Central Astronomy Advantage Area	VIA	Visual Impact Assessment
km	Kilometre	WASA	Wind Atlas for South Africa
LEDS	Local Economic Development Strategy	WAsP	Wind Atlas Analysis and Application Programme
LM	Local Municipality	WEF	Wind Energy Facility
m	Metres	WESSA	Wind Energy Summit South Africa
MPRDA	Mineral and Petroleum Resources Development Act	WRF	Weather and Research Forecasting
MW	Megawatt	WULA	Water Use License Application

PART 1

Strategic Environmental Assessment

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Introduction

The National Development Plan (NDP) was officially adopted in 2012 and sets targets for eliminating poverty and reducing inequality in South Africa by 2030. The strategic perspective of the NDP is based on the New Growth Path for South Africa with the objectives, by 2020, of creating five million new jobs, resolving structural problems in the economy, and identifying opportunities in specific sectors and markets which may serve as job drivers. The first job driver was identified as infrastructure development. The lack of adequate infrastructure is considered an obstacle to the development of the wider South African economy and to Government achieving its social, economic and political goals.

The National Infrastructure Plan (NIP) is fully aligned with the NDP and sets goals for improving South Africa's economic landscape, creating job opportunities, and improving the delivery of basic services through infrastructure development. In order to address the challenges identified by the NIP, Cabinet established the Presidential Infrastructure Coordinating Committee (PICC). Under the guidance of the PICC 18 Strategic Integrated Projects (SIPs) have been developed to promote fast-tracked development and growth of social and economic infrastructure across all nine provinces. Among the 18 SIPs, three target the energy sector. The three energy related SIPs are: SIP 8 – Green energy in support of the South African economy; SIP 9 – Electricity generation to support socio-economic development; and SIP 10 – Electricity transmission and distribution for all. SIP 8 in particular aims at facilitating the implementation of sustainable green energy initiatives as envisaged in the NDP and Integrated Resource Plan (IRP2010).

The Department of Environmental Affairs (DEA) has committed to facilitate the implementation of SIPs by undertaking Strategic Environment Assessments (SEAs) which identify adaptive assessment processes that would streamline the regulatory environmental requirements and inform the planning and design of the SIPs to safeguarding the environment. This wind and solar PV SEA was commissioned by DEA in support of SIP 8 and is the first of its kind. It aims to provide strategic guidance and ensure that the development of wind and solar PV projects in terms of SIP 8 is undertaken in a sustainable manner. The study identifies areas where large scale wind and solar PV energy facilities can be developed in a manner that limits the potential for significant negative impact on the natural environment, while yielding the highest possible social and economic benefits to the country. These areas are referred to as Renewable Energy Development Zones (REDZs) and will be prioritised for large scale wind and solar PV development. Although the prioritisation of development will be focused in REDZs, it will not be limited to these areas. Suitable wind and solar PV development is still promoted across the country.

The identification and official adoption of REDZs as areas of strategic importance for large scale wind and Solar PV development in terms of SIP 8 will give effect to provisions in the National Development Act (Act 23 of 2014) and the Spatial Planning and Land Use Management Act (SPLUMA) (Act 13 of 2013) that allow for the streamlining of development in geographical areas associated with SIPs. Through these provisions the PICC and local government will able to ensure that wind and solar PV development in REDZs is given priority in planning, approval and implementation.

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Section 1. Renewable Energy in South Africa

Renewable energy is internationally recognised as having the potential not only to reduce the negative environmental impacts associated with conventional energy sources, but also being able to yield significant socio-economic benefits at national and local levels. Considering this, together with the abundance of renewable resources (especially wind and solar), South Africa has committed to the greening of its economy through renewable energy development.

The White Paper on the Renewable Energy Policy of the Republic of South Africa in 2003 first proposed renewable energy development and set a modest target of 4% (1 667 MW) of the country's generation capacity to be from renewable sources by 2013. It was, however, only with the onset of rolling blackouts in 2008, and the realisation that Eskom would not have the capacity to singlehandedly develop the required generation capacity, that renewable energy and the introduction of Independent Power Producers (IPPs) to the energy market became a priority.

Initial programmes for the procurement of the much needed new generation capacity from IPPs were first drafted in 2007-2008 under the administration of Eskom. These programmes allowed for the procurement of electricity from a range of generation sources, including renewables, but never resulted in any Power Purchase Agreements (PPAs) with IPPs. The National Energy Regulator of South Africa (NERSA) subsequently developed the Renewable Energy Feed-In Tariff (REFIT) programme in 2008. Under this programme Eskom, as the exclusive buyer, would buy power from IPPs at a predetermined and regulated tariff. After several changes in the regulated tariffs during 2009 and 2010 it was eventually found that procurement at a fixed tariff faced challenges in terms of national public finance procurement legislation. The REFIT programme was thus never officially implemented.

In August 2011 the current Renewable Energy Independent Power Producer Procurement Programme (REI4P) was introduced by the Department of Energy (DoE), assisted by the National Treasury. Under this programme renewable energy is procured from IPPs through a competitive bidding process and total procurement targets are set in line with the IRP2010. Capacities are allocated per technology type and bidding window, which generally occur once a year. According to this process IPPs submit bids to develop renewable energy projects which are evaluated 70% on price competitiveness and 30% on economic development criteria (e.g. job creation, use of locally produced goods, community ownership, and social development initiatives). The successful projects receive what is termed 'Preferred Bidder' status, and once financial closure has been reached, enter a 20 year PPA with Eskom.

The REI4P process has since earned international acclaim for its success in procuring competitively priced renewable energy. The first phase of the REI4P was initiated in 2011 to procure 3 625 MW by 2016 over a maximum of five bidding windows. The success of the REI4P in attracting large oversubscriptions to each bidding window, and consequent reductions in prices, led in December 2012 to the DoE gazetting an additional 3 100 MW allocation for the 2017 – 2020 period, bringing the current total REI4P allocation to 6 725 MW.

The REI4P process is thus well underway to reaching the target of 17 800 MW installed renewable energy generation capacity by 2030 as set out in the first version of the IRP2010. The first 28 preferred bidder projects were announced late 2011, and after a further two bidding windows, 64 projects representing a total installed generation capacity of 3 912 MW, and a committed private investment of more than R 120 billion[1], have been selected as preferred bidders by 2013. These projects include wind, solar PV, concentrated solar power (CSP), landfill gas, and biomass technologies. In particular, 22 wind projects representing 1 980 MW and 33 solar PV projects representing 1 484 MW make up the largest portion of the total preferred bidder capacity after bidding window 3. Including the 64 projects already identified as preferred bidders after window 3, by December 2013 approximately 550 projects representing about 41 000 MW of generation capacity were in the process of applying for, or had already received, environmental authorisation in South Africa (see Table 1).

Table 1: Approximate number of renewable energy projects in the process of applying for, or having received environmental authorisation by December 2013

Province	Number of Active Renewable Energy Applications					MW of Active Renewable Energy Applications				
	In Process	Approved	Preferred Bidders			In Process	Approved	Preferred Bidders		
			REI4P Window 1	REI4P Window 2	REI4P Window 3			REI4P Window 1	REI4P Window 2	REI4P Window 3
Northern Cape	71	142	15	7	10	9146	11204	685	330	1015
Western Cape	22	46	4	4	1	2326	4476	133	244	75
Eastern Cape	19	38	5	6	2	2145	2804	470	402	197
Kwazulu Natal	2	4	0	0	1	170	120	0	0	16
Mpumalanga	3	4	0	0	0	90	246	0	0	0
Limpopo	13	13	2	0	1	670	432	58	0	60
Gauteng	2	9	0	0	1	95	282	0	0	18
Free State	16	21	1	2	1	809	842	64	64	75
North West	20	25	1	0	0	997	683	7	0	0
All Provinces	**168**	**302**	**28**	**19**	**17**	**16447**	**21087**	**1416**	**1040**	**1456**

[1] Eberhard, A., Kolker, J. and Leigland, J. 2014. South Africa's renewable energy IPP procurement program: Success factors and lessons. World Bank: Washington.

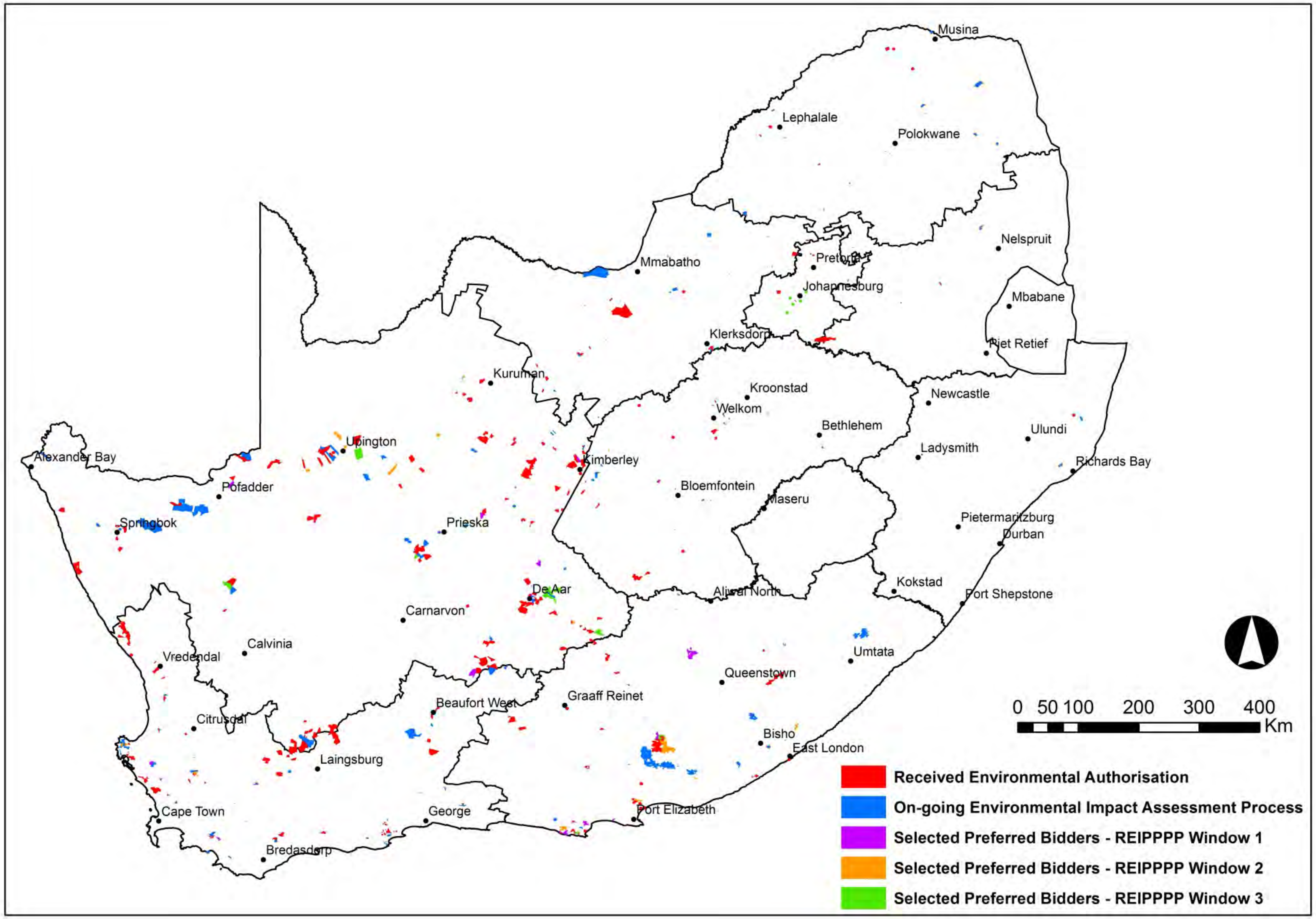
The success of the REI4P is evident from the 42.6% wind and 68.1% solar PV average bid price reduction over the three years between bidding rounds one and three[1]. A recent study[2] furthermore found that approximately 600 MW of wind and 1000 MW of solar PV generation capacity that gradually connected to the electricity grid in 2014 cost the country R 4.5 billion in tariff payments, while saving the national economy R 5.3 billion in avoided fuel and unserved electricity (load shedding) costs. This R 800 million net saving in 2014 resulted predominantly from the more expensive round one projects. With the significant reduction in price of subsequent bidding rounds and electricity shortages expected to persist for some time to come, renewable energies are likely to result in even greater national savings in the near future. While diversifying and greening the South African energy mix renewable energies and the REI4P will thus also result in net savings to the national economy for as long as the electricity grid is constrained.

The South African Government's commitment to the roll-out of renewable energy, in combination with the overriding success of the REI4P, raises questions as to how the growing spatial extent of renewable energy development in South Africa can be managed strategically and sustainably. The IRP2010 and REI4P do not define spatially the generation capacity allocations, which makes strategic spatial planning challenging. As illustrated in Map 1, proposed renewable energy projects are widely distributed over most of the country. With the progression of the REI4P and the need to optimise strategic investment, particularly in the electricity grid, the wide distribution of projects together with the uncertainty inherent to a bidding process are becoming a significant challenge for sustaining the success of the programme. There is, therefore, a growing need for strategic planning that enables a proactive approach to infrastructure development to ensure the continued success of renewable energy development in South Africa.

A recent analysis[3] of different solar PV allocation scenarios in South Africa found that the overall economic implication of focusing solar PV projects in the highest resource areas, and consequently necessitating significant electricity grid investments, are similar to deploying the same projects in lower resource areas that make better use of existing electricity grid infrastructure. The study therefore concluded that in addition to resource potential, other criteria such as required transmission and distribution upgrades, socio-economics, and environmental impacts should be taken into account when considering the allocation of generation capacities. It is in line with this conclusion, and through integrated spatial analyses and wide stakeholder consultation, that the proposed REDZs have been identified based on energy resource potentials, infrastructure availability, environmental suitability and socio-economic needs. The proposed REDZs are identified as geographical areas in which large scale wind and solar PV development is considered most appropriate from a national strategic perspective.

[2] Bischof-Niemz, T. 2015. Financial benefits of renewables in South Africa in 2014. CSIR Energy Centre: Pretoria

[3] GIZ, DoE and Eskom, 2014. Analysis of options for the future allocation of PV farms in South Africa



Map 1: Spatial distribution of renewable energy projects that have applied for, or already received environmental authorisation by December 2013

Section 2. Study Objectives

The continued success of the REI4P in years to come is of paramount importance for renewable energy to fulfil its potential of making a significant contribution to the South African economy in terms of energy shortage alleviation, carbon emission reduction, job creation, skills development and the establishment of a local manufacturing industry that potentially could service the renewable energy market in the rest of Southern Africa. The success of renewable energy development in South Africa, however, cannot only be measured by the amount of installed capacity achieved or investment attracted. Consideration must also be given to the realisation of tangible socio-economic benefits and the avoidance of significant environmental impacts.

The vision of this SEA is that further large scale wind and solar PV projects that contribute to the goals of the NDP are supported by strategic planning, endorsed by government, embraced by stakeholders, and attractive to investors. In order to create the enabling environment required to reach the envisioned future, the mission of this SEA is to identify REDZs that are of strategic importance for large scale wind and solar PV development in terms of SIP 8, and in which the significant negative impacts on the natural environment are limited and social and economic benefits to the country are enhanced. With this vision and mission in mind, the following key objectives were developed to guide the study.

2.1 Sustainable Development

A balance between environmental, social and economic factors is required for effective and sustainable development. The SEA takes a strategic and integrated approach to identifying geographical areas in which large scale wind and solar PV development would be most appropriate. Integration is achieved through utilising the best available spatial data to identify large clusters of land with the highest economic potential (i.e. highest resource potential and infrastructure availability), highest social need (i.e. local municipalities with highest need for development), and lowest environmental sensitivity (i.e. fewest environmental constraints).

2.2 Participation

The successful continuation of renewable energy development in South Africa to a great deal depends on the level of agreement that can be reached between individual government departments, the three spheres of government, the private sector, and the public. The implementation of strategic planning and proactive initiatives to create an enabling environment for appropriate renewable energy development will require the buy-in and commitment from the key role players. Early consultation and formal agreement are thus of vital importance to the success of the SEA process. From the onset of the process extensive consultation was undertaken with the relevant government departments, key stakeholders and the general public.

2.3 Integration

Once agreement has been reached, the alignment of national, provincial and local plans and policies is necessary to allow for the efficient implementation of REDZs. The alignment allowed for by the SEA starts with the designation of the REDZs as geographical areas associated with SIP 8 through a publication in the *Government Gazette*. Subsequent to the gazetting of the REDZs, provincial and local governments will be required to consider these areas for inclusion in the relevant spatial plans and policies. Further alignment in terms of national and local infrastructure development plans, especially the electricity grid, will create an enabling environment for development in these areas.

The alignment of all SEAs undertaken in support of the SIPs also caters for the integration of large scale strategic infrastructure development at a national level, as is intended by the SIP programme. An example of such alignment is the incorporation of the proposed REDZs as an output of this SEA into the Electrical Grid Infrastructure (EGI) SEA[4], commissioned by the DEA in support of SIP 10, to make provision for the development of the transmission infrastructure required for the success of the REDZs.

2.4 Enabling Environment

Without compromising environmental protection, the integrated approach followed to identify the REDZs, official agreement to these areas, and the alignment of policies and plans to create an enabling environment, ultimately allow for the streamlining of development and approval processes. The scoping level pre-assessments undertaken in the REDZs are sufficient to meet the requirements of the scoping phase of a Scoping and Environmental Impact Assessment (S&EIA) process and to focus project level environmental assessments on those potential impacts that are of significant importance. With the scoping requirements being met, all future proposed wind and solar PV projects that require environmental authorisation in an adopted REDZ will require a streamlined project level environmental assessment process in the form of a Basic Assessment (BA), rather than a full S&EIA process. The project level BA process in REDZs will be undertaken in accordance with current EIA Regulations, including the relevant public participation process. The potential significant impacts that require assessment, as well as the level to which they need to be assessed during the BA process, will be informed by the identified sensitivities and associated protocols developed through the SEA process.

Key stakeholder agreement to the protocols related to matters of water, agriculture, defence, heritage, etc., leads to some level of integration in approval processes. Additional streamlining beyond the environmental authorisation process is thus achieved. Further streamlining in terms of local and national planning will result from the identification and official adoption of REDZs as areas of strategic importance in terms of SIP 8, which enables the PICC and local government to ensure that wind and solar PV development in these areas is given priority in planning, approval and implementation.

[4] https://egi.csir.co.za/

Section 3. Legal Framework

The three key pieces of legislation that enable the identification and implementation of REDZs are summarised below:

3.1 National Environmental Management Act (NEMA), Act no. 107 of 1998

NEMA provides for co-operative environmental governance by establishing principles for decision-making on matters affecting the environment, institutions that will promote cooperative governance, and procedures for co-ordinating environmental functions exercised by organs of state.

The SEA is undertaken under section 24(2) of NEMA which allows for the identification of geographical areas (e.g. REDZs) based on environmental attributes, and specified in a spatial development tool adopted in the prescribed manner by the competent authority, in which specified activities may not commence without environmental authorisation from the competent authority. Sensitivity maps prepared as part of the SEA process give effect to Section 24(3) of NEMA that allows for the compilation of information and maps that specify the attributes of the environment that need to be taken into consideration by all competent authorities. The assessment requirements in the form of development protocols prepared through the SEA process further give effect to Section 24(5) of NEMA which allows for the laying down of procedures to be followed in respect of application for environmental authorisation and decision making as well as any matter necessary for dealing with and evaluating applications for environmental authorisation.

An additional Government Notice that will be published with the EIA Regulations under NEMA will make provision for wind and solar PV development in the REDZs as pre-defined and pre-assessed geographical to require only a Basic Assessment (BA) process in terms of Section 19 of the 2014 EIA Regulations.

3.2 Infrastructure Development Act, Act no. 23 of 2014

This act provides for the facilitation and co-ordination of public infrastructure development which is of significant economic or social importance to the country. It ensures that infrastructure development in the country is given priority in planning, approval and implementation. It furthermore ensures that the development goals of the state are promoted through infrastructure development and improves the management of such infrastructure during all life-cycle phases. The act designates the development of green energy in support of the South African economy as SIP 8 and gives the PICC the mandate to ensure that infrastructure development in respect of any SIP is prioritised.

The official adoption of REDZs as geographical areas associated with SIP 8 will give effect to Sections 7 and 8 of this act and give the PICC the mandate to give priority to the planning, approval and implementation of wind and solar PV development in REDZs.

3.3 Spatial Planning and Land Use Management Act (SPLUMA), Act no. 16 of 2013

SPLUMA as a framework act for all spatial planning and land use management legislation in South Africa seeks to promote consistency and uniformity in procedures and decision-making in this field. The other objectives of the act include addressing historical spatial imbalances and the integration of the principles of sustainable development into land use planning, regulatory tools and legislative instruments.

Chapter 8 of the 2014 draft SPLUMA regulations prescribes the institutional, spatial planning, and land use management requirements for municipalities in whose jurisdiction a SIP has been designated. If this section remains in the final regulations the designation of the REDZs as areas associated with SIP 8 will give effect thereto and require local government to take these areas into consideration in terms of local planning.

Section 4. Process Overview

The process followed to identify and assess the REDZs is briefly summarised below and discussed in detail in Parts 2 and 3.

4.1 Context

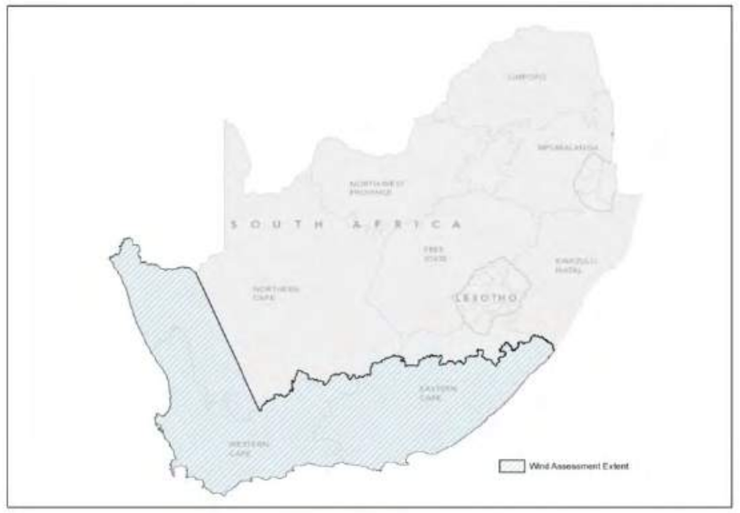
This SEA process bridges the gap between non-spatial national level policies, plans and programmes (i.e. the NDP, NIP and IRP2010) and individual projects. The SEA specifically aims at providing strategic spatial guidance to allow for integrated and streamlined implementation of national policies. It achieves this by identifying priority areas (i.e. REDZs) to which spatial planning can be aligned, authorisation processes streamlined, and proactive initiatives implemented to allow for the effective and efficient development of appropriate large scale wind and solar PV projects. The SEA process is undertaken at a strategic level and cannot replace the requirement for project level environmental assessment. The high level environmental, social and economic data utilised to identify and pre-assess the REDZs is not sufficient for project-level decision making in terms of environmental authorisation. The pre-assessment does, however, allow for the streamlining of project level assessment processes.

4.2 Extent

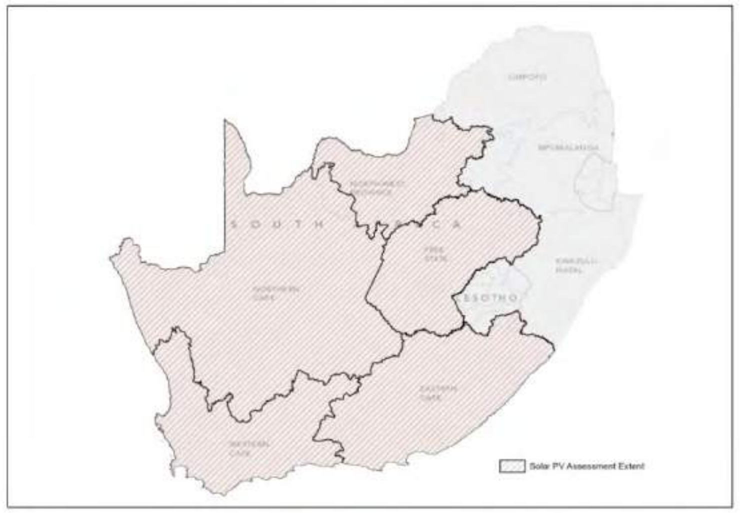
In terms of the assessment for wind development, this SEA was limited by the coverage of the Wind Atlas for South Africa (WASA)[5]. The modelled WASA dataset is considered to be the best available public wind resource data in South Africa and well suited for regional level assessments. At the commencement of the SEA, the WASA domain was limited to parts of the Northern Cape, Western Cape and Eastern Cape provinces (see Map 2). It is planned for the coverage of WASA to be expanded in the near future.

Although solar resource data used for this SEA have been made publicly available[6] for the entire country, the extent of the solar PV component of the study is limited to five provinces (see Map 3). The Northern Cape, Western Cape, Eastern Cape, Free State, and North West provinces were identified as having the most prospective solar isolation levels and the highest number of proposed solar PV projects at the time this SEA was initiated.

The SEA process is intended to be iterative with the study being expanded to expand and identify more REDZs as new learning, data and resources become available.



Map 2: Extent of wind assessment



Map 3: Extent of solar PV assessment

4.3 Phase 1

As illustrated by Figure 1 the SEA process consisted of three phases. A brief summary of the two tasks undertaken as part of Phase 1 is provided below while a more detailed description is provided in Part 2: Section 1.

The first task of Phase 1 of the SEA was to identify areas of high development potential. Resource data served as the basis for the determination of development potentials. Power density in watts per square metre (W/m^2) at 100 m hub height, as modelled by the WASA project at a 250 m raster resolution, was used as the basis for the wind assessment. The solar PV assessment was based on the Global Horizontal Irradiation (GHI) in kilowatt hours per square metre per annum ($kWh/m^2/a$) as modelled by GeoModel Solar at a 250 m raster resolution. Resource data as the primary economic consideration were adjusted with additional economic (e.g. transmission losses, infrastructure availability, and pre-identified priority industrial areas) and social (e.g. areas with higher social development needs and potentials) factors to create a development potential layer. In order to achieve a spread of development, as is technically and socio-politically required, the development potential layer was further analysed to identify the areas of highest development potential per province. Consultation with provincial governments on matters related of social pull factors, and Eskom on issues related to grid infrastructure, formed a crucial component of this task.

The second task undertaken as part of Phase 1 entailed the development of an environmental and technical constraints mask. The constraints mask consists of environmental features such as protected areas, sensitive ecological features and areas of known bird and bat sensitivity. It also includes existing and future planned land uses such as agriculture, existing infrastructure, and the Square Kilometre Array (SKA) electro-magnetic telescope. The mask furthermore contains technical constraints such as slopes with a gradient of more than 10 degrees.

Integration of environmental, social and economic considerations was achieved through combining the development potential and constraints layers to identify large clusters of land with the highest potential for wind and solar PV development and lowest potential for significant negative environmental and land use impacts. From this process, 15 wind and 8 solar PV study areas were delineated for further consideration.

[5] http://www.wasaproject.info/
[6] http://egis.environment.gov.za/

4.4 Phase 2

Additional consultation with provincial governments, the private sector and the public was undertaken to narrow the study areas down to eight focus areas. While a brief summary of this process is provided below, a detailed description is provided in Part 2: Section 2 and Appendix B.

Developers from the wind and solar PV industries were given the opportunity to provide input via a survey into where future development, from the industries' perspectives, should be prioritised. In total, 18 wind and 21 solar PV developers responded to the survey. The priority areas identified were aggregated and overlayed with the initial study areas and used to identify eight focus areas. Additional socio-political considerations highlighted by provincial and local governments as well as public consultation further informed the delineation of the eight focus areas.

4.5 Phase 3

Phase 3 of the study involved scoping level pre-assessments and sensitivity mapping in each of the eight focus areas. A brief summary of the phase 3 is provided below, with detailed results from this process provided in Part 3 and Appendix A.

Specialist scoping level pre-assessments were undertaken for agriculture, landscape, heritage, terrestrial and aquatic biodiversity, birds, bats, and socio-economic sensitivities. Further aspects of sensitivity in terms of aviation, defence, telecommunication, weather services, SKA, mining, noise and flicker effects were determined in consultation with the relevant authorities. Sensitivity maps were produced for all but the socio-economic assessment. The results were used to develop further assessment requirements in the form of protocols that will inform project level environmental assessments and authorisation processes.

The identified sensitivities were subsequently combined and used to eliminate land in the eight focus areas that is potentially unsuited for development (i.e. of Very High sensitivity). The remainder of the land was used to estimate the development capacity in each of the focus areas. These development capacities were also compared with the current and potential foreseeable transmission evacuation capacity that was determined in consultation with Eskom. More details on the development and transmission evacuation capacities are provided in Part 4.

4.6 Additional information

4.6.1 Consultation Process

A comprehensive consultation process formed the foundation for this SEA and while a brief summary is provided below, details of the process are provided in Appendix B.

The SEA process was governed by a Project Steering Committee (PSC) consisting of key authorities relevant to renewable energy development in South Africa. The process was also informed by an Expert Reference Group (ERG) consisting of key stakeholder groups with an interest in renewable energy development. Provincial departments responsible for spatial planning and environmental affairs were not only consulted through the formal PSC and ERG structures, but also on an individual basis through provincial workshops in each of the provinces under investigation. In total seven such provincial government workshops were undertaken.

District and local municipalities in the focus areas were also consulted through workshops in these areas. In total eight such workshops with local governments were undertaken by the SEA team and in collaboration with provincial government. In addition to a continuous web-based consultation process used to disseminate project information and solicit inputs from the general public, public meetings were also undertaken in each of the focus areas, 16 printed newspaper advertisements were placed, seven media articles were published and eight conference presentations were made. Additionally, 20 focus group meetings were undertaken to consult with key stakeholders at critical stages in the SEA process.

4.6.2 Renewable Energy Application Mapping

As part of the SEA process, a map including all renewable energy EIA applications was produced. The application map (see Map 1) was used only as an informative layer and not for the identification of priority areas. The main reasoning for not using existing applications to identify priority areas is that an integrated approach, in accordance with the objectives of this study, may not have been followed when siting all proposed developments. With projects distributed all over the country the SEA process is able to identify those areas that are of greater interest to the country from a strategic perspective.

A first version of the EIA applications map was released in the public domain in 2013 and a second version in 2014. The second version of the EIA application map includes all renewable energy EIA applications submitted to DEA up to December 2013.

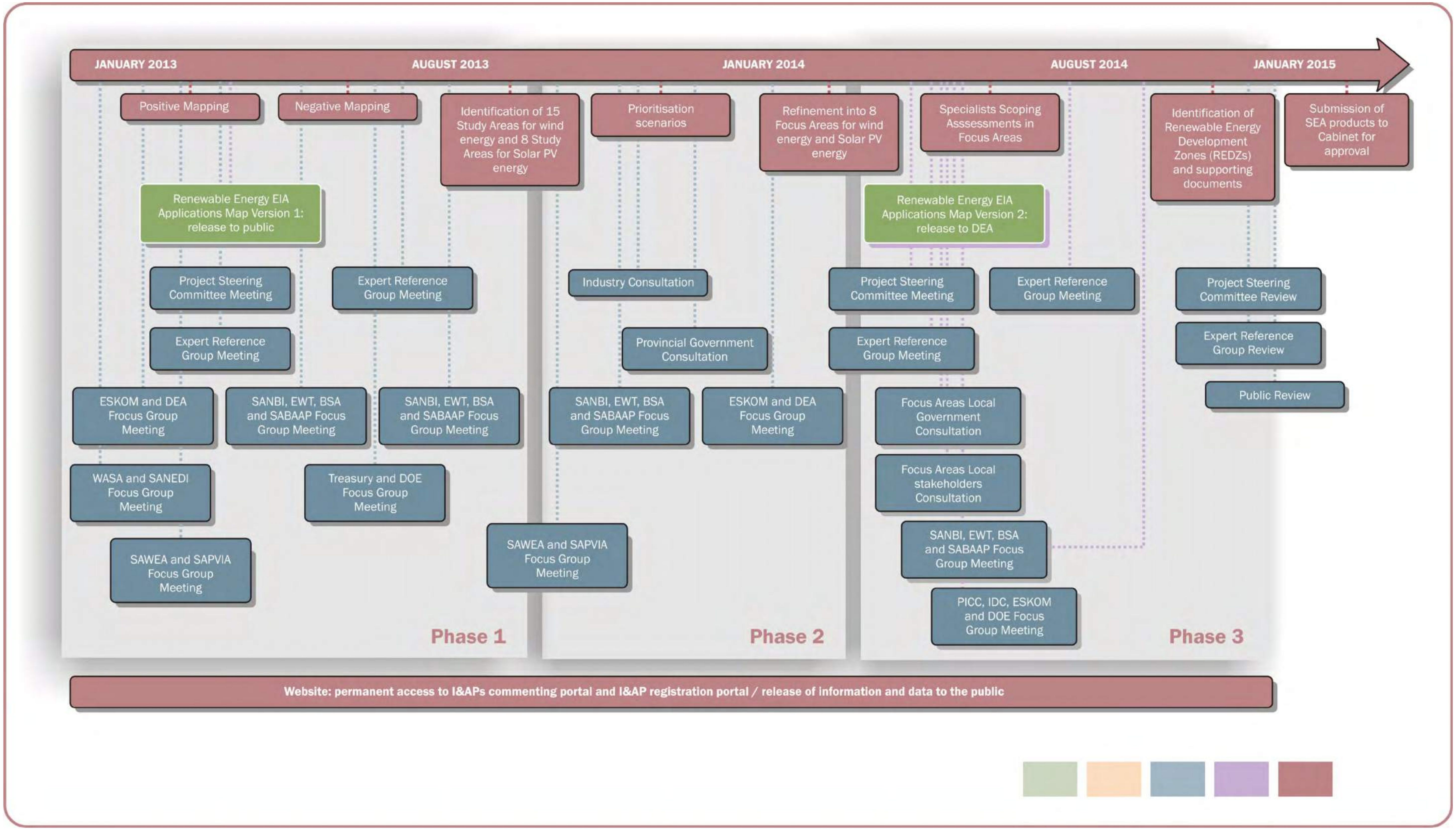
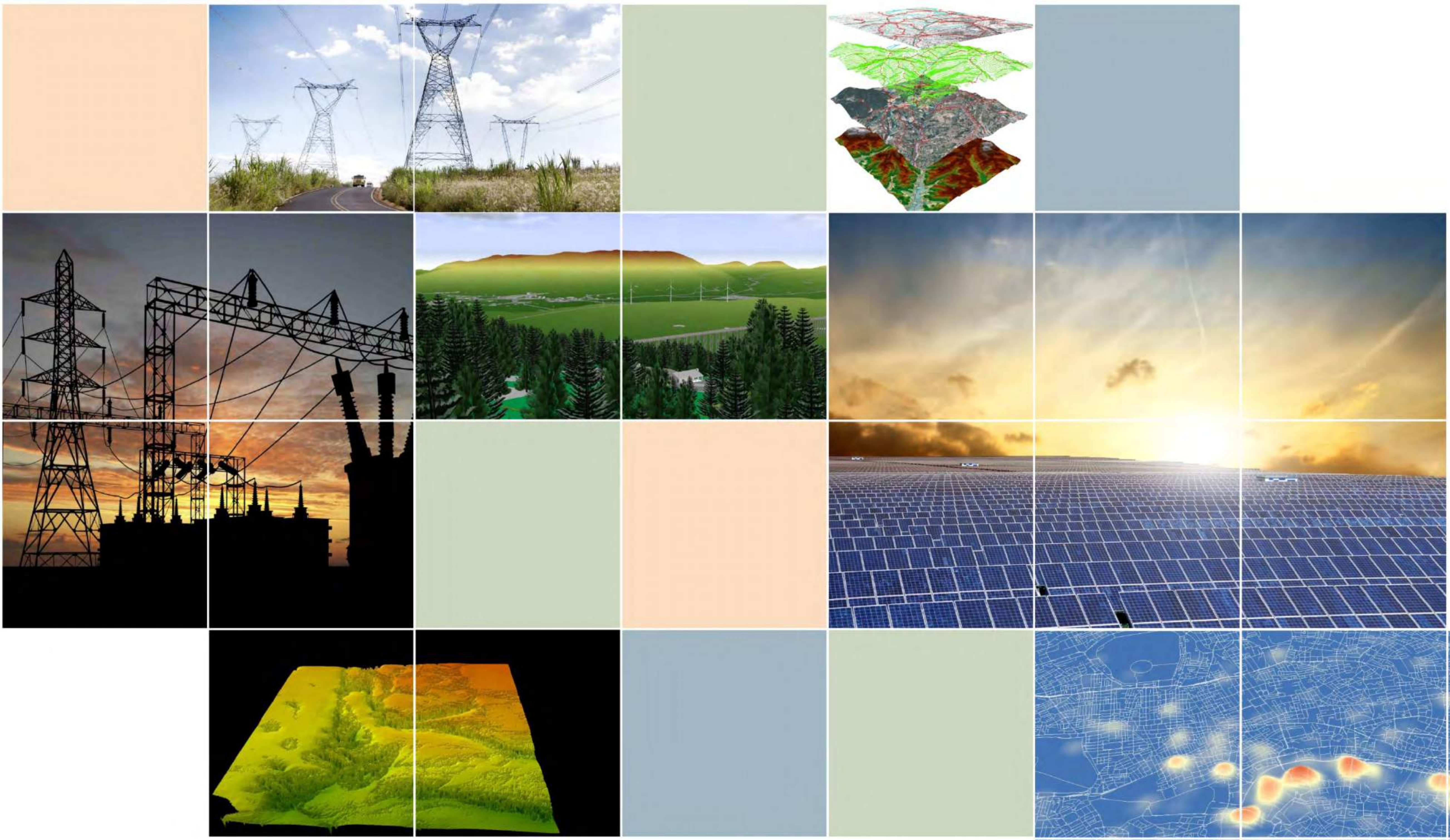
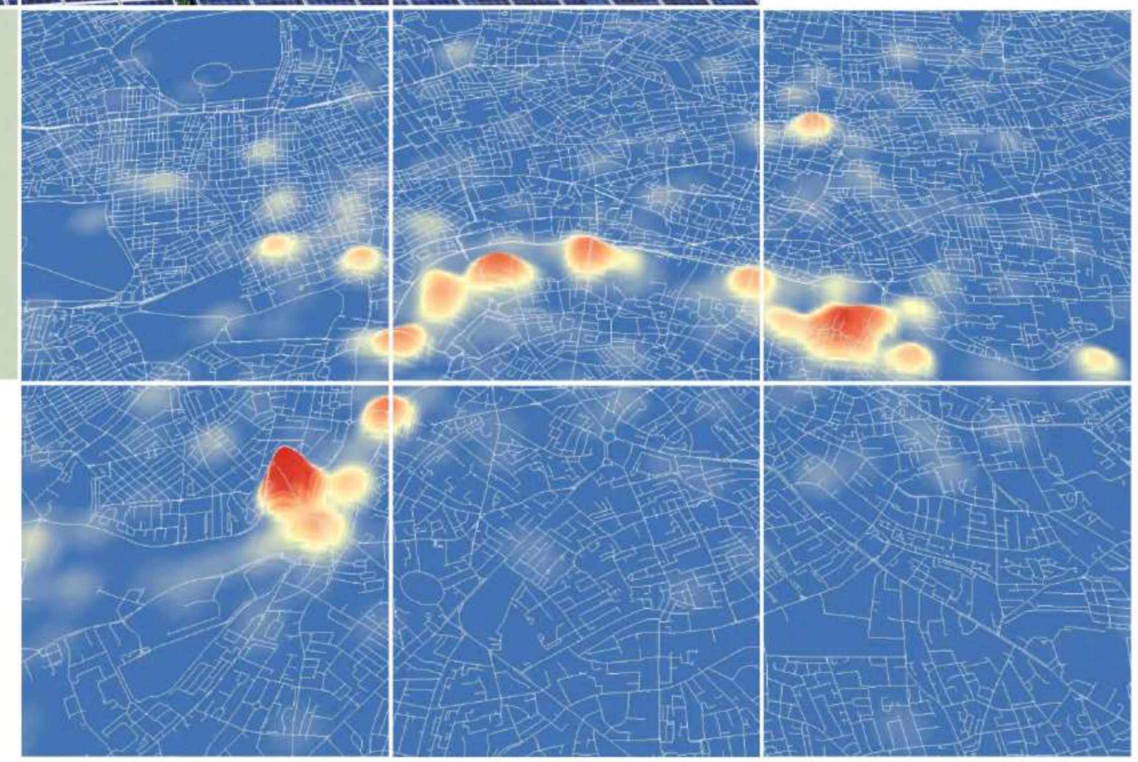


Figure 1: SEA process diagram





PART 2

Identification of the wind and solar PV Focus Areas

contents

Introduction

This part of the report describes the approach followed to identify the eight focus areas (FAs) during Phases 1 and 2 of the SEA process. The approach was developed in line with the context and study objectives described in the previous part of the report and broadly based on an integrated spatial analysis of the best available data at the time. At the end of the first phase, 15 wind and 8 solar PV study areas were identified as having the highest potential for large scale wind and solar PV development and the lowest environmental sensitivity. Subsequent consultation with government, industry and the public during the second phase formed the basis for prioritising some of the study areas and the identification of the eight FAs that were further assessed as part of the SEA process.

Section 1. Identification of Study Areas

Phase 1 of the SEA process consisted of the identification of 15 wind and 8 solar PV study areas that are considered strategically best suited for large scale wind and solar PV development based on a high level integrated spatial analysis of the best available environmental, technical and social data. The identification of the study areas consisted of two spatial analyses. Firstly, a positive mapping exercise was undertaken during which the development potential was determined based on wind and solar resources, as well as other pull factors such as electrical grid evacuation capacity, need for socio-economic investment, network losses, and priority areas for renewable energy industries [e.g. Special Economic Zones (SEZs)]. Secondly, a negative mapping exercise was undertaken to identify environmental (e.g. protected areas, known bird and bat sensitivity, agricultural sensitivity, etc.) and technical (e.g. slope) constraints. Through a combination of the positive and negative mapping results it was possible to delineate study areas. The positive and negative mapping exercises were undertaken for the specific purpose of identifying study areas that could be further assessed during the SEA process and the results are not suited for decision making outside the SEA context.

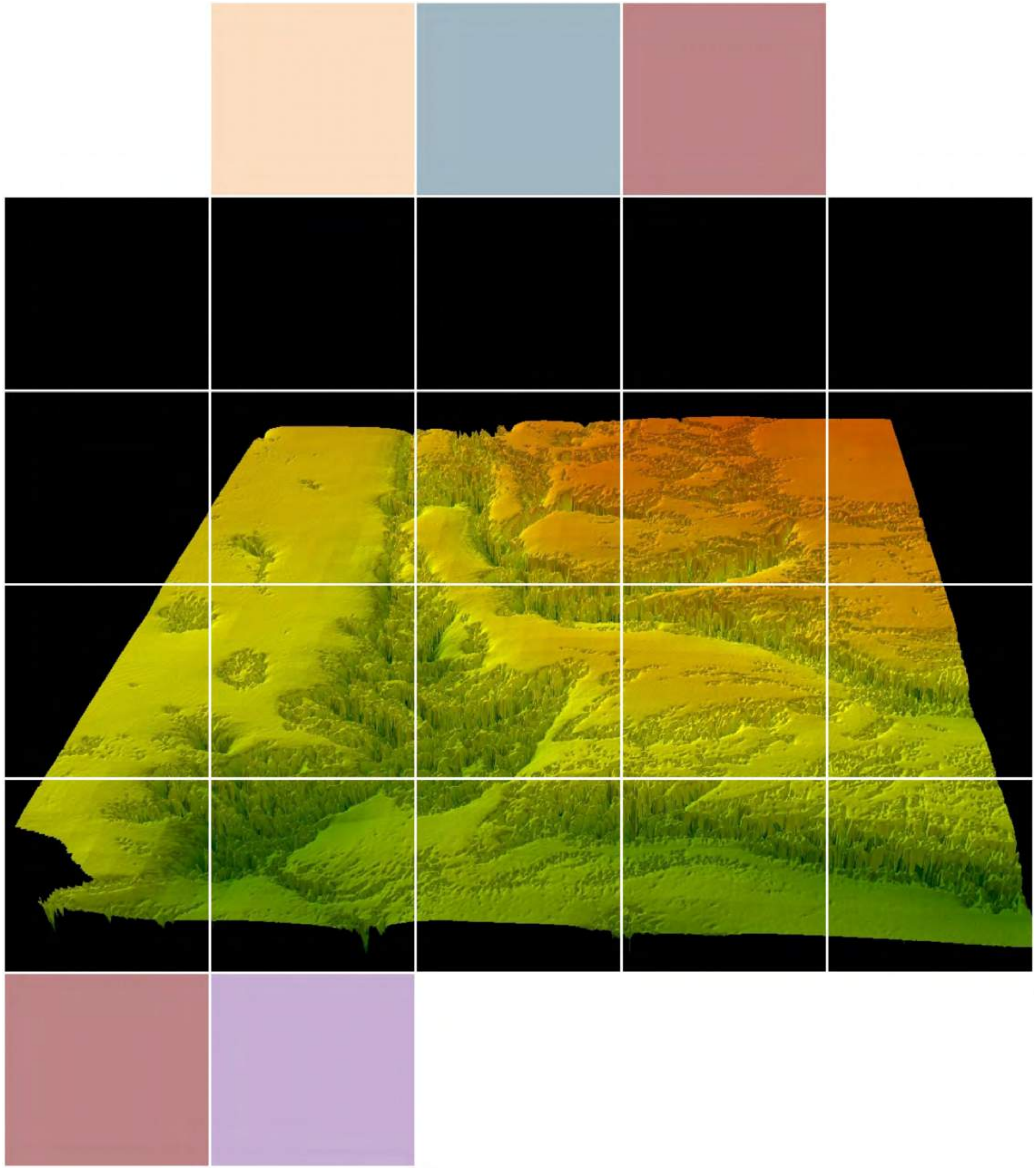
1.1 Positive Mapping

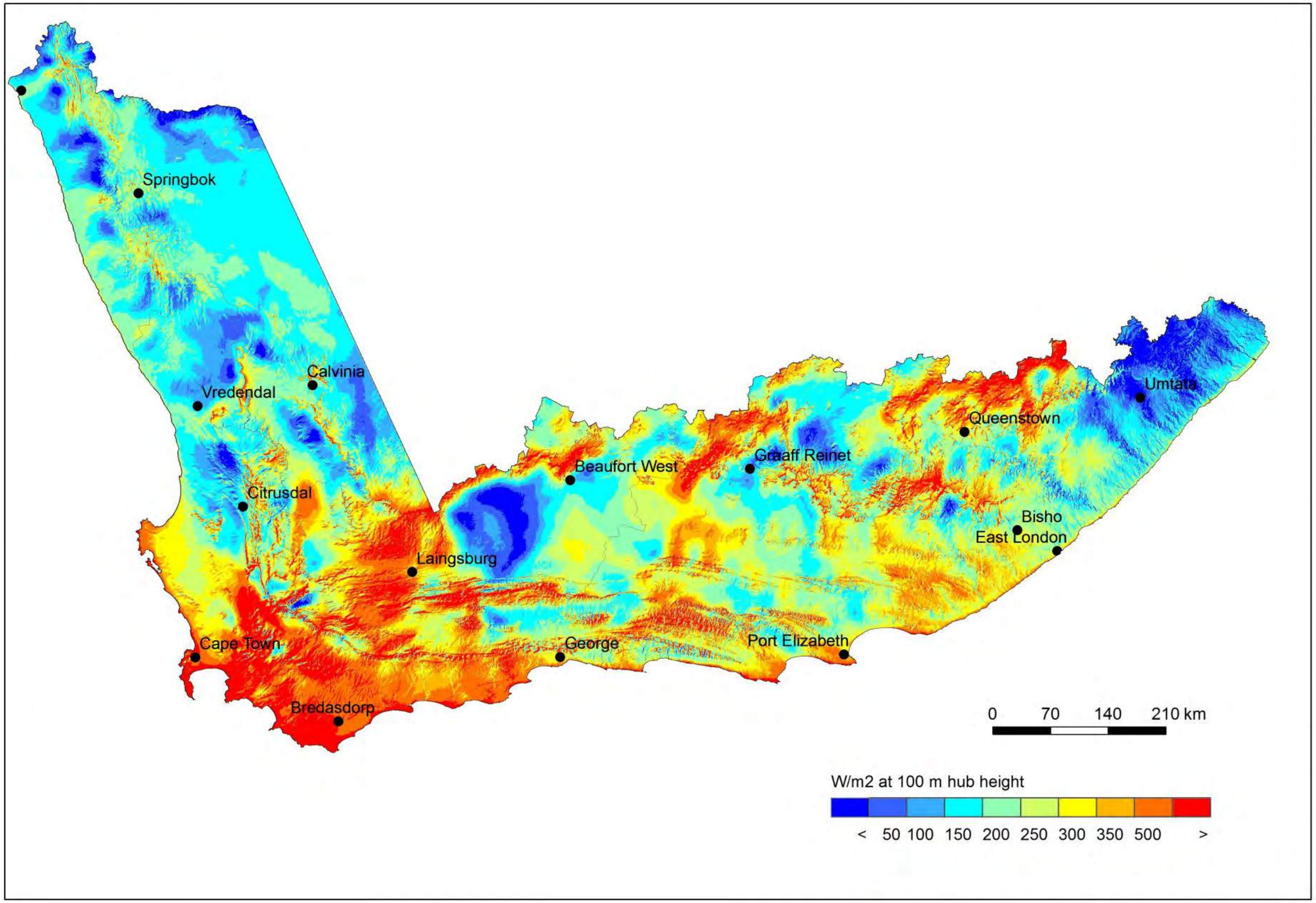
1.1.1 Resource

Resource potential is considered to be the most important criterion for the determination of development potential due to the fact that it is one of the key factors influencing the cost of renewable energy, and hence the macro-economic benefits to the country. Resource data formed the basis of the positive mapping exercise with data being converted to percentile basis before being adjusted spatially by adding or subtracting percentile values based on the distance from developmental pull factors.

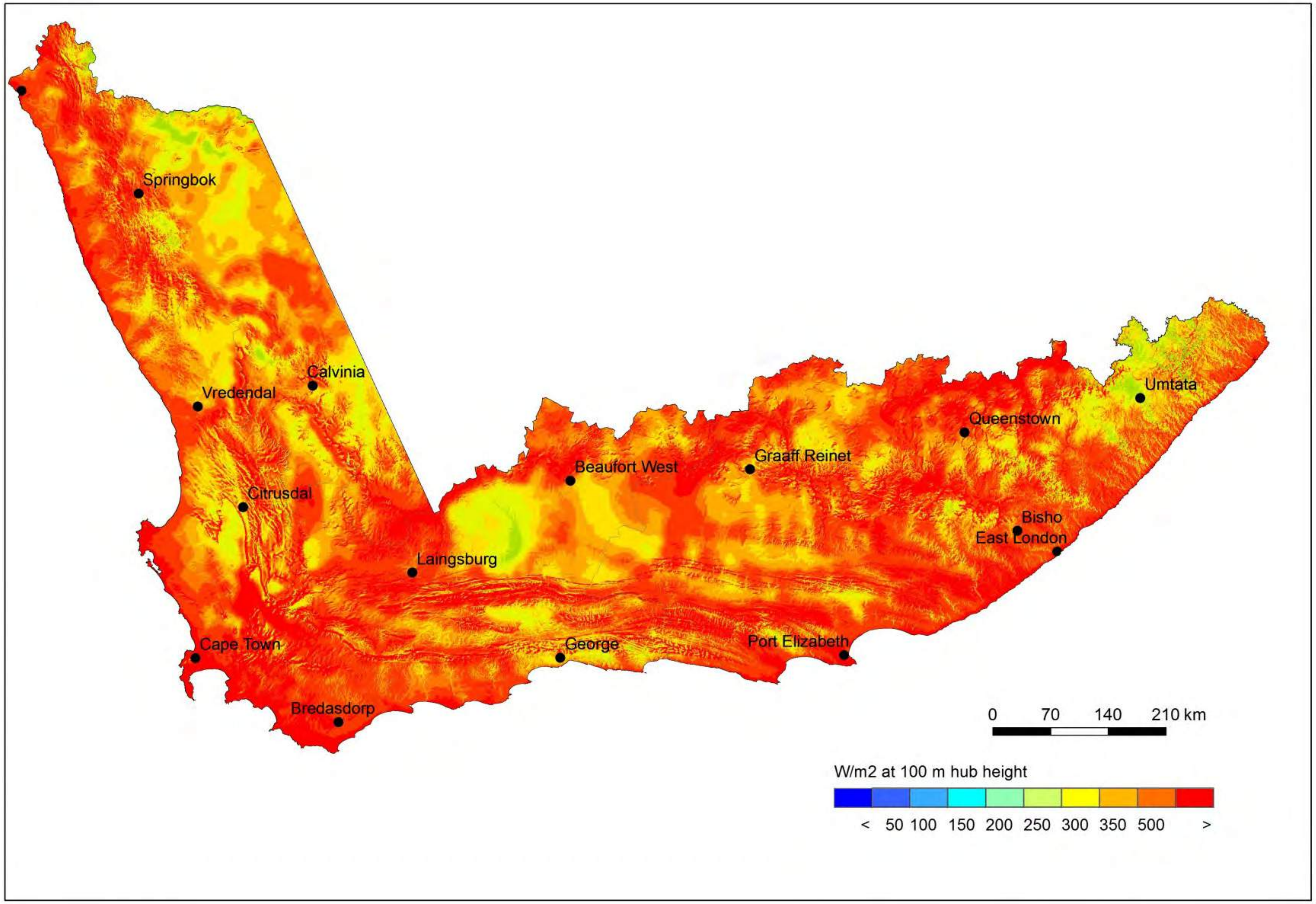
For the wind analysis the power density in watts per square metre (W/m^2) at 100 m hub height as modelled by the Wind Atlas for South Africa (WASA) project at a 250 m raster resolution was used as the raw resource potential data (see Map 1). The version of the dataset used for this study was released in early 2013 and modelled using the Wind Atlas Analysis and Application Programme (WAsP). Being a modelled dataset which has been verified with measurements from 11 wind measuring masts, the data inherently have uncertainties and some degree of inaccuracy. The data are, however, sufficient for providing regional and relative indications of resource potential as required for the purpose of this study. To limit the impacts of potential data inaccuracies the industry was also afforded the opportunity to provide inputs with regard to which areas should be prioritised for development. It is assumed that accurate resource data as measured by the industry would have been taken into consideration when preparing these inputs. This process is further discussed under Section 2.1.

In 2014 an updated WASA dataset which is based on the integration of the WAsP and Weather and Research Forecasting (WRF) models was released (see Map 2). This updated dataset predicts wind resource potentials significantly higher than those contained in the previous dataset and is believed to be more accurate. A high level comparison of the two datasets indicated that even though the absolute resource potentials were estimated to be higher across the entire WASA domain, the relatively higher wind resource areas that are of interest to this study remained similar across the two datasets. Due to the fact that the industry also guided the identification of FAs based on their measured data, and the fact that the SEA was already advanced in the process of assessing the FAs at the time when the new dataset was released, the new data were not used to amend the FAs under investigation.





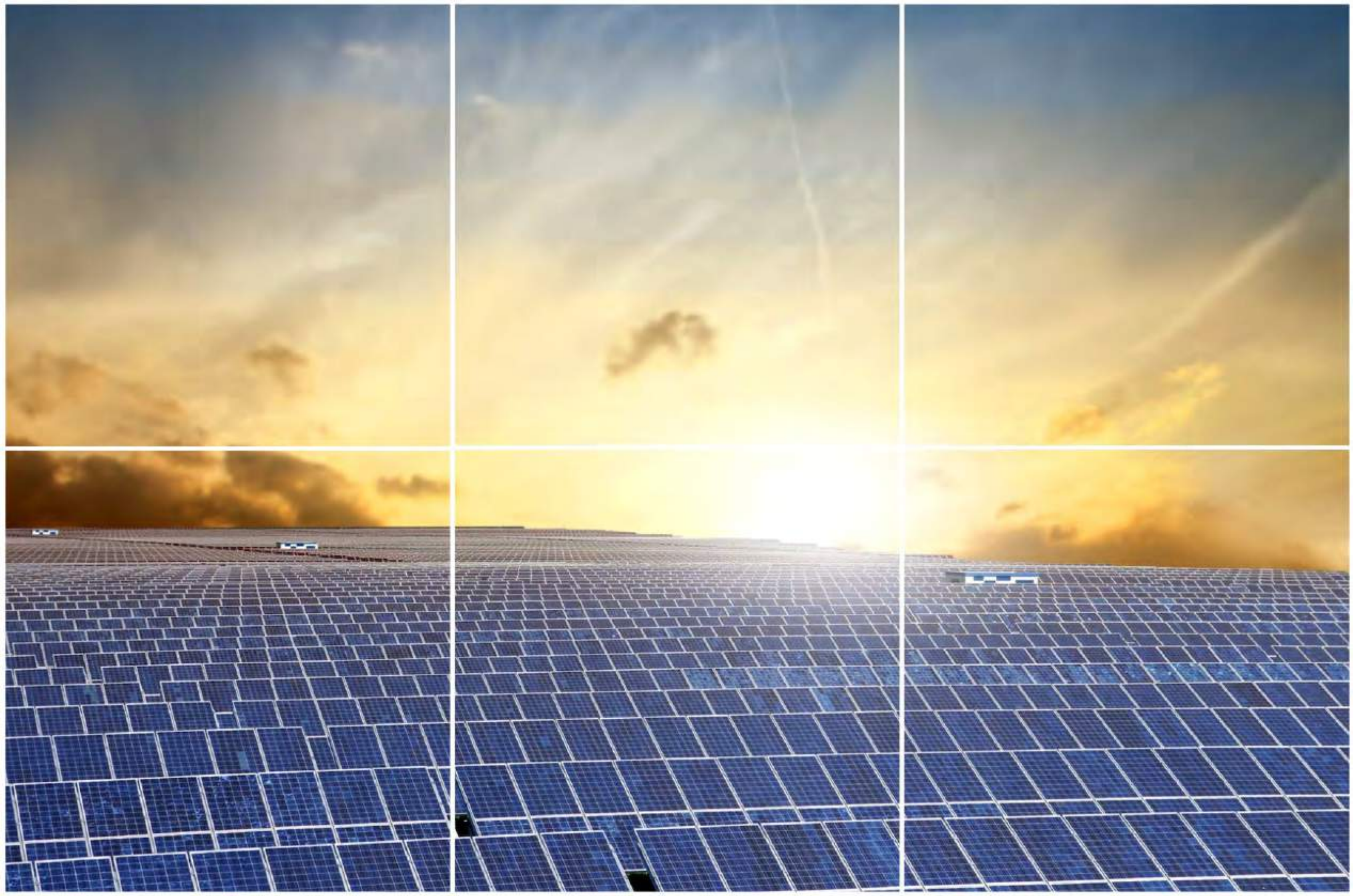
Map 1: Wind power density in watts per square metre (W/m^2) at 100 m hub height as modelled by the WASA project at a 250 m raster resolution (2013 WAsP).



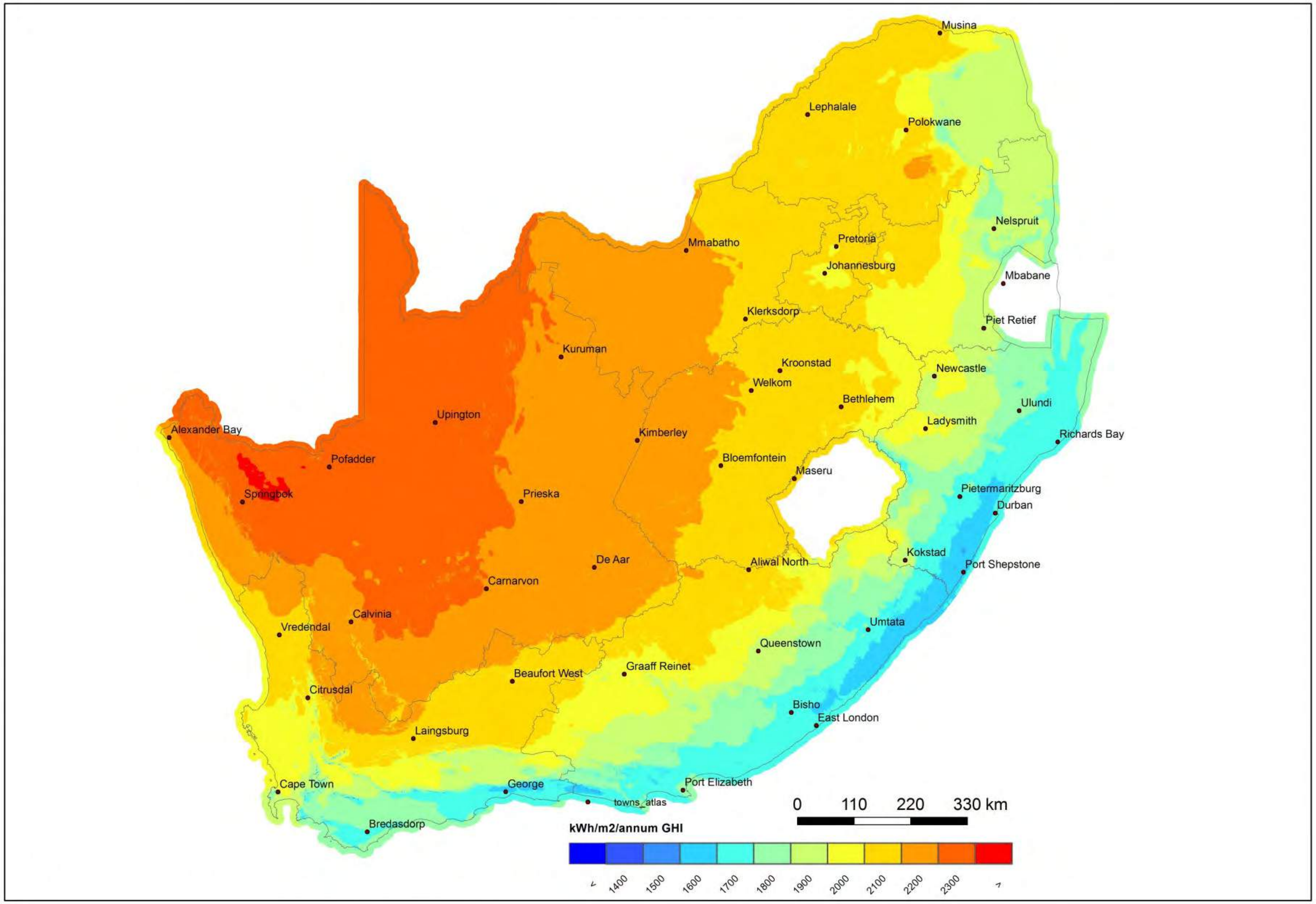
Map 2: Wind power density in watts per square metre (W/m2) at 100 m hub height as modelled by the WASA project at a 250 m raster resolution (2014 WAsP/WRF).

For the solar PV analysis the Global Horizontal Irradiation (GHI) in kilowatt hours per square metre per annum (kWh/m²/a) as modelled by GeoModel Solar at a 250 m raster resolution was used as the raw resource potential data (see Map 3). In total, four solar resource datasets were purchased by the Department of Environmental Affairs (DEA) as part of the SEA process. These datasets include the: 1) Global Horizontal Irradiation (GHI), 2) PV electricity potential for fixed-mounted modules, 3) optimal angle for maximising PV energy yield from fixed modules, and 4) PV electricity potential for single axis North-South tracking modules datasets. These data have been made publicly available[1] by DEA and have since been used widely for national research and planning purposes.

In terms of this study only the GHI dataset was used as it provides the raw resource potential for PV development, while the other datasets are PV technology specific. Generally, GHI data would be used to identify areas of interest for development, and the selection of the PV technology to be installed on an identified site will depend on other factors such as site properties and pricing implications. The GHI dataset was thus considered best suited for the identification of study areas.



[1] Data available from http://egis.environment.gov.za/Download.aspx?m=25&amid=66



Map 3: Solar Global Horizontal Irradiation (GHI) in kilowatt hours per square metre per annum (kWh/m²/a) at a 250 m raster resolution

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1.1.2 Transmission Network Losses

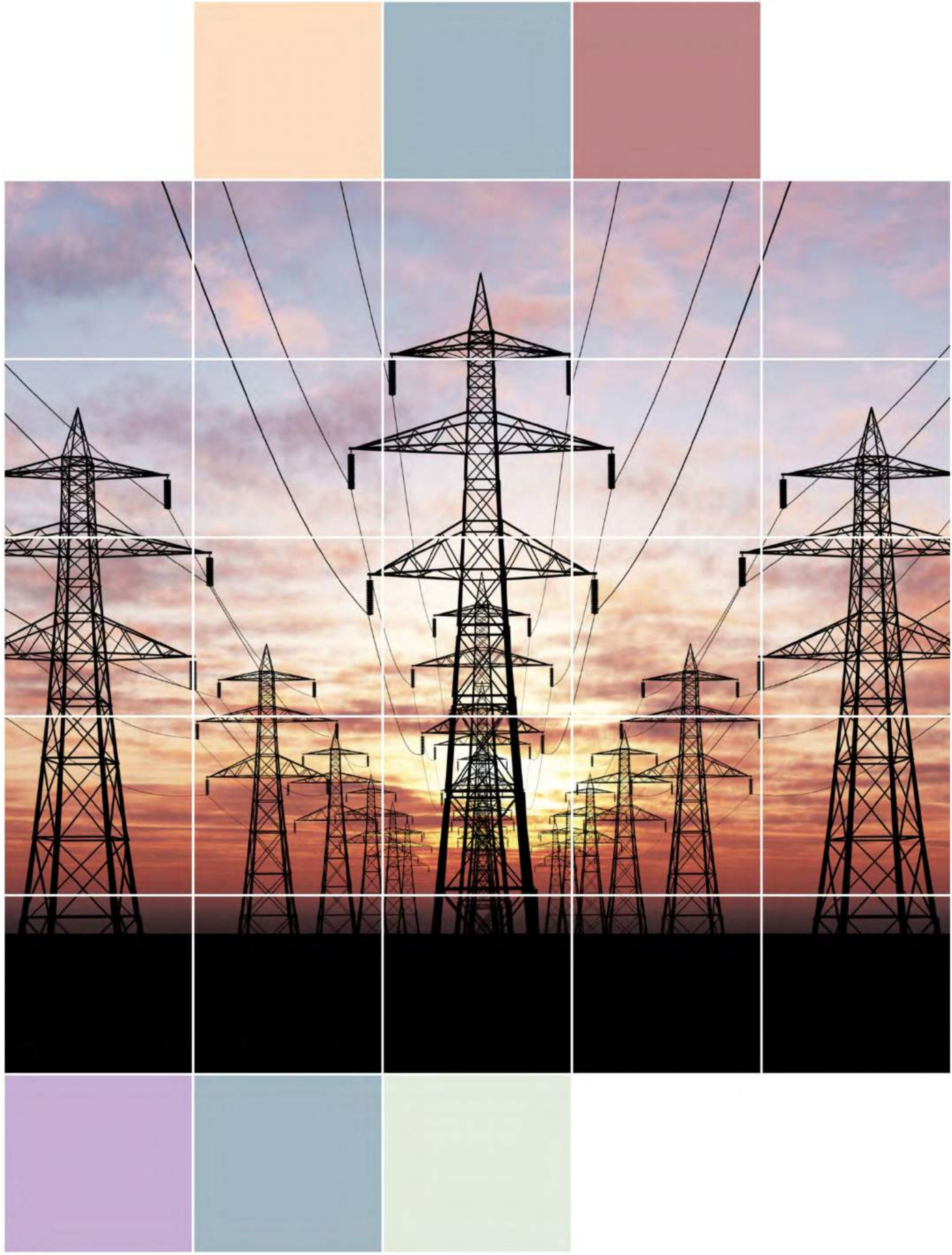
The majority of South Africa's base load electricity generation is derived from coal fired power stations located near the coal fields in Mpumalanga and Limpopo provinces in the northern and eastern parts of the country. Much of the electricity generated from these power stations is transmitted to the rest of the country which currently has limited generation capacity. There is thus a net north to south transmission of electricity which results in significant transmission losses. Any new generation capacity connecting in the south of the country would off-set this north to south flow of electricity and hence reduce the national transmission losses, while additional generation in the north of the country near the existing power stations would increase such losses.

The net north to south transmission of electricity could be reversed when ageing coal power stations are decommissioned and replaced by either new coal stations in different locations near new coal mining areas, or the growing generation capacity of the Cape provinces which include renewable and potential gas or nuclear generators. With Gauteng still being the largest load centre, and abundant transmission infrastructure becoming available when existing coal power stations are decommissioned, it would make sense for new renewable energy generators at that time to be placed in the northern parts of the country. This scenario will, however, only result from significant growth in generation capacities in the south of the country and the decommissioning of existing coal power stations, which is not anticipated before 2030. Until such time it is safe to assume that connection toward the southern part of the country would reduce national transmission losses.

Average loss factors for transmission-connected generators as used for this study were determined by Eskom based on voltage and geographic location considerations[2]. Six geographical zones differentiated in terms of transmission loss factors were identified and include the Cape, Karoo, KwaZulu-Natal, Vaal, Mpumalanga, and Waterberg zones. These zones with their associated transmission loss factors (see Table 1) were used to adjust the resource potential datasets by accordingly increasing the values in the Cape and Karoo zones and decreasing it in the other four zones (see Figure 1).

Table 1: Zonal transmission network losses for transmission-connected generators

Transmission Network Loss Zones (Wind & Solar)	Percentile Adjustment Factor	Data Source	Extent
Cape	+2.9%	Eskom 2013/14 Tariffs and Charges	National
Karoo	+0.5%		
KwaZulu-Natal	-0.4%		
Vaal	-2%		
Mpumalanga	-2.1%		
Waterberg	-2.3%		



[2] Tariffs & Charges Booklet 2013/14 Eskom. Available online at: http://www.eskom.co.za/CustomerCare/TariffsAndCharges/Documents/ESKOM%20TC%20BOOKLET%202013-14.pdf

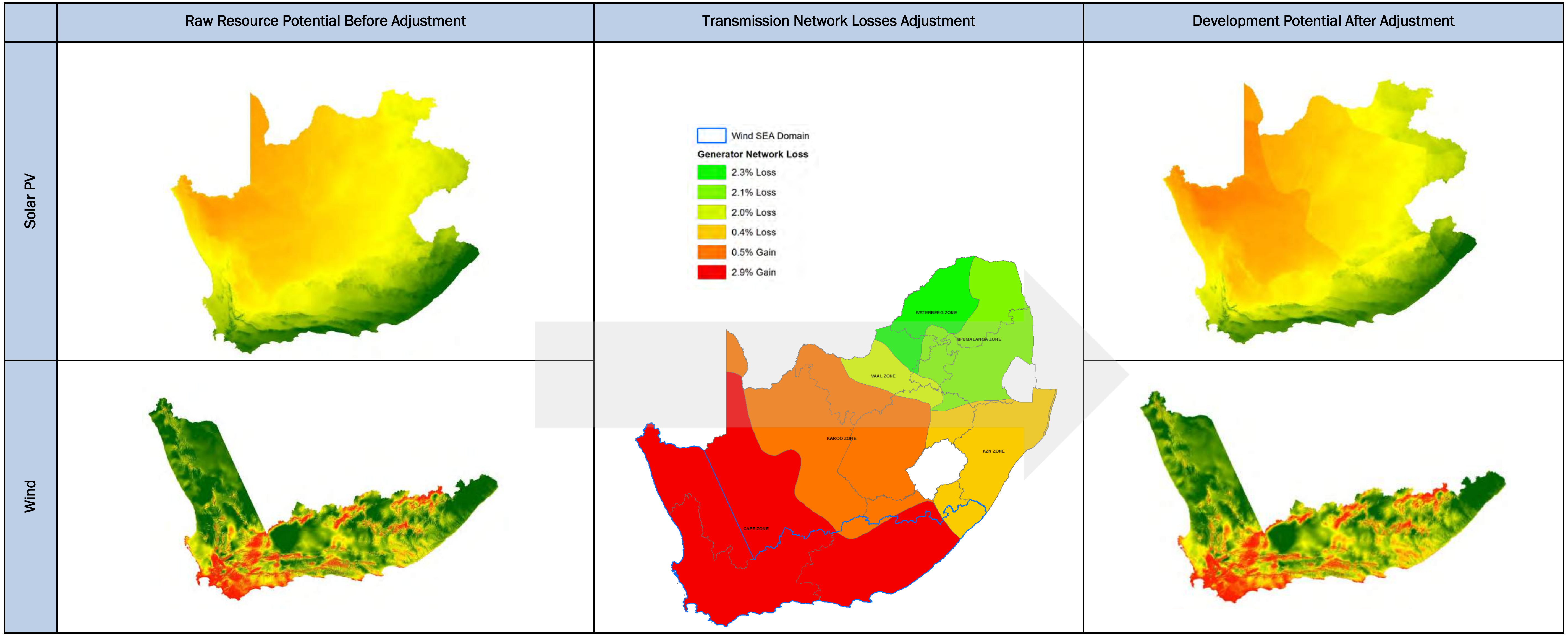


Figure 1: Adjustment of raw resource data for transmission loss factors

1.1.3 Priority Industrial Areas

Certain areas in South Africa have been identified through national and provincial planning initiatives as either being of priority for the development of renewable energy projects or for renewable energy related manufacturing industries. Such areas include the solar and wind corridors identified in the Northern Cape Province, the proposed Special Economic Zones (SEZs) for renewable energy manufacturing in Atlantis and Upington, as well as the existing Industrial Development Zones (IDZs) in ports such as Saldanha, Port Elizabeth, Ngqura, Durban and Richards Bay at which components can be imported or manufactured.

In this study, renewable energy development in and around these priority areas is promoted to support the proposed manufacturing industries. Development in the vicinity of these areas would also reduce the requirement for road transportation of large components from these importation or manufacturing hubs to project sites. These priority areas with applicable buffer distances (see Table 2) were used to further adjust the development potential datasets (see Figure 2).

Table 2: Priority industrial areas including IDZs, proposed renewable energy related SEZs, and other areas identified for the pritoritisation of renewable energy development

Priority Industrial Areas	Distance	Percentile Adjustment Factor	Data Source	Extent
DTI Proposed RE SEZ (Wind & Solar): Atlantis **NC Solar Corridor (Solar only)**: Upington, Kakamas, Keimoes, Groblershoop, Prieska and De Aar **NC Wind Corridor (Wind only)**: Port Nolloth and Keinzee **Industrial Ports (Wind & Solar):** Saldanha, Port Elizabeth, East London, Durban and Richards Bay	< 20 km	+ 5 %	**SEZs**: Special Economic Zones Planning presented to the Portfolio Committee on Trade and Industry on 26 April 2013. **Solar and Wind Corridor:** Northern Cape Provincial Spatial Development Framework 2012.	National
	20 – 50 km	+ 3 %		
	50 – 100 km	+ 1 %		
	> 100 km	+ 0%		

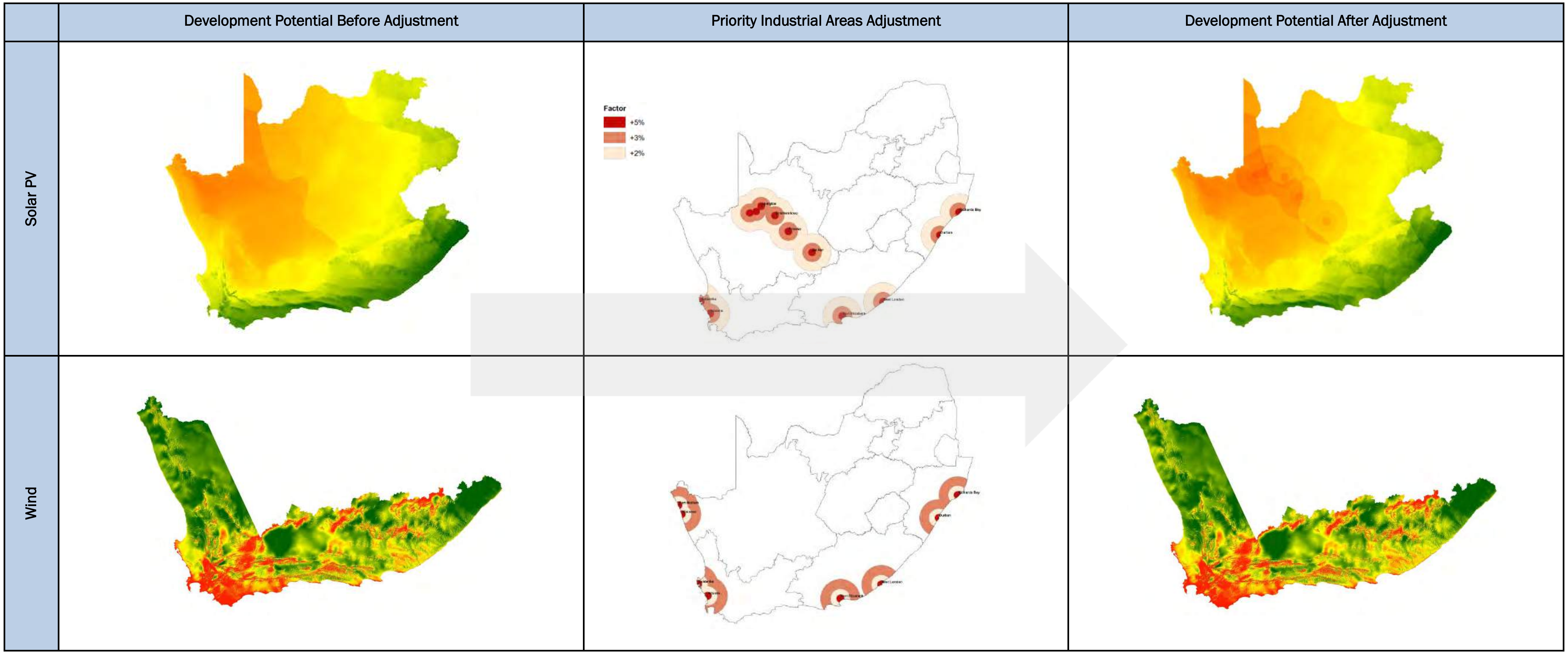


Figure 2: Adjustment of development potential for IDZs, proposed renewable energy related SEZs, and other areas identified for the pritoritisation of renewable energy development

1.1.4 Areas with Highest Need for Social Investment

Renewable energy development in South Africa is seen as a vehicle for achieving substantive positive socio-economic outcomes. Moreover, it has a rare potential for stimulating socio-economic investment and growth in rural areas that would otherwise struggle to attract investment. Through the economic development requirements stipulated by the Renewable Energy Independent Power Producer Procurement Programme (REI4P), renewable energy projects could result in significant direct benefits for the local communities in which they are sited.

Even though most communities in South Africa require additional socio-economic investment, some are particularly needy and lacking economic growth drivers. For renewable energy development to be feasible in such areas the local community and economy also need to be able to provide the required services and absorb the development. A certain degree of development potential is thus required. The National Spatial Development Perspective (NSDP) of 2006 considered the economic development potential in combination with the social need of the area when assessing the potential distribution of economic activity. It is on this principle that this study identified local communities which stand to benefit the most from renewable energy development.

Based on official documentation, and in close consultation with provincial governments, local municipalities with the highest need for the socio-economic investment associated with renewable energy development were identified as part of this study. To ensure that those areas were also able to provide the required services for renewable energy development the municipal seats, which generally represent the largest towns serving as regional service delivery hubs, were selected as anchor points in these needy municipalities.

For the purpose of adjusting the development potential in the vicinity of the anchor points, and in line with the REI4P, a 50 km radius was used to define the local communities (see Table 3 and Figure 3).

Table 3: Seats of local municipalities with the highest need for social investment

Seats of local municipalities with high need for social investment (Wind & Solar):	
Local Municipality	**Municipal Seats**
Eastern Cape:	
EC121 Mbhashe	Idutywa
EC133 Ikwanca	Molteno
EC137 Engcobo	Engcobo
EC153 Ngquza Hill	Flagstaff
EC154 Port St Johns	Port St Johns
EC155 Nyandeni	Libode
EC442 Umzimvubu	Mount Frere
EC443 Mbizana	Bizana
Free State:	
FS161 Letsemeng	Koffiefontein
FS163 Mohokare	Zastron
FS164 Naledi	Dewetsdorp
FS181 Masilonyana	Theunissen
FS182 Tokologo	Boshof
FS184 Matjhabeng	Welkom
FS185 Nala	Bothaville
FS194 Maluti a Phofung	Phuthaditjhaba
FS195 Phumelela	Vrede
FS203 Ngwathe	Parys
Northern Cape	
NC071 Ubuntu	Victoria West
NC072 Umsobomvu	Colesberg
NC075 Renosterberg	Petrusville
NC081 Mier	Mier
NC091 Sol Plaatje	Kimberley
NC092 Dikgatlong	Barkley West
NC093 Magareng	Warrenton
NC094 Phokwane	Hartswater
NC451 Moshaweng	Mothibistad
NC452 Ga-Segonyana	Kuruman
North West	
NW372 Madibeng	Brits
NW373 Rustenburg	Rustenburg
NW375 Moses Kotane	Mogwase
NW382 Tswaing	Delareyville
NW383 Mafikeng	Mafikeng,
NW384 Ditsobotla	Lichtenburg
NW385 Ramotshere Moiloa	Zeerust
NW403 Matlosana	Klerksdorp
Western Cape:	
WC011 Matzikama	Vredendal
WC041 Kannaland	Ladismith
WC044 George	George
WC053 Beaufort West	Beaufort West

Distance	Percentile Adjustment Factor	Data Source	Extent
0 – 20 km	+ 5 %	**FS:** Draft Free State Rural Development Plan 2013 **EC:** Regional Global Insights Data 2013 **NC:** Northern Cape Provincial Spatial Development Framework 2012 **WC:** Growth Potential Study of Towns in the Western Cape (Van der Merwe et al. 2004) and revision thereof in 2010 **NW:** North West Provincial Spatial Development Framework 2008.	WC, NC, FS, EC and NW
20 – 30 km	+ 4 %		
30 – 40 km	+ 3 %		
40 – 50 km	+ 2 %		
> 50 km	+ 0 %		

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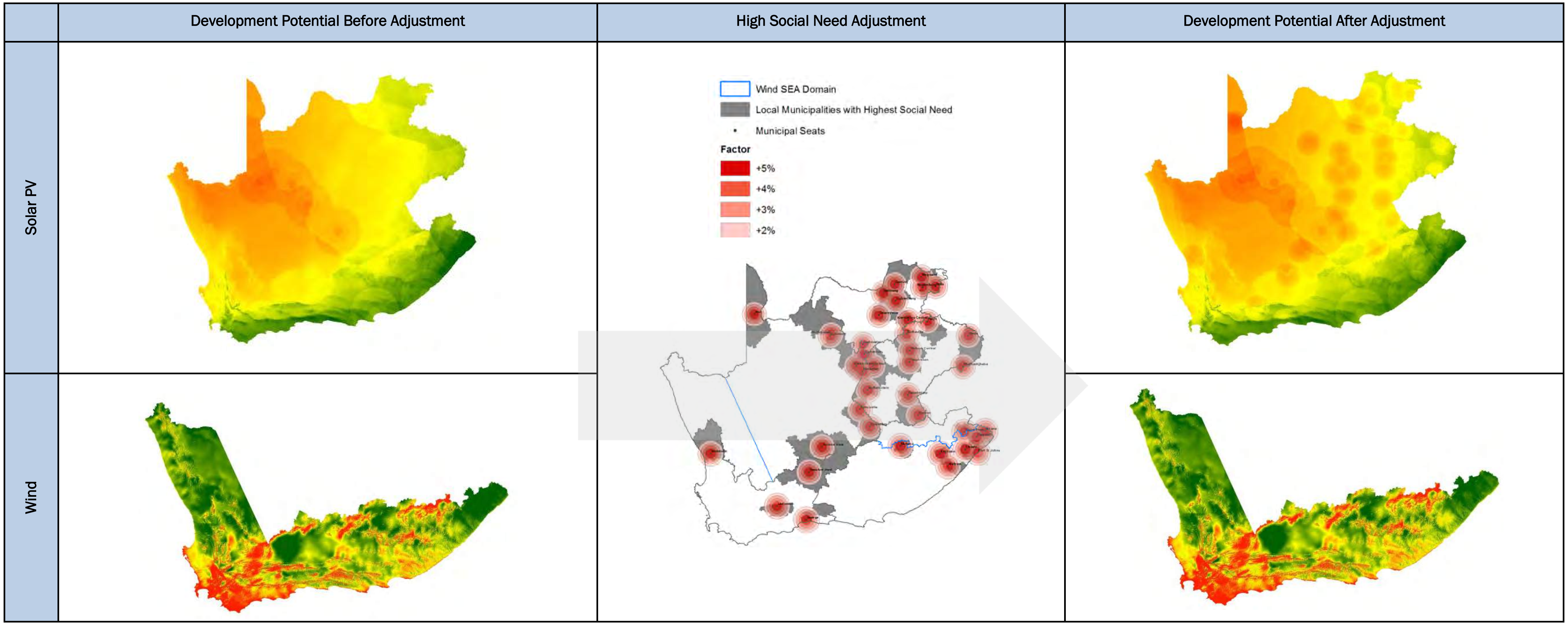


Figure 3: Adjustment of development potential for areas with the highest needs for social investment

1.1.5 Transmission Evacuation Capacity

The availability of evacuation capacity on the electricity grid is a growing constraint for renewable energy development in South Africa. Although this study aims to facilitate the development of additional grid infrastructure and the unlocking of new high development potential areas through proactive and strategic investment, the use of existing infrastructure must be given precedence where appropriate. In other words, the substantial investment and time required to develop new grid infrastructure and unlocking new areas only make sense if the areas being unlocked present a higher development potential than those with existing infrastructure.

In consultation with Eskom and using the Generation Connection Capacity Assessment of the 2016 Transmission Network (GCCA-2016) study, transmission substations with sufficient evacuation capacity, that either already exists or can be unlocked with limited investment, were identified. The identified substations were used to adjust development potential values spatially. Only transmission level substations were considered for this purpose since these are the central evacuation points which require major investment and long timeframes to develop, whilst distribution level collection infrastructure requires less investment and can be developed faster.

The following assumptions were made in order to identify transmission substations with sufficient evacuation capacity that either exists or can be unlocked with limited investment:

1. Substations with a Transformer N-1 Limit indicated in the GCCA-2016 as "N/A" were assigned the Busbar N-1 Limit;
2. Substations with only one transformer were assigned that transformer's capacity to overcome the N-1 constraint;
3. Only substations with an area stability limit (i.e. network capacity) of greater than 1 000 MW and a transformer limit greater than 100 MW, as determined according to the above assumptions, were identified as anchor points for the adjustment of development potentials; and
4. It was assumed that grid connection costs for large scale wind and solar PV developments become prohibitive with connection distances greater than 100 km from transmission substations.

The identified transmission substations with applicable buffer distances (see Table 4) were used to adjust and determine the final development potentials (see Figure 4).

Table 4: Transmission substations with sufficient evacuation capacity that either exists or can be unlocked with limited investment

<table>
<tr><th>Transmission Substations with sufficient evacuation capacity that exists or can be unlocked with limited investment (Wind & Solar)</th><th>Distance</th><th>Percentile Adjustment</th><th>Data Source</th><th>Extent</th></tr>
<tr><td rowspan="5">Acornhoek
Aggeneis
Alpha
Apollo
Ararat
Ariadne
Aries
Athene
Aurora
Avon
Bacchus
Benburg
Bighorn
Bloedrivier
Bloukrans
Borutho
Boundary
Brenner
Carmel_A
Carmel_B
Chivelston
Chivelston
Craighall
Croydon
Danskraal
Dedisa
Delphi
Delta_A
Delta_B
Dinaledi
Droerivier
Eiger
Eros
Esselen
Etna
Everest
Ferrum
Fordsburg
Foskor
Garona
Georgedale Glockner
Grassridge
Gromis
Gumeni
Harvard
Hector
Helios
Hera
Hermes
Hydra
Hydra2
Illovo
Impala
Incandu
Ingagane
Invubu
Juno
Jupiter
Kappa
Klaarwater
Komatipoort
Kookfontein A
Kookfontein B
Kookfontein C
Kruispunt
Kwagga
Leander
Lepini
Leseding
Lomond
Lulamisa
Makalu
Malelane
Marang
Marathon
Marathon B
Merapi
Mercury
Merensky
Mersey
Midas
Minerva
Mookodi
Muldersvlei
Nama
Neptune
Nevis
Ngwedi
Njala
Normandie
Northrand
Olien
Olympus
Olympus_A
Omega
Oranjemond
Paulputs
Pelly
Pembroke
Perseus
Phillipi
Pieterboth
Pluto
Poseidon1_1
Poseidon1_2
Poseidon2_1
Poseidon2_2
Prairie
Princess
Proteus
Quattro
Rabbit
Rigi
Rockdale
Rockdale_1
Rockdale_2
Roodekuil
Ruigtevallei
Scafell
Senakangwedi
Simmerpan
Simplon
Snowdon
Sol
Spencer
Spitskop
Spitskop2
Stikland
Tabor
Taunus
Theseus
Trident
Tugela
Umfolozi
Venus
Verdun_A
Verdun_B
Verwoerdburg
Vulcan
Vuyani
Warmbad
Watershed
Westgate
Witkop
Zeus</td><td>< 10 km</td><td>+ 5 %</td><td rowspan="5">Eskom Generation Connection Capacity Assessment of the 2016 Transmission Network release in 2013 (GCCA-2016)</td><td rowspan="5">National</td></tr>
<tr><td>10 - 50 km</td><td>+2.5 %</td></tr>
<tr><td>50 - 100 km</td><td>+ 0 %</td></tr>
<tr><td>100 – 150 km</td><td>- 2.5 %</td></tr>
<tr><td>> 150 km</td><td>- 5 %</td></tr>
</table>

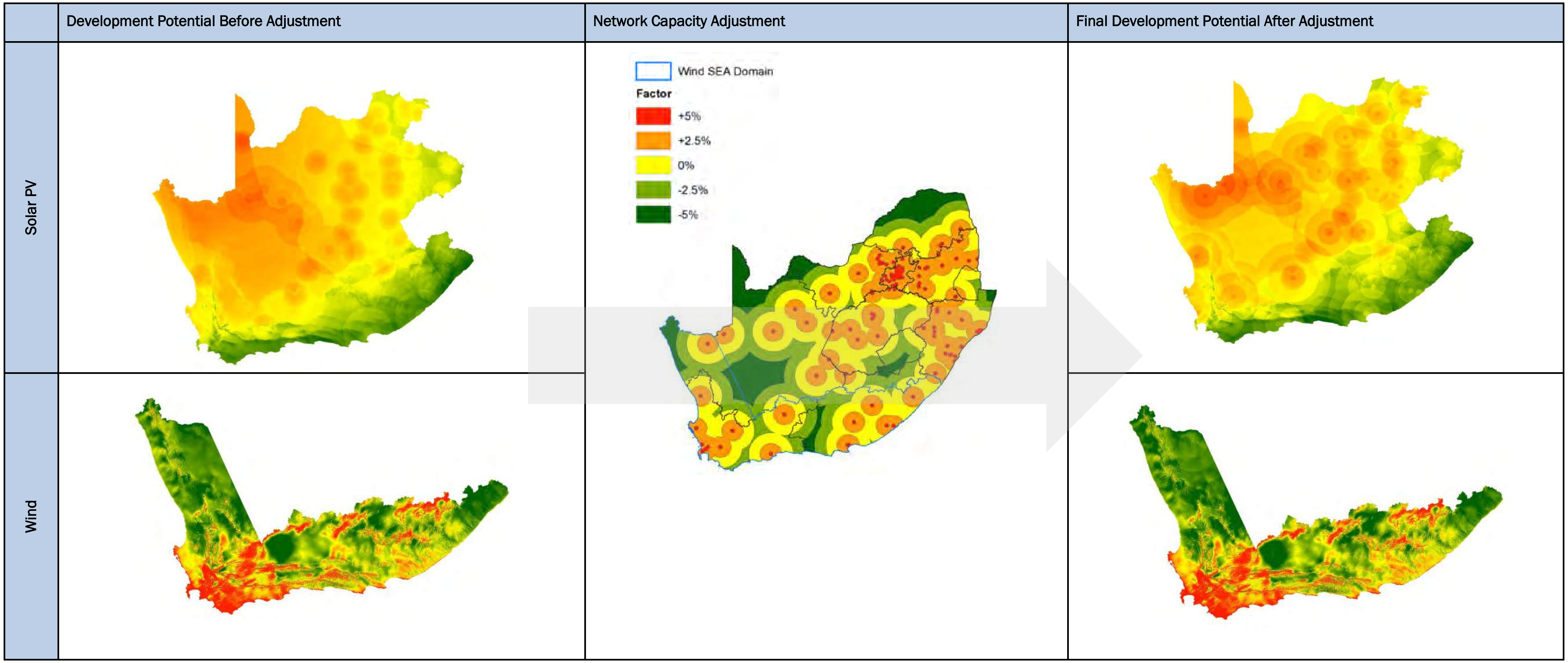


Figure 4: Adjustment of development potential for transmission substations with sufficient evacuation capacity that either exists or can be unlocked with limited investment

1.1.6 Identification of Top Development Potential per Province

Due to technical (e.g. impacts of the weather on grid stability), socio-political (e.g. provincial commitments to renewable energy development) and environmental considerations, large scale wind and solar PV development must be spread across the country. In order to achieve the required spread across all provinces under investigation, the areas of highest development potential per province were identified. The total high development potential area identified per province needs to be relative to the overall potential of the province. In other words, the higher the resource potential of a province, the larger share of renewable energy development should be located in that province and the larger the area that should be identified in that province.

The high development potential area per province was determined according to the percentage of the province that has a resource above what was considered to be the economically exploitable threshold. The economically exploitable resource threshold values were derived from bids submitted during the REI4P bid window 1 and determined as a GHI of greater than 1850 kWh/m^2/annum for solar PV and a wind power density of greater than 400 W/m^2 at 100 m hub height. Based on the fact that there are less social and environmental constraints applicable to solar PV development than to wind, the relative areas identified for solar PV development (i.e. the top 5 to 10% area) (see Table 5 and Figure 5) were smaller than those identified for wind development (i.e. the top 15 to 35% area) (see Table 6). The top development potential areas per province represent the final outputs of the positive mapping exercise.

Table 5: Criteria for identifying top solar PV development potential per province

Factor	Province	Percentage of province with an economically exploitable solar resource (GHI>1850 kWh/m^2)	Development potential area identified	Extent
Identification of top development potential per province (Solar)	Northern Cape	100%	Top 10%	Provincial
	North West	100%	Top 10%	
	Free State	100%	Top 10%	
	Western Cape	78%	Top 8%	
	Eastern Cape	50%	Top 5%	

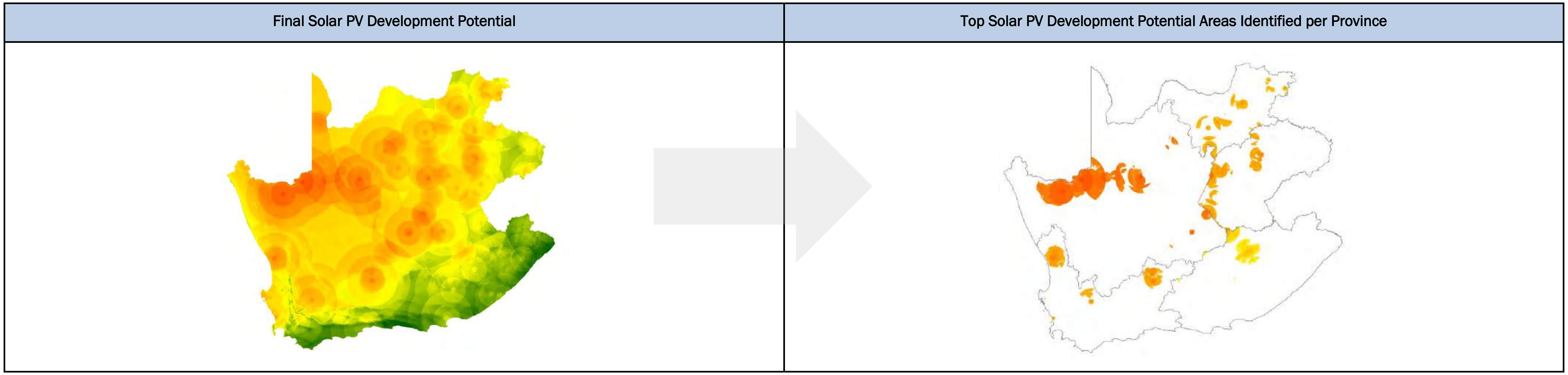


Figure 5: Identification of top solar PV development potential per province

Table 6: Criteria for identifying top wind development potential per province

Factor	Province	Percentage of province with an economically exploitable wind resource (PD>400 W/m²)	Development potential area identified	Extent
Identification of top development potential per province **(Wind)**	Western Cape	24%	Top 35%	Provincial within WASA Domain
	Eastern Cape in WASA Domain	8%	Top 25%	
	Northern Cape in WASA Domain	2%	Top 15%	

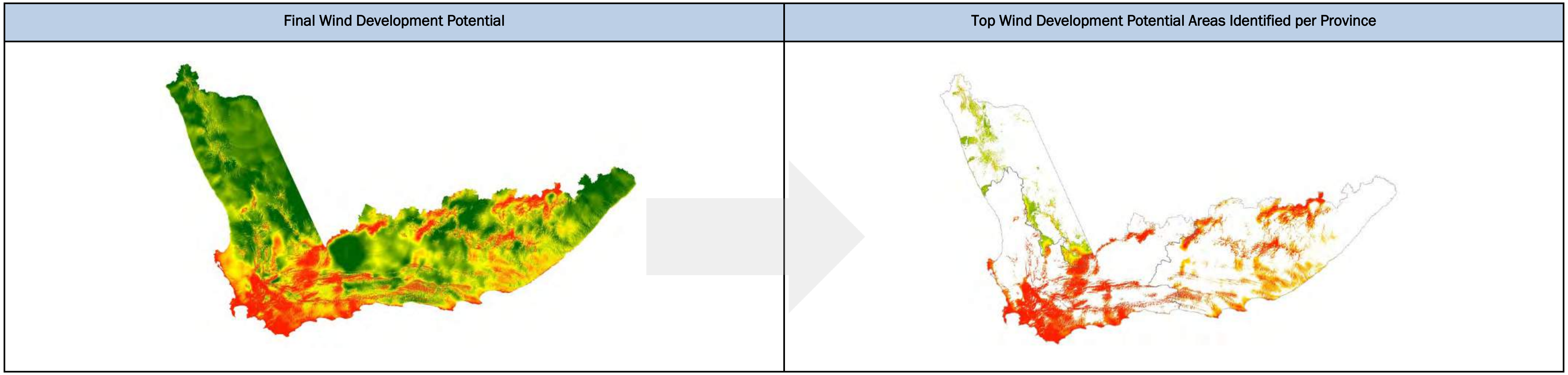


Figure 6: Identification of top wind development potential per province

1.2 Negative Mapping

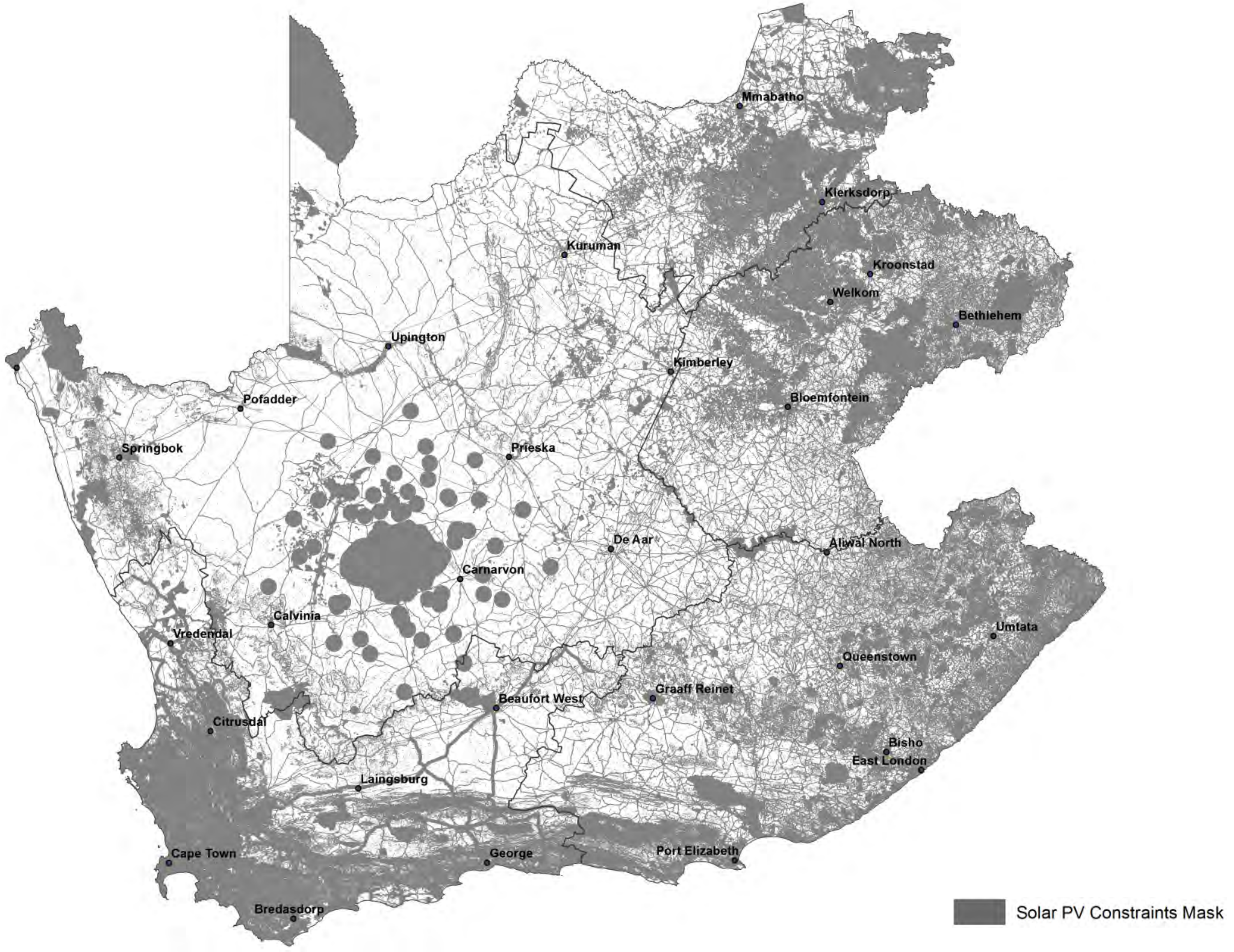
The negative mapping exercise consisted of identifying high level environmental and technical constraints for large scale wind and solar PV development based on the best available data at a national scale. Datasets and applicable buffers were selected in consultation with the relevant authorities and key stakeholders. In instances where data were not available (e.g. for birds and bats) indicative sensitive areas were provided by relevant key stakeholders (e.g. Birdlife South Africa and the Endangered Wildlife Trust) in consultation with the specialist fraternities. Further environmental and technical constraints considered during the analysis include various environmental features such as protected areas and other sensitive ecological features. Also included were existing and future planned land uses such as agriculture, existing infrastructure and the Square Kilometre Array (SKA). Technical constraints such as slopes with a gradient greater than 10 degrees were also considered (see Table 7).

The primary assumption for the selection of environmental and technical constraints was that clusters of large scale wind and solar PV development were under consideration. The environmental and technical constraints masks resulting from this exercise thus only served to inform the identification of study areas which would be further assessed through the SEA process (see Part 3 of this report). The environmental and technical constraints masks resulting from the negative mapping exercise (see Maps 4 and 5) are thus not suited for the evaluation of individual projects within or outside of REDZs, but rather serve as sensitivity indicators that can be used to inform the requirements for further assessments.

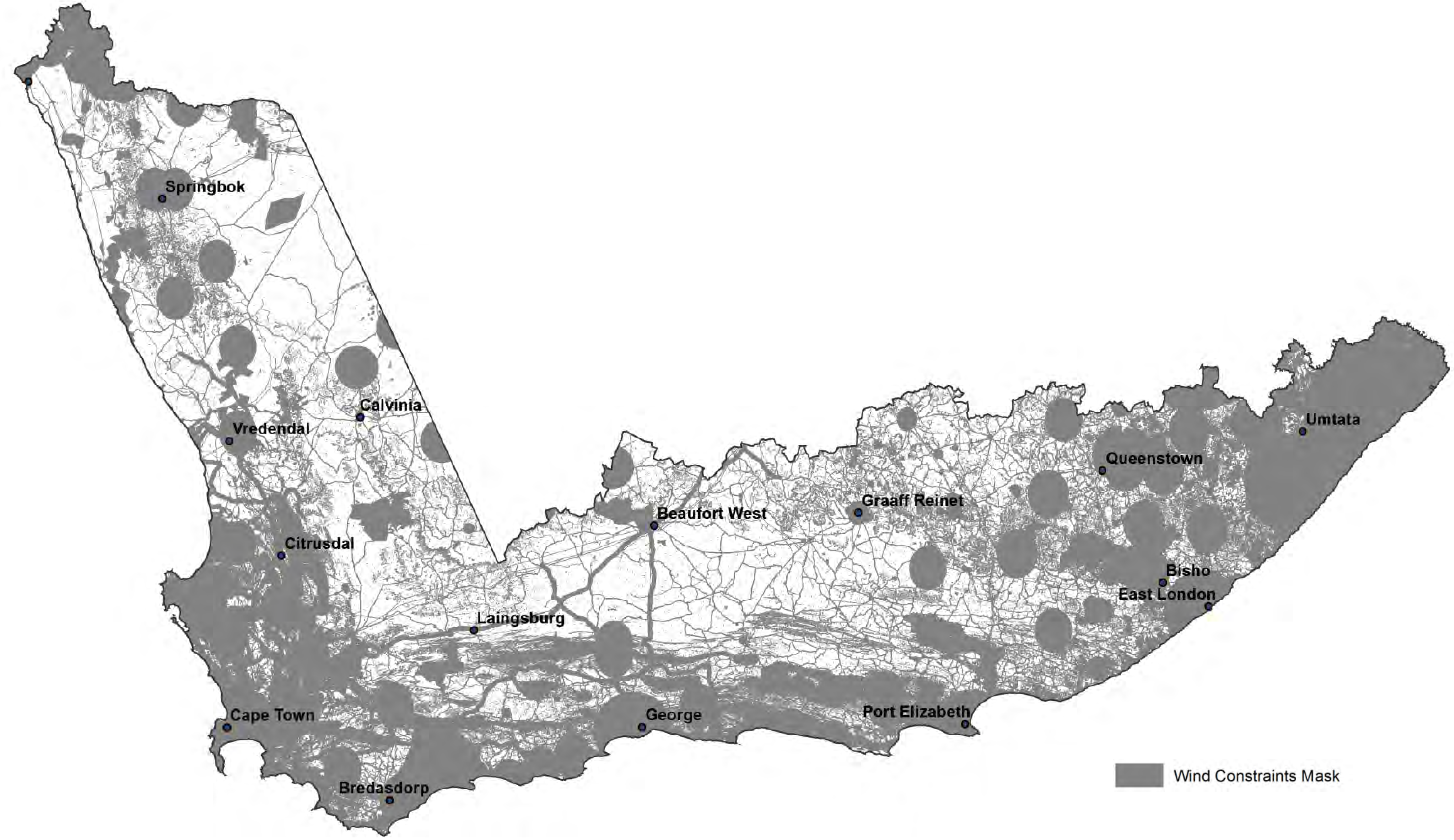
Table 7: Data used to prepare high level environmental and technical constraints masks

Feature		Attributes	Wind Buffer	Solar PV Buffer	Data info	Extent
Natural	South African National Biodiversity Institute (SANBI) Protected Areas	Forest Act Protected Areas	500 m	500 m	SANBI, 2012 updated 2013	National
		Island Reserves	500 m	500 m		
		Local Nature Reserves	500 m	500 m		
		Marine Protected Areas	500 m	500 m		
		Mountain Catchment Areas	500 m	500 m		
		National Botanical Gardens	500 m	500 m		
		Protected Environment	500 m	500 m		
		Provincial Nature Reserves	500 m	500 m		
		Special Nature Reserves	500 m	500 m		
		World Heritage Sites	500 m	500 m		
		National Parks	500 m	500 m		
	Ramsar sites	All	500 m	500 m	Ramsar, 2013	National
	Critical Biodiversity Areas (CBAs)	Irreplaceable	No buffer	No buffer	SANBI, 2013 updated	National
	Remaining Threatened Ecosystems	Critically Endangered Ecosystems	No buffer	No buffer	SANBI, 2013 updated	National
		Endangered and Poorly Protected Ecosystems	No buffer	No buffer		
	Threatened Forests	All	No buffer	No buffer	Department of Agriculture, Forestry and Fisheries (DAFF), 2013	National
	Coast (including estuaries)	Coastline and Estuaries	1 km	1 km	Coastline: Department of Rural Development and Land Reform (DRDLR) 50k Topo, 2006 Estuaries: CSIR, SANBI 2009	National
	Strategic Water Source Areas	>220 mm/annum rainfall (30 % of county's rainfall)	Not considered	No buffer	SANBI/ Council for Scientific and Industrial Research (CSIR) 2013	National
	Rivers	River Freshwater Ecosystem Priority Areas (FEPA)s	100 m	100 m	SANBI/CSIR, 2011	National
		National Freshwater Ecosystem Priority Areas (NFEPA) Rivers Order 3-7	100 m	100 m		
	Wetlands	Wetland FEPAs	100 m	100 m		
		Wetland clusters	No buffer	No buffer		

Feature		Attributes	Wind Buffer	Solar PV Buffer	Data info	Extent
Natural	Birds	Specific Important Bird Areas (IBAs) in whole	No buffer	Not considered	Bird Areas provided by BirdlifeSA, 2013	National
		Amur Falcon colonies	10 km	1 km		
		Bearded Vulture nests	20 km	2 km		
		Lesser Kestrel colonies	10 km	1 km		
		Priority Vulture colonies	20 km	2 km		
		Largest Vulture colonies	40 km	4 km		
		Potberg Vulture colonies	40 km	4 km		
		Transkei Vulture IBA	No buffer	Not considered		
		Saldanha flyway	No buffer	Not considered		
		Verlorenvlei flyway	No buffer	Not considered		
		Lower Breede River	20 km	Not considered		
	Bats	Major Bat Roosts (> 500 bats)	20 km	2 km	Bat Areas provided by Endangered Wildlife Trust (EWT), 2013	National
Land Use	Land Capability	Class 1 to 3	No buffer	No buffer	DAFF, 2002	National
	Field Crop Boundaries	Horticulture & Viticulture	No buffer	No buffer	DAFF, 2013	
		Pivots	No buffer	No buffer		
		Shadenet	No buffer	No buffer		
		Tea Plantations	No buffer	No buffer		
		Annual Crop Cultivation / Planted Pastures Rotation	Not considered	No buffer		
	Square Kilometer Array (SKA)	Telescope Sites	20 km	10 km	SKA, 2013	National
	South African Astronomical Observatory	All	5 km	5 km	Department of Sciences and Technology (DST), 2013	National
	Buildings	All	300 m	300 m	SPOT Building Count, 2009	WC, EC, NC, NW, FS
	Roads	Major Roads (national, arterial, main)	500 m	500 m	DRDLR 50k Topo, 2006	National
		Secondary Roads (secondary)	500 m	500 m		National
		Tourist Routes (Western Cape only)	2 km	2 km		WC
	Railway	All	300 m	300 m	DRDLR 50k Topo, 2006	National
	Power lines and substations	Existing Transmission and Distribution with 2022 Planned Transmission	300 m	300 m	Eskom, 2013	National
	Airports	Major Airports	35 km	Not considered	DRDLR 50k Topo, 2006	National
		Landing Strips	1 km	Not considered		
		Military Air Force Bases	27 km	Not considered	Centre for Renewable and Sustainable Energy Studies (CRSES)/ South African Defence Force (SADF), 2013	National
	Telecommunication towers	Towers >20 m	500 m	500 m	Civil Aviation Authority (CAA)/CRSES, 2012	National
Technical	Slope	Slope >10%	No buffer	No buffer	RSA Shuttle Radar Topography Mission (STRM) 20m Digital Elevation Model (DEM), 2002	National

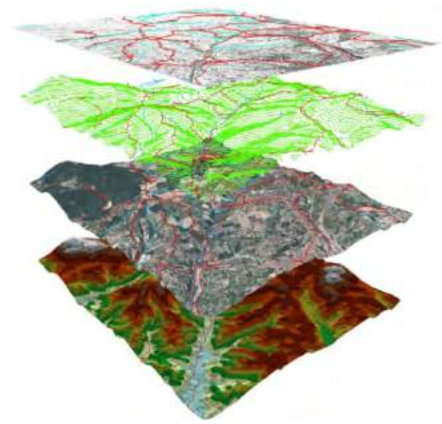


Map 4: High level environmental and technical constraints mask for large scale solar PV development



Map 5: High level environmental and technical constraints mask for large scale wind development

1.3 Study Areas



The integration of environmental, social and economic considerations was achieved by applying the large scale wind and solar PV environmental and technical constraints masks (resulting from the negative mapping exercise) to the top development potential areas (resulting from the positive mapping exercise) in order to identify the highest development potential areas that are available for development (i.e. unconstrained) (see Figure 7). The largest clusters of unconstrained top development potential areas were subsequently identified through a point density analysis. The areas that were statistically delineated from this process were selected as study areas (see Figure 8). The 15 wind and 8 solar PV Study Areas were the final outputs of Phase 1 of the SEA process.

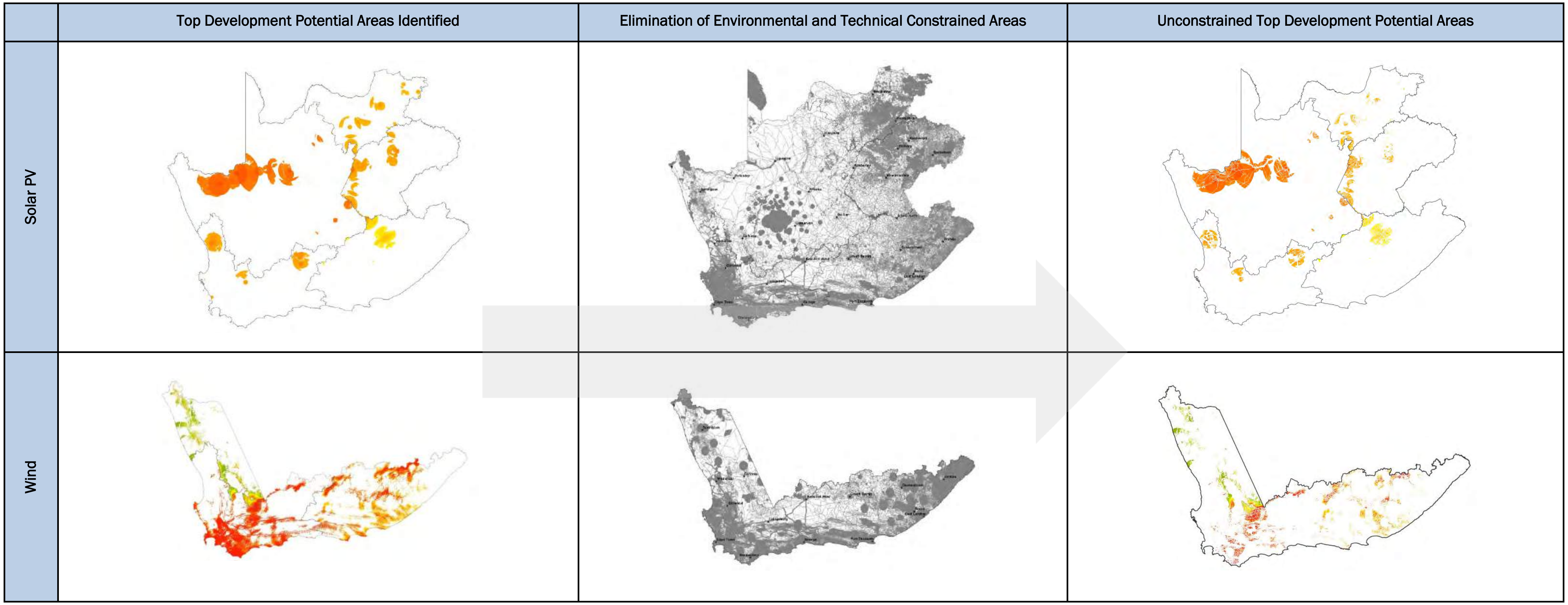


Figure 7: Integration of positive and negative mapping results to identify the highest development potential areas that are not constrained

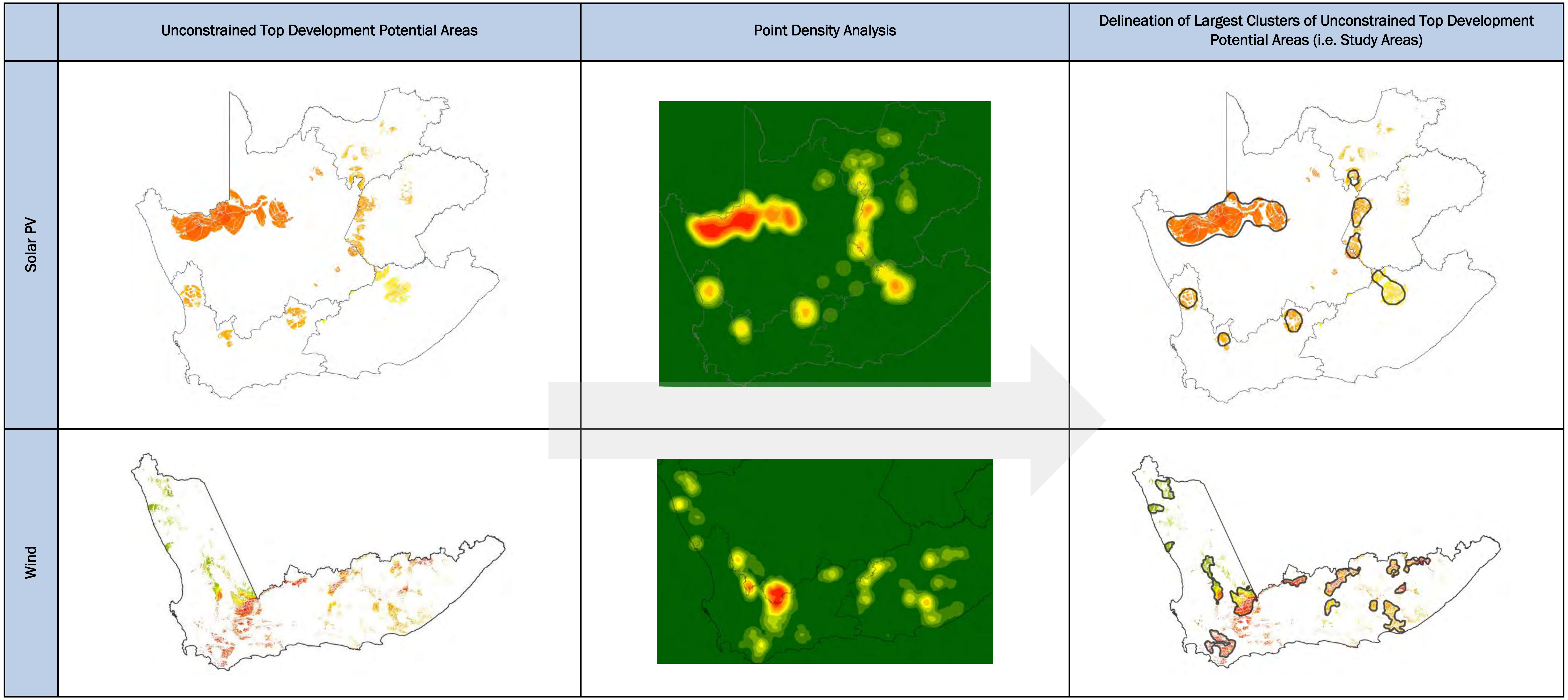


Figure 8: Identification of largest clusters of unconstrained top development potential areas

Section 2. Identification of Focus Areas

After having identified the unconstrained top development potential areas (i.e. Study Areas), a verification and prioritisation process was undertaken. This included an extensive consultation process with the industry, provincial governments, local governments, other key stakeholders, and the wider public. The consultation process was primarily aimed at identifying the areas that best serve both the strategic objectives of the country (which include economic, environmental and socio-political considerations) and the needs of the industry. The outcome of the process was the identification of eight Focus Areas (FAs) that would be further assessed during Phase 3 of the SEA process.

1.4 Industry Consultation

Much data and knowledge exist in the private sector that cannot be made available for public studies such as this SEA due to the competitive nature of the renewable energy industry. Measured resource data which are collected by developers across the country and more accurate than the modelled resource data used for this study is an example of such confidential data. In order to afford the industry an opportunity to provide inputs based on the confidential data and knowledge at their disposal, without having to actually disclose such information, an appropriate consultation process was designed.

The consultation process consisted of a survey including a map of the area covered by the SEA divided into 100 km × 100 km grid cells. This survey was distributed to the members of the South African Wind Energy Association (SAWEA), the South African Photovoltaic Industry Association (SAPVIA), and any other developers registered as stakeholders in the SEA process. A commitment was made that all individual submissions by developers would be treated as confidential while the aggregated results would be used for the study. Developers were requested to select up to 5 different grid cells where wind or solar PV development should be prioritised in 0-5, 5-10, or 10-15 year timeframes. In total, 18 developers from the wind industry and 21 developers from the solar PV industry submitted inputs which were used to inform the SEA refinement of the study areas (see Figure 9).

Developers make use of different selection criteria when identifying priority sites for development, and a wide range of grid cells were consequently identified through the consultation process. The objective of this consultation process was to identify the cells that have been selected by several developers, and thus demonstrate some agreement among developers. As the certainty on infrastructure availability decreases with the longer timeframes, the level of agreement in the developers' submissions decreased. For the purpose of this study the grid cells selected by most developers (i.e. representing the highest level of agreement from the industry) in the 0-5 year timeframe and overlapping with the study areas were used to delineate eight FAs. For practical reasons the delineation of FAs needed to be according to well defined geographical features. Existing roads were, therefore, used to delineate the FAs (see Figure 10).

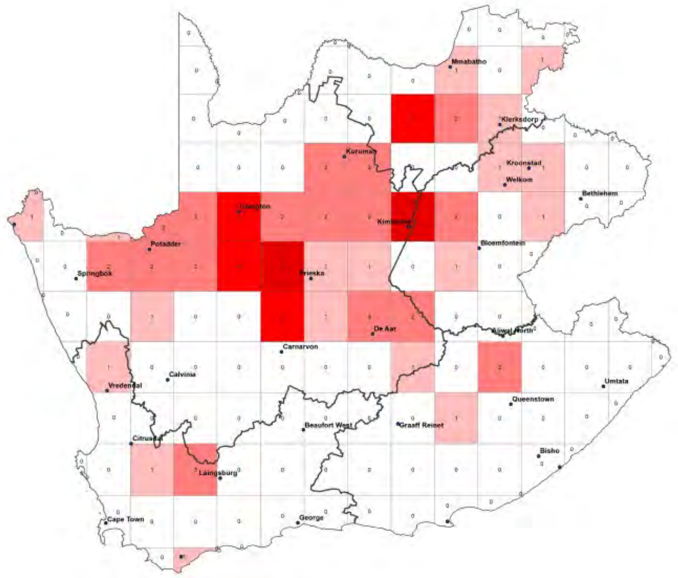
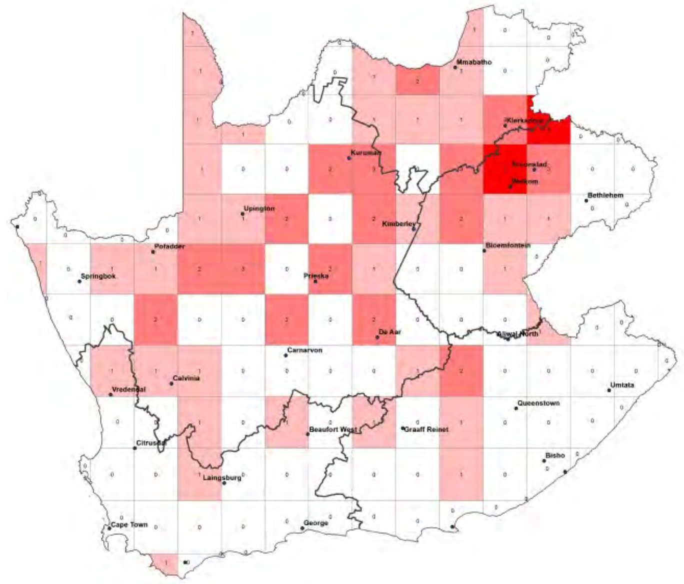
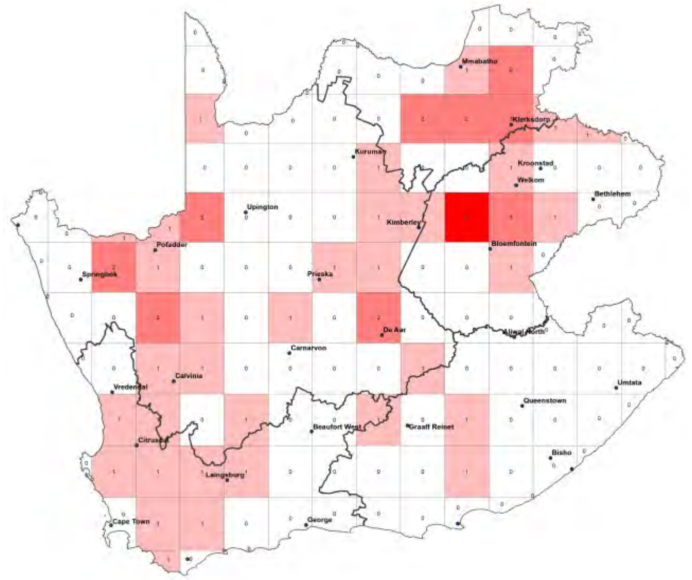
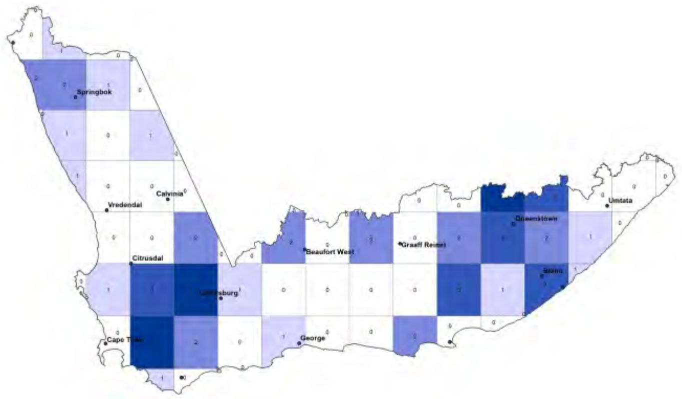
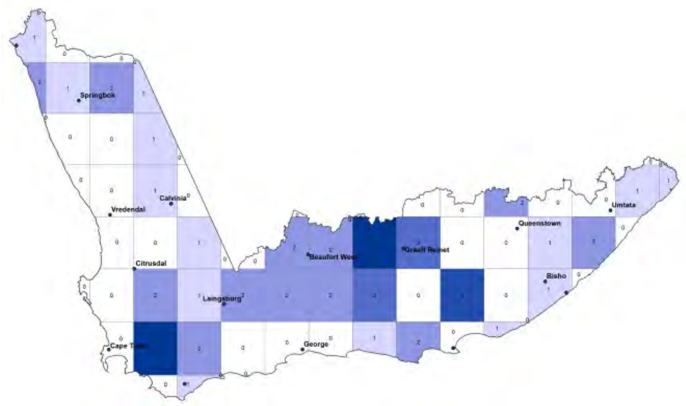
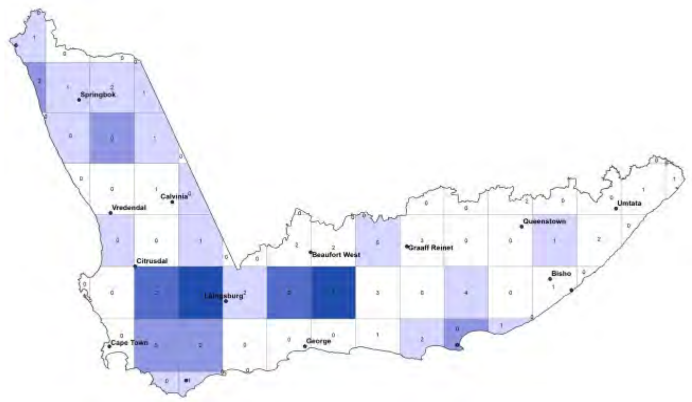
	0-5 Year Industry Priority	5-10 Year Industry Priority	10-15 Year Industry Priority
Solar PV			
Wind			

Figure 9: Results of the industry survey to identify areas where development according to the industry be prioritised

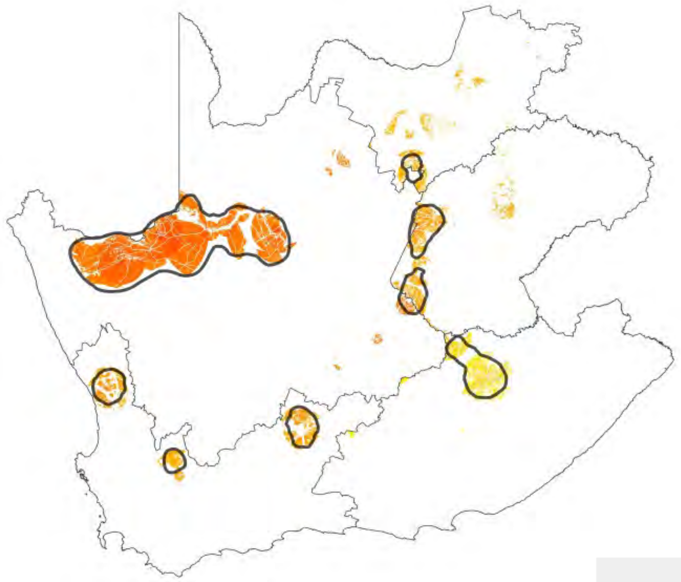
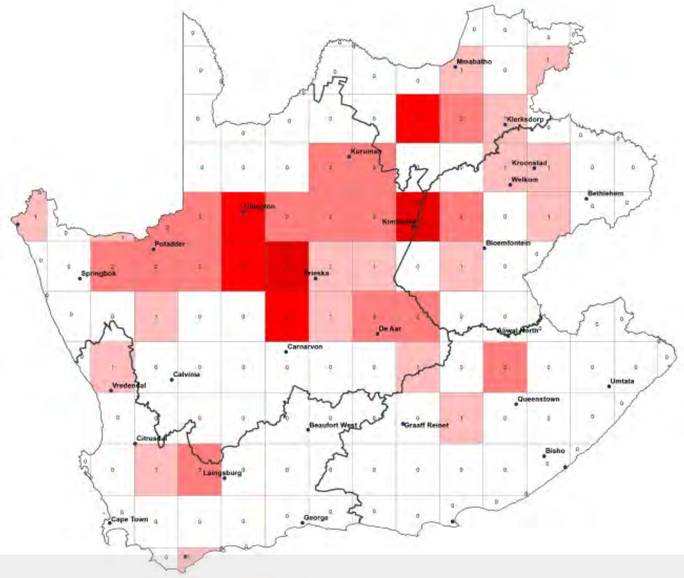
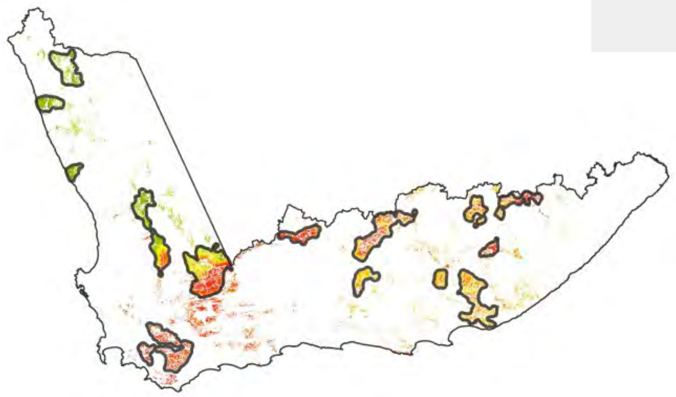
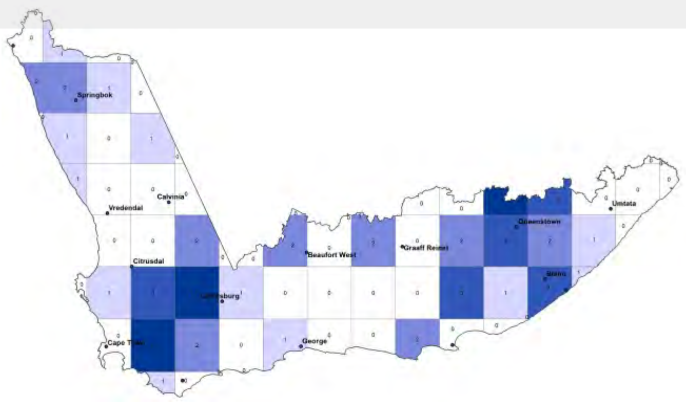
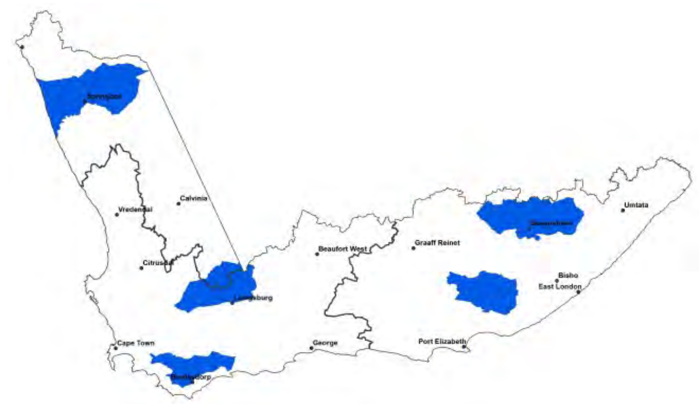
	Largest Clusters of Unconstrained Top Development Potential Areas (i.e. Study Areas)	5 Year Industry Priority	Focus Areas for Further Assessment
Solar PV			
Wind			

Figure 10: Identification of Focus Areas where Study Areas overlap with grid cells identified by the industry for development prioritisation in the 0-5 year timeframe

1.5 Provincial Government Consultation

Following the delineation of the eight FAs, a dedicated consultation process with provincial authorities was undertaken to discuss the proposed FAs and their alignment with provincial and regional planning. The opportunity was also used to identify additional information and potential concerns from provincial departments that needed to be taken into consideration going forward. Five workshops hosted at the relevant departments' provincial offices were undertaken during November and December 2013. While the outcomes of these workshops are discussed in more detail in Appendix B, outcomes of particular interest include the Eastern Cape Government's request to keep the former Transkei homeland area as part of the Stormberg wind FA, despite the known vulture sensitivities in this area. The Eastern Cape Government committed to commission vulture tracking studies in this area to further inform and find potential mitigation measures. The Western Cape Government requested that all eight FAs be assessed for both wind and solar PV development to allow for the optimal utilisation of any strategic investment made into these areas.

1.6 Local Government Consultation

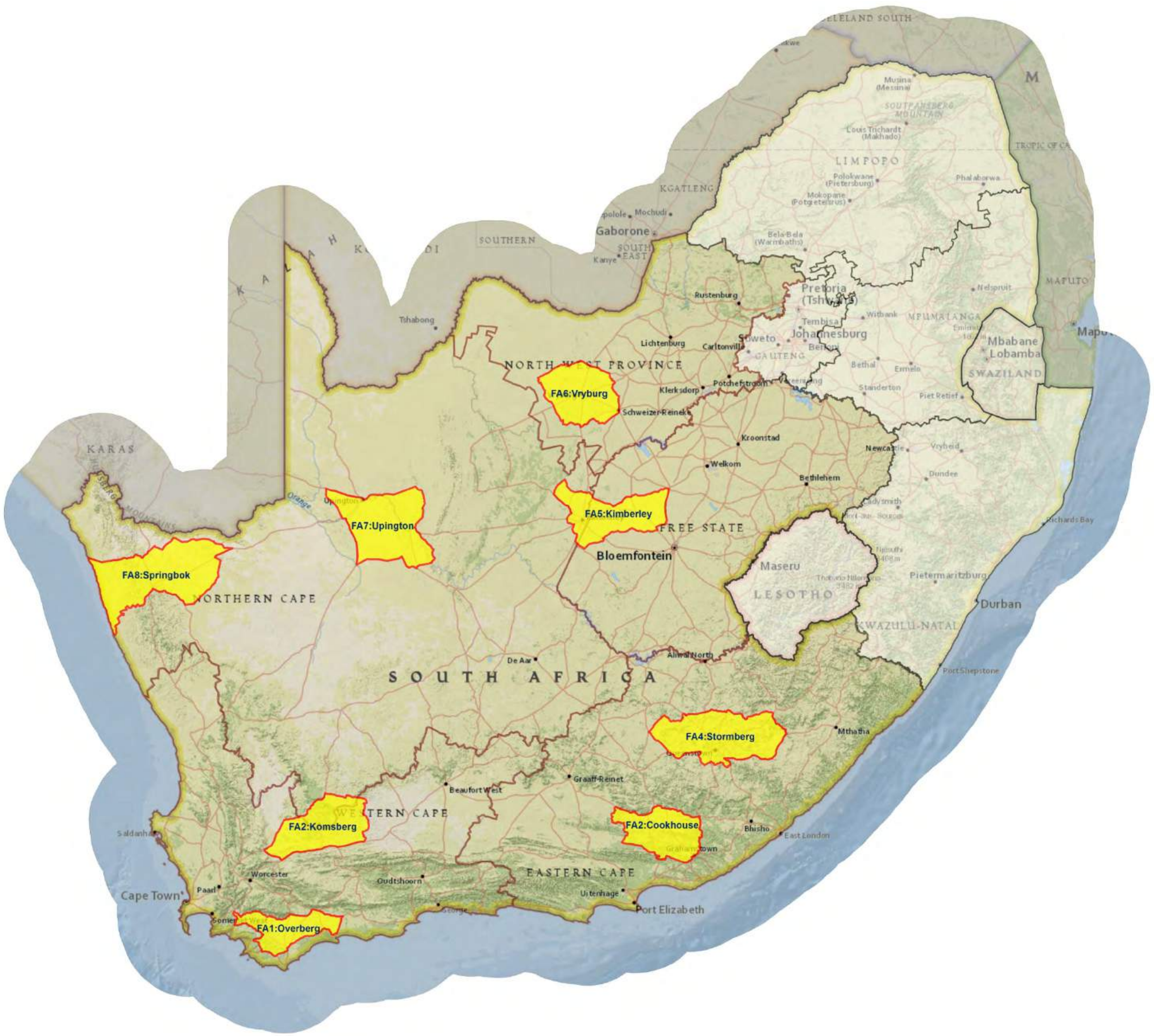
During March and April 2014, another round of consultation was undertaken in collaboration with provincial governments and with all district and local municipalities with jurisdictions in the FAs. The purpose of these workshops was to inform local government of the SEA process, discuss any additional relevant information available at local and regional levels, verify the obstacles and benefits that would be associated with wind and solar PV development, and finally discuss the inclusion of REDZs, once adopted, into Spatial Development Frameworks (SDFs) and Integrated Development Plans (IDPs). Details of the outcomes of these workshops are provided in Appendix B.

1.7 Public Consultation

In addition to consulting key stakeholder groups through the Expert Reference Group (ERG), extensive wider public consultation was conducted through the exchange of information and data via a dedicated online platform (project website) as well as public meetings hosted at appropriate locations in each of the eight FAs during March and April 2014. The public meetings were widely advertised in newspapers as well as electronic and telephonic invitations that were extended to all registered stakeholders and additional key stakeholders identified in each FA. The purpose of the public meetings was to inform local communities and other stakeholders of the SEA process, present the findings to date, discuss additional issues and collect additional relevant information that should be considered during the further assessment of the FAs. Details on the organisation and outcomes of these meetings are provided in Appendix B.

1.8 Focus Areas

Taking into consideration all information and data gathered during the consultation process, the final boundaries of the eight FAs were determined. The final FAs covered approximately 80 000 km^2 (which is almost the size of Ireland) and 17 154 land parcels over five provinces (see Figure 10).



Map 6: Final wind and solar PV Focus Areas (FAs) identified for further assessment

PART 3

Scoping Assessments and Development Protocols

PART 3

Part 3.
Scoping Assessments and Development Protocols

Introduction

Having identified the eight Focus Areas (FAs) (see Figure 1) as areas of strategic importance for wind and solar PV development, the following part of the report has been prepared in consultation with relevant authorities and key stakeholders with the aim of determining indicative spatial sensitivities for wind and solar PV development in each FA. The data presented in the following sections are released with this report and in GIS format. This data is intended to widely inform and streamline project level environmental assessment processes. In instances where the required data were available at a national scale, the indicative sensitivities are provided for the entire country.

The assessments informing this part of the report were conducted at a level equivalent to the scoping phase of a Scoping and Environmental Impact Assessment (S&EIA) process in terms of the National Environmental Management Act (NEMA) (Act 107 of 1998). The results are thus not sufficient for project level decision making in terms of NEMA, and further project level impact assessment is still necessary. These assessments are, however, sufficient to meet the requirements of the scoping phase of an S&EIA process and to focus project level impact assessments on those potential impacts that are of significance. With the scoping requirements being met, all wind and solar PV projects in REDZs, with their associated infrastructure, requiring environmental authorisation will follow a streamlined project level environmental assessment process in the form of a Basic Assessment (BA). The scope of the project level BA process in REDZs will be informed by the identified sensitivities and associated protocols contained in the following sections, and will be undertaken in accordance with the relevant regulations current at the time. The project level BA process will also include the associated public participation process.

The criteria (e.g. buffer distances) used to determine different levels of sensitivity in the following sections can be considered as national guidelines, but there may be data inaccuracies and site specific considerations that will influence the suitability of each individual proposed project. The requirements specified in this section must thus be negotiated and adapted at a project level based on the merits of the specific development under consideration. In some instances projects proposed in areas of low sensitivity can be found to be unsuitable, and in other instances projects proposed in highly sensitive areas can be found to be acceptable based on the project's specific merits and/or the fact that it is not possible to avoid all impacts. Appropriate mitigation measures can also adequately reduce and address any identified sensitivities.

The following concepts and definitions are important for the correct interpretation and implementation of the findings and protocols in the following sections.

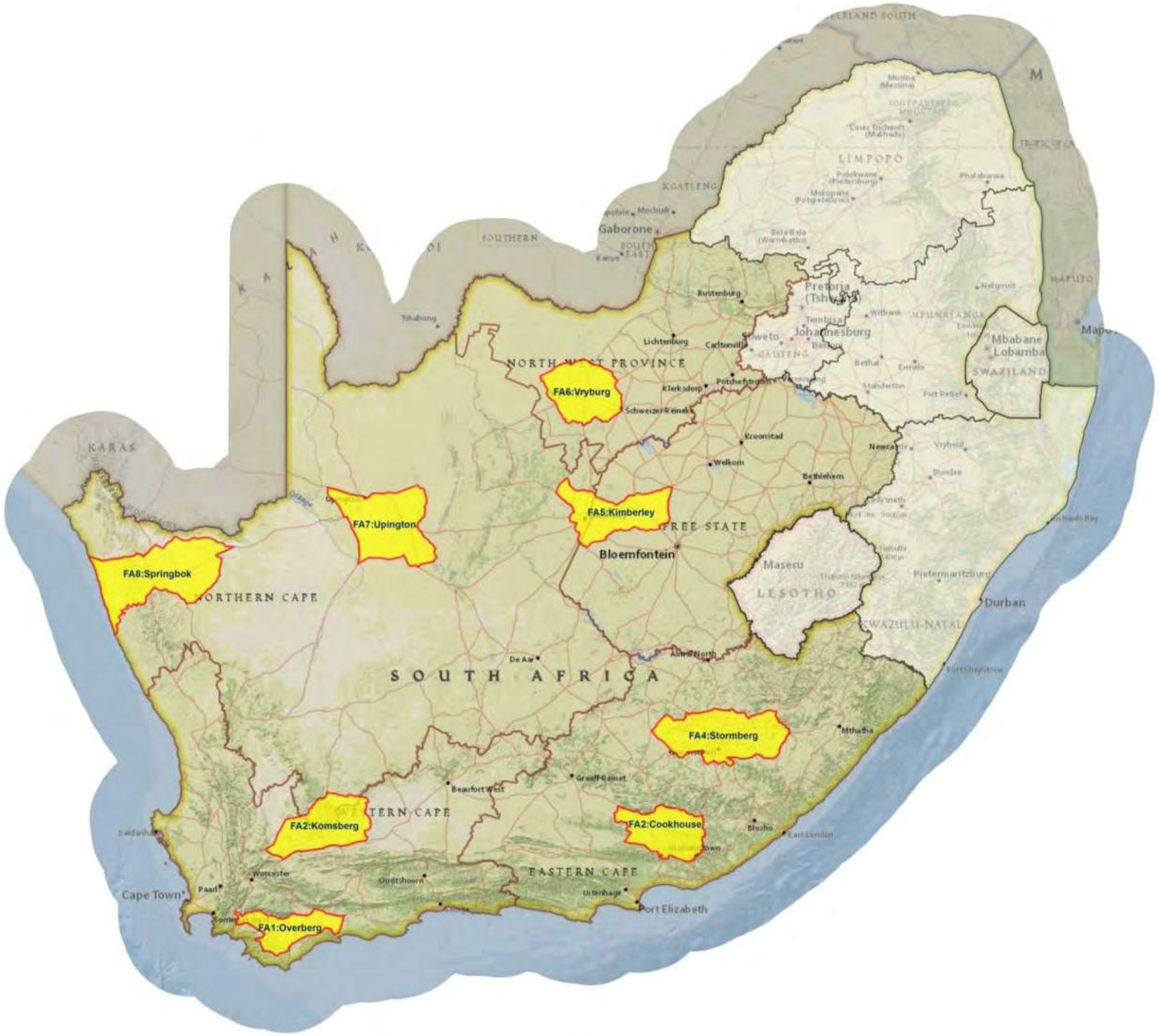


Figure 1: Final wind and solar PV Focus Areas (FAs) identified for further assessment

Reasonable and Responsible Solutions for Balancing Competing Interests:

The information provided in the following sections is intended to provide a common base from which authorities, developers, and other stakeholders can consider and negotiate wind and solar PV development at a project level. The results and requirements are not intended to be absolute, but rather constitute guidelines that can be sensibly negotiated and adapted on a project-by-project basis. The results and requirements presented in the following sections have not been developed to meet all needs of any specific stakeholder, but rather aimed at reaching reasonable and responsible solutions for balancing competing interests. The results and requirements seek to strike a balance between environmental protection and the socio-economic need for development. Due to future changes in the needs of stakeholders, the availability of new data, and a growing understanding of the impacts of wind and solar PV energy development in South Africa, the following sections should be revised and updated continually. The SEA process must, therefore, be an iterative process updated at less than five year intervals to ensure that accurate and current information is used to inform development and decision making.

Competent and Commenting Authorities:

The sensitivities and associated protocols in the following sections were prepared with the primary objective of informing and streamlining the environmental authorisation process required in terms of NEMA. The relevant competent authority referred to is thus the competent authority in terms of NEMA, and is likely to be either the national or provincial department responsible for environmental affairs. There is, however, additional legislation applicable to large scale wind and solar PV development for which authorisation requirements are often met through the environmental assessment process. As far as practically possible, these additional requirements are considered and addressed in the following sections.

The competent authorities in terms of the additional legislation serve as commenting authorities in the environmental assessment process and provide the competent authority in terms of NEMA with information to be able to make better informed decisions when considering environmental authorisation in terms of NEMA. In order to enable integrated and coherent decision-making the protocols contained in the following sections make provision for inputs from relevant commenting authorities into the environmental assessment process. In order for the competent authority in terms of NEMA to meet the regulatory timeframes prescribed by the EIA Regulations, commenting authorities are required to meet the relevant timeframes prescribed by the same regulations when providing input into the environmental assessment process. The commitment of commenting authorities to provide inputs as provided for in the protocols, and within prescribed timeframes, is crucial to avoid the competent authority in terms of NEMA having to assume that there are no objections from commenting authorities, and accordingly proceeding with decision making in terms of NEMA. The unwillingness or inability of all relevant authorities to commit to decision-making integration in the form of timeous inputs into the environmental assessment process as proposed in the protocols, will be a missed opportunity to address the current inefficiencies and development blockages resulting from cascading and contradicting decision-making processes.

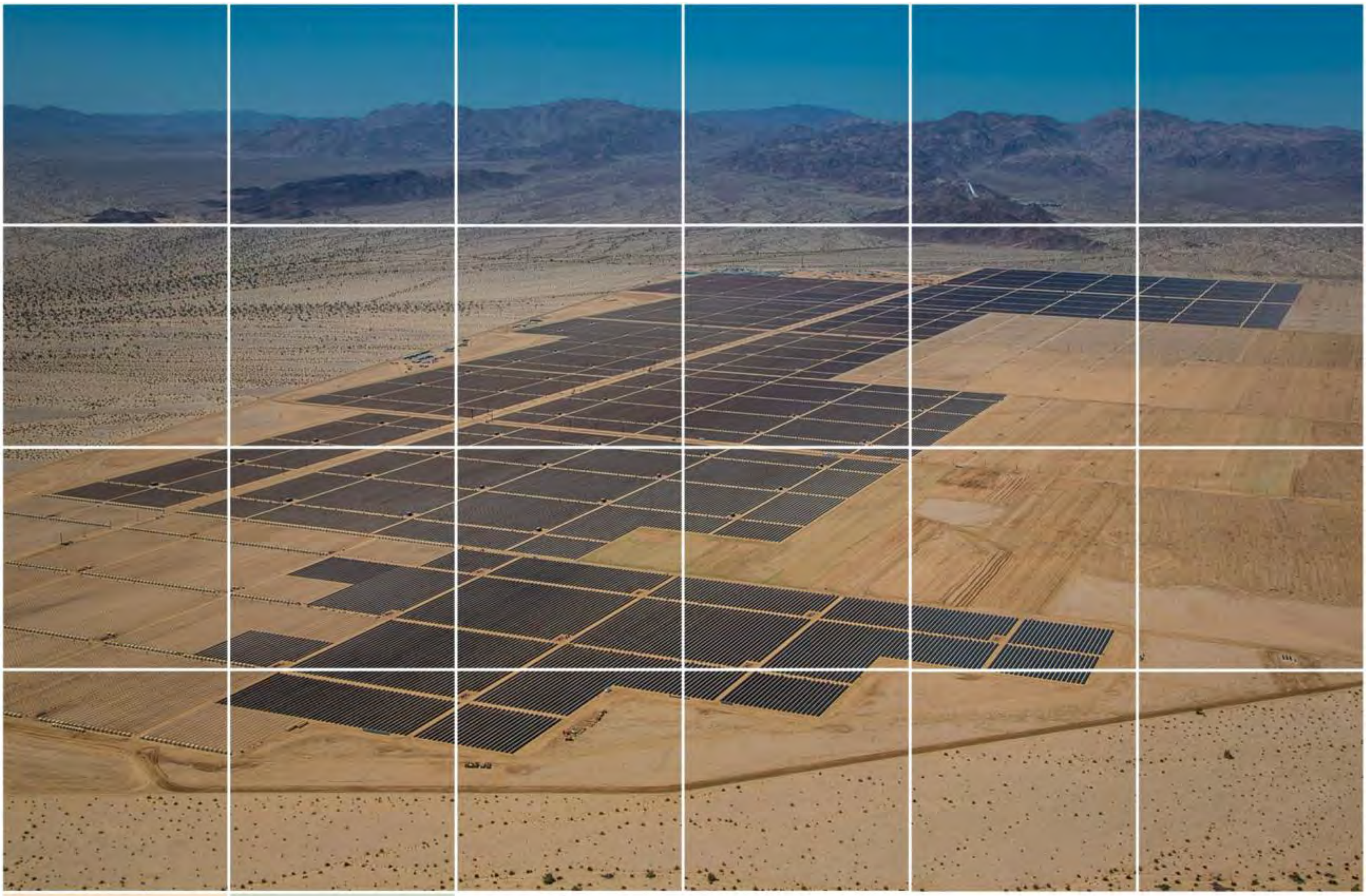
Competent Specialists and EAPs:

It is important to ensure that specialists as well and Environmental Assessment Practitioners (EAPs) are competent to provide studies and inputs that are adequate for decision making by the competent authority.

The competent specialist referred to in the following sections is one of the following:

- A natural science specialist who is registered with the South African Council for Natural Scientific Professionals (SACNASP) in his/her field of expertise;
- A non-natural science specialist who has accreditation or registration applicable to his/her field of expertise; or
- Where registration does not exist, a specialist who has at least 5 years of experience in undertaking impact assessments or similar studies.

The competent EAP referred to in the following sections is a practitioner that is registered with the Environmental Assessment Practitioners Association of South Africa (EAPASA) or has the relevant registration with SACNASP. Where registration is not available (i.e. until EAPASA is officially operational), a competent EAP should have at least 5 years' experience in managing EIAs.



Assessment of Cumulative Impacts:

At the time of assessing a proposed development it is not possible to foresee future developments that might contribute to cumulative impacts in a region. It is also not practical to re-evaluate every development when another development is proposed in the same area. Cumulative impacts and the assessment thereof in the following sections, therefore, refer to existing and potential impacts resulting from developments for which an application for environmental authorisation has been lodged prior to the application for the development under investigation. This implies that the first project proposed in an area only considers its own impacts, and that the last project proposed in that same area must consider the cumulative impacts of all projects already proposed. If the cumulative impact of the last project is found to be unacceptable it must be concluded that that project is not suitable, but previously proposed developments in the same area would not be affected. If an application for environmental authorisation for a proposed project has been withdrawn or lapsed, the application was rejected by the competent authority, or the environmental authorisation itself has lapsed, such a project no longer needs to be considered in terms of cumulative impacts.

Cumulative impacts are addressed in this SEA by determining development density limit guidelines based on landscape sensitivities, and determines as a guiding principle that wind developments within 6 km and in the same viewshed, and solar PV development within 3 km and the same viewshed, would result in cumulative impacts from a landscape perspective. Such development density limits ensure that all environmental cumulative impacts are controlled to some extent.

Physical Project Footprint and Development Envelope:

In order to allow for minor changes to the project footprint (i.e. proposed project layout plan) following authorisation, as is often found being a technical requirement, it is necessary for the competent authority to approve a development envelope rather than only the physical project footprint. The area that needs to be assessed in detail during the project level impact assessment thus needs to include a 50 m buffer from the edge of the proposed physical footprint of all infrastructure associated with the development. The assessment and approval of such a development envelope will allow for minor changes in the project layout without having to seek amendment or re-authorisation, provided that such a change in layout does not impinge on any additional sensitive areas identified in the envelope, or result in any increase in the significance ratings of impacts. It must be noted that the assessment of impacts related to a particular project is not limited to the development envelope; rather this area is assessed in more detail based on the assumption that the final physical footprint has the potential to be moved within this envelope.

SECTION 1

AGRICULTURE

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PART 3. SCOPING ASSESSMENTS AND DEVELOPMENT PROTOCOLS

SECTION 1: AGRICULTURE

The following section is informed by the scoping level specialist agricultural pre-assessment of the eight focus areas (FAs) for which the complete report is provided as Appendix A1. Due to the integrated and strategic nature of this Strategic Environmental Assessment (SEA), and based on consultation with relevant government departments and wider stakeholders, the final interpretation of sensitivities and development protocols presented in this section differ from those contained and recommended in the specialist report.

The Land Capability data on which this assessment is predominantly based are currently being updated by the national Department of Agriculture, Fisheries and Forestry (DAFF). The allowable development limits put forward in this section must be updated with the new data as soon as it becomes available.

1.1 Renewable Energy and Agriculture

1.1.1 Preservation of High Potential Agricultural Land

The major concern from an agricultural perspective with any development is the possible 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, agricultural land capability classes I to III, which represents high potential arable land, constitute only approximately 12.6 percent (%) of the country's land surface.

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

Not only is it too little, but what is available 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 agricultural land capability classes I to III is already being utilised for non-agricultural purposes.

In addition to the impact of the actual footprint of alternative developments on agricultural land, the subdivision and fragmentation of land portions is of further concern. The subdivision of land portions may lead to the creation of land portions that are too small to be economically viable in terms of agriculture. Furthermore, the development footprint can lead to the division of fields that result in the isolation of portions of land into non-viable small areas for cultivation. According to the Subdivision of Agricultural Land Act (SALA) no. 70 of 1970, an agricultural unit becomes too small to be financially viable if it cannot support grazing of at least 60 large stock units.

It is for these reasons that DAFF in principle does not support any renewable energy related footprint in high potential or cultivated agricultural land. Within the context of South Africa's very limited availability of arable land, DAFF considers any land that is capable of consistently and sustainably producing agricultural crops to be high potential agricultural land. According to this definition any land that has been cultivated at least once in the past 10 years, or has the potential to be cultivated in future, is precluded from renewable energy development in terms of the current DAFF internal guidelines. To address the impacts of fragmentation and the creation of non-viable agricultural land portions DAFF further limits the percentage (up to 10 %) of any agricultural land portion that can be utilised for renewable energy development.

1.1.2 Land Use Integration

From an agricultural perspective it would be desirable for all renewable energy development to be sited off high potential agricultural land. In the case of solar energy this is probably feasible since the solar resource is generally mutually exclusive from high potential agricultural land (i.e. those parts of the country with the highest solar irradiance are generally too arid for crop production). However, in the case of wind energy there is overlap between where the high wind energy resource and high potential agricultural land occur. The most significant areas of overlap in terms of identified FAs are within the Overberg area (FA 1), due to wheat production, and the Stormberg area (FA 4), due to high land capability in the former Transkei homeland area.

As part of this SEA process a land use integration system, whereby reasonably small footprints of renewable energy development can be allowed on appropriate agricultural land, is developed in order to allow for the utilization of high wind resources in the Overberg and Transkei areas. The main motivations for such integration can be summarised under the headlines of small footprint, economic returns, food security and regional benefits as discussed below.

[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.

1.1.2.1 Small Footprint

The footprint of disturbance for a wind farm leading to actual agricultural land losses is small enough to allow for mutually beneficial land use integration. An investigation of six proposed wind farms ranging from 30 megawatts (MW) to 150 MW in size and situated in the Western and Eastern Cape provinces provides some perspective. The total footprint of each wind farm was calculated as the total area that would be directly occupied by all wind farm infrastructure during its operational phase. This includes turbine foundations, hard standing areas, new roads, substations and buildings. With footprints ranging between 0.15 to 0.19 MW/ha, the percentage of the farm portions taken up by the investigated 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 entire 2030 renewable energy target of 16.8 gigawatts (GW) of wind and solar generation capacity, as set by the Integrated Resource Plan (IRP) 2010. In a United States (US) study[2], which evaluated 172 existing or proposed wind farm projects, the average permanent direct footprint was found to be approximately 0.3 ha/MW, while the above assessment of six locally proposed projects yielded footprints ranging from 0.15 to 0.19 ha/MW. Given the local and US data, it is safe to assume a permanent and direct footprint of wind development of 0.3 ha/MW. The footprint of solar photovoltaic (PV) development is significantly higher than for wind energy development and based on consultation with the industry, the average footprint of fixed and tracking PV technology is approximately 2.5 ha/MW.

Table 1 contains the calculated land requirements and also provides an indication of what percentage of the identified FAs would be taken up by the physical footprint of renewable energies if all of the IRP 2010 allocation was to be developed in these areas. The available surface area per technology in the focus areas is calculated as the sum of all focus areas identified for its potential in terms of that particular technology. Where a FA (e.g. FA 8) is known as having potential for both wind and solar PV technologies, it is assumed that half the focus area surface is available for the one type of technology and half for the other technology.

The calculations show that the total physical footprint of the IRP 2010 wind allocation is only 2 520 ha, which constitute less than 0.1 % of the identified FAs. The total IRP 2010 solar PV allocation translates to a 21 000 ha physical footprint which would take up less than 0.4 % of the FAs identified for its high solar development potential. The greatest possible national loss of agricultural land due to renewable energy development is thus 23 520 ha. Considering the fact that agricultural land in South Africa comprises approximately 98.7 million ha (81 % of country area)[3] this maximum area required for renewable energy development is marginally small at only 0.02 % of agricultural land in South Africa. Should all this development take place in the 26.8 million ha of high potential agricultural land, it would still only take up less than one thousandth (0.09 %) of this land class in the country.

Table 1: Land required to fulfil the total energy requirement of IRP2010

	IRP Target (MW by 2030)	Physical Footprint (ha/MW)	Total Footprint of IRP 2010 Allocation (ha)	Total surface area of focus areas per energy type (ha)	Percentage of Focus Areas required (%)
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%

1.1.2.2 Economic Returns

The total economic returns per unit area of land used for renewable energy far outweigh the returns from agricultural production. The rental for land on which a wind farm is situated is generally paid per turbine or based on a percentage (typically 1 to 2 %) of the value of power sold. The area of footprint per turbine calculated for the same six wind farms as in Section 1.1.2.1, and using the same definition of footprint, provides a range from 0.27 to 0.57 ha/turbine. Although the rental amounts agreed with farmers are confidential, the developers of the projects independently provided an approximate range of their agreed rentals. All of these were between R 100 000 to R 200 000 per turbine per year. Calculated using a worst case scenario of 0.6 ha per turbine, this amounts to between R 166 667 and R 333 333 of net rental income per hectare per year. Solar PV rental is calculated similarly and paid per occupied hectares. Ranges provided by solar PV developers are between R 2 000 and R 12 000 per hectare per year.

This is greater than most 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 the Overberg area (FA 1) ranges between R 812 and R 2 581 per hectare per year (see Table 2). The net annual farm income from agricultural production can thus be as much as 400 times less than the rental income earned by a farmer from a wind energy development. As mentioned previously, solar PV development generally takes place in areas of lower agricultural potential and low net annual farm income per hectare. Solar PV development will thus generally also generate significantly higher income than farming in these low potential areas.

Since the rental income from energy facilities greatly increases the economic returns per hectare of land it improves the economic viability of farms, particularly small and marginal ones. Many farm units already exist in low potential areas that are either too small (e.g. subsistence farmers in the former homelands) or of marginal agricultural potential (e.g. in very arid parts of the Northern Cape) to be economically viable in terms of agricultural production. With the setting aside of restrictions on how much of a land portion can be used for renewable energy development (i.e. 10 % of land portion) the rental from renewable energy facilities can offer a way for such small and marginal farm units to achieve independent economic viability.

In addition to generating higher income, renewable energy development can also offer benefits by improving roads and other agricultural infrastructure. If used as an investment into the farm, the additional income derived from renewable energy development can potentially increase the overall agricultural production of the farm, despite the loss of agricultural land. There is thus significant potential for mutually beneficial integration of renewable energy and agricultural land uses.

Table 2: Net farm income for grain producers in the Overberg FA

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

[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, Colorado. Available electronically at http://www.osti.gov/bridge

[3] Strategic plan DoA: Sectoral overview and performance. 2007. Available electronically at http://www.nda.agric.za/docs/StratPlan07/07sectoral.pdf

1.1.2.3 Food Security

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. The concept carries importance for society and is currently a fashionable one that effectively dispels argument against it, but using it to prohibit all non-agricultural land use may not be justified. All agricultural land uses do not necessarily contribute to food security. One example is wine farming. If it was essential to retain all agricultural land for food security, then wine farming on agricultural land that was suitable for production of other food crops should not be permitted.

Furthermore, it can be argued that any export food crop does not actually contribute to the country's food security since it does not feed South Africans. It does, however, earn income that contributes to the country's Gross Domestic Product (GDP). A large proportion of South Africa's agricultural land is used for production of export commodities including fruit, maize and cane sugar. 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 land use in terms of food security are thus made not in terms of agricultural production, but in terms of profit. The primary reason why any of the products discussed above are farmed is not because they contribute to South African food security through producing food, but because they earn revenue that contributes to food security.

Considering the potentially higher financial returns of renewable energy generation, it can be argued that this land use can contribute more to food security than several agricultural land uses. Both agriculture and renewable energy generation 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 is the one that can sustainably generate the highest income.

1.1.2.4 Regional Benefits

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 less than 0.1 % (as calculated above) will lead to considerable 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 an increased local economic base will lead to job creation in an area. The socio-economic study undertaken as part of this SEA found that, for example, in the Overberg focus area (FA 1) agricultural production has declined by 1.6 % and 12 059 jobs (49.1 %) were lost in the agricultural sector between 2005 and 2011. The sector that is growing and creating jobs is the finance and business services sector to which renewable energy development can further contribute. The Cape Agulhas Local Municipality, which makes up the largest part of the Overberg FA, has identified their dependency on agriculture as a key challenge and notes the diversification and growth of the local economy as priorities. This is also true for rural areas dependent on subsistence farming, such as the former homelands, where economic growth and diversification is essential. There is thus motivation for agricultural and renewable energy land use integration in terms of regional benefits, especially in areas of strategic importance such as the assessed FAs.

1.2 Sensitivity Mapping

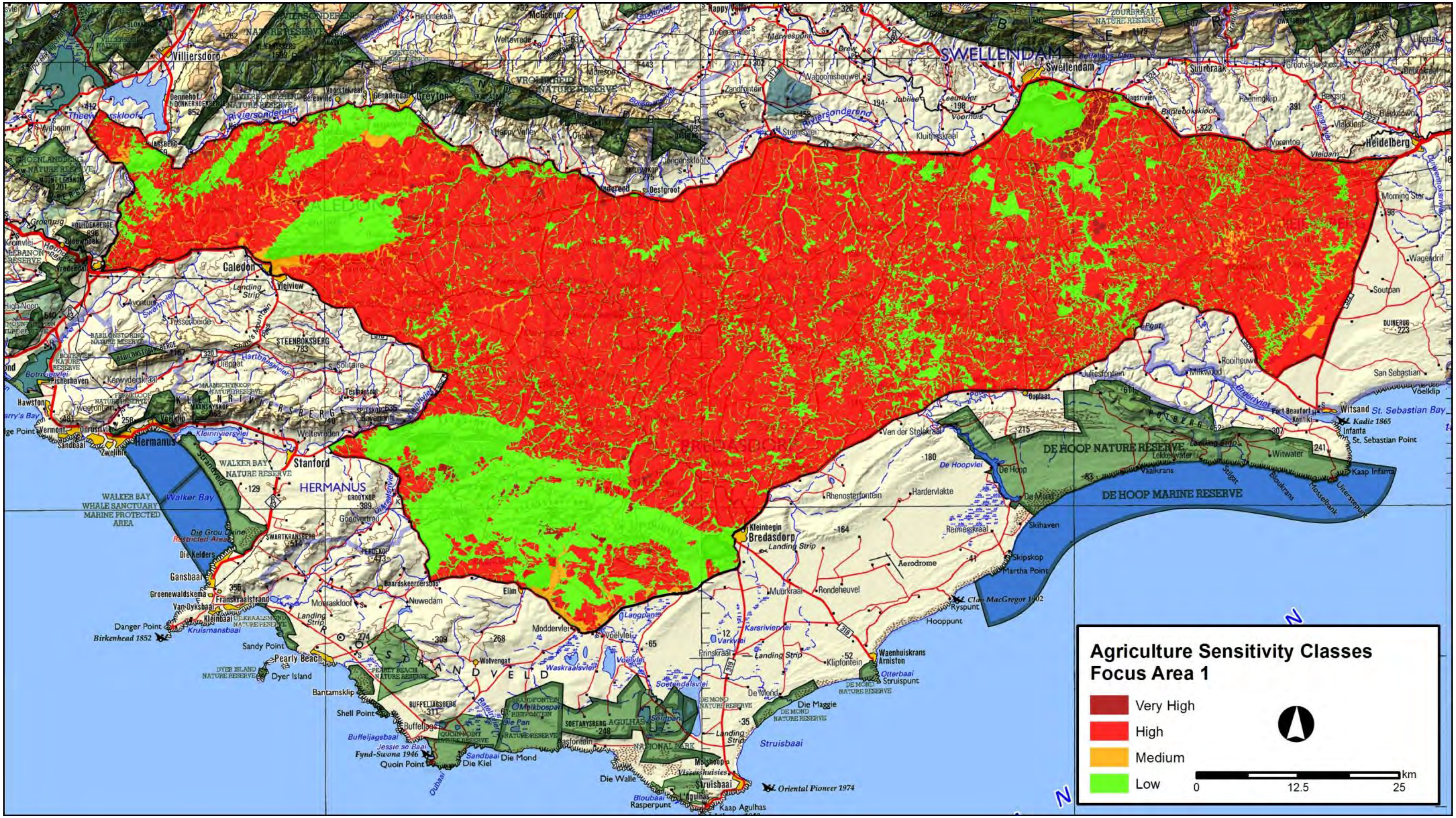
As part of the agricultural assessment of the eight focus areas, sensitivity mapping based on the best data available at the time was undertaken. The data used consist of the DAFF 2002 Land Capability dataset which categorises all land nationally into 8 different classes of agricultural land capability. The land capability dataset was supplemented by the DAFF 2013 Field Crop Boundaries dataset which delineates the boundaries of all cultivated land, based on satellite and aerial imagery. By combining these two datasets, four sensitivity classes, as described in Table 3, could be mapped over the eight FAs. The sensitivity mapping results are illustrated in Maps 1 to 8. Since wind and solar PV development have the same agricultural impact of land loss, the same sensitivity maps are applicable to both technologies.

As already mentioned, DAFF is currently in the process of updating the Land Capability dataset to address some of its shortcomings. The sensitivity criteria presented below should be updated with the new data as soon as it becomes available.

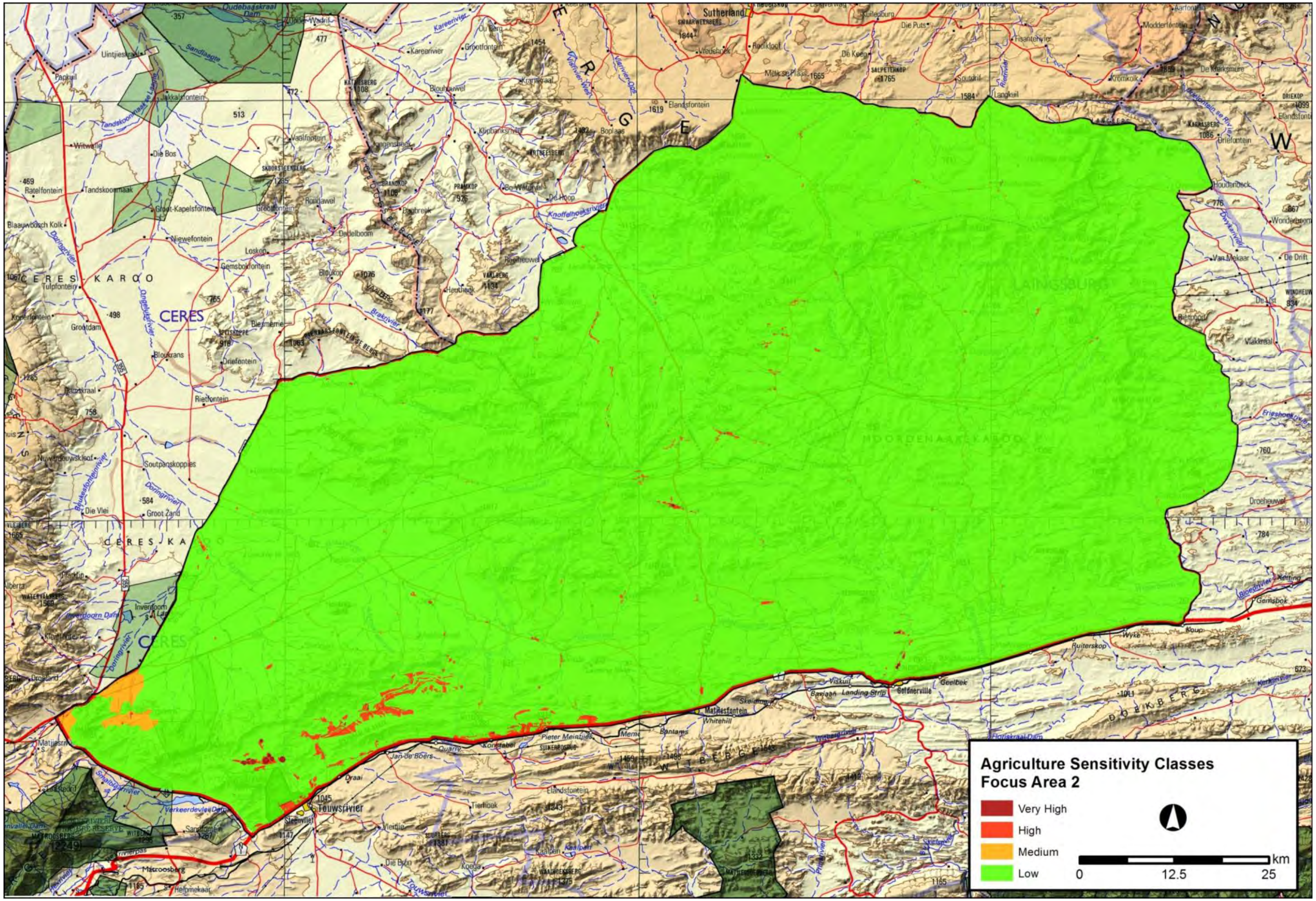
Table 3: Criteria for defining agricultural sensitivities

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

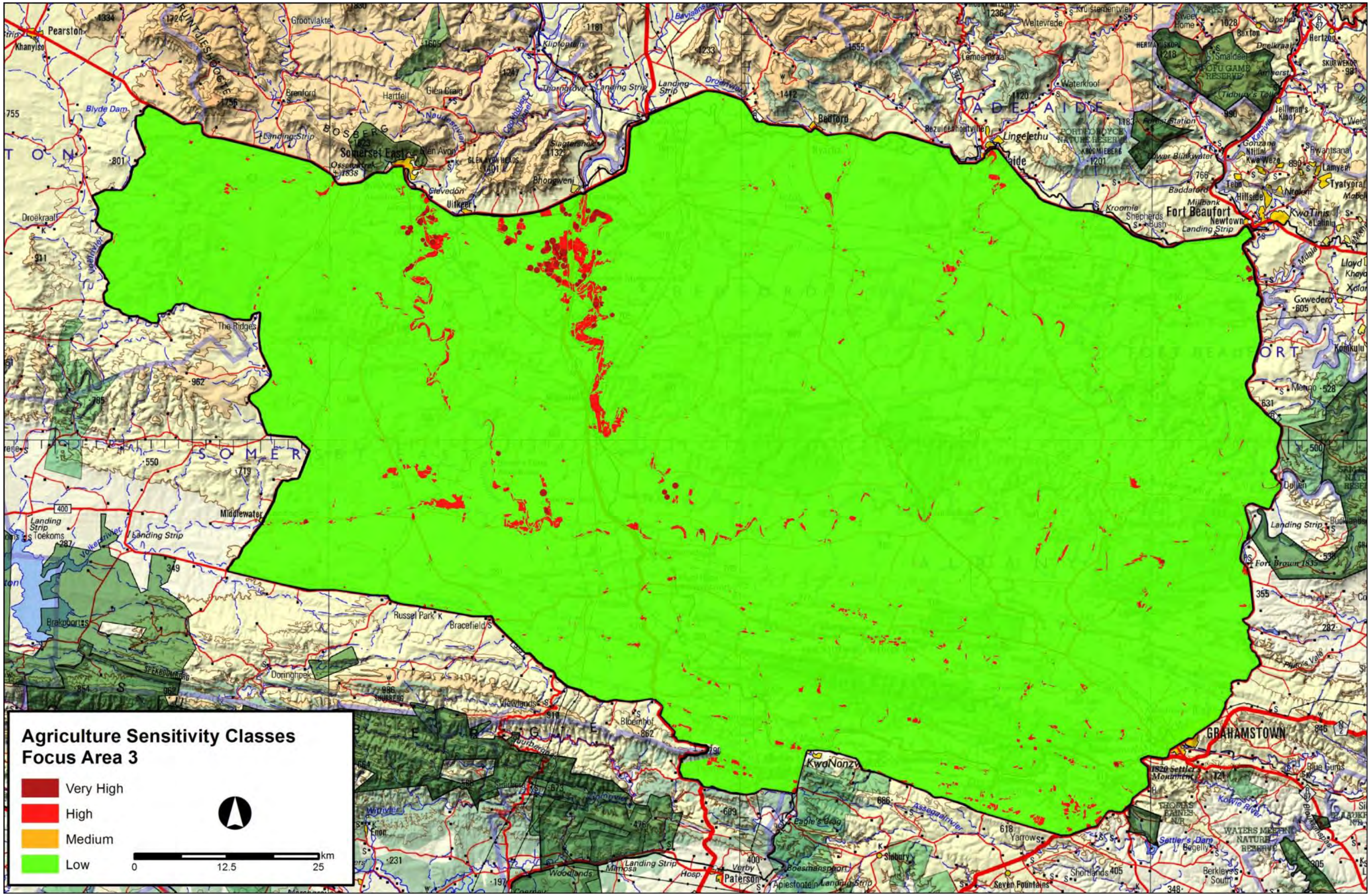
* The field crop boundaries dataset does not include a specific category for any other irrigated land. It is assumed that all irrigated land is included in these 3 categories. All irrigated land is considered as having Very High sensitivity.



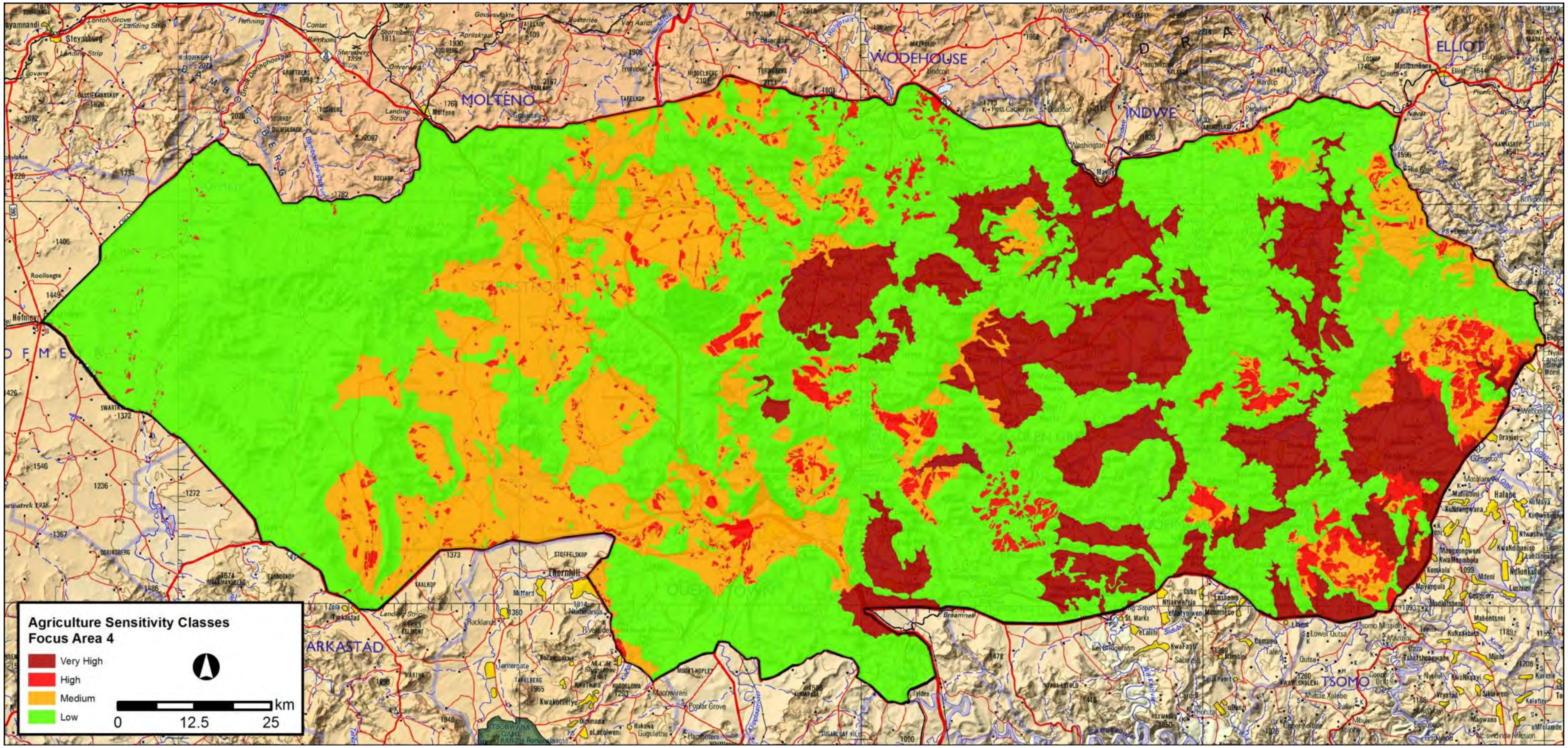
Map 1: Agricultural sensitivity for wind and solar PV development in the Overberg focus area (FA 1)



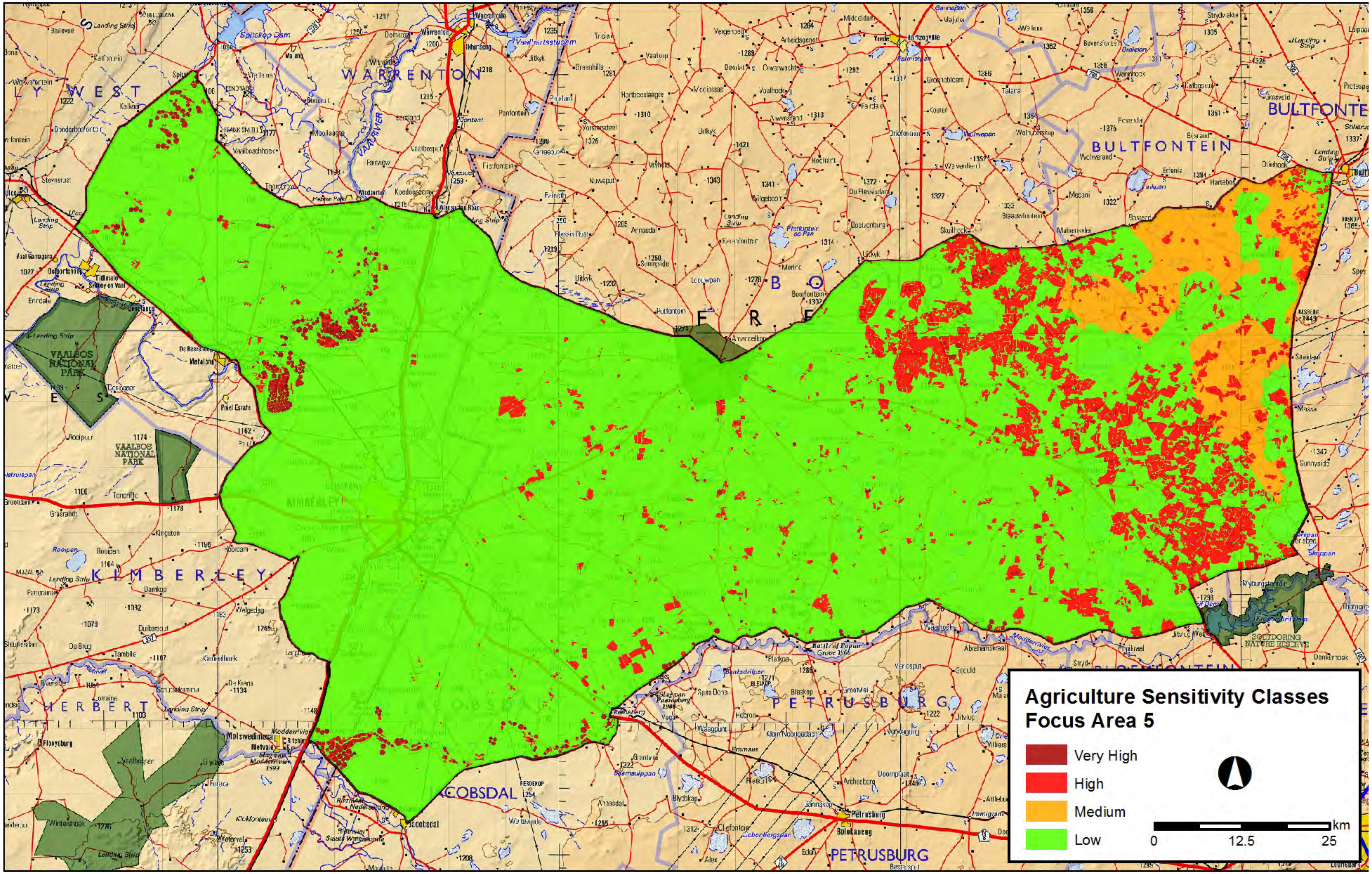
Map 2: Agricultural sensitivity for wind and solar PV development in the Komsberg focus area (FA 2)



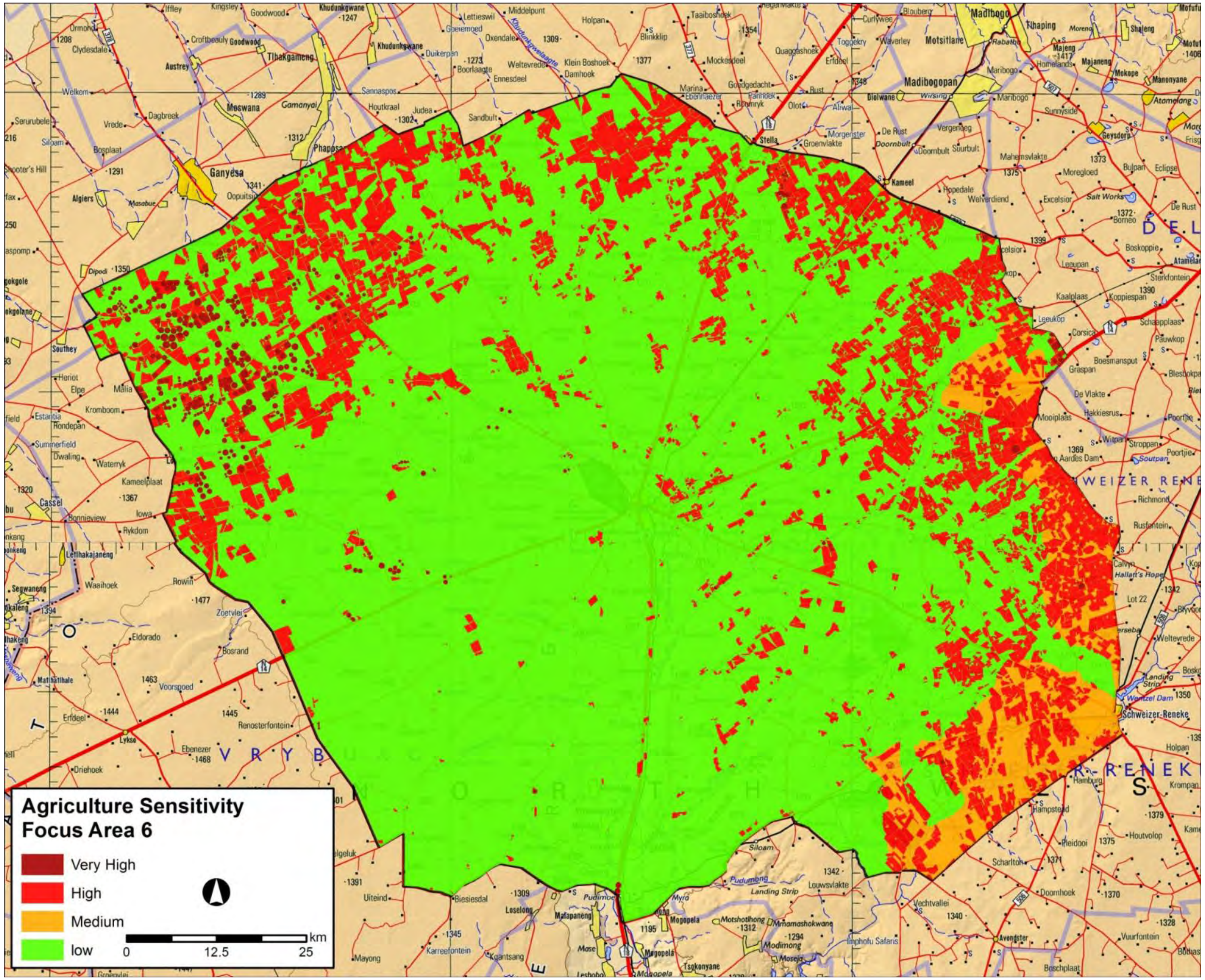
Map 3: Agricultural sensitivity for wind and solar PV development in the Cookhouse focus area (FA 3)



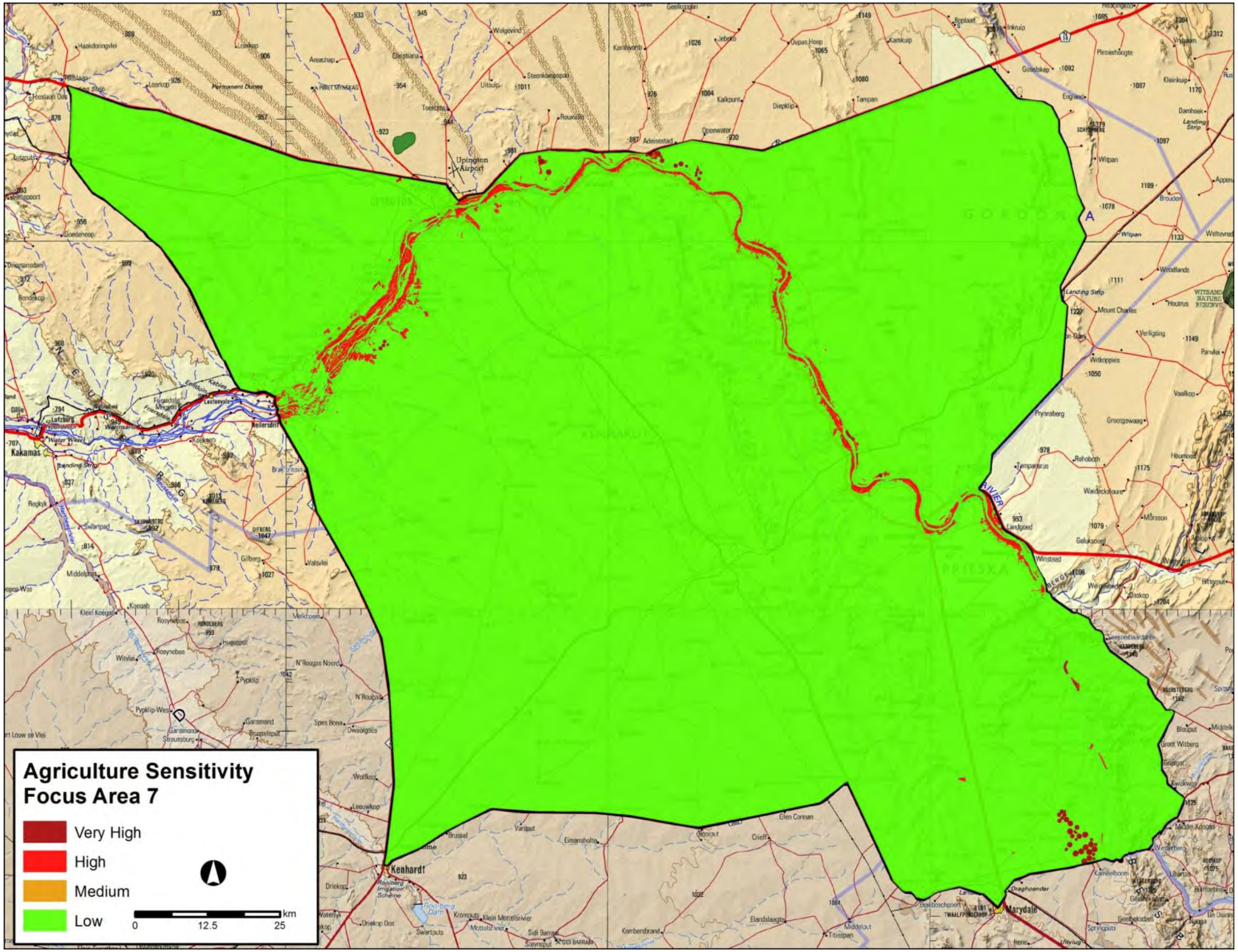
Map 4: Agricultural sensitivity for wind and solar PV development in the Stormberg focus area (FA 4)



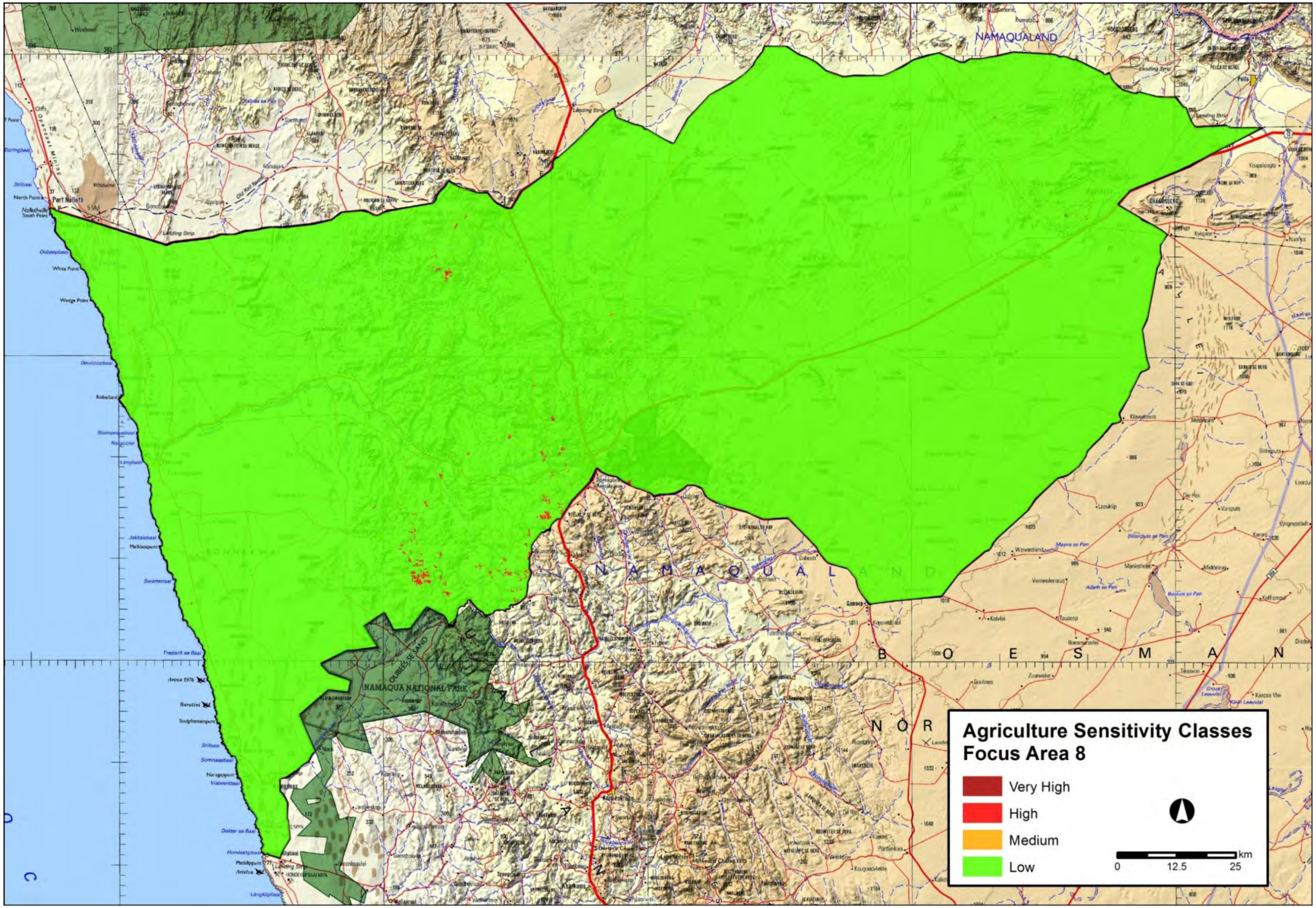
Map 5: Agricultural sensitivity for wind and solar PV development in the Kimberley focus area (FA 5)



Map 6: Agricultural sensitivity for wind and solar PV development in the Vryburg focus area (FA 6)



Map 7: Agricultural sensitivity for wind and solar PV development in the Upington focus area (FA 7)



Map 8: Agricultural sensitivity for wind and solar PV development in the Springbok focus area (FA 8)

1.3 Development Protocols

1.3.1 Allowable Development Limits

Based on the arguments made above for agricultural and renewable energy land use integration, and bearing in mind that the loss of potentially arable land must be strictly controlled and limited to the absolute minimum, allowable limits of wind and solar PV development in agricultural land have been developed and captured in Table 4. Again the impact of wind and solar PV development on agriculture is the same in that the development footprint takes up agricultural land, and the same allowable development limits thus apply to both technologies. The smaller footprints associated with wind development allows for this technology to be integrated with higher potential agricultural land. It should again be noted that these limits need to be adapted with the updated DAFF Land Capability data as soon as it become available.

The allowable development limits have been developed with the following outcomes in mind:

- All renewable energy development is excluded from Very High sensitivity land unless a developer can prove to the satisfaction of the relevant authority that the footprint of the energy facility is on land that is unsuitable for sustainable crop production. Development on Very High sensitivity land may also be considered in cases where off-sets that increase overall agricultural production are agreed to by the relevant authority;
- Solar PV developments, which have a much larger footprint than wind, are also excluded from High and Medium sensitivity land, unless a developer can prove to the satisfaction of the relevant authority that the footprint of the energy facility is on land that is unsuitable for sustainable crop production. Solar PV development on High and Medium sensitivity land may also be considered in cases where off-sets that increase overall agricultural production are agreed to by the relevant authority;
- While renewable energy development is allowed and incentivised to be located on low sensitivity land, a minimal footprint of wind energy development is also allowed for mutually beneficial integration with certain cultivated land; and
- By not limiting the percentage of a land portion available for renewable energy development, with such limitations effectively precluding small land portions from renewable energy development, it is made possible for wind and solar development to contribute to the financial performance of such small and marginal land portions which are potentially unable to achieve independent economic viability through agriculture alone.

Table 4: Allowable development limits of renewable energy in different categories of agricultural sensitivity.

Criteria (land capability class and category of crop boundary)	Allowable development footprint in hectares per MW of installed generation capacity	
	Within field crop boundaries	Outside field crop boundaries
I, II, III, Irrigation, horticulture/viticulture, 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

*The colour coding in this table refers to the 4 tiers of sensitivity as introduced in sub-Section 1.2.

Allowable development limits refer to the area of a particular category of land that can be directly impacted (i.e. taken up by the physical footprint) by a renewable energy development. Footprint in this context is the area that is directly occupied by all infrastructures, including roads, hard standing areas, buildings, substations etc., that is associated with the renewable energy facility during its operational phase, and that result 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 expanding existing infrastructure (e.g. 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 as a result of the renewable energy facility.

1.3.2 Approvals

In Table 5 the current requirements for agricultural assessment for wind or solar PV developments are described. In Table 6 the new agricultural assessment requirements that will apply for wind and solar PV projects inside the FAs, once they have been adopted as REDZs, are described. These requirements are specific to sensitivity classes and are therefore related to the sensitivity maps in sub-Section 1.2.

Table 5: Interpretation of agricultural sensitivity and current agricultural assessment requirements

Assumed Sensitivity	Interpretation of the sensitivity	Current assessment requirements
Any agricultural land is potentially of very high sensitivity.	In the absence of any pre-assessment it is assumed that any land is potentially capable of consistently and sustainably producing agricultural crops. Any land that has been cultivated at least once in the past 10 years, or has potential to be sustainably cultivated in the future, is considered unsuitable for development. The percentage of any agricultural land portion that can be taken up by a renewable energy development footprint is limited to 10% of the portion extent.	Proponents intending to develop a wind or solar PV facility that triggers an environmental impact assessment process must prove to the relevant competent authority that the proposed development will not have a footprint in any land that is considered to be potentially suitable for the consistent and sustainable production of agricultural crops. In order to do so, a **comprehensive Agricultural Impact Assessment** undertaken by a competent agricultural specialist, and in accordance with National Environmental Management Act (NEMA) regulations pertaining to specialist reports and impact assessment, is required. Such a study must be submitted to the relevant agricultural authority for comment. Such comment, if provided within the stipulated timeframes, is then considered by the relevant competent authority for decision making. In the absence of standardised sensitivity criteria and allowable development limits, every project and its associated impacts are currently adjudicated on an *ad-hoc* basis.

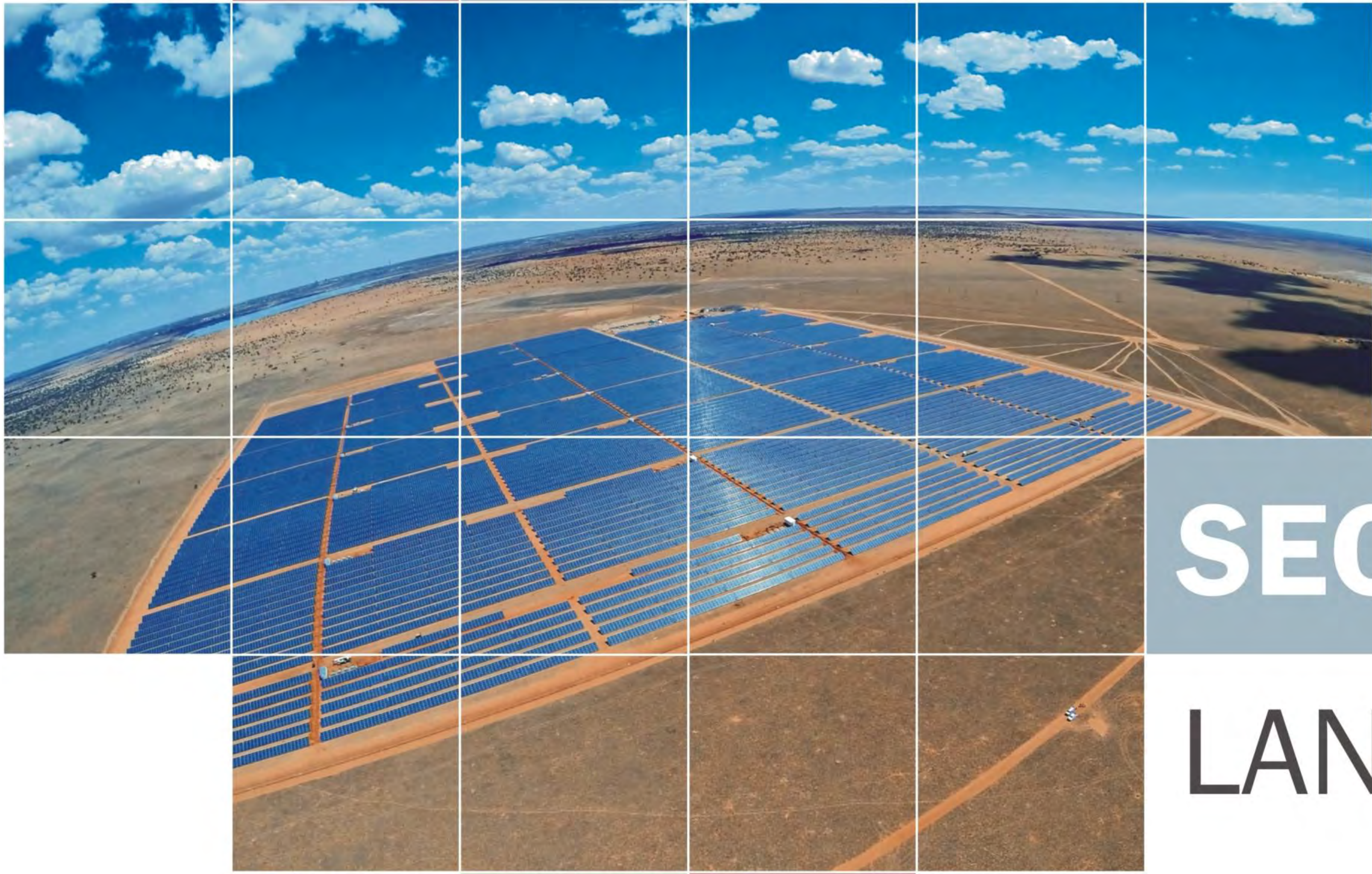
Table 6: Interpretation of agricultural sensitivity maps and associated new assessment requirements inside REDZs

<table>
<tr><th>Colour</th><th>Sensitivity</th><th>Interpretation of the sensitivity</th><th>Further assessment requirements for wind and solar PV developments</th></tr>
<tr><td>Dark red</td><td>Very High</td><td>Very high sensitivity areas are potentially unsuited for development owing to its high agricultural potential and preservation importance. This land includes all high capability arable land, high productivity land and land into which significant agricultural investment has been made.</td><td>Proponents intending to develop a wind or solar PV facility that triggers an environmental impact assessment process in very high sensitivity areas inside adopted REDZs must prove to the relevant competent authority that the proposed development will not have an unacceptable negative impact on agriculture. In order to do so, a comprehensive Agricultural Impact Assessment undertaken by a competent agricultural specialist, and in accordance with NEMA regulations pertaining to specialist reports and impact assessment, is required. Such a study must also be submitted to the relevant agricultural authority for comment. Such comment, if provided within stipulated timeframes, will be considered by the relevant competent authority for decision making. For the development to be considered such a study must prove that the footprint of the proposed energy facility is on land that is unsuitable for sustainable crop production, or that the proposed development complies with the allowable development limits specified in this study. Development on very high sensitivity land may also be considered in cases where off-sets that increase overall agricultural production are agreed to by the agricultural authority.

In addition to the NEMA requirements such a report must contain:
project footprint (including supporting infrastructure) with a 50 m buffered development envelope, overlaid on a sensitivity map prepared in accordance with the sensitivity criteria set out in this study;
calculations confirming the development footprint in different land classes and comparison thereof with allowable limits specified in this study;
a clear and justified opinion statement by the specialist recommending whether the project should from an agricultural perspective receive approval. If this statement is subject to any conditions these must also be clearly stated; and
where required, proposed mitigation measures for inclusion in the Environmental Management Programme (EMPr).</td></tr>
<tr><td>Red</td><td>High</td><td>High sensitivity areas are still preservation worthy since it includes unique agricultural land and marginal land that has been cultivated. In keeping the loss of agriculturally valuable land to a minimum this land has been identified as being suited for only limited development, while such development is steered towards the more marginal of it.</td><td rowspan="3">If the wind or solar PV development that triggers an environmental impact assessment process is proposed inside adopted REDZs, and complies with the allowable development limits, the project will only require a Compliance Statement prepared by a competent agricultural specialist. Such a statement must also be submitted to the relevant agricultural authority for comment. Such comment, if provided within stipulated timeframes, will be considered by the relevant competent authority for decision making.

The minimum requirements for the compliance statement are:
details and relevant expertise of the specialist preparing the statement;
project footprint (including supporting infrastructure) with a 50 m buffered development envelope, overlaid on a sensitivity map prepared in accordance with the sensitivity criteria set out in this study;
calculations confirming allowable development limit compliance;
confirmation that all reasonable measures have been taken through micro-siting to minimise fragmentation and disturbance of agricultural activities;
a clear and justified opinion statement by the by the EAP/specialist recommending whether the project should from an agricultural perspective receive approval. If this statement is subject to any conditions these must also be clearly stated; and
where required, proposed mitigation measures for inclusion in the Environmental Management Programme (EMPr).
If a wind or solar PV development that triggers an environmental impact assessment process and is proposed inside an adopted REDZs deviates from the allowable development limits, the proponent must prove to the relevant competent authority that the proposed development will not have an unacceptable negative impact on agriculture. In order to do so, a comprehensive Agricultural Impact Assessment undertaken by a competent agricultural specialist, and in accordance with NEMA regulations pertaining to specialist reports and impact assessment, is required. Such a study must also be submitted to the relevant agricultural authority for comment. Such comment, if provided within stipulated timeframes, will be considered by the relevant competent authority for decision making. For the development to be considered such a study must prove that the footprint in excess of the allowable development limits is on land that is unsuitable for sustainable crop production. Additional footprint area beyond the allowable development limit may also be considered in cases where off-sets that increase overall agricultural production are agreed to by the relevant agricultural authority.

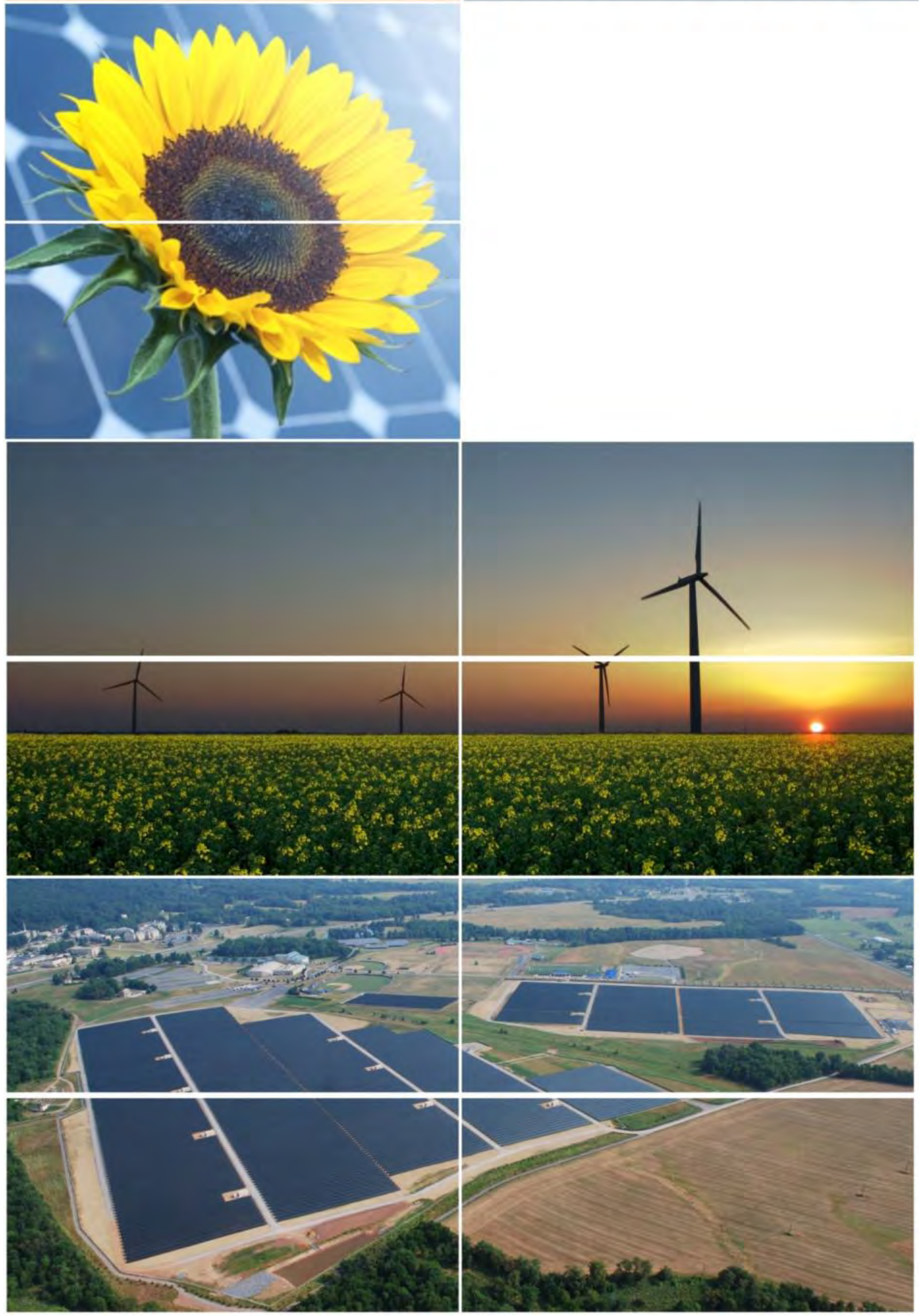
In addition to the NEMA requirements such a report must contain:
project footprint (including supporting infrastructure) with a 50 m buffered development envelope, overlaid on a sensitivity map prepared in accordance with the sensitivity criteria set out in this study;
calculations confirming the development footprint in different land classes and comparison thereof with allowable limits specified in this study;
determination of whether the proposed development footprint is on land that is unsuitable for sustainable crop production, complies with the allowable development limits specified in this study, or whether proposed off-sets will increase overall agricultural production; and
a clear and justified opinion statement by the specialist recommending whether the project should from an agricultural perspective receive approval. If this statement is subject to any conditions these must also be clearly stated; and
where required, proposed mitigation measures for inclusion in the Environmental Management Programme (EMPr).</td></tr>
<tr><td>Orange</td><td>Medium</td><td>Medium sensitivity areas are likely to be more marginal arable land, but use of it for renewable energy development is still limited.</td></tr>
<tr><td>Green</td><td>Low</td><td>Low sensitivity areas are likely to not be arable land, and are therefore not particularly preservation worthy. It is this land onto which most of the renewable energy footprint, including all solar PV projects, should be steered.</td></tr>
</table>



SECTION 2

LANDSCAPE

contents



LIST OF TABLES

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PART 3. SCOPING ASSESSMENTS AND DEVELOPMENT PROTOCOLS

SECTION 2: LANDSCAPE

The following section is informed by the scoping level specialist landscape pre-assessment of the eight Focus Areas (FAs) for which the complete report is provided as Appendix A2. Due to the integrated and strategic nature of this Strategic Environmental Assessment (SEA), and based on consultation with relevant government departments and wider stakeholders, the final interpretation of sensitivities and development protocols presented in this section differ from those contained and recommended in the specialist report.

2.1 Renewable Energy and Landscapes

While it is recognised that renewable energy is required to address the effects of climate change and has the potential to contribute to socio-economic development in rural areas, wind and solar photovoltaic (PV) facilities must be sited and designed in a manner that minimises the impact on South Africa's rich cultural resources and landscapes. Renewable energy facilities, including supporting infrastructure such as power lines, can be perceived as industrial structures which have the potential to impact negatively on sensitive landscapes. The natural and cultural landscape characteristics generally encompass visual, scenic, aesthetic and amenity values, which contribute to the overall 'sense of place' of an area. Wind turbines in particular are tall structures that can be visible from long distances and have a high potential to impact on landscapes and visual resources.

According to the Scottish Natural Heritage Guideline[1] the visual impact of a wind farm depends on the distance from which it is viewed, weather conditions, turbine siting and the landscape context. Several guidance documents have provided generic categories for the degrees of visibility and visual impact related to distance. Table 1 was adapted from the Scottish Planning Advice Note 45[2] and offers general guidance on the effect of distance on the perception of a wind farm in an open landscape. Although the document does not clearly specify the turbine size this table refers to, the document mentions turbines with tower heights of more than 70 metres (m) and rotor diameters of more than 80 m. Turbines have since increased in size and can now reach hub heights of 120 m and rotor diameters of 130 m, resulting in a wind farm in some conditions being visible from a distance of up to 50 kilometres (km) away[1]. Even though the below table considers smaller turbines than what is generally proposed in South Africa, it still places the potential visual impacts of wind farms into perspective.

The cumulative impacts of renewable energy development on the landscape are of specific concern. According to the Scottish Natural Heritage Guideline[1], cumulative impacts may be perceived when more than one facility is visible from one viewpoint, when several facilities are seen during a single journey, and when there is a gradual increase in the number or size of facilities over time. The same guidelines suggest that SEAs such as this one may show that some degree of development clustering in strategic areas (such as the Renewable Energy Development Zones) is preferable to a more widely distributed pattern.

Table 1: General perception of wind farm in an open landscape

Distance from turbine	Perception
< 2 km	Likely to be a prominent feature
2-5 km	Relatively prominent
5-15 km	Only prominent in clear visibility – seen as part of the wider landscape
15-30 km	Only seen in very clear visibility – a minor element in the landscape

Source: Scottish Planning Advice Note 45 (revised 2002): Renewable Energy Technologies

2.2 Sensitivity Mapping

Landscape sensitivity was determined as part of this study 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. The resources considered include features of topographic, geological or cultural interest, together with landscape grain or complexity. Protected landscapes, such as national parks, nature reserves, game parks or game farms, as well as heritage sites, add to the cultural value of an area and were thus considered as essential criteria in the determination of landscape sensitivities. Landscape sensitivity was further determined by taking into account existing receptors in the area including settlements, national roads, arterial roads, scenic routes, and tourist destinations such as guest farms and resorts. The specific features and spatial data used to create sensitivity Maps 1 to 16 are contained in Table 2.

[1] Scottish Natural Heritage (2014) Siting and Designing Wind Farms in the Landscape . Available from: http://www.snh.org.uk/pdfs/strategy/renewables/Guidance_Siting_Designing wind_farms.pdf
[2] Scottish Executive (2002) Planning Advice Note 45: Renewable Energy Technologies.

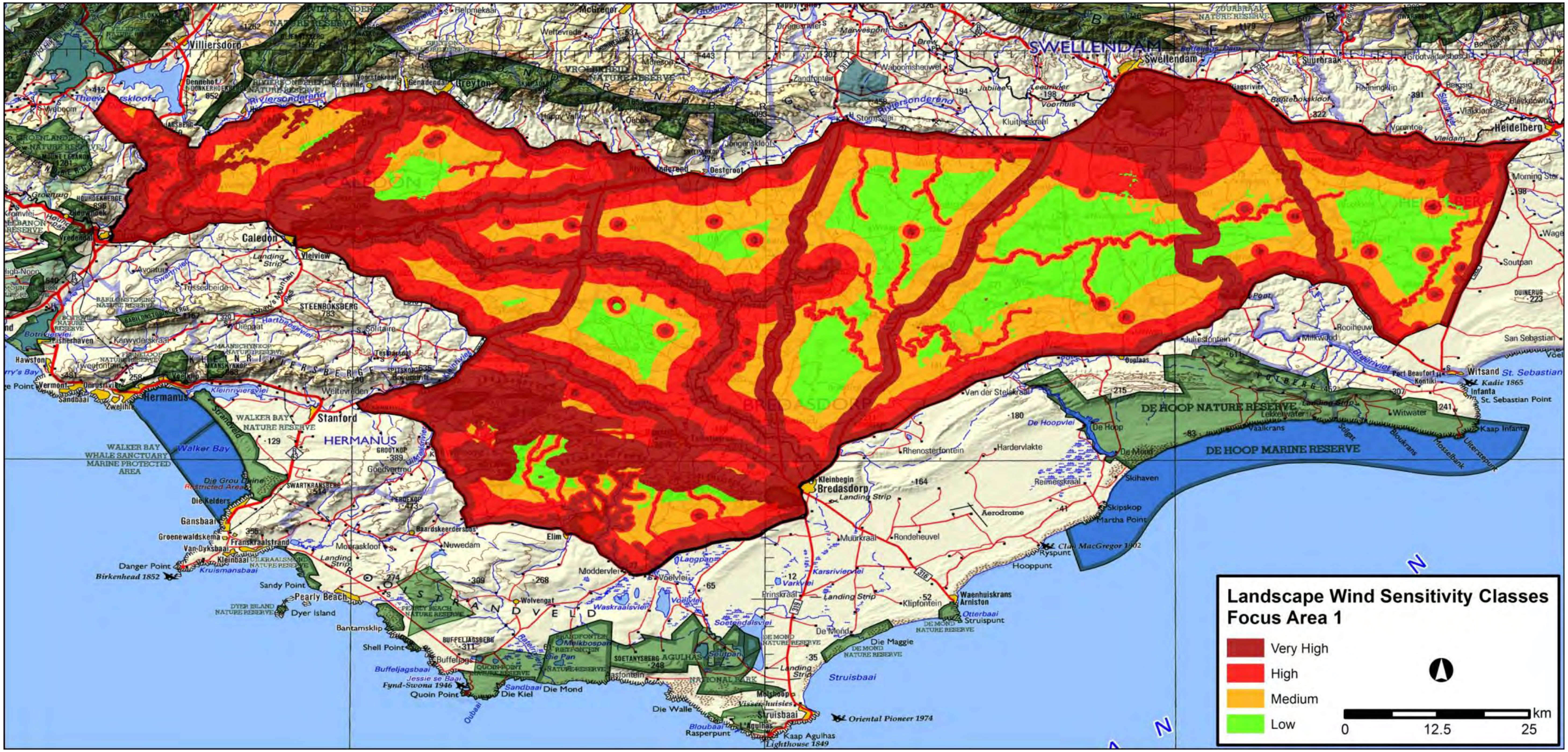
Table 2: Spatial data used in the landscape scoping assessment

Sensitivity Feature	Data Source	Sensitivity Mapping Application	
		Wind	Solar PV
Ridgelines, scarps, prominent elevations and geological features as identified by landscape specialists	· Surveys and Mapping 1:50 000 topographical maps of South Africa · National Aeronautics and Space Administration (NASA) Shuttle Radar Topographic Mission (SRTM) at 90 m resolution and 16 m vertical accuracy.	· **Very High Sensitivity** identified areas only	· **Very High Sensitivity** identified areas only
Steep slopes	· Surveys and Mapping 1:50 000 topographical maps of South Africa · NASA SRTM	· **Very High Sensitivity** areas with slopes of more than 1:4 · **High Sensitivity** areas with slopes between 1:4 and 1:10	· **Very High Sensitivity** areas with slopes of more than 1:4 · **High Sensitivity** areas with slopes between 1:4 and 1:10
Major rivers, water bodies perennial rivers and wetlands with scenic value as identified by landscape specialists	· National Freshwater Ecosystem Priority Areas (NFEPA) - 2011	· **Very High Sensitivity** within 250 m · **High Sensitivity** between 250 and 500 m · **Medium Sensitivity** between 500 and 1000 m	· **Very High Sensitivity** within 250 m · **High Sensitivity** between 250 and 500 m · **Medium Sensitivity** between 500 and 1000 m
Ramsar sites	· National Department of Environmental Affairs South African Protected Areas Database (SAPAD) - 2014	· **Very High Sensitivity** within 5 km · **High Sensitivity** between 5 and 10 km · **Medium Sensitivity** between 10 and 15 km	· **Very High Sensitivity** within 2.5 km · **High Sensitivity** between 2.5 and 5 km · **Medium Sensitivity** between 5 and 7.5 km
Coastal zones	· Surveys and Mapping 1:50 000 topographical maps of South Africa	· **Very High Sensitivity** within 1 km · **High Sensitivity** between 1 and 2 km · **Medium Sensitivity** between 2 and 4 km	· **Very High Sensitivity** within 1 km · **High Sensitivity** between 1 and 2 km · **Medium Sensitivity** between 2 and 4 km
National parks	· SAPAD - 2014	· **Very High Sensitivity** within 5 km viewshed* · **High Sensitivity** between 5 and 10 km viewshed · **Medium Sensitivity** between 10 and 15 km viewshed	· **Very High Sensitivity** within 2.5 km viewshed · **High Sensitivity** between 2.5 and 5 km viewshed · **Medium Sensitivity** between 5 and 7.5 km viewshed

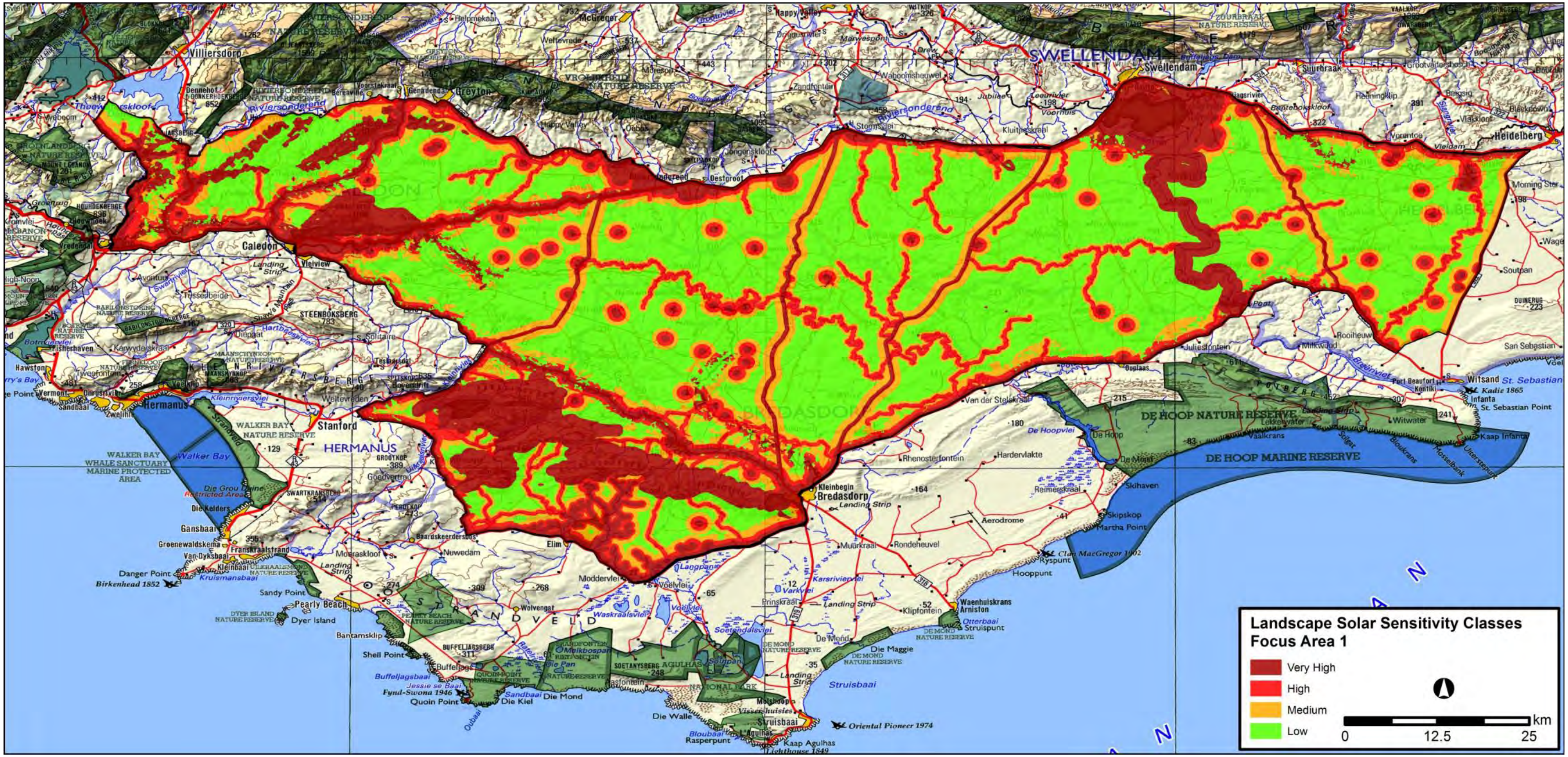
Sensitivity Feature	Data Source	Sensitivity Mapping Application	
		Wind	Solar PV
Other officially protected landscapes included in the South African Protected Areas Database, including nature reserves and botanical gardens	· SAPAD - 2014	· **Very High Sensitivity** within 3 km viewshed · **High Sensitivity** between 3 and 5 km viewshed · **Medium Sensitivity** between 5 and 10 km viewshed	· **Very High Sensitivity** within 1.5 km viewshed · **High Sensitivity** between 1.5 and 3 km viewshed · **Medium Sensitivity** between 3 and 5 km viewshed
Private reserves and game farms	· SAPAD – 2014 · Google Maps · Eastern Cape Province Protected Areas Expansion Strategy - 2012 · North West Province Game Farm Database	· **Very High Sensitivity** within 2 km viewshed · **High Sensitivity** between 2 and 5 km viewshed · **Medium Sensitivity** between 5 and 7 km viewshed	· **Very High Sensitivity** within 1 km viewshed · **High Sensitivity** between 1 and 2 km viewshed · **Medium Sensitivity** between 2 and 3 km viewshed
South African Large Telescope (SALT)**	· Surveys and Mapping 1:50 000 topographical maps of South Africa	· **Very High Sensitivity** within 25 km viewshed	· **Very High Sensitivity** within 25 km viewshed
Heritage, archaeological sites, battle sites, cemeteries and cultural landscapes as identified by heritage specialists	· SEA Heritage specialist scoping pre-assessment - 2014	· **Very High Sensitivity** within 500 m · **High Sensitivity** between 500 and 1000 m · **Medium Sensitivity** between 1000 and 1500 m	· **Very High Sensitivity** within 500 m · **High Sensitivity** between 500 and 1000 m · **Medium Sensitivity** between 1000 and 1500 m
Towns, villages and settlements***	· AfriGIS Towns - 2013	· **Very High Sensitivity** within 2 km viewshed · **High Sensitivity** between 2 and 4 km viewshed · **Medium Sensitivity** between 4 and 6 km viewshed	· **Very High Sensitivity** within 500 m viewshed · **High Sensitivity** within 1 km viewshed · **Medium Sensitivity** between 1 and 2 km viewshed
National roads	· Surveys and Mapping 1:50 000 topographical maps of South Africa	· **Very High Sensitivity** within 1 km viewshed · **High Sensitivity** between 1 and 3 km viewshed · **Medium Sensitivity** between 3 and 5 km viewshed	· **Very High Sensitivity** within 500 m viewshed · **High Sensitivity** between 500 and 1000 m viewshed · **Medium Sensitivity** between 1 and 2 km viewshed

Sensitivity Feature	Data Source	Sensitivity Mapping Application	
		Wind	Solar PV
Scenic routes, passes and poorts as identified by landscape specialists	· Surveys and Mapping 1:50 000 topographical maps of South Africa	· **Very High Sensitivity** within 1 km viewshed · **High Sensitivity** between 1 and 3 km viewshed · **Medium Sensitivity** between 3 and 5 km viewshed	· **Very High Sensitivity** within 500 m viewshed · **High Sensitivity** between 500 and 1000 m viewshed · **Medium Sensitivity** between 1 and 2 km viewshed
Passenger rail lines	· Surveys and Mapping 1:50 000 topographical maps of South Africa	· **Very High Sensitivity** within 1 km viewshed · **High Sensitivity** between 1 and 3 km viewshed · **Medium Sensitivity** between 3 and 5 km viewshed	· **Very High Sensitivity** within 500 m viewshed · **High Sensitivity** between 500 and 1000 m viewshed · **Medium Sensitivity** between 1 and 2 km viewshed
Provincial and arterial routes	· Surveys and Mapping 1:50 000 topographical maps of South Africa	· **Very High Sensitivity** within 1 km · **Medium Sensitivity** between 1 and 3 km	· **Very High Sensitivity** within 250 m · **Medium Sensitivity** between 250 and 1000 m

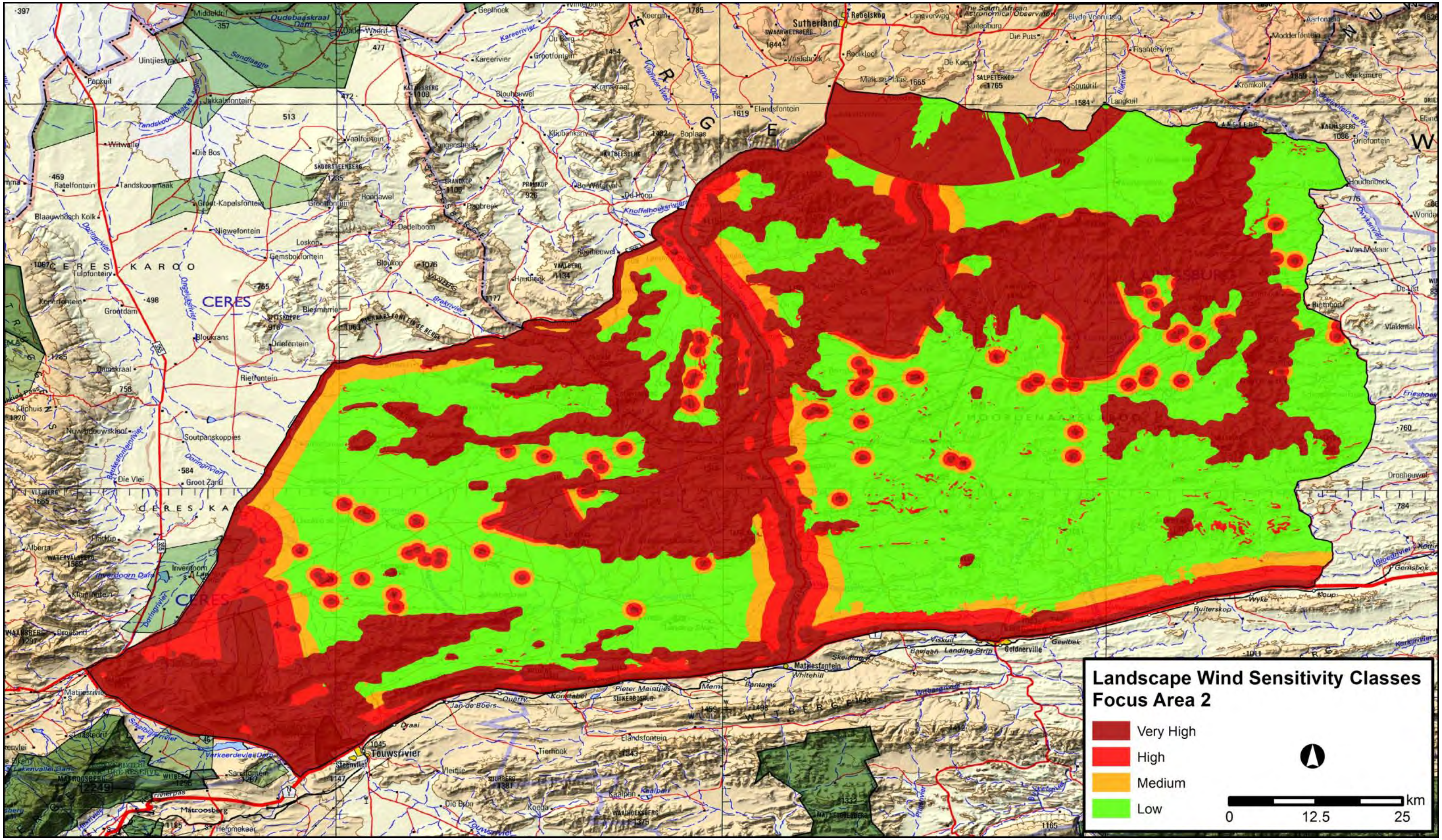
* Viewsheds were calculated by assuming an observer of 2 m above ground level on the boundary of sensitive areas, and indicates where structures of 100 m (wind) and 5 m (solar PV) above ground level would be visible to such an observer. More detailed viewsheds will be required to inform actual project siting.
** The approximate height of 17 m for the telescope platform was used for the viewshed calculation of Southern African Large Telescope (SALT).
*** Rural kraals were not included in settlements.



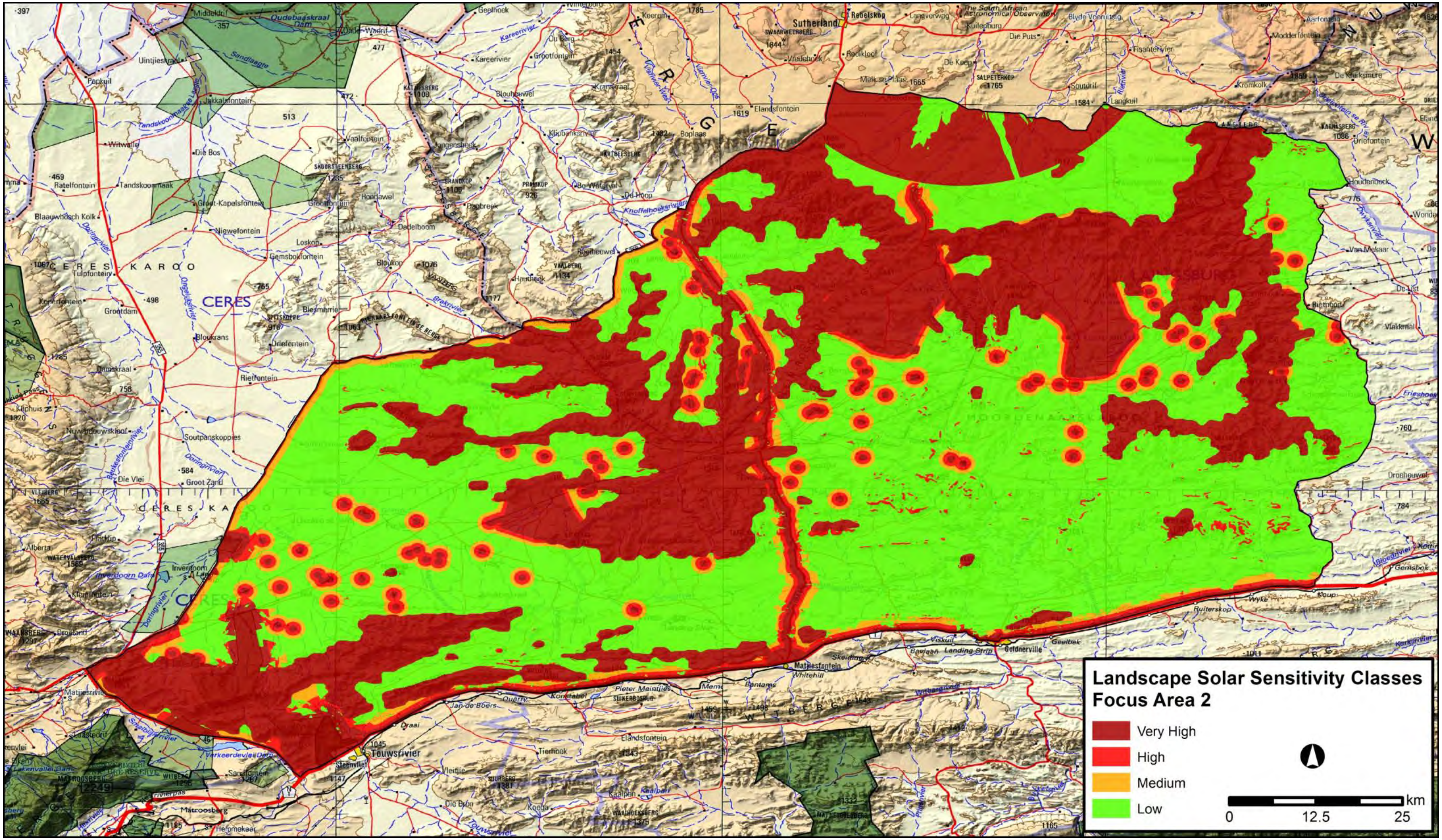
Map 1: Landscape sensitivity map for Wind development in the Overberg focus area (FA 1)



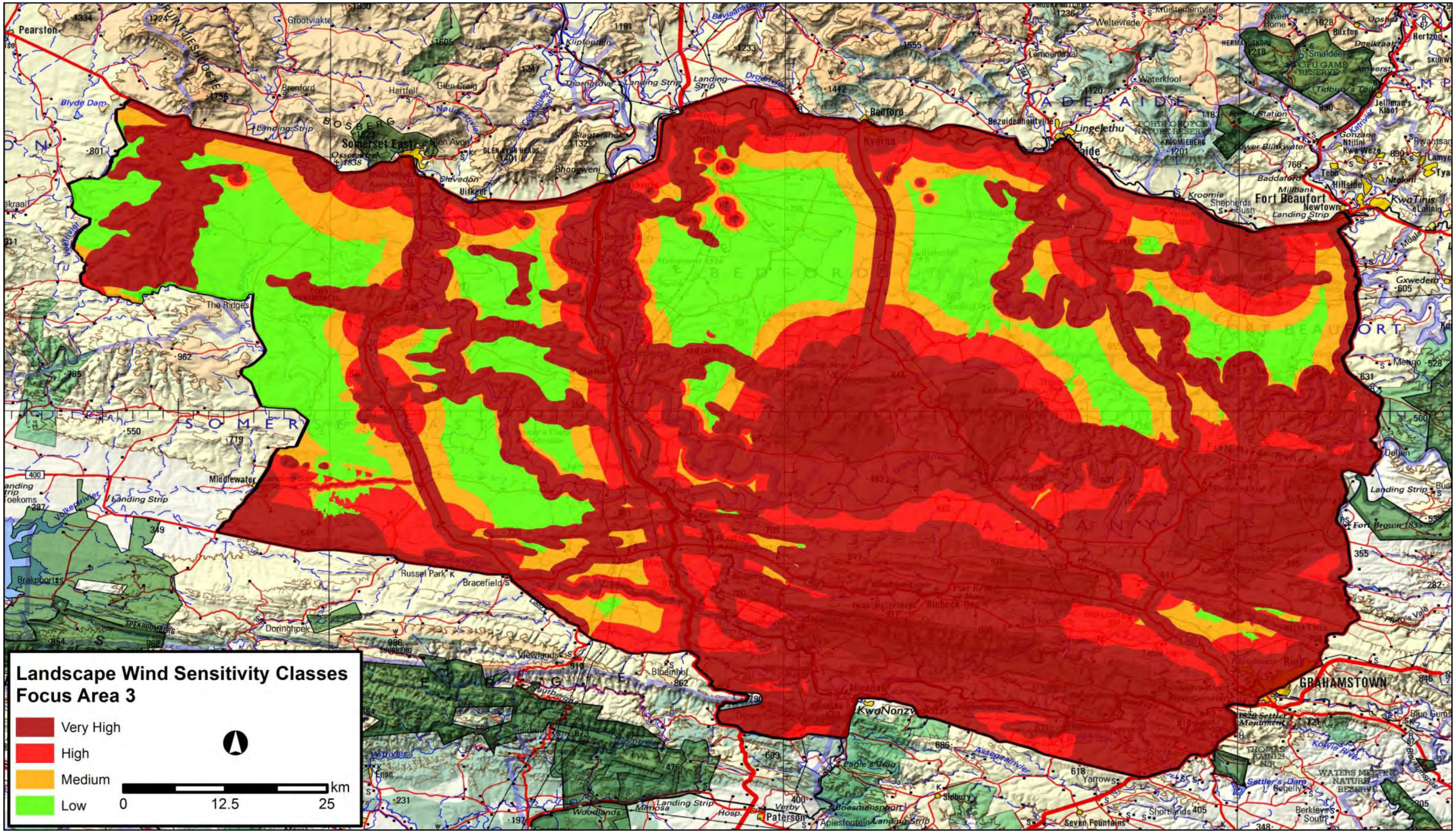
Map 2: Landscape sensitivity map for Solar PV development in the Overberg focus area (FA 1)



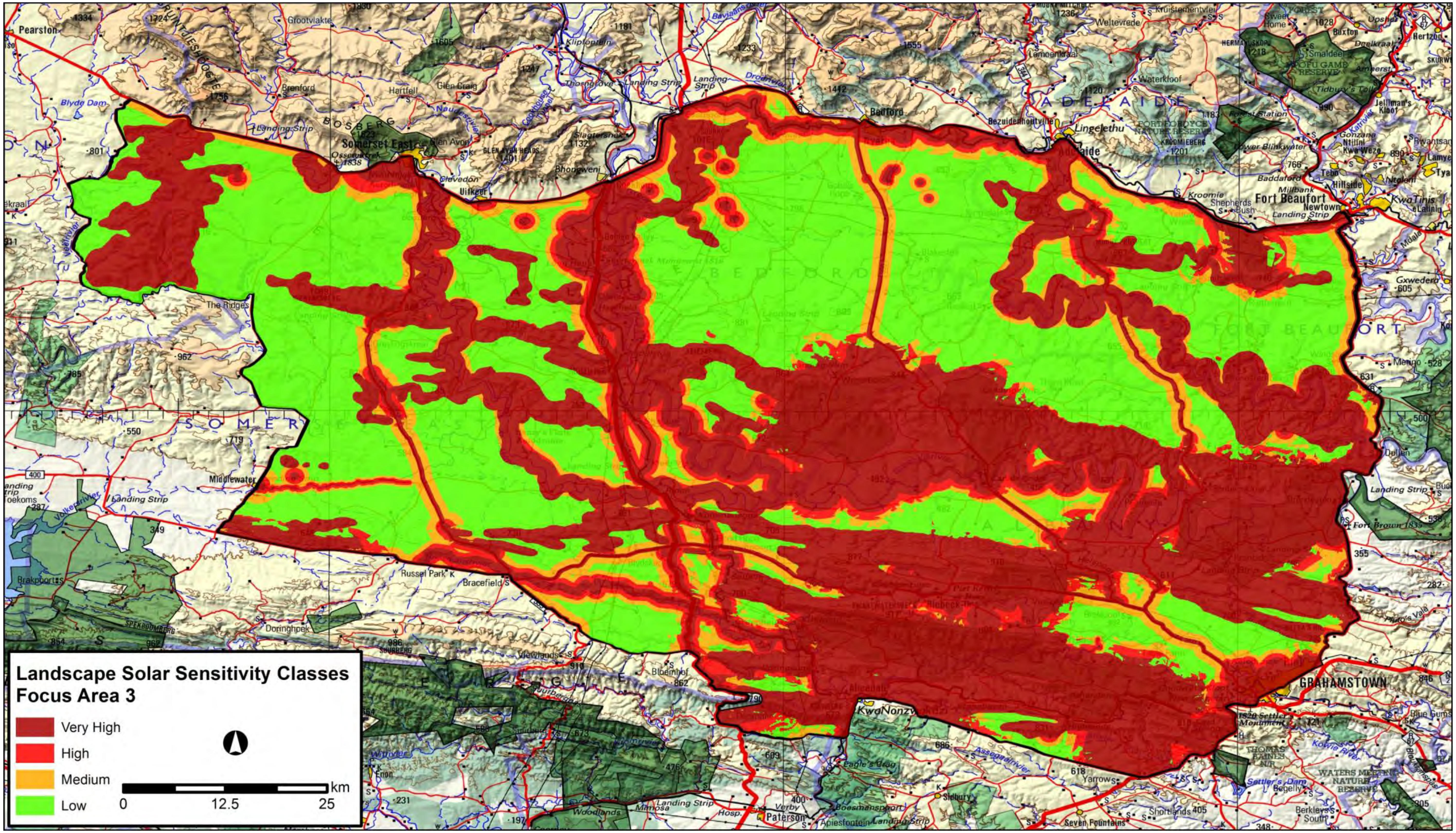
Map 3: Landscape sensitivity map for Wind development in the Komsberg focus area (FA 2)



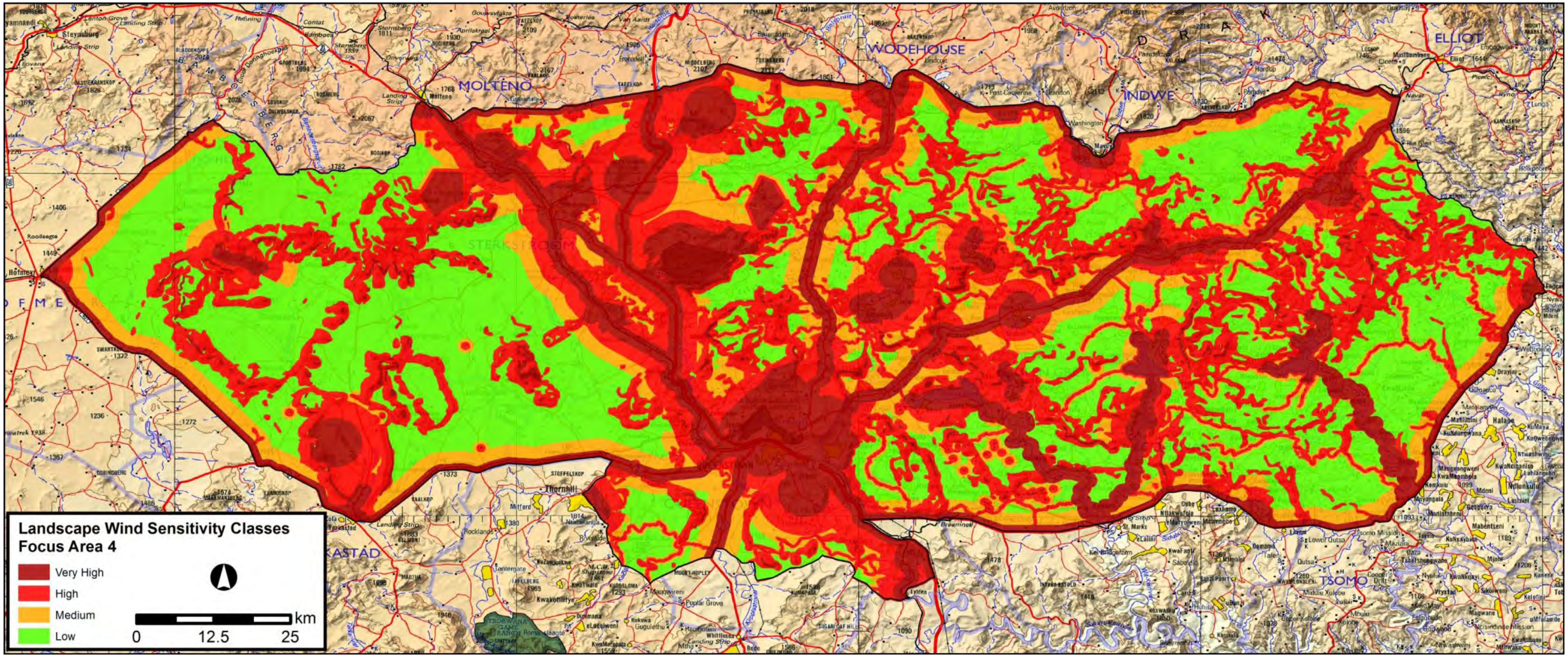
Map 4: Landscape sensitivity map for Solar PV development in the Komsberg focus area (FA 2)



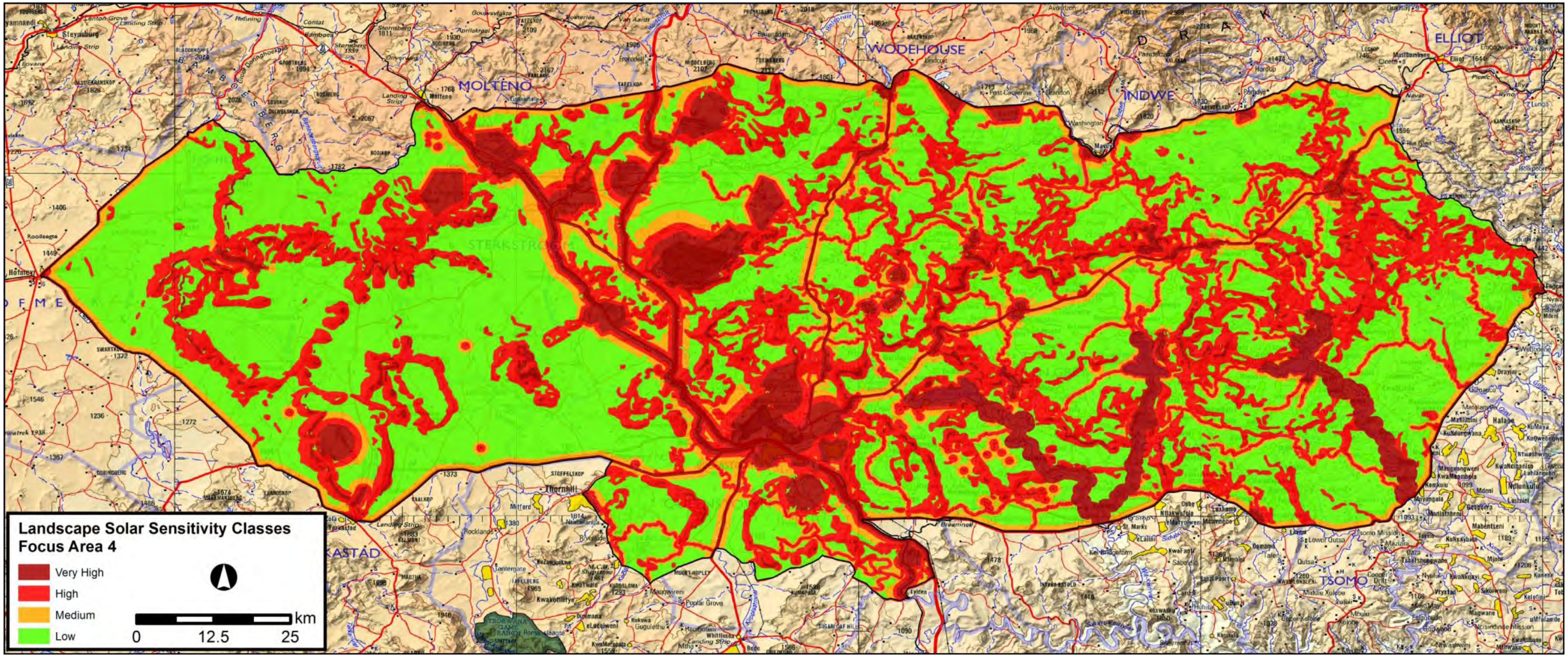
Map 5: Landscape sensitivity map for Wind development in the Cookhouse focus area (FA 3)



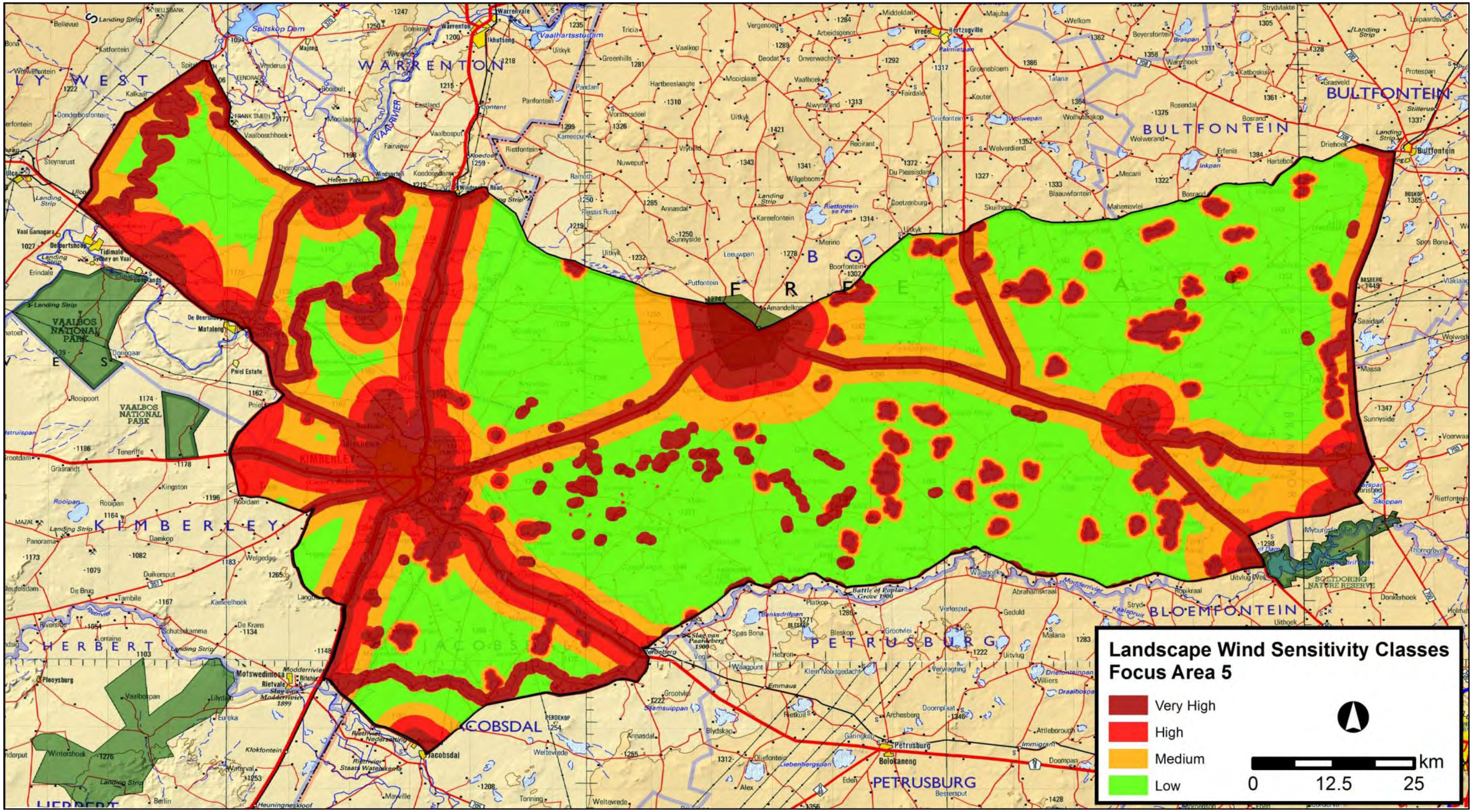
Map 6: Landscape sensitivity map for Solar PV development in the Cookhouse focus area (FA 3)



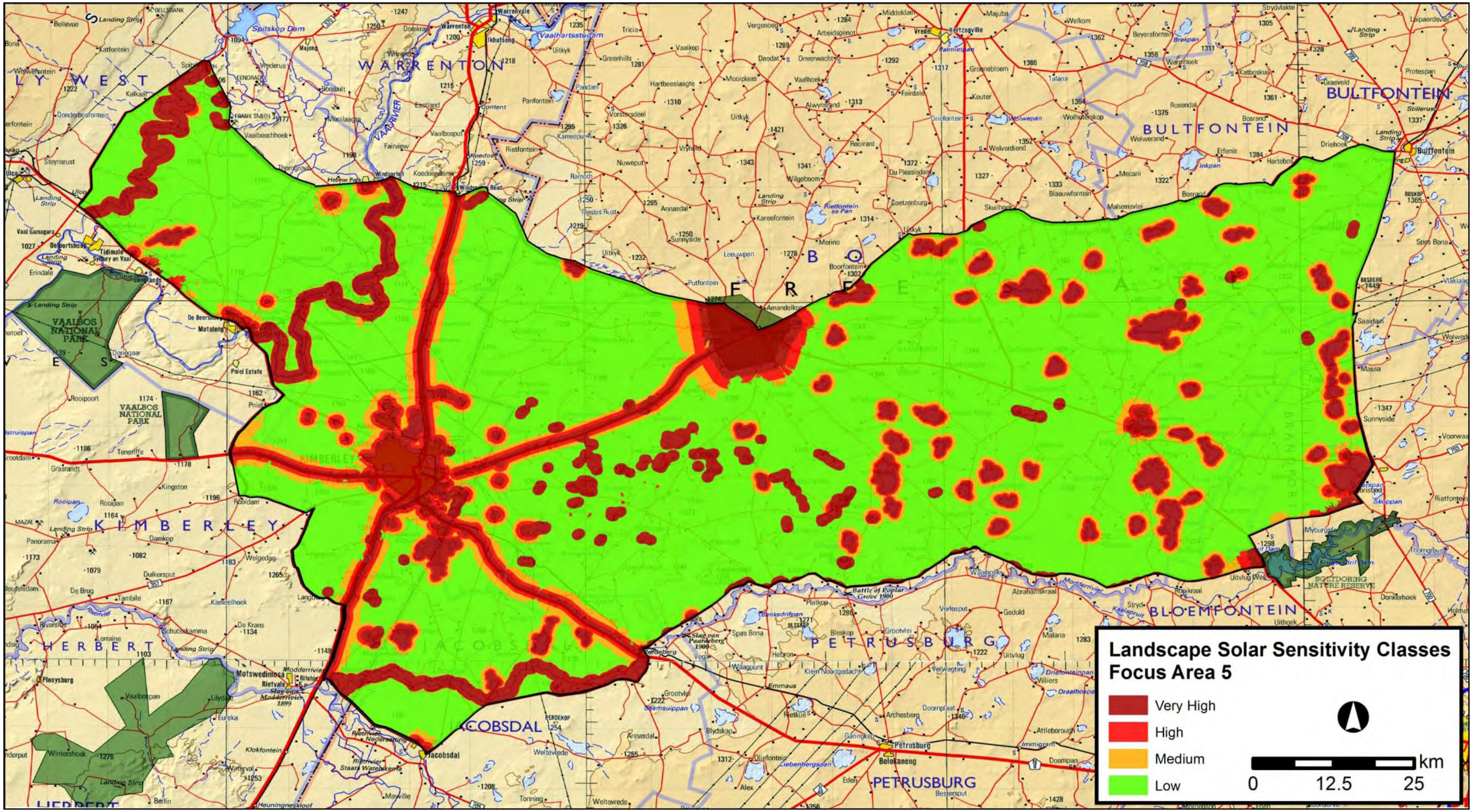
Map 7: Landscape sensitivity map for Wind development in the Stormberg focus area (FA 4)



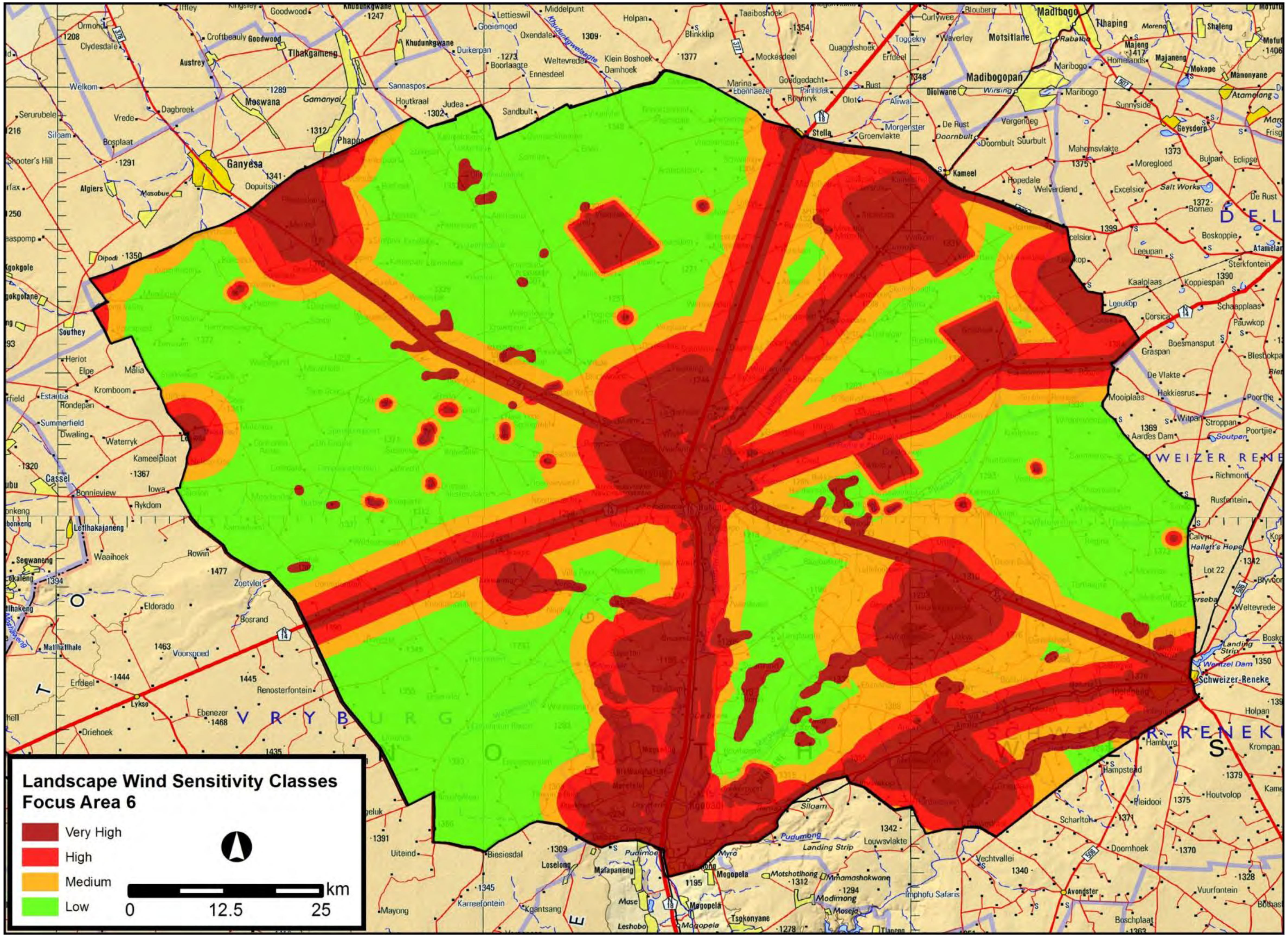
Map 8: Landscape sensitivity map for Solar PV development in the Stormberg focus area (FA 4)



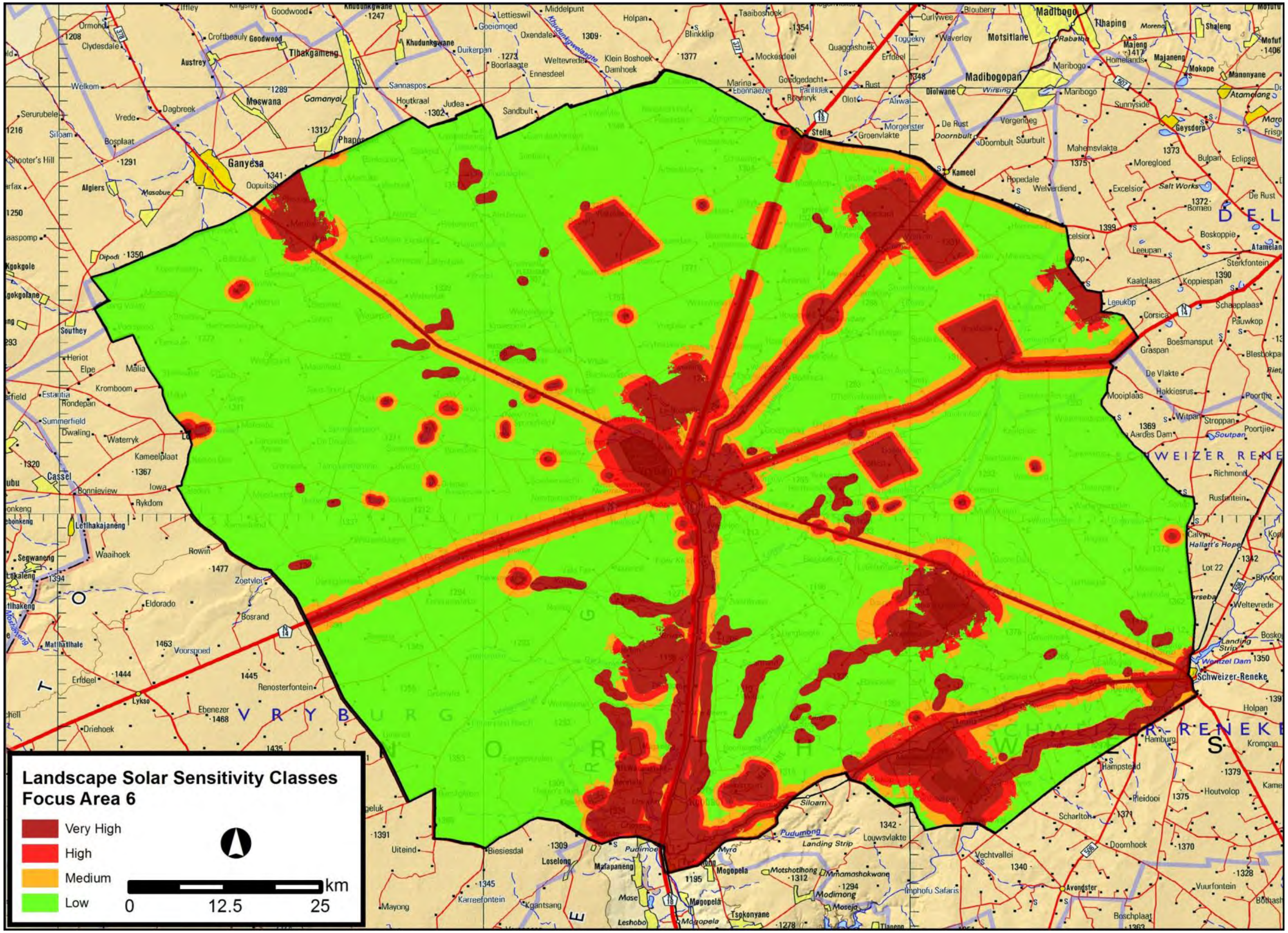
Map 9: Landscape sensitivity map for Wind development in the Kimberley focus area (FA 5)



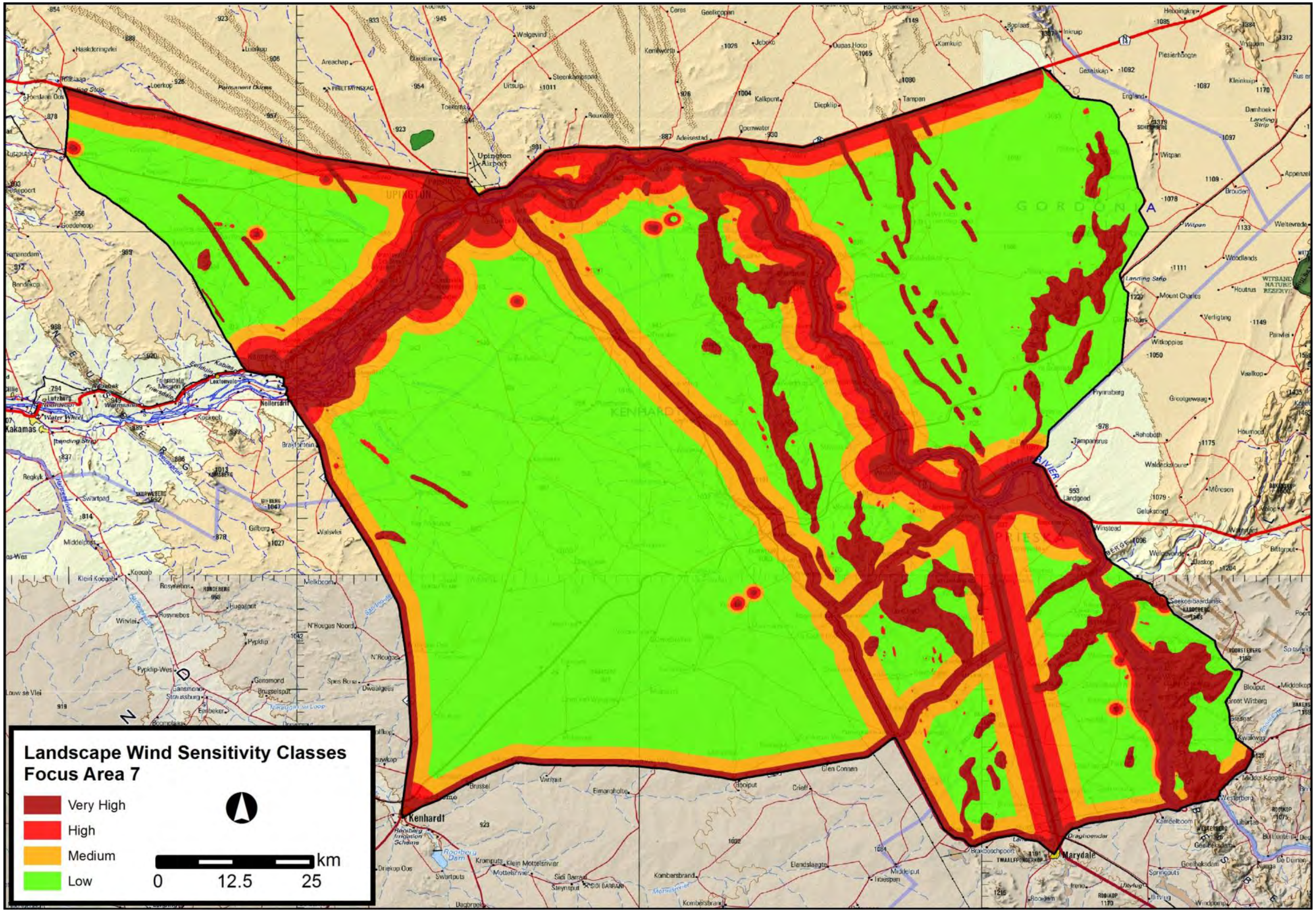
Map 10: Landscape sensitivity map for Solar PV development in the Kimberley focus area (FA 5)



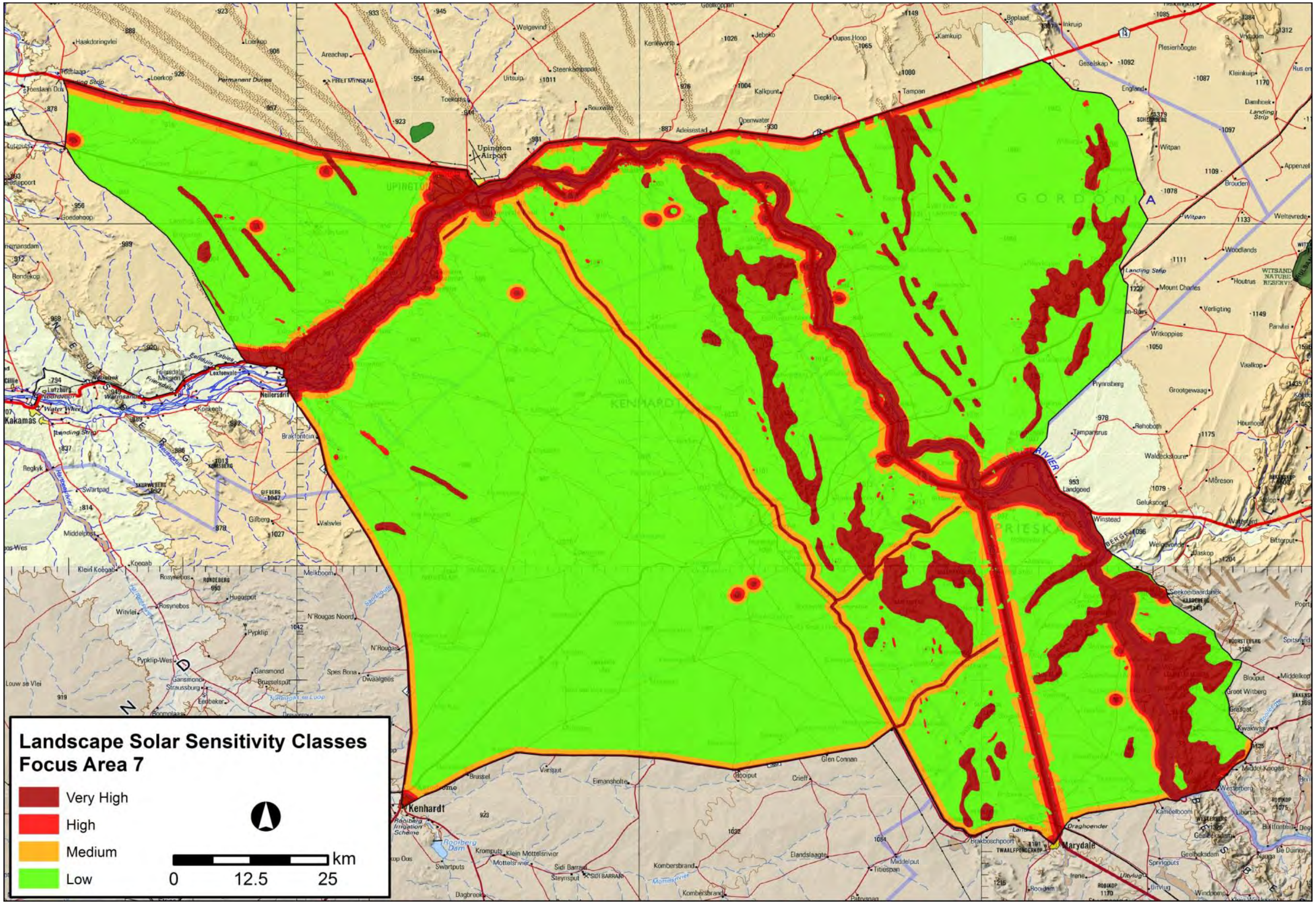
Map 11: Landscape sensitivity map for Wind development in the Vryburg focus area (FA 6)



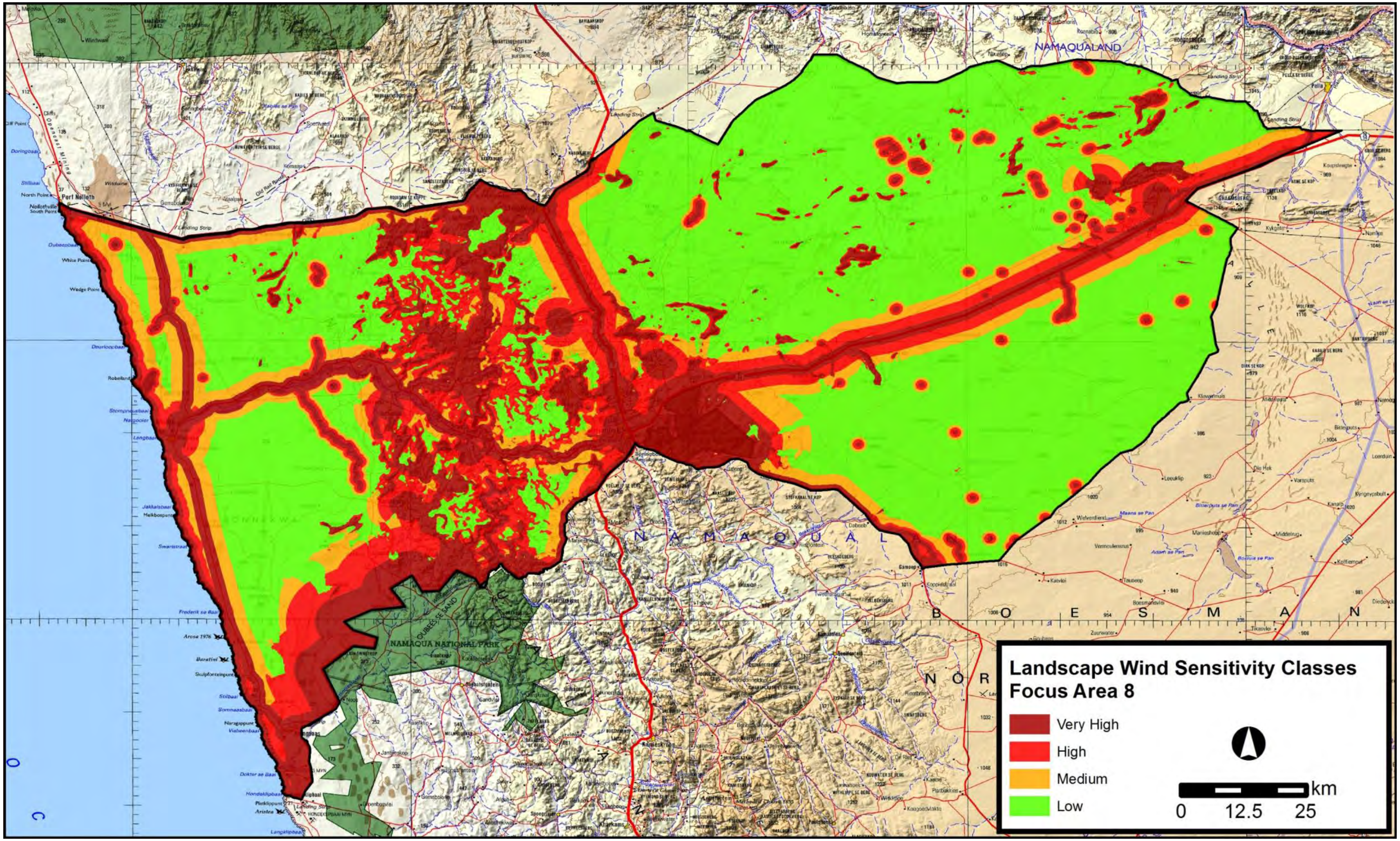
Map 12: Landscape sensitivity map for Solar PV development in the Vryburg focus area (FA 6)



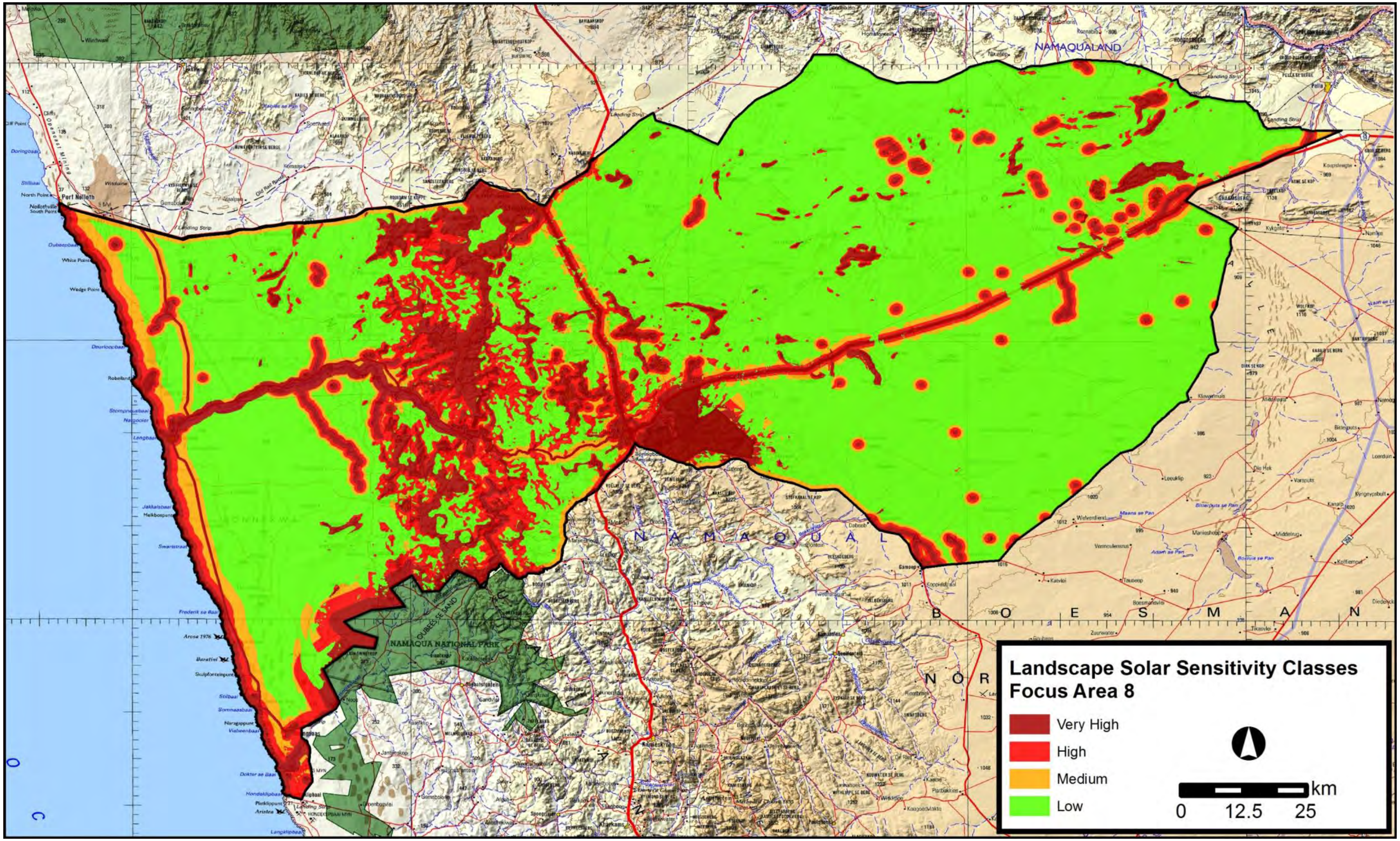
Map 13: Landscape sensitivity map for Wind development in the Upington focus area (FA 7)



Map 14: Landscape sensitivity map for Solar PV development in the Upington focus area (FA 7)



Map 15: Landscape sensitivity map for Wind development in the Springbok focus area (FA 8)



Map 16: Landscape sensitivity map for Solar PV development in the Springbok focus area (FA 8)

2.3 Development Protocols

2.3.1 Development Density Limits Guidelines

From a landscape perspective the appropriate size, density and configuration of a renewable energy development is dependent on the local and regional landscape sensitivities. The appropriate cluster size and densities can thus be determined as development density limits. Development density limits are related to the size and spacing of wind or solar PV facilities and determined by the type of terrain (the receiving environment) as well as viewsheds from sensitive receptors. These together determine the acceptable development density limits in terms of mitigating cumulative visual impacts.

This study determines development density limits as guidelines for appropriate development in landscapes of varying sensitivities. The guidelines presented in Tables 3 to 5 are based on the assumption that the FAs have been identified as areas of strategic importance for large scale wind and solar PV development. These limits will inform project level Visual Impact Assessments (VIAs) and/or project siting in the FAs, once these areas have been adopted as Renewable Energy Development Zones (REDZs). It must be noted that these are merely guidelines to inform proponents, authorities and other interested and affected parties in terms of what may constitute significant visual or other cumulative environmental impacts. The guidelines must, however, be adapted on a case by case basis based on the merits of the development in question.

Table 3: Wind development density limit guidelines

Colour	Sensitivity	Cluster* size guide	Buffer** between clusters	Indicative overall development density***	
				ha/Turbine	MW/km^2
Dark red	Very High	Further assessment required before development can be considered			
Red	High	30 turbines	6 km if within same viewshed as another cluster	302	0.8
Orange	Medium	60 turbines		208	1.1
Green	Low	120 turbines		160	1.4

* All turbines within 6 km of each other and within the same viewshed are considered as being in the same cluster. Clusters include all turbines having a valid environmental authorisation or for which an environmental application has already been lodged and the assessment process is underway. Proposed turbines for which the environmental application was lodged subsequent to the development under investigation do not need to be taken into account when considering cluster limits.

** Buffers are only applicable once the total number of turbines in a cluster, including those of new proposed developments, will exceed the defined cluster limit.

*** Development densities include the buffers between clusters and are based on the following assumptions:

- 2.3 MW turbines;
- 130 m rotor diameter (D);
- spacing of 650 m (5×D) between turbines and 910 m (7×D) between rows;
- 30 turbines in 5×6 (number of units × number of rows) layout;
- 60 turbines in 10×6 layout; and
- 120 turbines in 20×6 layout.

Table 4: Solar PV development density limit guidelines

Colour	Sensitivity	Cluster* size guide (approximate capacity in brackets)	Buffer between clusters	Indicative overall development density*** (MW/km^2)*
Dark red	Very High	Further assessment required before development can be considered		
Red	High	100 ha (40 MW)	3 km if within same viewshed as another cluster	2.5
Orange	Medium	200 ha (80 MW)		4.2
Green	Low	400 ha (160 MW)		6.3

* All solar PV installations within 3 km of each other and within the same viewshed are considered as being in the same cluster. Clusters include those facilities having a valid environmental authorisation or for which an environmental application has already been lodged and the assessment process is underway. Proposed installations for which the environmental application was lodged subsequent to the development under investigation do not need to be taken into account when considering cluster limits.

** Buffers are only applicable once the total area of a solar PV development in a cluster, including those of new proposed developments, will exceed the relevant cluster limit.

*** Development densities include the relevant buffers between clusters based on the assumption that the footprint of solar PV technology currently occupies approximately 2.5 ha/MW installed capacity.

Table 5: Integrated wind and solar PV density limit guidelines

		High sensitivity	Medium sensitivity	Low sensitivity
		100 ha solar PV cluster	200 ha solar PV cluster	400 ha solar PV cluster
High sensitivity	30 turbine wind cluster	3 km buffer* if within same viewshed		
Medium sensitivity	60 turbine wind cluster			
Low sensitivity	120 turbine wind cluster			

* Buffers are only applicable once either the number of turbines or solar PV footprint in a cluster will exceed the defined cluster limit.

2.3.2 Approvals

In Table 6 the current requirements for landscape assessment for wind or solar PV developments are described. In Table 7 the new landscape assessment requirements for wind and solar PV projects that will apply in the FAs, once these areas are adopted as REDZs, are described. These requirements are specific to sensitivity classes and are therefore linked to the sensitivity maps in Section 2.2.

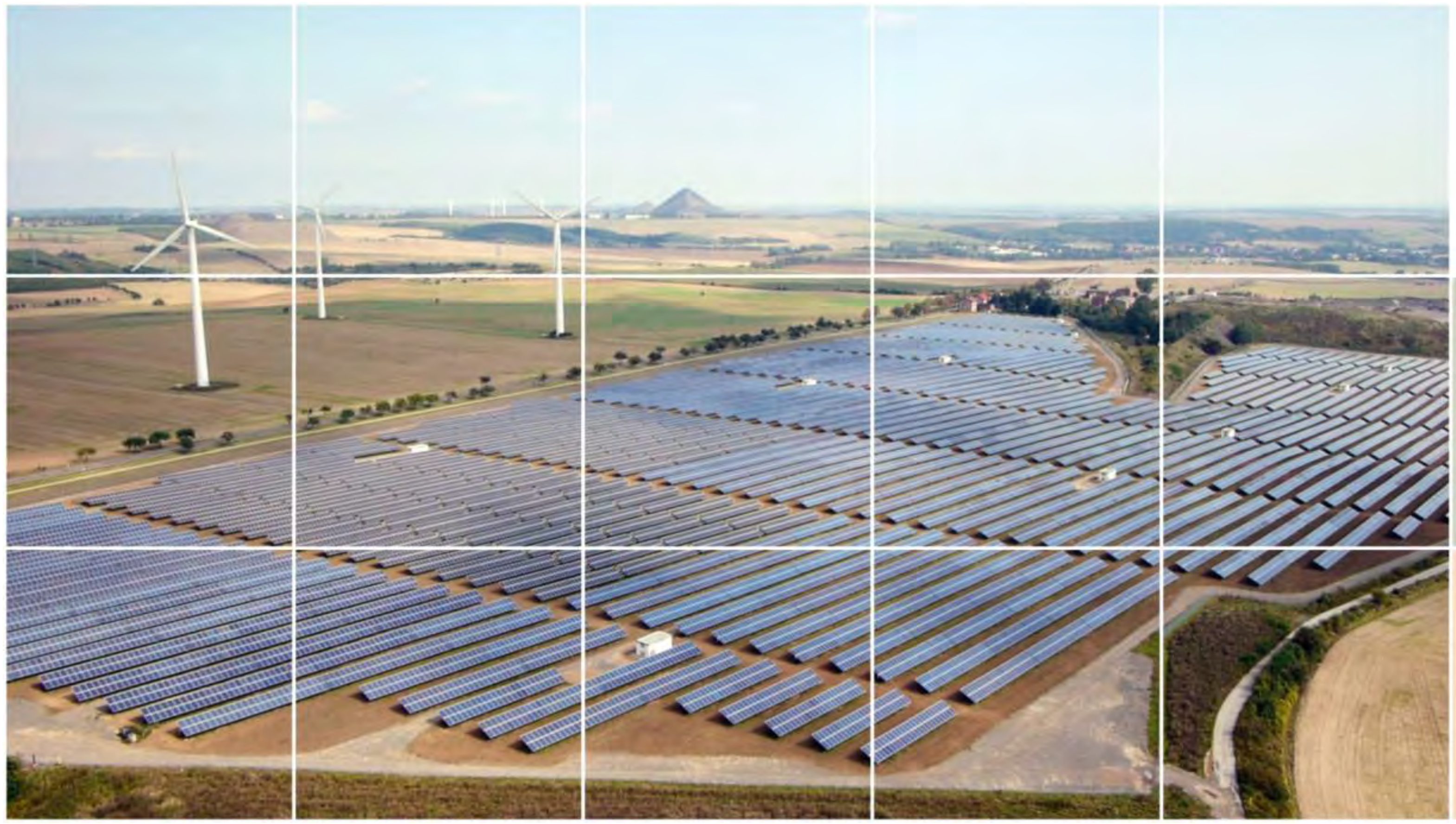


Table 6: Interpretation of landscape sensitivity and current assessment requirements

Assumed Sensitivity	Interpretation of the sensitivity	Current landscape assessment requirements
Any landscape is potentially of very high sensitivity.	In the absence of any pre-assessment it is assumed that any landscape may contain, or be in close proximity to, sensitive or scenic resources, including important ecological areas (national parks, nature reserves, botanical or biosphere reserves, private reserves, game farms), cultural landscapes, heritage sites, settlements, scenic routes, and/or tourism attractions.	Proponents intending to develop a wind or solar PV facility that triggers an environmental impact assessment process must prove to the relevant competent authority that the proposed development will not have an unacceptable negative impact on sensitive local and/or regional aesthetic and scenic values. In order to do so, a comprehensive **Visual Impact Assessment (VIA), integrated into a wider Heritage Impact Assessment (HIA)**, must be undertaken by a competent visual specialist and in accordance with National Environmental Management Act (NEMA) regulations pertaining to specialist reports and impact assessment. Such a study must be submitted to the relevant heritage authority for comment. Such comment, if provided within stipulated timeframes, is then considered by the relevant competent authority for decision making. In the absence of standardised sensitivity criteria and development density limit guidelines, every project and its associated impacts are dealt with and adjudicated on an *ad-hoc* basis.

Table 7: Interpretation of landscape sensitivity maps and associated new assessment requirements inside REDZs

<table>
<tr><th>Colour</th><th>Sensitivity</th><th>Interpretation of the sensitivity</th><th>Further assessment requirements</th></tr>
<tr><td>Dark red</td><td>Very High</td><td>Very high sensitivity areas are potentially unsuited for large scale development owing to their aesthetic or scenic values. These landscapes contain visually sensitive or scenically valuable resources which include skyline ridges and other prominent topographic features. These landscapes may also be very sensitive due to their close proximity to protected areas (national parks, nature reserves, botanical or biosphere reserves and private reserves), game farms, cultural landscapes, heritage sites, settlements, scenic routes, tourism facilities and/or other sensitive receptors.</td><td>Proponents intending to develop a wind of solar PV facility that triggers an environmental impact assessment process in very high sensitivity areas inside adopted REDZs must prove to the relevant competent authority that the proposed development will not have an unacceptable negative impact on sensitive local and/or regional aesthetic and scenic values. In order to do so, a comprehensive Visual Impact Assessment (VIA), integrated into a wider Heritage Impact Assessment (HIA), undertaken by a competent visual specialist, and in accordance with NEMA regulations pertaining to specialist reports and impact assessment, is required. Such a study must be submitted to the relevant heritage authority for comment. Such comment, if provided within stipulated timeframes, will be considered by the relevant competent authority for decision making.

In addition to the NEMA requirements the VIA must include:
• project footprint (including supporting infrastructure) with a 50 m buffered development envelope, overlaid on a sensitivity map prepared in accordance with the sensitivity criteria set out in this study;
• calculations of development densities* considering all surrounding projects that applied for environmental authorisation prior to the project currently under investigation, and comparison thereof with the limits set out in this study;
• a clear and justified opinion statement by the specialist recommending whether the project should from a landscape perspective receive approval. If this statement is subject to any conditions these must also be clearly stated; and
• where applicable, proposed mitigation measures for inclusion in the Environmental Management Programme (EMPr).</td></tr>
<tr><td>Red</td><td>High</td><td>High sensitivity areas are characterised by:
• complex terrain with high topographic diversity and landscape dissection;
• intimate landscape scale and fine-grain texture of fields;
• high level of landscape and scenic constraints; and
• close proximity to protected areas and sensitive receptors.

Due to the characteristics of this type of landscape the size and density of appropriate development is limited.</td><td rowspan="2">If the solar PV or wind development, triggering an environmental impact assessment process and is being proposed inside an adopted REDZ, complies with the density limit guidelines developed by this study, the project will only require a <u>Landscape Compliance Statement</u> prepared by a competent visual specialist. Such a statement must be submitted to the relevant heritage authority for comment. Such comment, if provided within stipulated timeframes, will be considered by the relevant competent authority for decision making.

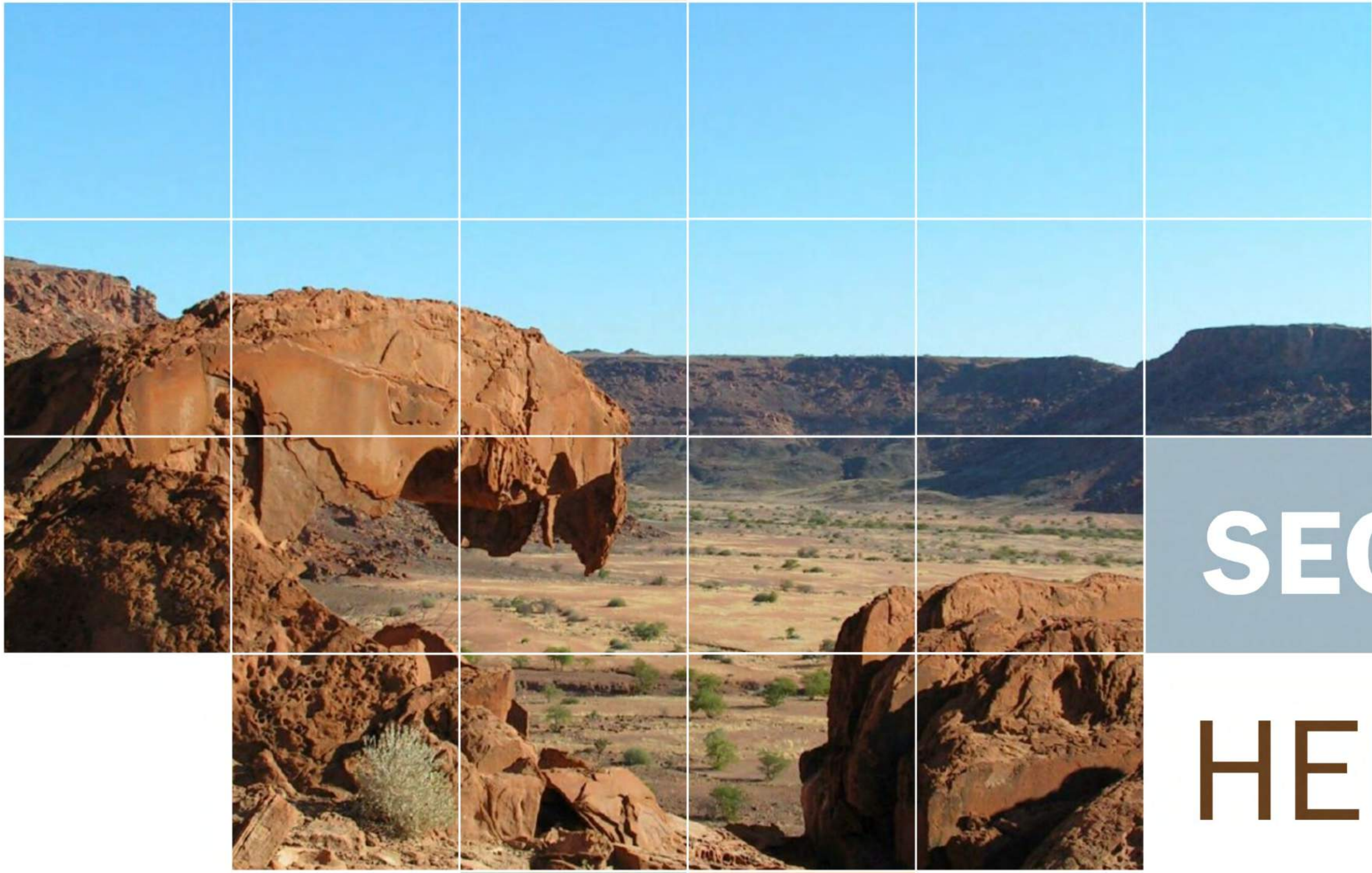
The minimum requirements for the compliance statement are:
• details and relevant expertise of the specialist preparing the statement;
• project footprint (including supporting infrastructure) with a 50 m buffered development envelope, overlaid on a sensitivity map prepared in accordance with the sensitivity criteria set out in this study;
• calculations confirming density limit compliance and considering all surrounding projects that applied for environmental authorisation prior to the project currently under investigation;
• confirmation that all reasonable measures have been taken through project layout to minimise visual impacts;
• clear and justified opinion statement by the specialist recommending whether the project should from a landscape perspective receive approval. If this statement is subject to any conditions these must also be clearly stated; and
• where applicable, proposed mitigation measures for inclusion in the Environmental Management Programme (EMPr).

If a wind or solar PV development, triggering an environmental impact assessment process and is being proposed inside an adopted REDZ, exceeds the density limit guidelines developed by this study the proponent must prove to the relevant competent authority that the proposed development will not have an unacceptable negative impact on sensitive local and/or regional aesthetic and scenic values. In order to do so, a <u>comprehensive Visual Impact Assessment</u> (VIA), integrated into a</td></tr>
<tr><td>Orange</td><td>Medium</td><td>Medium sensitivity areas are characterised by:
• moderately complex terrain with some topographic diversity and landscape dissection,
• medium landscape scale and texture,
• moderate level of landscape and scenic constraints, and
• intermediate proximity of protected areas and sensitive receptors.

Due to the characteristics of this type of landscape the size and density of appropriate development may be limited.</td></tr>
</table>

Colour	Sensitivity	Interpretation of the sensitivity	Further assessment requirements
Green	Low	Low sensitivity areas are characterised by: • relatively even terrain; • flat to gently rolling topography and slopes less steep than 1:10 gradient; • large expansive landscape scale and coarse-grain texture; • few landscape and scenic constraints; and • absence of protected areas and few sensitive receptors. This type of landscape is considered the best suited for large scale development.	**wider Heritage Impact Assessment (HIA)** undertaken by a competent visual specialist, and in accordance with NEMA regulations pertaining to specialist reports and impact assessment, is required. Such a study must be submitted to the relevant heritage authority for comment. Such comment, if provided within stipulated timeframes, will be considered by the relevant competent authority for decision making. In addition to the NEMA requirements the VIA must include: • project footprint (including supporting infrastructure) with a 50 m buffered development envelope, overlaid on a sensitivity map prepared in accordance with the sensitivity criteria set out in this study; • calculations of development densities* considering all surrounding projects that applied for environmental authorisation prior to the project currently under investigation, and comparison thereof with the limits set out in this study; • a clear and justified opinion statement by the specialist recommending whether the project should from a landscape perspective receive approval. If this statement is subject to any conditions these must also be clearly stated; and • where applicable, proposed mitigation measures for inclusion in the Environmental Management Programme (EMPr).

* Development densities are calculated for wind as the number of turbines within 6 km and the same viewshed, and for solar PV as the area of development within 3 km and the same viewshed.



SECTION 3

HERITAGE

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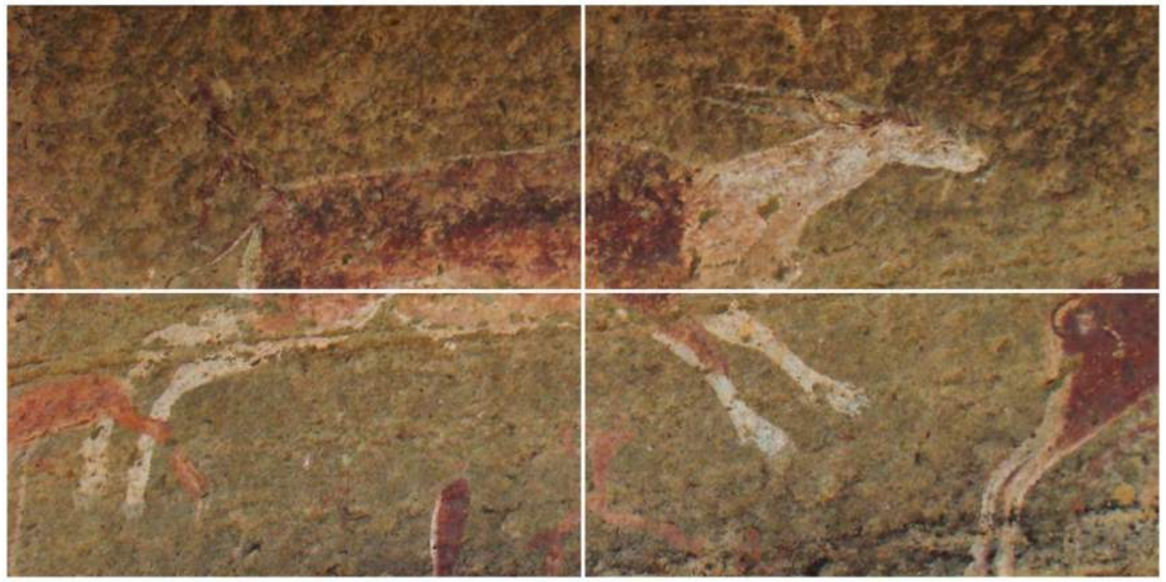


PART 3. SCOPING ASSESSMENTS AND DEVELOPMENT PROTOCOLS

SECTION 3: HERITAGE

The following section is informed by the scoping level specialist heritage pre-assessment of the eight Focus Areas (FAs) for which the complete report is provided as Appendix A3. Due to the integrated and strategic nature of this Strategic Environmental Assessment (SEA), and based on consultation with relevant government departments and wider stakeholders, the final interpretation of sensitivities and development protocols presented in this section differ from those contained and recommended in the specialist report.

3.1 Renewable Energy and Heritage

South Africa's rich heritage dates back to some of the earliest human settlements in the world. South Africa is built on a great diversity of cultures, beliefs, and traditions and associated with many archaeological and cultural resources. It is important to conserve these resources for the future generations while promoting environmentally-friendly and sustainable energy generation.

Wind and solar photovoltaic (PV) developments have the potential to impact on heritage resources either through physical disturbance during construction or by changing the wider landscape context. It is therefore important to ensure that wind and solar PV facilities are sited and constructed in a manner that minimises the impact on heritage resources. While the impacts on the wider landscape have been dealt with in the landscape section (Part 3: Section 2) of this report, these are integrated into this section to determine the overall heritage sensitivities. The additional sensitivity mapping discussed in this section predominantly focuses on the potential physical impacts of wind and solar PV development on heritage resources.

The potential physical impacts are greatly dependent on the micro-siting of infrastructure. Although it is possible to identify and protect known and above ground heritage resources (e.g. cultural sites and historical structures), it is more challenging to assess the potential impacts on unknown and underground heritage resources (e.g. the potential presence of fossils or middens). Even at a project level it is difficult to identify and confirm such heritage resources prior to excavation. For this reason the focus of heritage resource assessment and management must be to protect any known heritage resources, while also ensuring that development in areas with unconfirmed sensitivities proceeds in a manner that would identify and preserve any heritage resources should they be unearthed. Excavation and construction activities associated with wind and solar PV development do not only have the potential to physically disturb or destroy cultural resources, but can also to contribute positively by adding to the record of both palaeontological and archaeological heritage.

3.2 Sensitivity Mapping

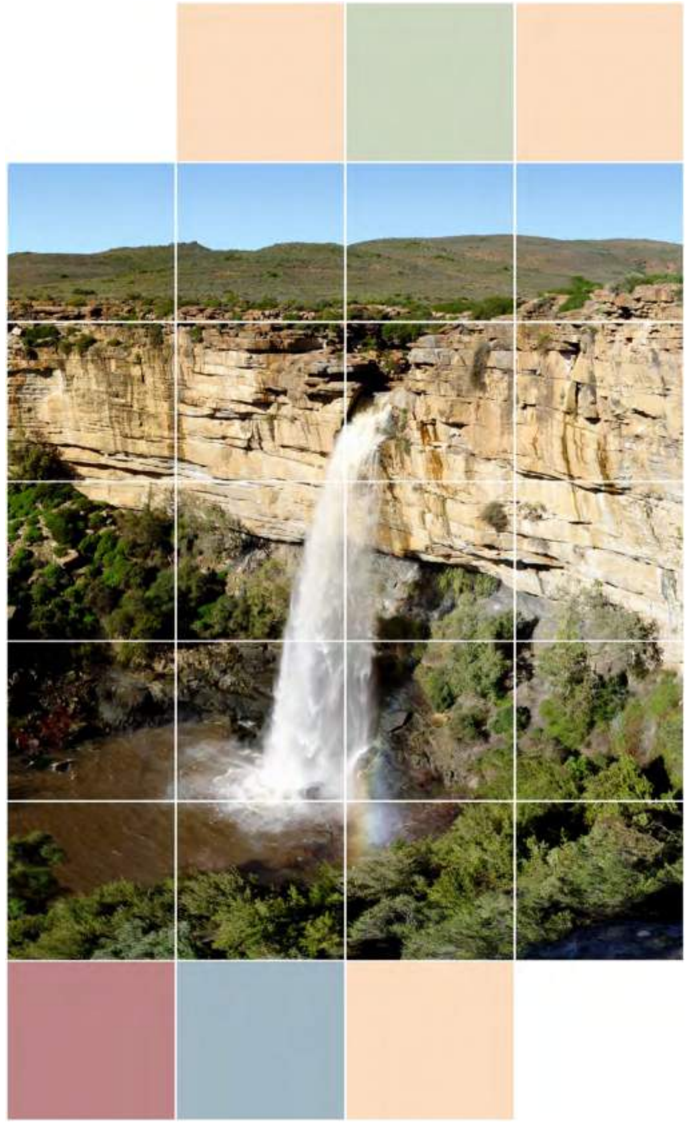
In terms of physical disturbance, this section investigates heritage resources in two categories namely: 1) paleontological, and 2) archaeology and all other heritage resources. In addition to known fossil sites, the paleontological component of the investigation is predominantly focused on inferring indicative paleontological sensitivities where fossiliferous rock units that are likely to occur according to geological maps. All archaeological and other heritage resources were identified from literature and existing heritage databases.

Heritage resources are protected under the National Heritage Resources Act (NHRA, Act 25 of 1999). As part of this assessment, resources were as far as possible assigned sensitivity ratings according to Section 3(3) of this act which provides a guideline for evaluating the cultural significance of heritage resources. The identification of resources was undertaken in accordance with Section 3(2) of the act which specifies the following types of heritage resources included in the national estate:

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;
d) landscapes and natural features of cultural significance;
e) geological sites of scientific or cultural importance;
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 Government 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; and
i) movable objects[1] (these resources are excluded from this study as by definition these objects are not spatially fixed).

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

Utilising the National Heritage Grading System[2], areas around relevant heritage resources were assigned a sensitivity rating based on their significance (i.e. local, provincial and national), scale, rarity, current condition, and stakeholders' experience as well as local knowledge gathered through previous heritage assessments. Considering these criteria, paleontological heritage resources were assigned sensitivity ratings for physical disturbance as described in Table 1, all archaeological and other heritage resources were assigned physical disturbance sensitivity ratings as described in Table 2, and landscape sensitivities as determined in the landscape section of this report. These three heritage sensitivities were then integrated by retaining the highest sensitivity class from each of the three types to determine combined sensitivities as illustrated in Maps 1 to 16.



[2] As described in NHRA Regulation 694 of 30 May 2003

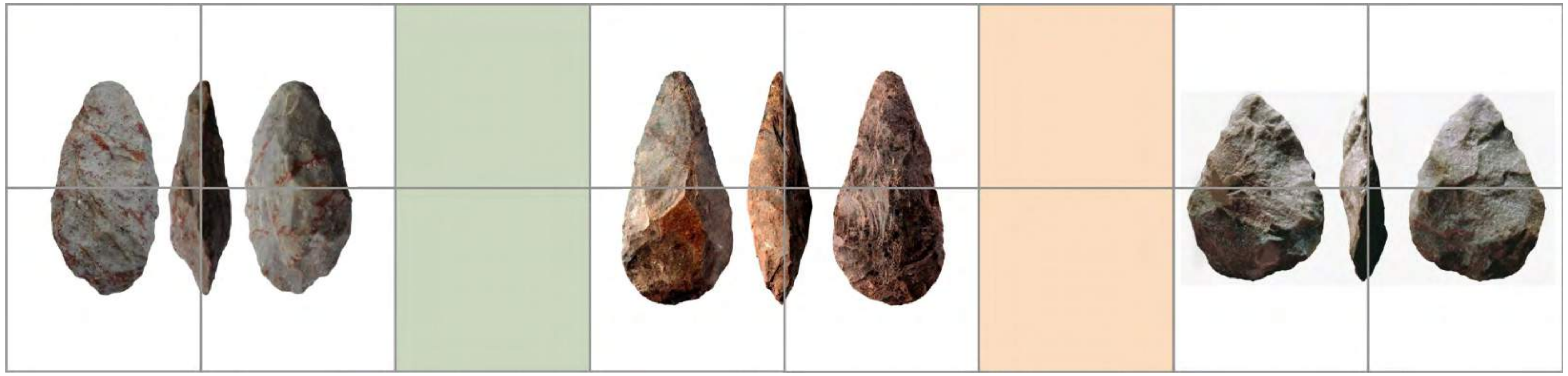
Table 1: Spatial data used to identify palaeontological heritage resources

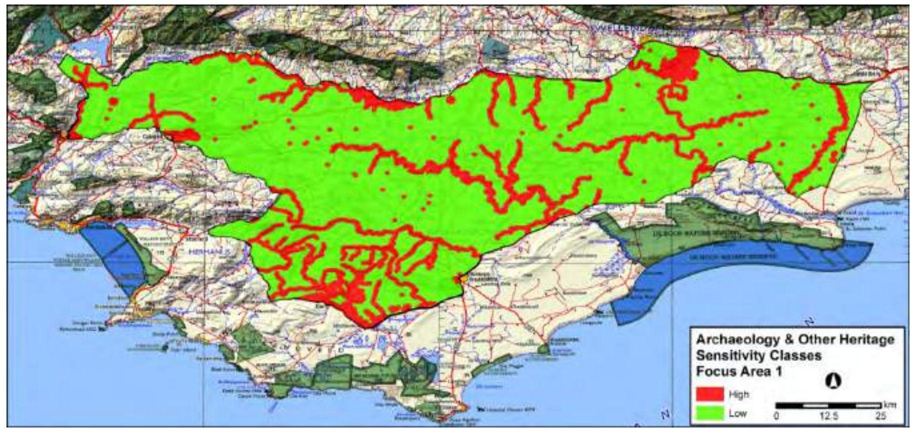
Paleontological Heritage Resource	Data Source	Sensitivity Mapping Application for wind and solar PV
Florisbad Cranium fossil site	– Henderson Z., Florisbad, South Africa: over 120 000 years of human activity. *Nyame Akuma* **44** December 1995. – National Heritage Site Nomination Form for the Florisbad 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 Spring Eye fossil site	– Henderson Z., Florisbad, South Africa: over 120 000 years of human activity. *Nyame Akuma* **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 Modder River fossil site	– Churchill et.al., Erfkroon: 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 Erfkroon Modder River section demarcated on map
Rock units with a high paleontological sensitivity 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, Council for Geoscience	– **High sensitivity** areas with rock units of high paleontological sensitivity
Rock units with a medium paleontological sensitivity including: • ACHAB • ALLANRIDGE • BIDOUW • BREDASDORP • CERES • CONCORDIA GRANITE • DWYKA • FORT BROWN • GESELSKAPBANK • GLADKOP • GRAHAMSTOWN • 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 GRANITE • RIETBERG GRANITE • SKOORSTEENBERG • STINKFONTEIN • STYGER KRAAL SYENITE • TABLE MOUNTAIN • TIERBERG • VOLKSRUST • WATERFORD	– 1:1 000 000 and 1:250 000 Geological Maps, Council for Geoscience	– **Medium sensitivity** areas with rock units of medium paleontological sensitivity

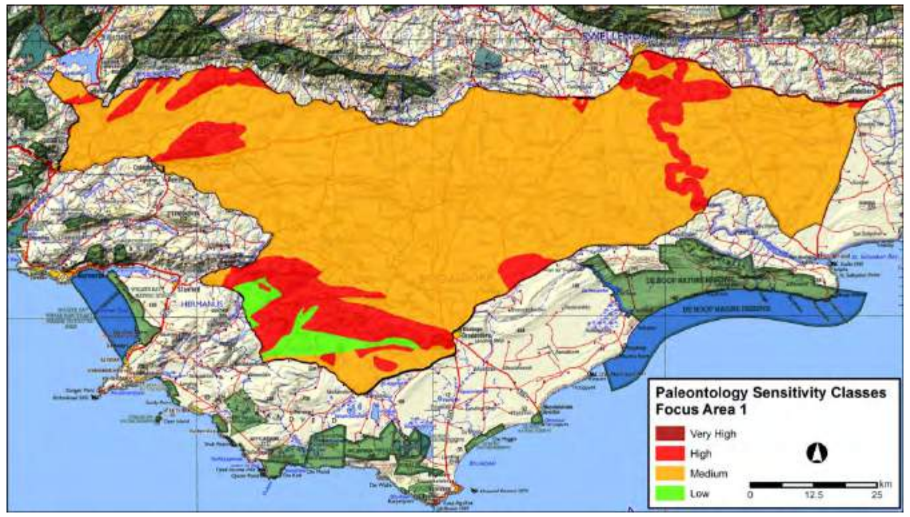
Table 2: Spatial data used to identify archaeology and other heritage resources

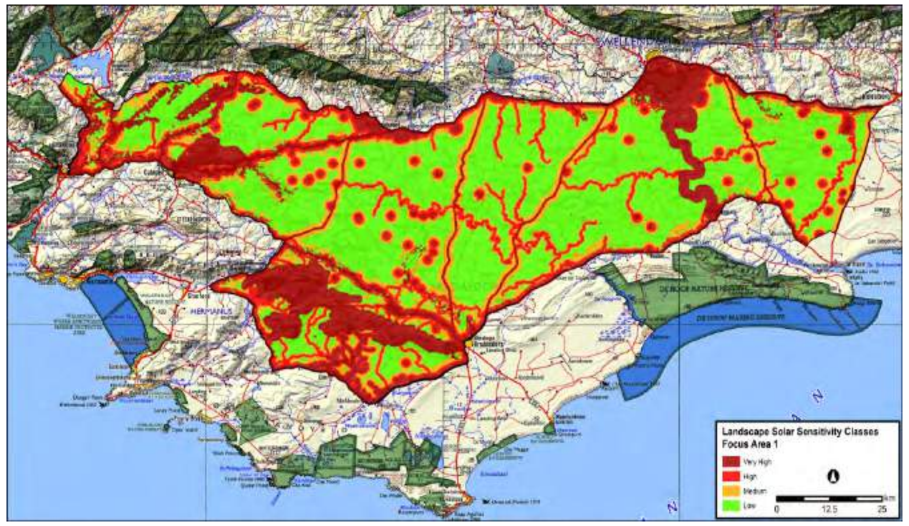
Archaeology and Other Heritage Resources*	Data Source	Sensitivity Mapping Application for wind and solar PV
National and Provincial Heritage Sites including sites with provisional heritage protection and consisting of: • Archaeological Sites • Heritage Structures • Burial Grounds and Graves • Geological Heritage Sites** • Other Places of Heritage Importance	– Provided by the South African Heritage Resources Agency (2014)	– **High sensitivity** within 500 m of provincial heritage sites
Other Heritage Sites* including: • Cultural Landscapes as identified by heritage specialists • Archaeological Sites • Palaeontological Finds • Cemeteries • Heritage Structures • Rock Art Sites • Monuments and Memorials • Important Wetlands and Rivers • Blockhouses and Camps • Battlefields • Concentration Camps • Siege Areas • Important Mountain Passes • Important Ridges • Important Hotsprings • Other Historical Sites • 1 km Coastal Belt	– Surveys and Mapping 1:50 000 topographical maps of South Africa – Google Earth Imagery (2014) – Garmap SA – Points of Interest (POI) – Africa 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* – GPS coordinates from Heritage reports available on the South African Heritage Resources Information System (SAHRIS)	– **High Sensitivity** within 500 m

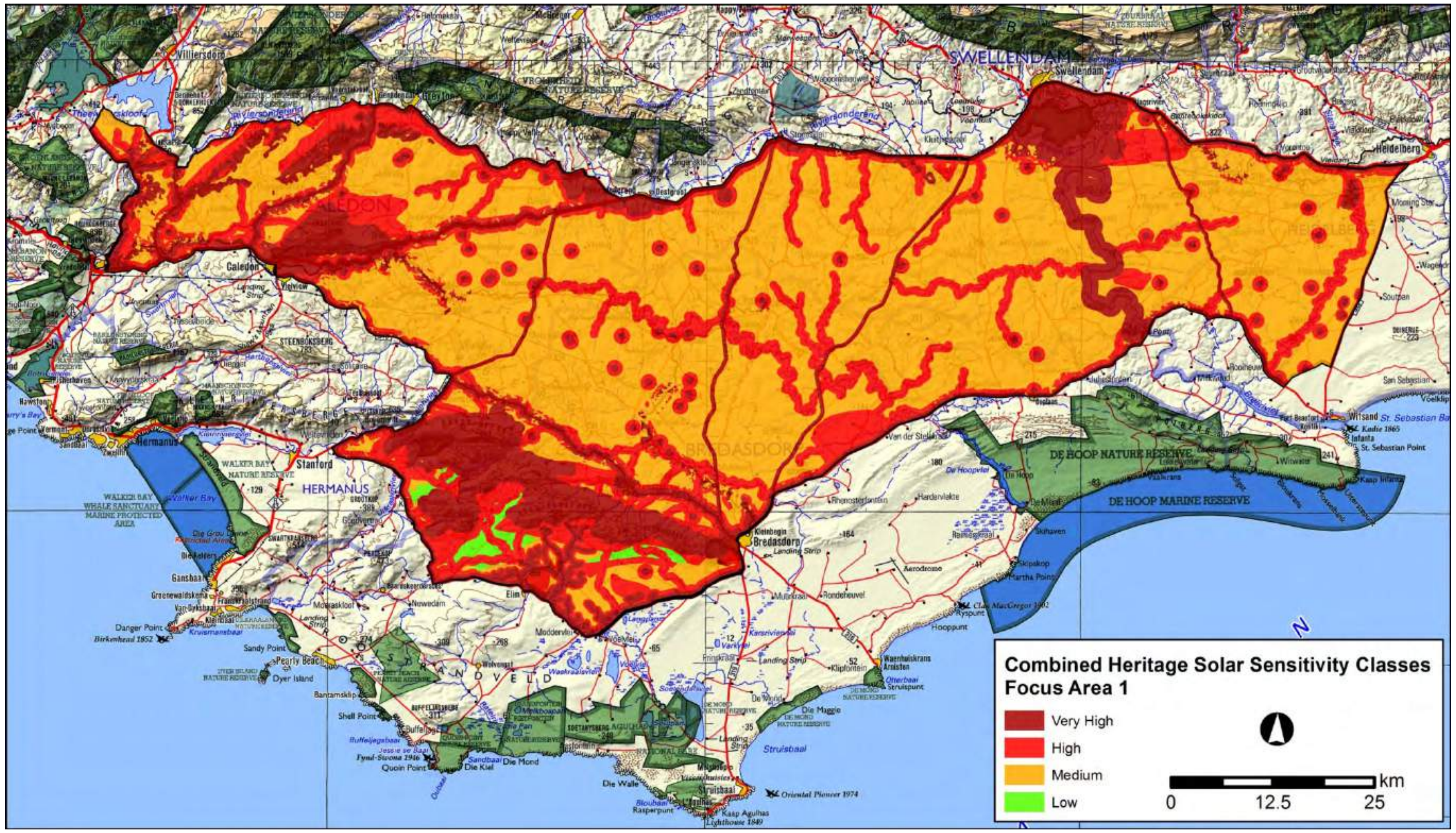
Notes: *World Heritage sites were considered but were not specified if falling outside the FAs
** Geological sites of scientific and cultural importance were not included in the analysis as there is as yet no comprehensive national or provincial database of significant geological sites available. Databases for special, conservation-worthy geological sites (or "geosites") in South Africa are currently being compiled by the Geological Society of South Africa and SAHRA.



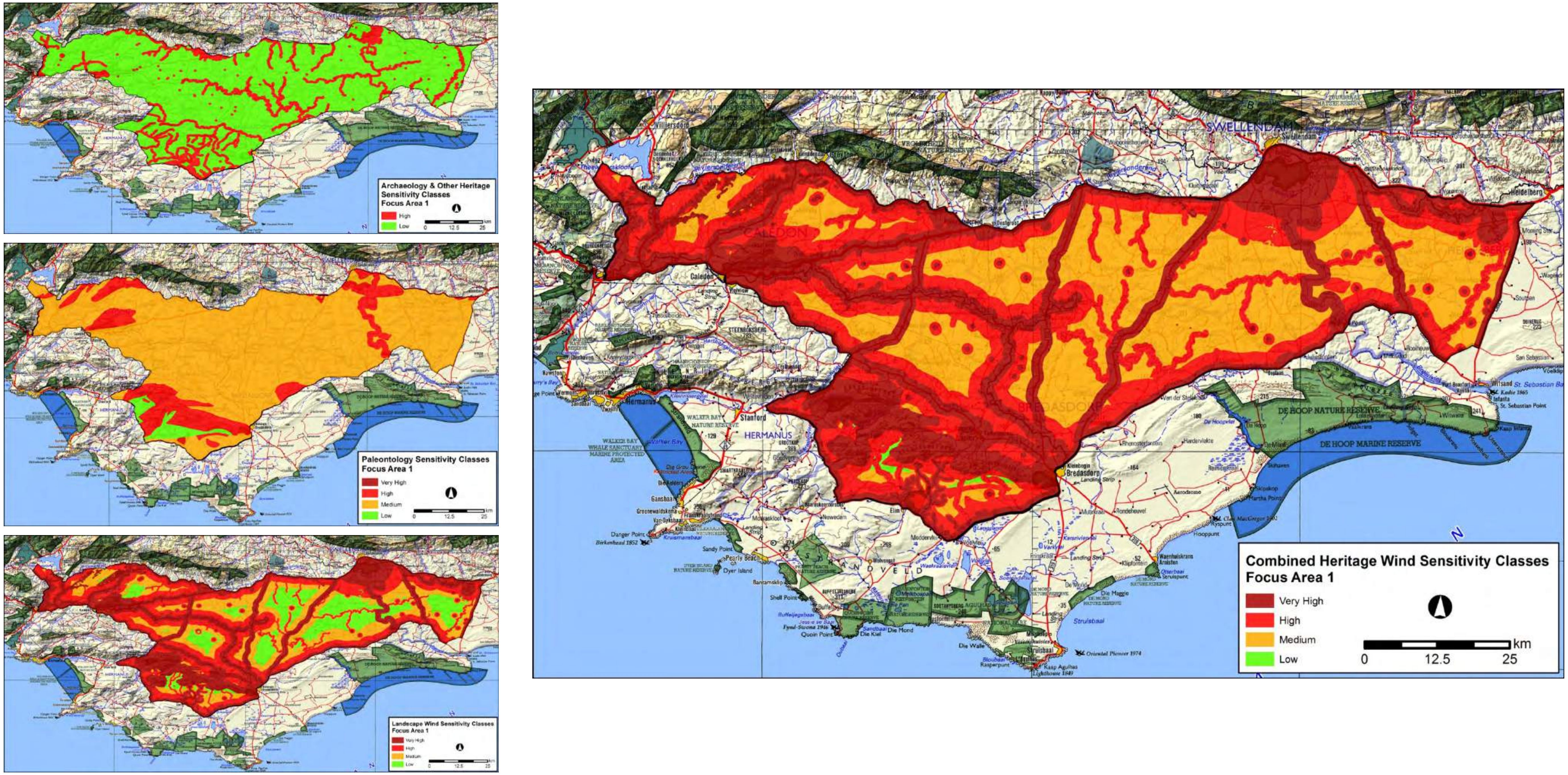




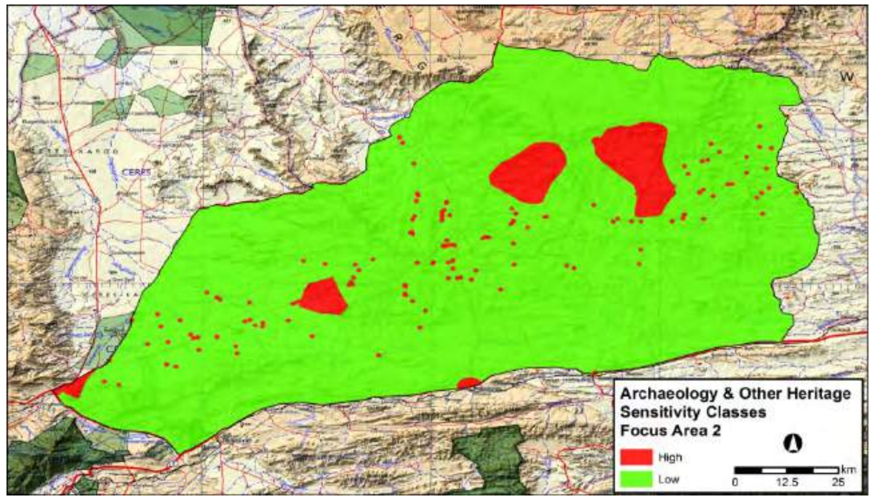


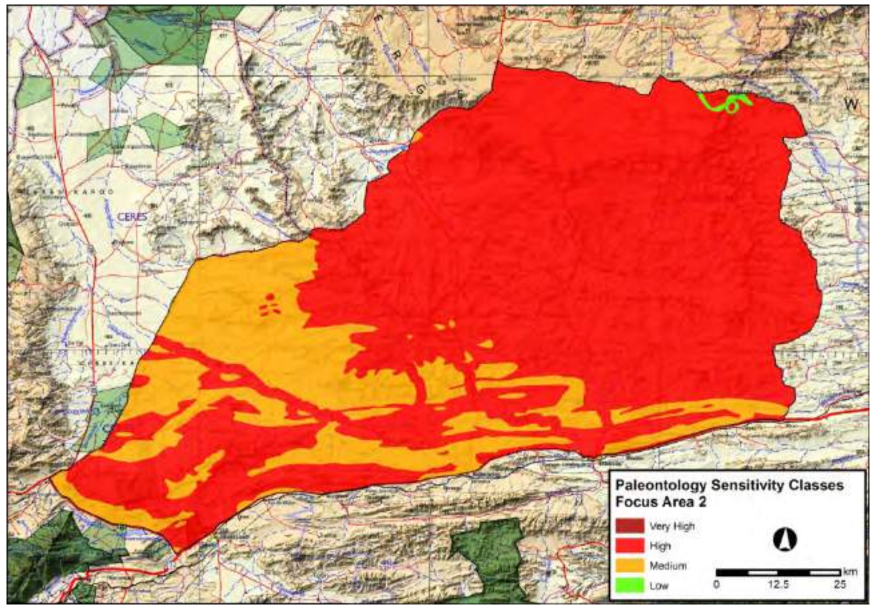


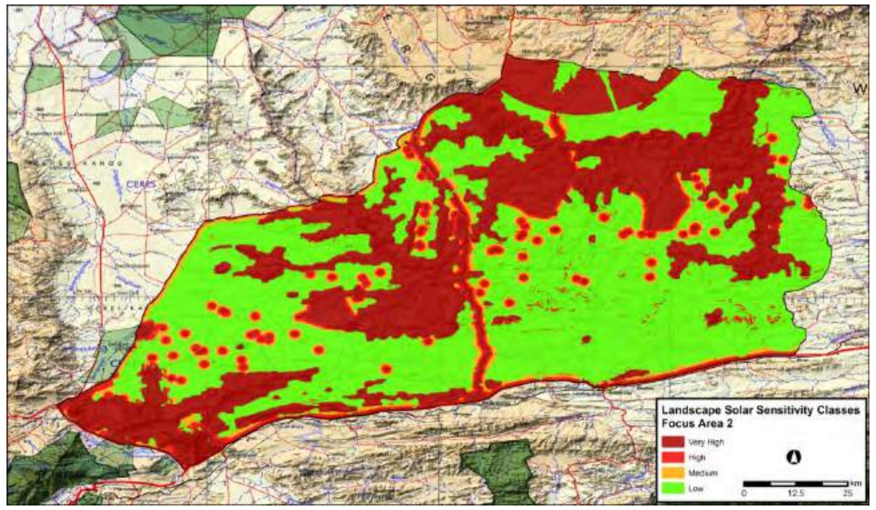
Map 1: Combined heritage sensitivity map (right) derived from integrating archaeology and other, palaeontology, and landscape sensitivities (left) for solar PV development in the Overberg Focus Areas (FA 1)

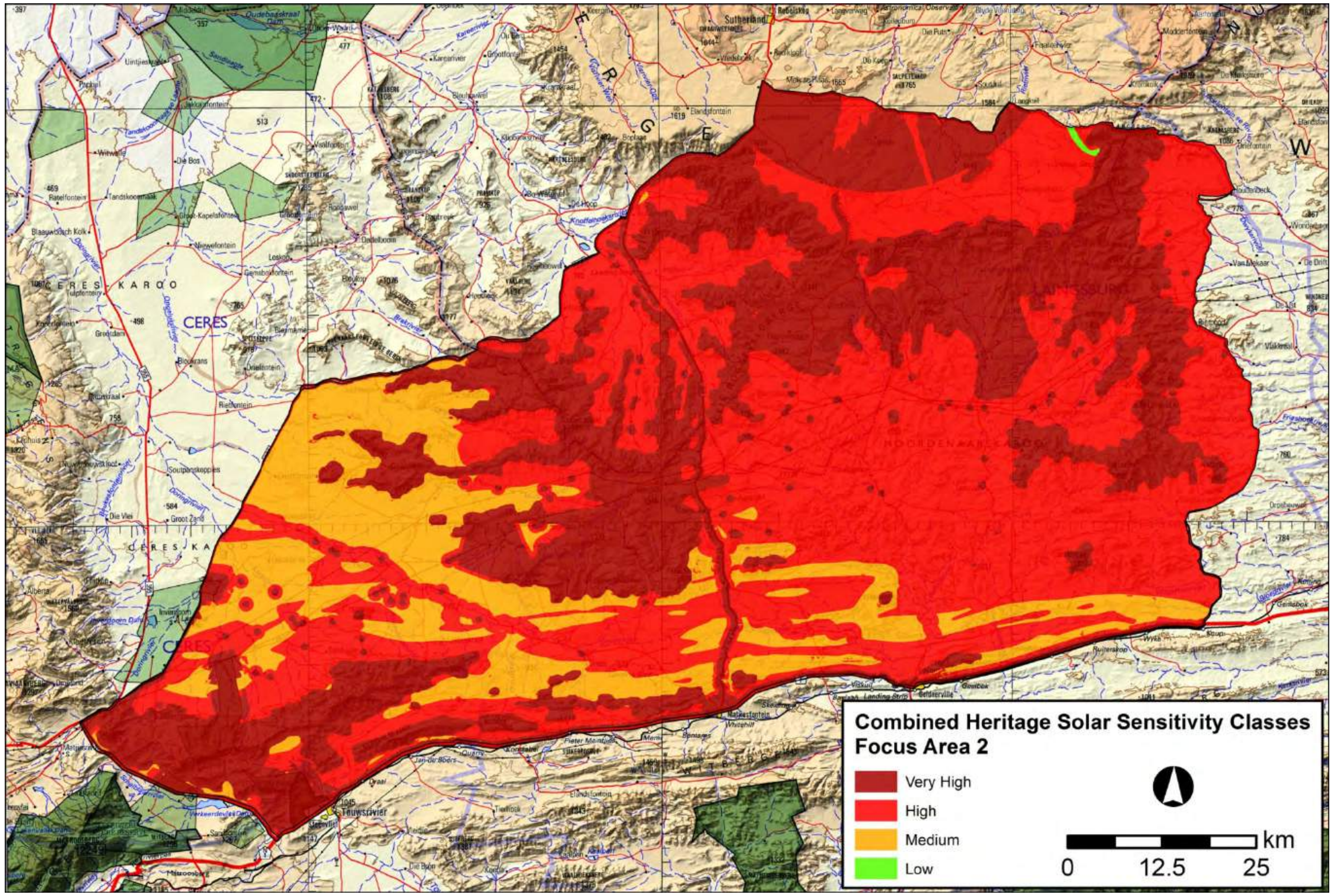


Map 2: Combined heritage sensitivity map (right) derived from integrating archaeology and other, palaeontology, and landscape sensitivities (left) for wind development in the Overberg Focus Area (FA 1)

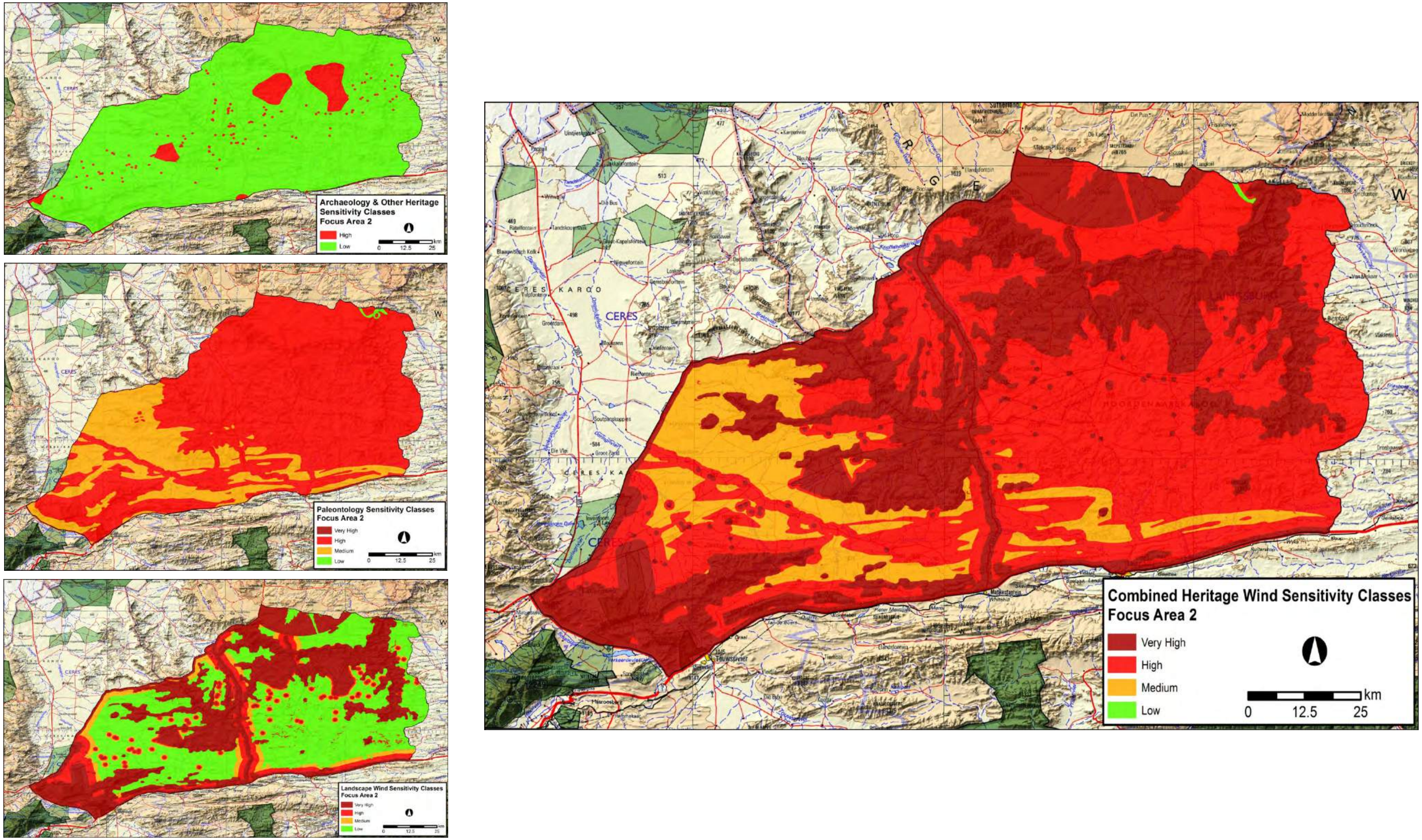




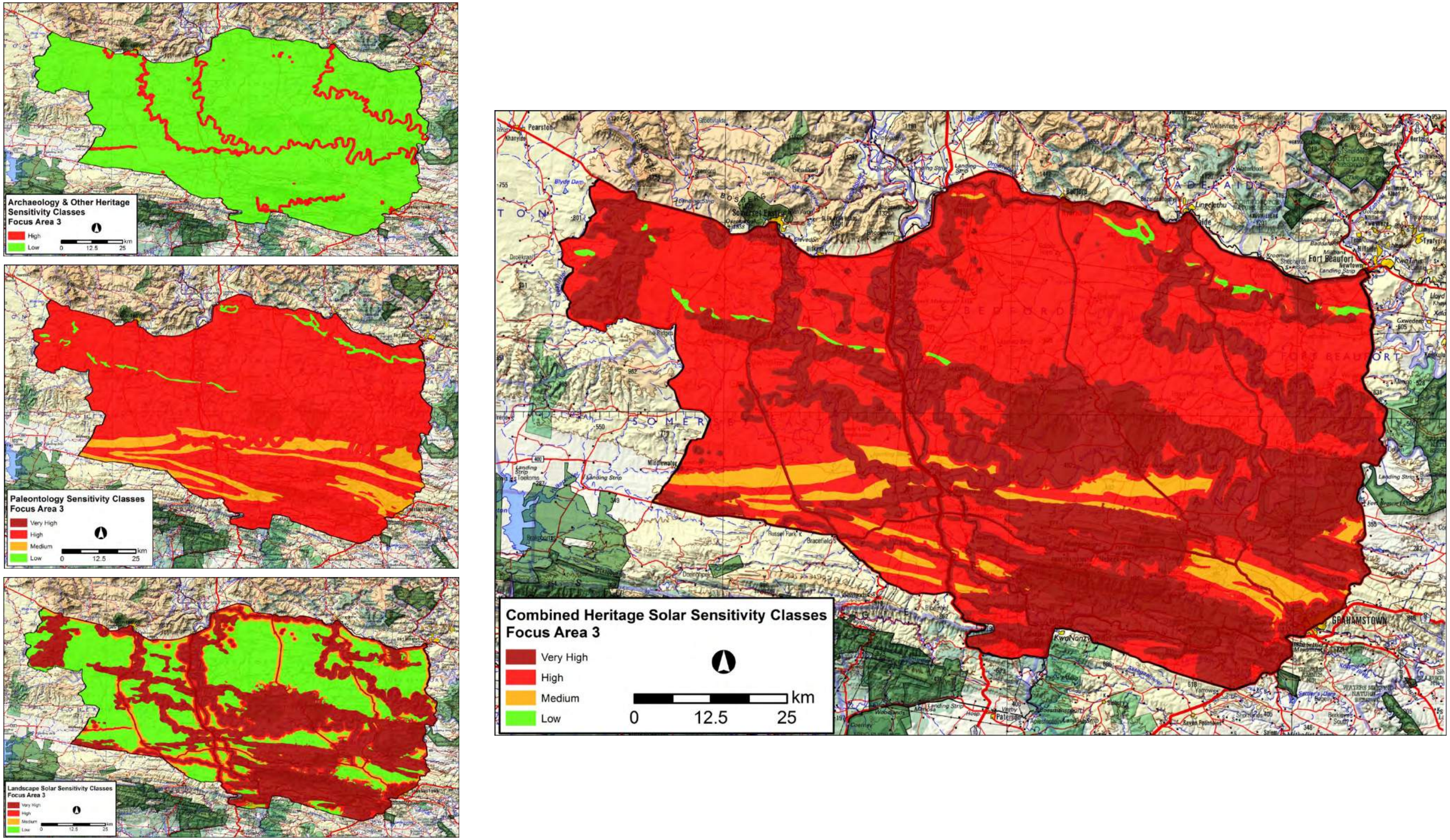




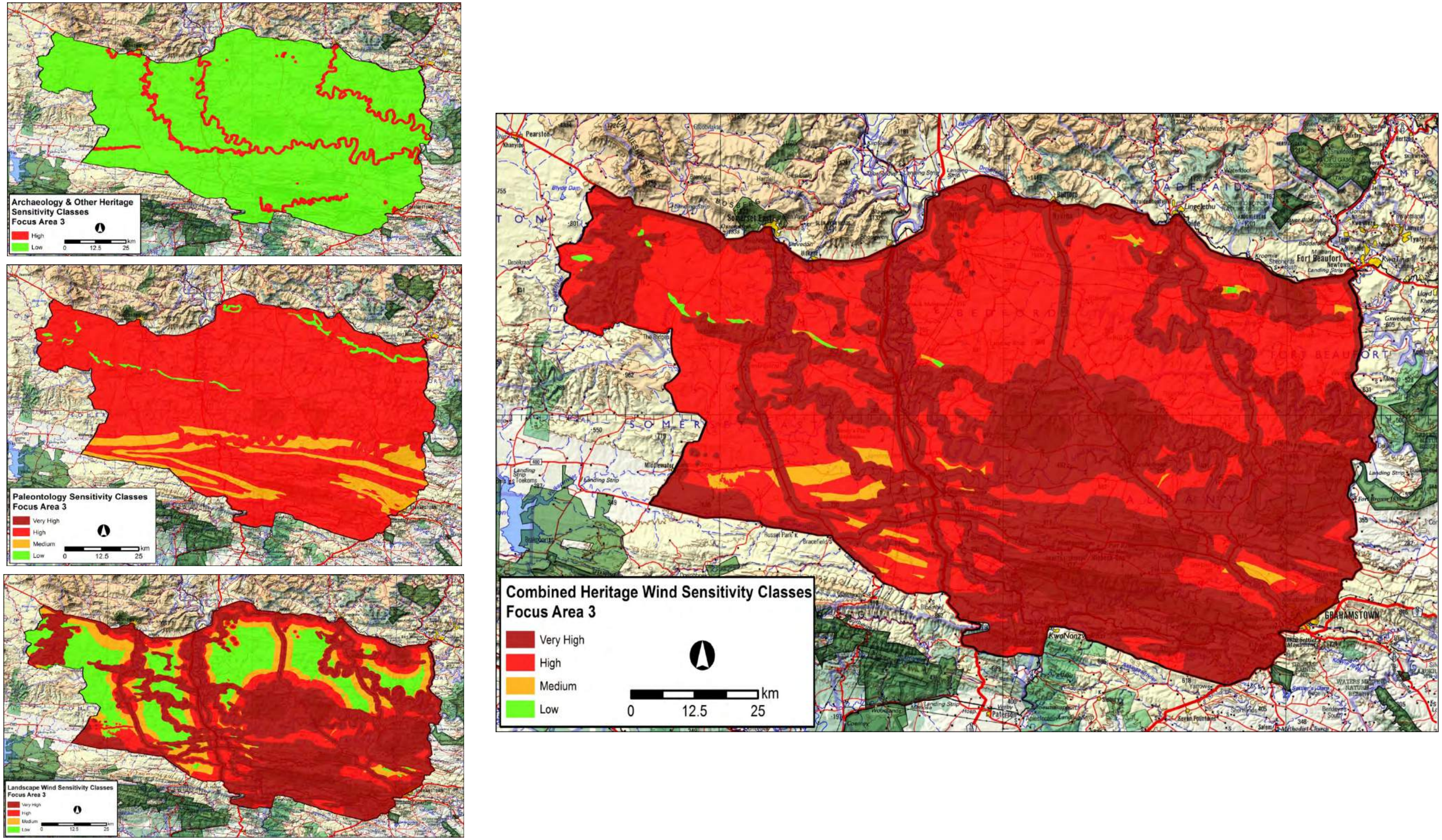
Map 3: Combined heritage sensitivity map (right) derived from integrating archaeology and other, palaeontology, and landscape sensitivities (left) for solar PV development in the Komsberg focus area (FA 2)



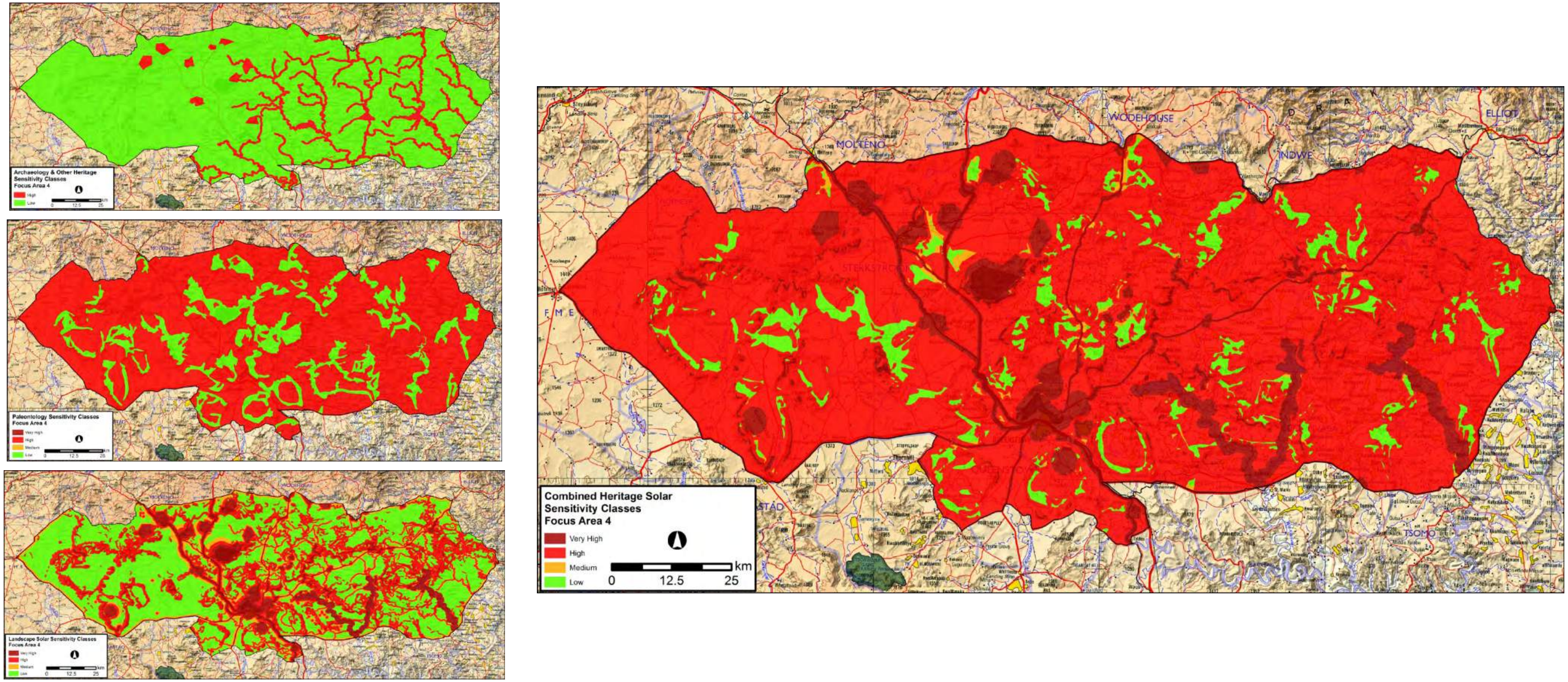
Map 4: Combined heritage sensitivity map (right) derived from integrating archaeology and other, palaeontology, and landscape sensitivities (left) for wind development in the Komsberg focus area (FA 2)



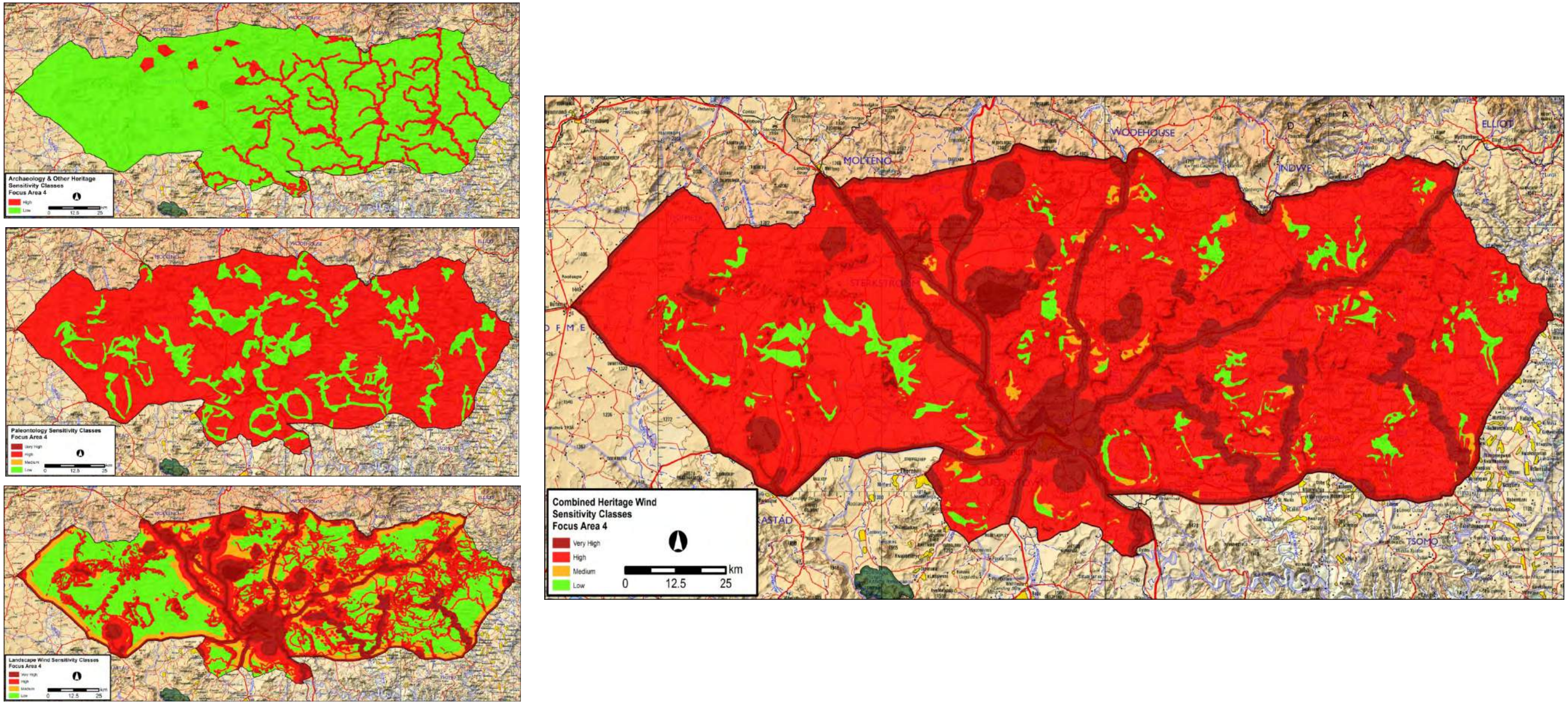
Map 5: Combined heritage sensitivity map (right) derived from integrating archaeology and other, palaeontology, and landscape sensitivities (left) for solar PV development in the Cookhouse focus area (FA 3)



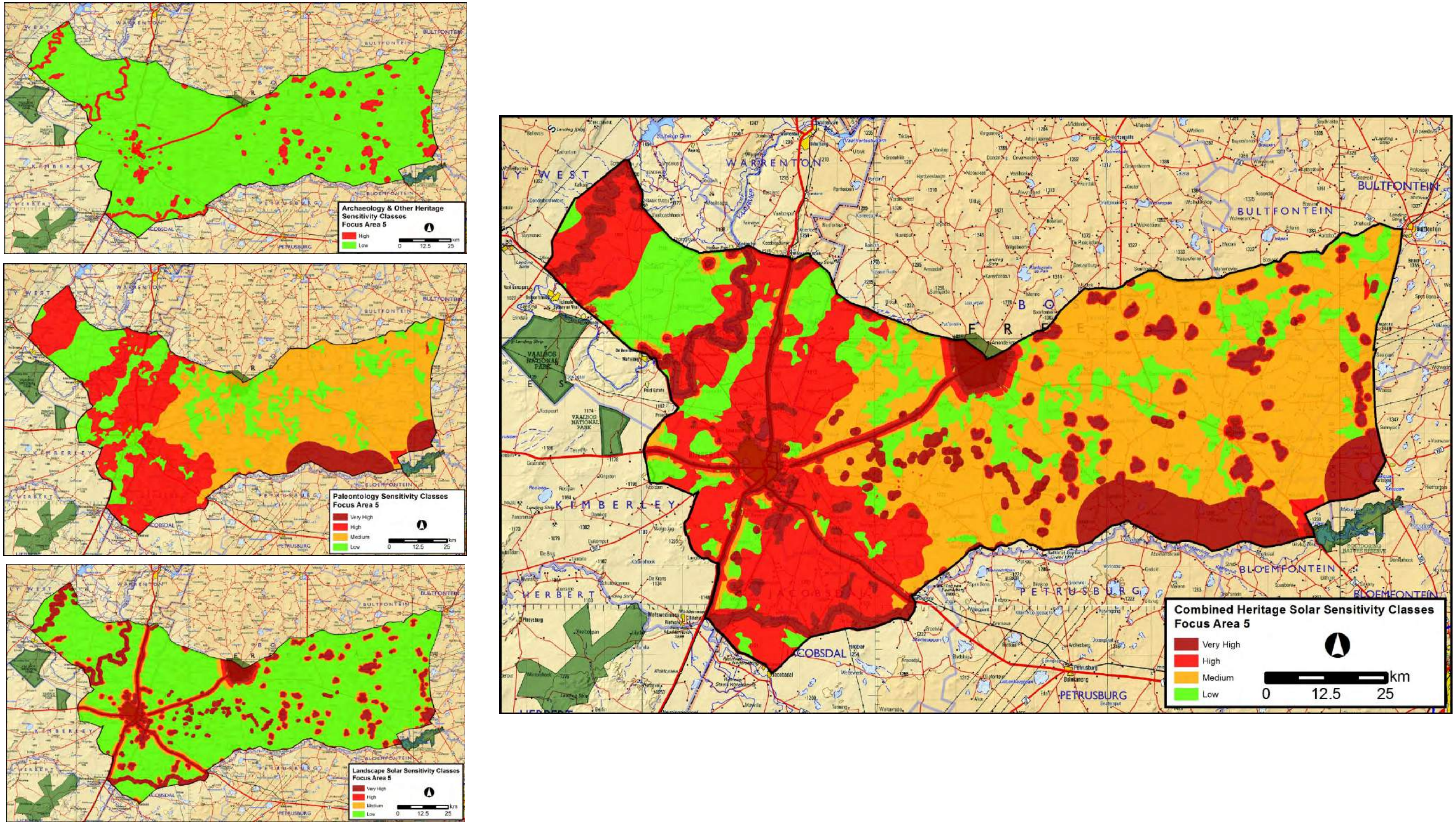
Map 6: Combined heritage sensitivity map (right) derived from integrating archaeology and other, palaeontology, and landscape sensitivities (left) for wind development in the Cookhouse focus area (FA 3)



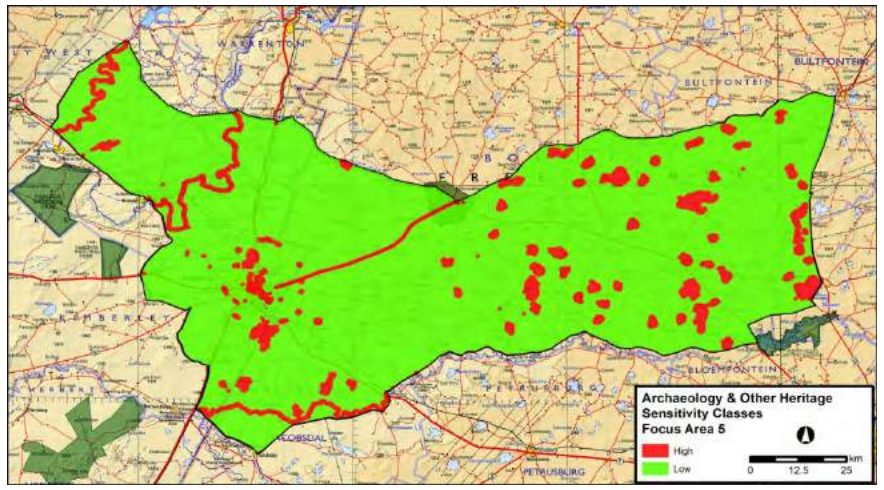
Map 7: Combined heritage sensitivity map (right) derived from integrating archaeology and other, palaeontology, and landscape sensitivities (left) for solar PV development in the Stormberg focus area (FA 4)

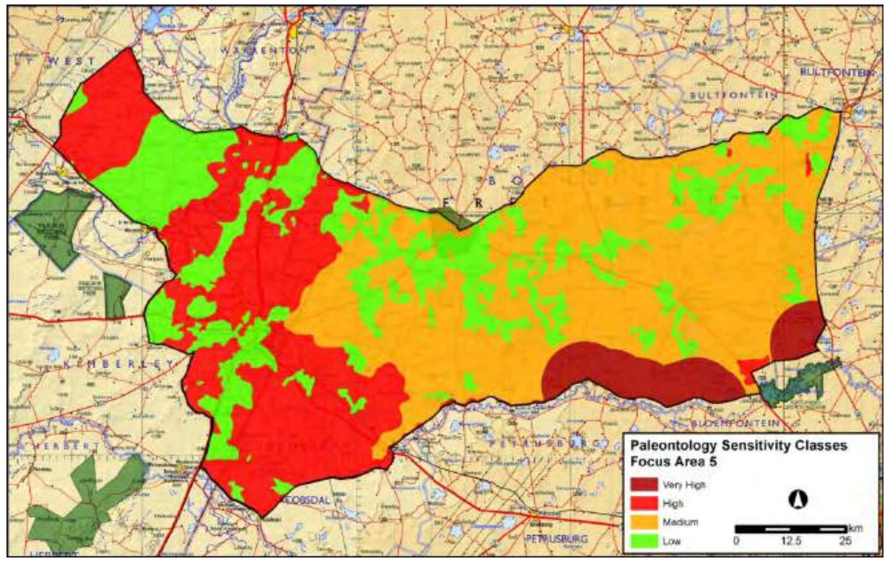


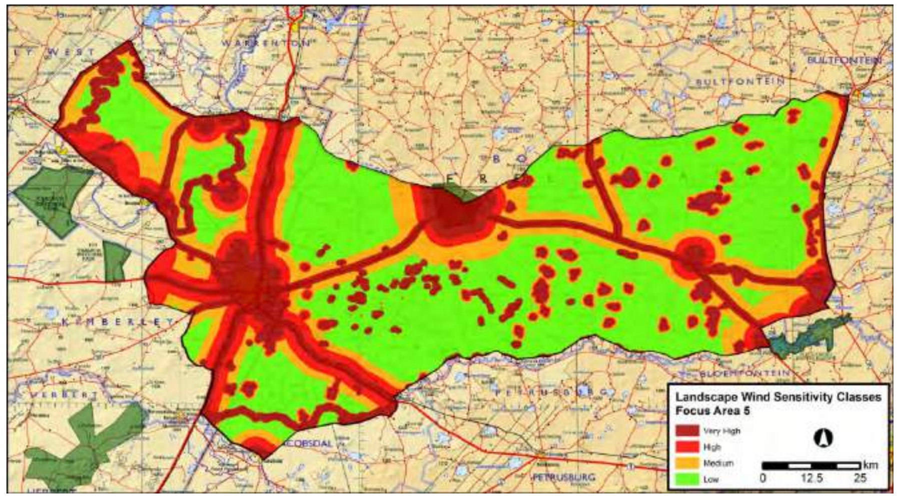
Map 8: Combined heritage sensitivity map (right) derived from integrating archaeology and other, palaeontology, and landscape sensitivities (left) for wind development in the Stormberg focus area (FA 4)

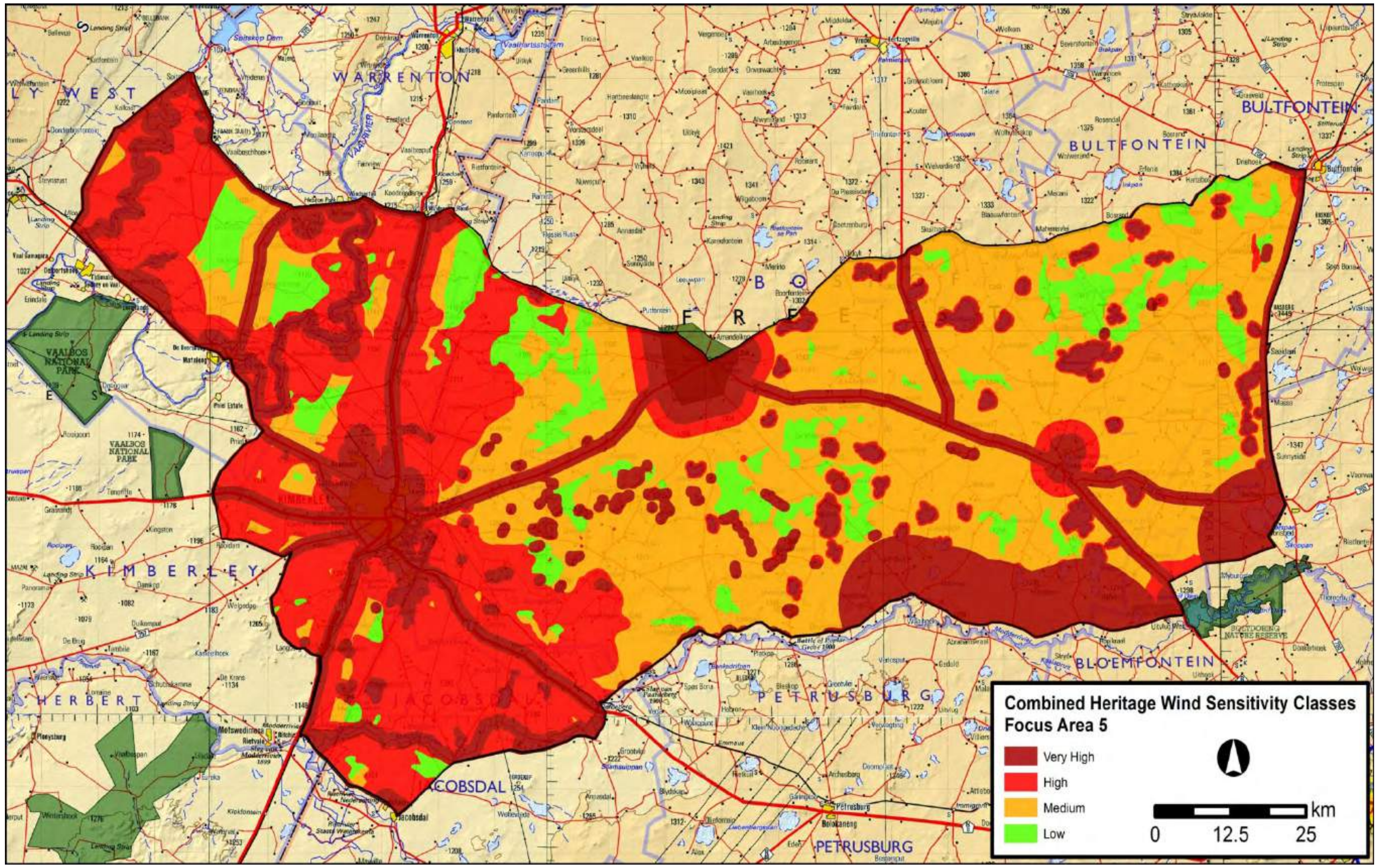


Map 9: Combined heritage sensitivity map (right) derived from integrating archaeology and other, palaeontology, and landscape sensitivities (left) for solar PV development in the Kimberley focus area (FA 5)

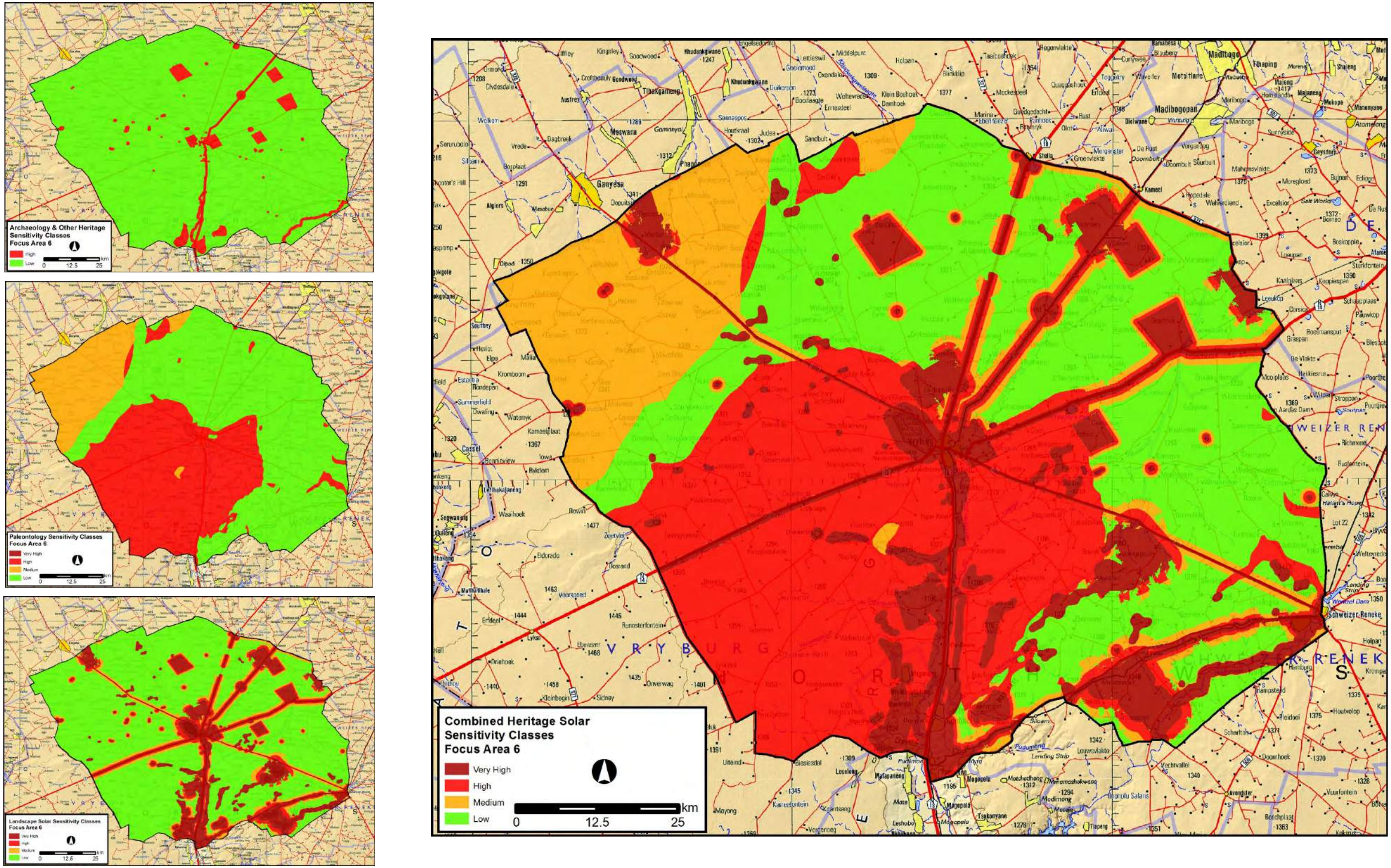




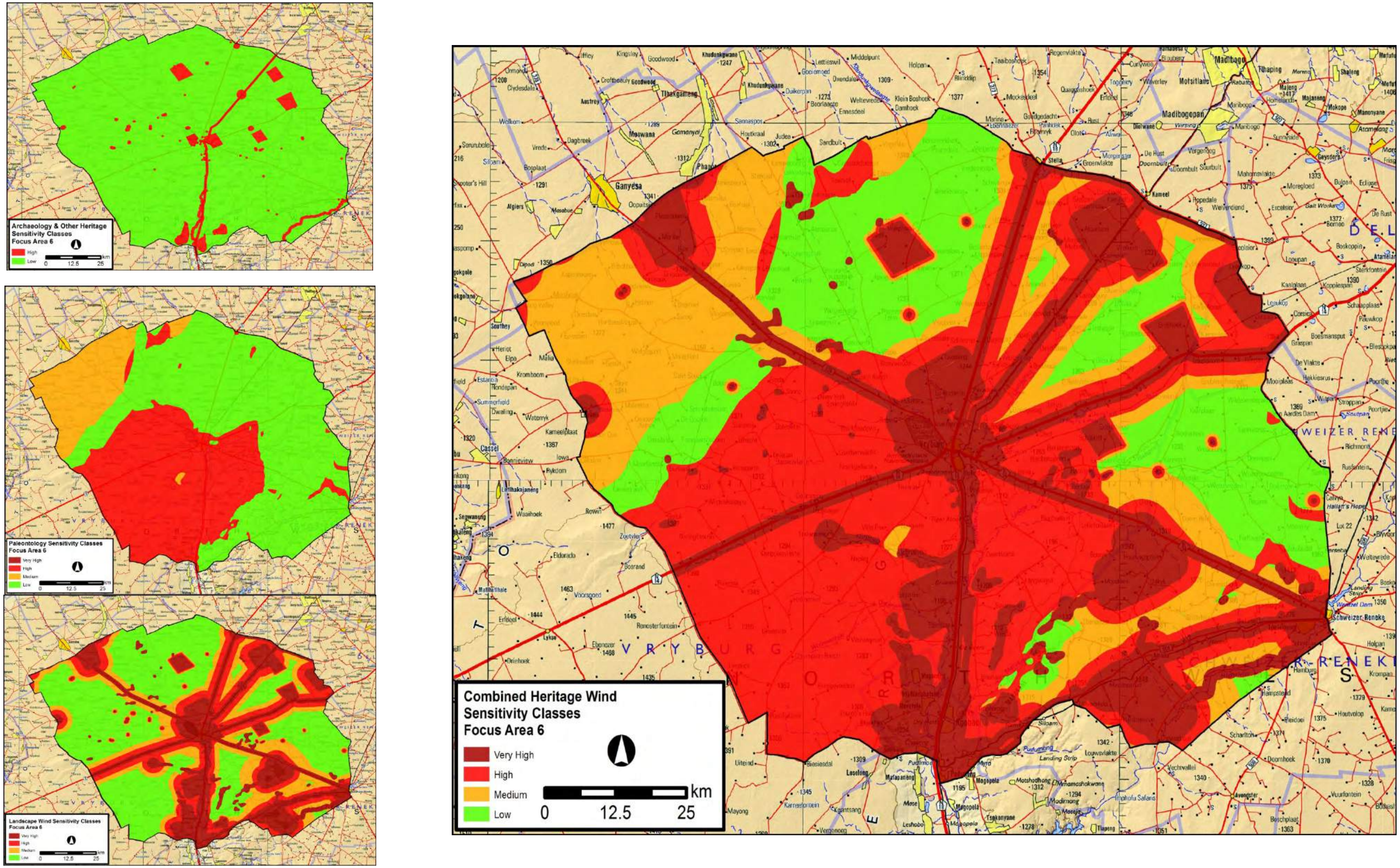




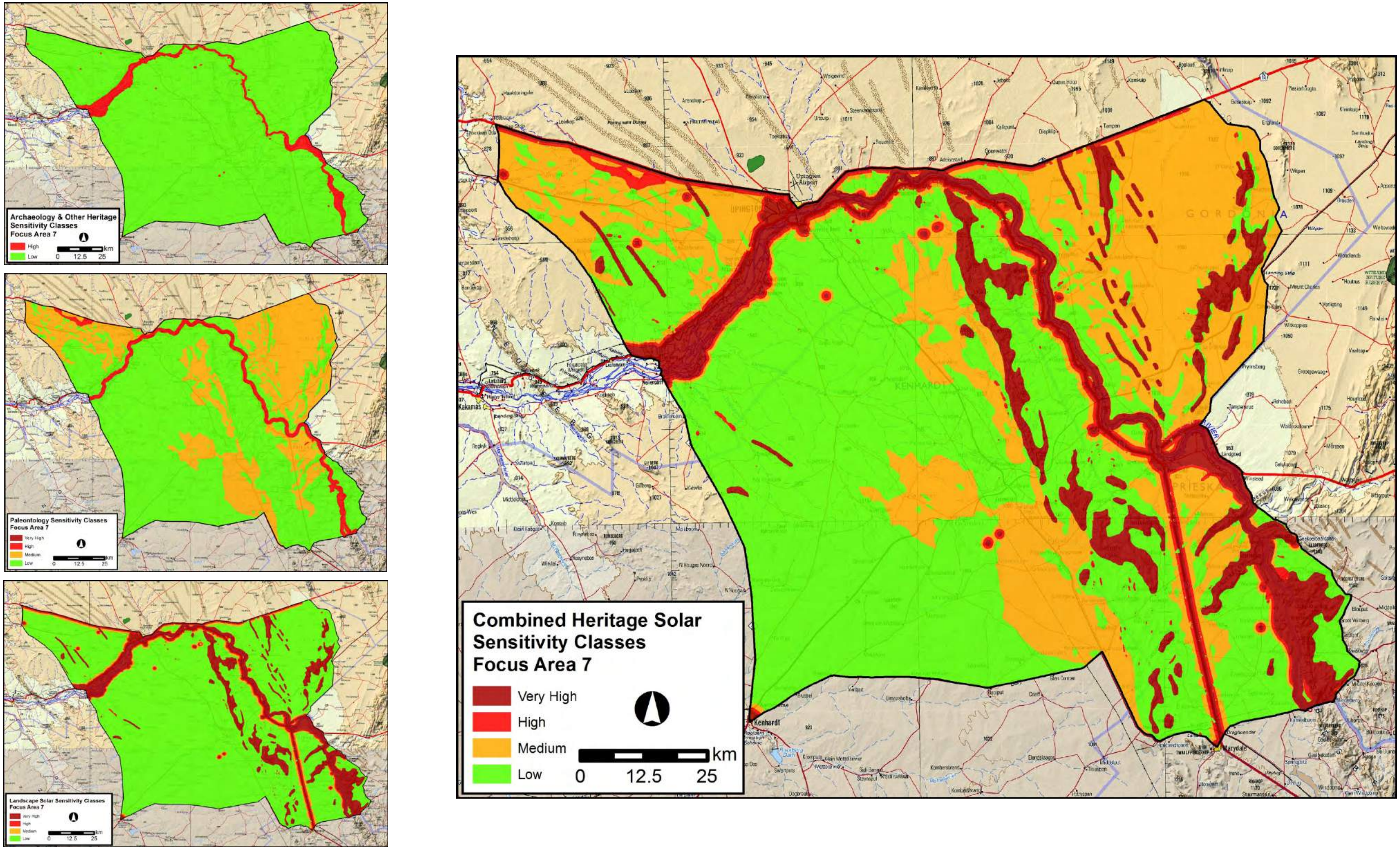
Map 10: Combined heritage sensitivity map (right) derived from integrating archaeology and other, palaeontology, and landscape sensitivities (left) for wind development in the Kimberley focus area (FA 5)



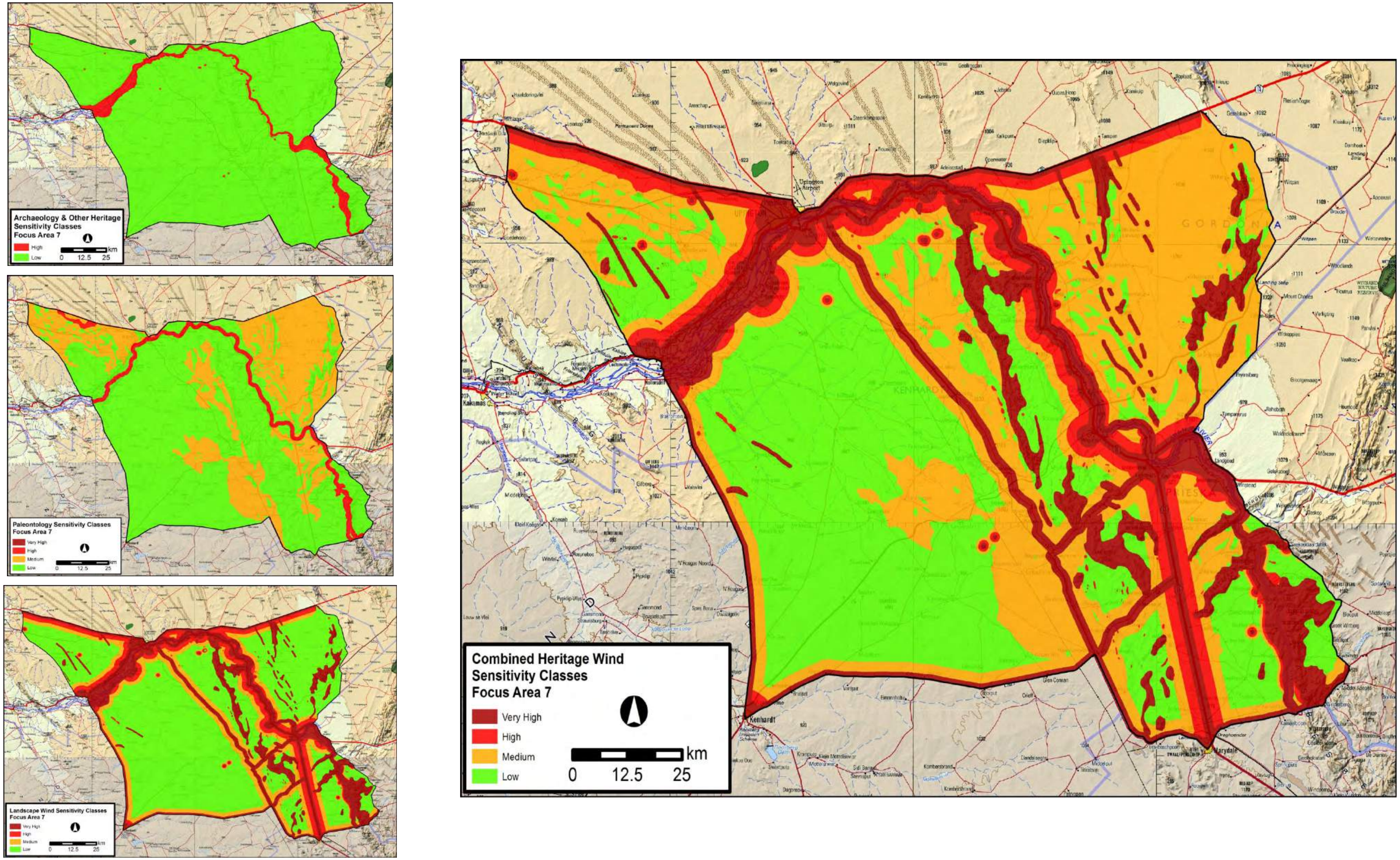
Map 11: Combined heritage sensitivity map (right) derived from integrating archaeology and other, palaeontology, and landscape sensitivities (left) for wind development in the Vryburg focus area (FA 6)



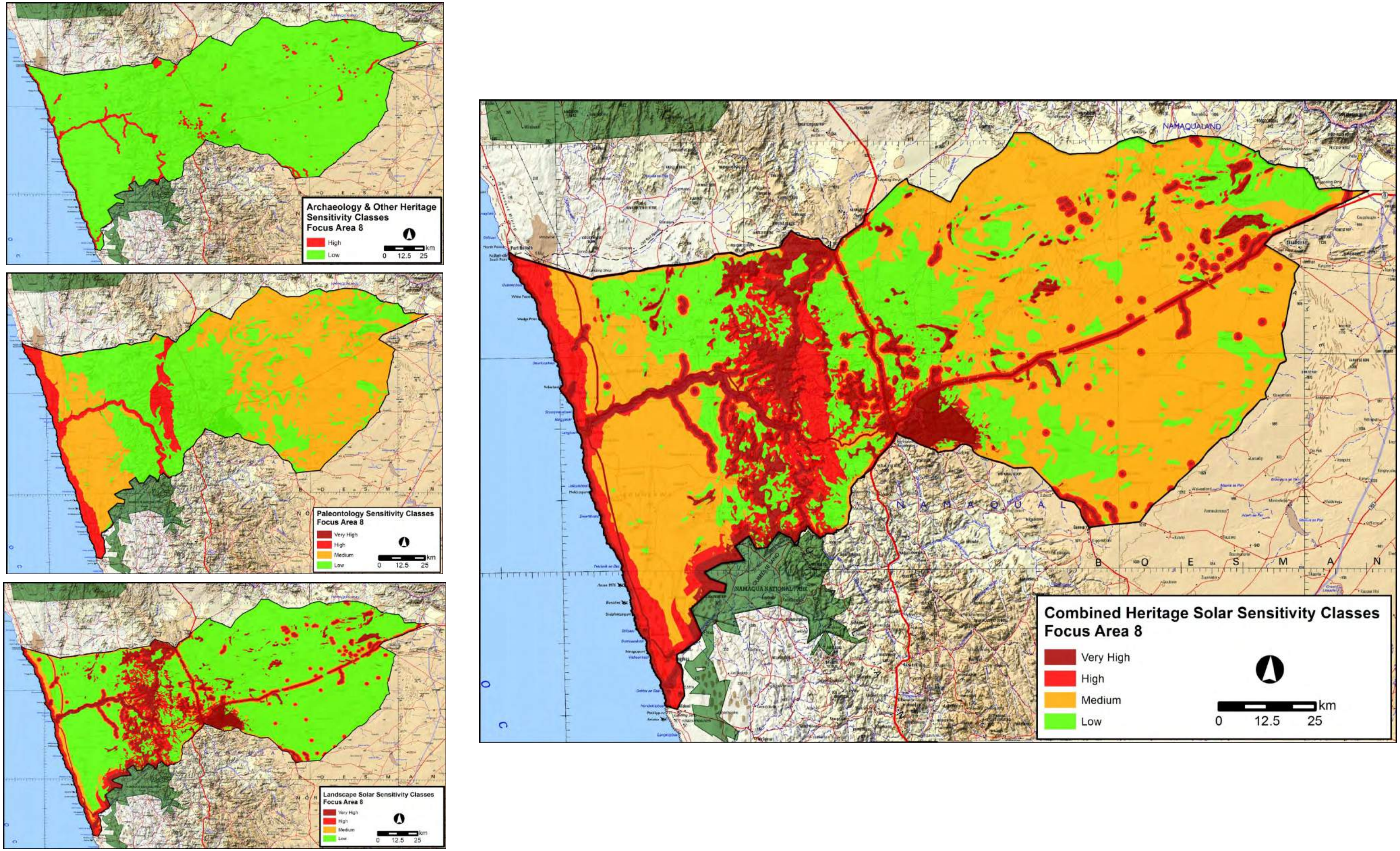
Map 12: Combined heritage sensitivity map (right) derived from integrating archaeology and other, palaeontology, and landscape sensitivities (left) for wind development in the Vryburg focus area (FA 6)



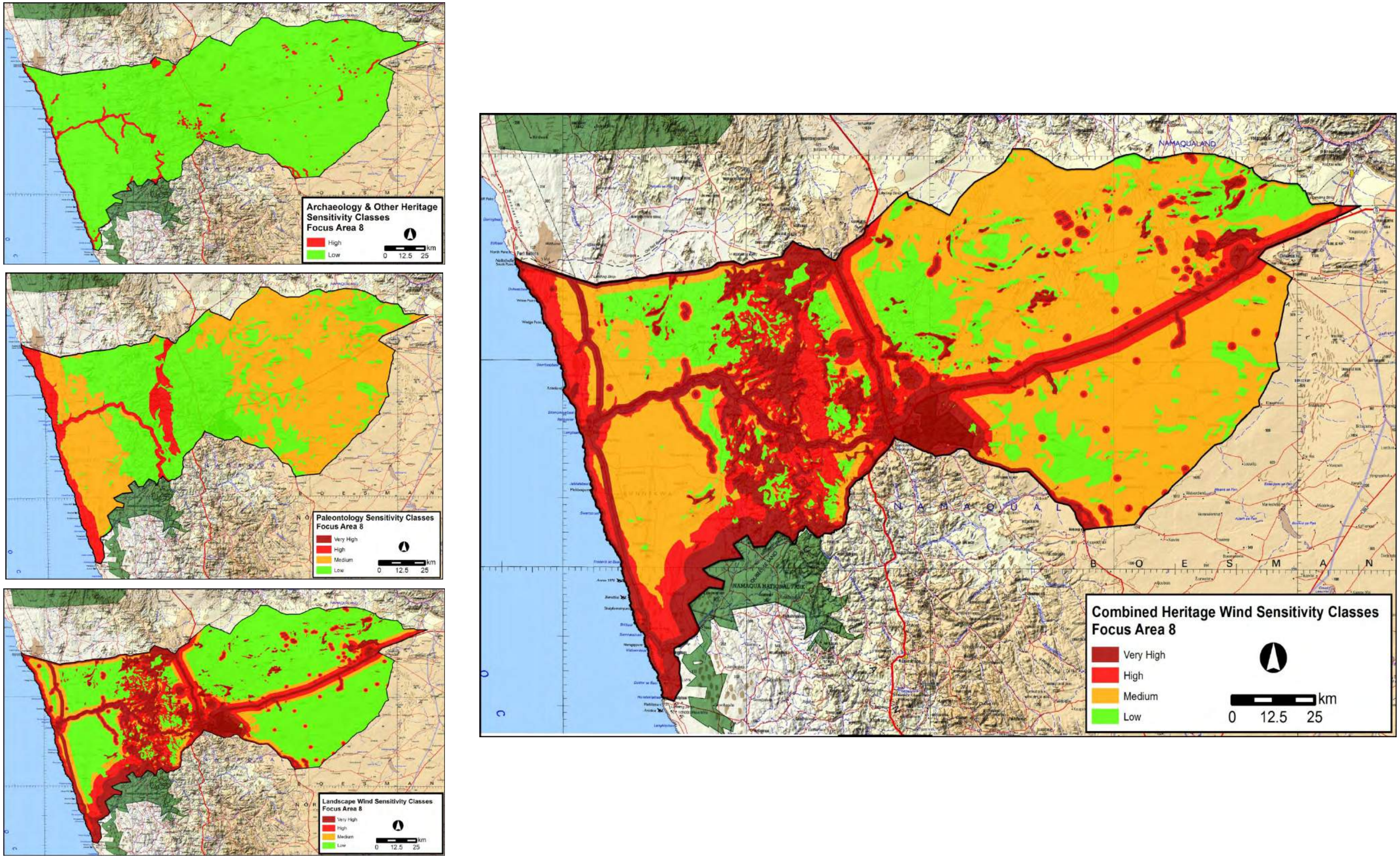
Map 13: Combined heritage sensitivity map (right) derived from integrating archaeology and other, palaeontology, and landscape sensitivities (left) for solar PV development in the Upington focus area (FA 7)



Map 14 Combined heritage sensitivity map (right) derived from integrating archaeology and other, palaeontology, and landscape sensitivities (left) for wind development in the Upington focus area (FA 7)



Map 15: Combined heritage sensitivity map (right) derived from integrating archaeology and other, palaeontology, and landscape sensitivities (left) for solar PV development in the Springbok focus area (FA 8)



Map 16: Combined heritage sensitivity map (right) derived from integrating archaeology and other, palaeontology, and landscape sensitivities (left) for wind development in the Springbok focus area (FA 8)

3.3 DEVELOPMENT PROTOCOLS

The aim of this heritage study is to provide a concise guideline for heritage impact assessment requirements. In Table 3 below the current requirements for heritage assessment are described. The new heritage assessment requirements for wind and solar PV projects that will be applicable in the FAs, once they have been adopted as Renewable Energy Development Zones (REDZs), are described in Table 4. These requirements are specific to sensitivity classes and thus related to the combined heritage sensitivity maps in Section 3.2.

Table 3: Interpretation of the heritage sensitivity and current assessment requirements

Assumed Sensitivity	Interpretation of the sensitivity	Current assessment requirements
Any area is considered as potentially being of very high sensitivity.	In the absence of any pre-assessment it is assumed that any area is potentially highly sensitive to development from a heritage perspective due to the possible presence of important heritage resources.	Proponents intending to develop a wind or solar PV facility that triggers an environmental impact assessment process must prove to the relevant commenting authority (i.e. the responsible heritage resources authority in terms of NHRA) and the competent authority (i.e. competent authority in terms of the National Environmental Management Act: NEMA) that the proposed development will not have an unacceptable negative impact on heritage resources. In most provinces, the responsible heritage resource authority requires preliminary information on the location, nature and extent of the proposed development at the outset of the assessment process. Except for Heritage Western Cape which developed a Notification of Intent to Develop (NID) form, there is no specific form in this regard to be completed and submitted to other heritage resource authorities. In provinces other than the Western Cape the required information is usually submitted in the form of a notification letter or a Background Information Document (BID). This submission is usually done by an Environmental Assessment Practitioner or heritage specialist appointed by the project proponent. Based on the preliminary information received and in accordance with Section 38(2) of the NHRA, the responsible heritage resource authority determines whether significant heritage resources potentially could be impacted, and accordingly notifies the proponent whether a comprehensive Heritage Impact Assessment (HIA) is required. In accordance with Section 38(3) of the NHRA the heritage resource authority may also specify what information is required as part of the HIA. Such information may include, amongst others, an Archaeological Impact Assessment (AIA), a Paleontological Impact Assessment (PIA), or other heritage related information such as a Visual Impact Assessment (VIA). In the absence of standardised sensitivity criteria and guidelines, every project and its associated impacts are considered on an *ad hoc* basis to determine whether an HIA is required, what the content of the HIA should be, and what the scope of the individual assessments entails (e.g. whether site visits are required or not). Based on either the preliminary information or the HIA, the responsible heritage resource authority provides comment on the proposed project. If such comment is received within stipulated timeframes it is considered by the competent authority in terms of NEMA for decision making.

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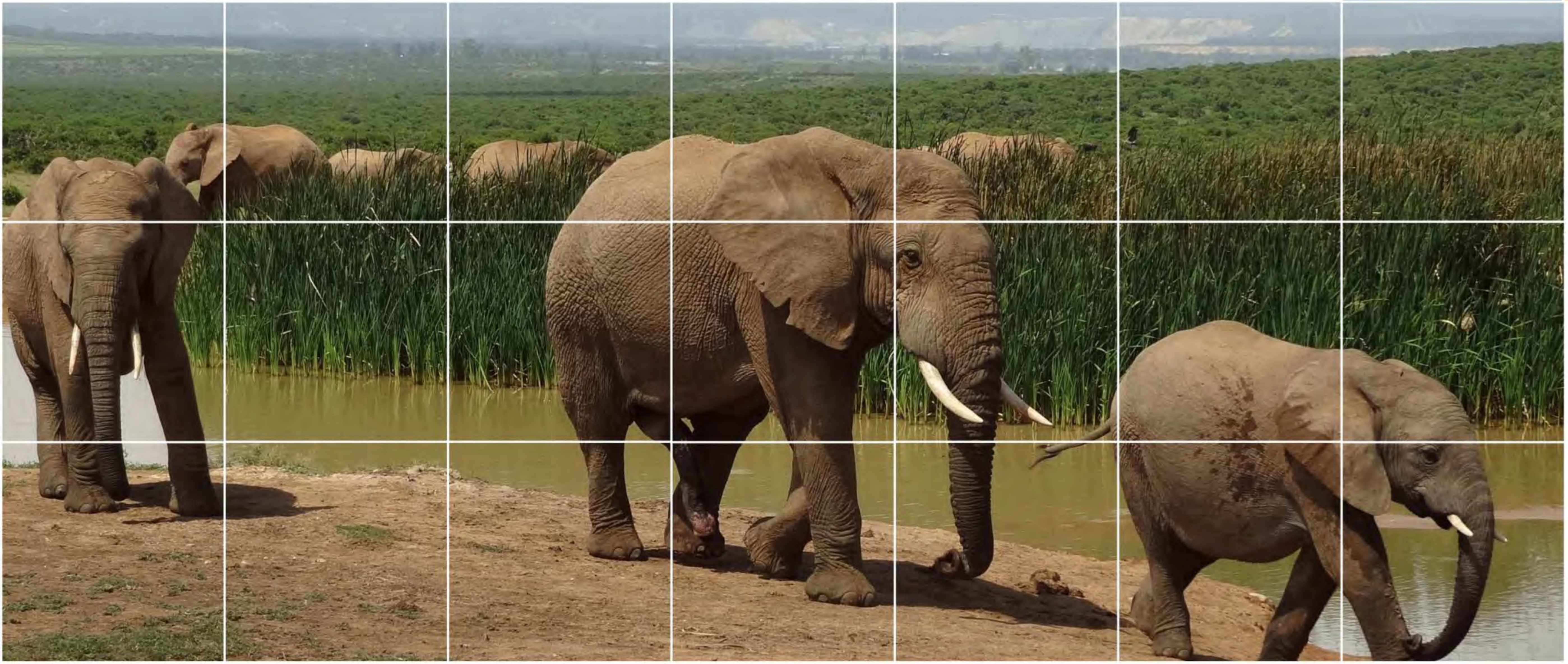
Table 4: Interpretation of the combined heritage sensitivity maps and associated new assessment requirements in REDZs

Colour	Sensitivity	Interpretation of the sensitivity	Further wind and solar PV assessment requirements
Dark red	Very High	Very high sensitivity areas are potentially very sensitive to development in terms of heritage sensitivities and possibly unsuitable for development.	Proponents intending to develop a wind or solar PV facility that triggers an environmental impact assessment process in an adopted REDZ must prove to the relevant commenting authority (i.e. the responsible heritage resources authority in terms of the NHRA) and the competent authority (i.e. competent authority in terms of NEMA) that the proposed development will not have an unacceptable negative impact on heritage resources. A notification prepared by a competent heritage specialist and containing the following information must be submitted to the relevant heritage authority at the outset of the assessment: • details and relevant expertise of the specialist preparing the notification; • project footprint (including supporting infrastructure) with a 50 m buffered development envelope, overlaid on a preliminary sensitivity map prepared in accordance with the sensitivity criteria set out in this study; • a clear and justified opinion statement by the specialist recommending whether further assessment in the form of an HIA is required; and • if further assessment is deemed necessary, the proposed HIA content (i.e. PIA, AIA and/or VIA), as well as scope of assessment (i.e. with or without site visits) must be specified by the heritage specialist preparing the notification. Based on the preliminary information received and in accordance with Section 38(2) of the NHRA, the responsible heritage resource authority will determine whether significant heritage resources potentially could be impacted, and accordingly notify the proponent whether a further assessment in the form of a HIA is required. In accordance with Section 38(3) of the NHRA the heritage resource authority will also specify what information is required as part of the HIA. Such information may, amongst others, include AIA, PIA and/or other heritage related information such as a VIA. In Very High and High sensitivity areas it is likely that an HIA will be required, in which only the sensitivities leading to the area being of Very High sensitivity and High sensitivity (i.e. Landscape, Palaeontology, and/or other heritage sensitivities including Archaeology) are addressed. In Medium and Low sensitivity areas it is likely that an HIA will not be required if such a motivation was included in the initial notification prepared by a competent heritage specialist. In order to motivate for an HIA not to be required the inputs from relevant specialists (e.g. landscape, palaeontology and archaeology) are required as part of the notification. Site visits to inform the notification may also be necessary to motivate for an HIA not being required, and are up to the discretion of the specialists providing input to the notification. In most cases it will be sufficient only the heritage specialist preparing the notification to visit the site before an exemption from further assessment (i.e. HIA) can be motivated for. If an exemption from further assessment is motivated for, the notification must, in addition to the above specified information, contain proposed mitigation measures for inclusion in the Environmental Management Programme (EMPr), if applicable. Based on either the preliminary information or the HIA, the responsible commenting heritage resource authority in terms of NHRA will provide comment on the proposed project. Such comment, if provided within prescribed timeframes, will be considered by the competent authority in terms of NEMA for decision making.
Red	High	High sensitivity areas are potentially sensitive to development in terms of heritage sensitivities. Mitigation measures may, however, exist.	
Orange	Medium	Medium sensitivity areas may have some heritage sensitivities that can be mitigated.	
Green	Low	Low sensitivity areas are unlikely to have significant heritage sensitivities.	



TERRESTRIAL & AQUATIC BIODIVERSITY

SECTION 4

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PART 3. SCOPING ASSESSMENTS AND DEVELOPENT PROTOCOLS

SECTION 4: TERRESTRIAL AND AQUATIC BIODIVERSITY

The following section is informed by the scoping level specialist terrestrial and aquatic biodiversity pre-assessment of the eight Focus Areas (FAs) for which the complete report is provided as Appendix A4. Due to the integrated and strategic nature of this Strategic Environmental Assessment (SEA), and based on consultation with relevant government departments and wider stakeholders, the final interpretation of sensitivities and development protocols presented in this section differ from those contained and recommended in the specialist report.

4.1 Renewable Energy and Terrestrial and Aquatic Biodiversity

From both an aquatic and terrestrial environment perspective, the major source of impacts from the construction and operation of wind and solar photovoltaic (PV) facilities result 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.

At a broad level, the major difference between wind and solar PV facilities is that solar PV sites are spatially compact, while wind developments are diffuse on account of the constraints on turbine spacing. Solar PV developments thus generate a high local impact which is relatively limited in extent, while wind developments generate a lower-level impact over a greater area. Solar PV facilities are generally constructed on relatively flat terrain and are thus usually located on open plains. Wind energy facilities are generally constructed in or higher-lying areas where the wind resource is higher. In terms of resource potential it is usually desirable to have the turbines located along exposed locations such as ridgelines and elevated plateaus. As a result of these differences, the parts of the landscape affected by wind and solar PV developments are often different, and thus the nature of impacts between the two technologies also differ 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, banks or flow regime of a watercourse, or where development encroaches on wetlands and their buffers). Little water is required for both the construction and operational phases of these facilities, but almost every application will require road or pipeline crossings over streams or wetlands.

4.1.1 Wind Energy

A major impact associated with wind energy facilities is that of the access roads which are required between the turbines. For a 100 megawatts (MW) facility, access roads usually amount to about 40 - 60 kilometres (km) in length, 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 more complex terrain associated with many wind energy facilities, these roads may traverse slopes where the risk of erosion is high. Although the width of access roads required during operation is usually about 6 metres (m), these are often much wider during construction when they may be required to be up to 12 m wide in places. In the context of some of the undisturbed environments where the wind facilities are located, this constitutes a significant disturbance in the form of habitat loss. It is also likely that these roads will cross over hill-slope seeps, thus altering the diffuse surface flow of water in these areas and lead to concentrated flow and subsequent erosion.

In terms of the turbines themselves, there is excavation required to establish the foundations, which 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 animals will avoid turbines due to the movement of the blades or by the noise generated. The noise may impact some species' ability to communicate or detect prey and avoid predators. Although the noise generated by turbines with distance relatively quickly drops off 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, including at frequencies not audible to humans but potentially impacting animals. 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, however, likely that many animals to become habituated to the presence and noise generated by wind turbines.

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

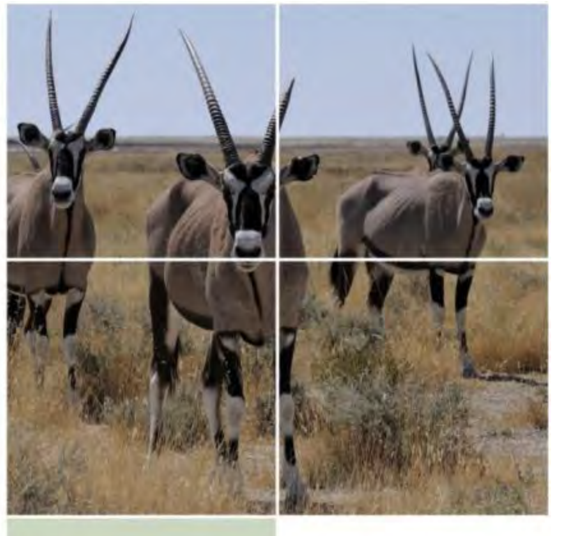
4.1.2 Solar PV Energy

Depending on the nature of the substrate, the footprint of solar PV facilities may or may not be cleared prior to construction. Although it is preferable not to clear the vegetation, this is not always possible where significant woody biomass is present. Cleared areas generate a greater risk of invasion by alien plants, 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 PV arrays, and such topographic alteration and intrusion of the development footprint across the myriad of minor drainage channels in some areas would alter the natural surface hydrology. Furthermore, extensive hardening of surfaces associated with solar PV facilities could result in increases in stormwater runoff and concentration of surface flow patterns. Infrastructural development such as cables and roads across watercourses could also 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 solar PV facilities as well as smaller carnivores such as mongooses. Solar PV 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 animals, except where there are other obstacles to movement which prevent animals from moving past the facility.

While solar PV facilities may be able to retain a proportion of the pre-construction biodiversity, the resulting habitat is fairly isolated from the surrounding landscape and will be largely anthropogenic in nature.



4.2 Water Use Authorisation

The National Water Act No. 36 of 1998 (NWA) regulates 11 water uses that require registration and/or authorisation which might be applicable to wind and solar PV 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;
e. Engaging in a controlled activity identified and declared as such in terms of the Act;
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 sections 21 (c) to 21 (k) refer to non-consumptive water uses. All of these uses may impact on the integrity and function of water resources and its overall quality and, therefore, must be registered and/or authorised as a water use by the Department of Water and Sanitation (DWS)[1] or another relevant competent authority (e.g. a Catchment Management Agency).

All consumptive and non-consumptive water uses not falling under Schedule 1 of the Water Act (which covers only reasonable domestic use and storage, gardening, watering of animals, and recreational use) require a water use license, unless the water use falls within the conditions and limits of a General Authorisation (GA), with a GA application being less detailed. The full Water Use License Application (WULA) process is more lengthy and onerous, requiring the determination of the "Reserve" for the relevant catchment in case of a consumptive water use application. WULAs for groundwater abstraction can thus only be processed in catchments where the groundwater reserve determination has already been undertaken (see Map 1 for such catchments). Similarly, WULAs for surface water abstraction can only be processed in catchments where surface water reserve determinations have been undertaken (see Map 2 for such catchments).

[1] Previously the Department of Water Affairs

A GA permits the use of water without requiring the full WULA process in a specific area, or according to a set of conditions and limits. DWS or a Catchment Management Agency can also generally authorise specific groups of users 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. There are two GAs, one for consumptive and one for non-consumptive use, with each specifying areas of applicability and exclusion. These two GAs can be summarised as follows:

- *Consumptive GA:*

  Government Notice (GN) 399 (26th March 2004) allows for up to 50 m^3/day of surface water, or up to 10 m^3/day of groundwater, or a combined storage of up to 10 000 m^3 per property, in catchments not excluded or with lower specified abstraction limits (see Maps 3 – 5), without requiring any water use registration or authorisation. Through the GA process it furthermore provides for the registration and authorisation of surface water abstraction up to 15 litres per second and not exceeding 150 000 m^3 per annum, abstraction of groundwater below specified limits, and the storage of up to 50 000 m^3 of water in catchments not excluded or with lower specified abstraction limits (see Maps 3 – 5). Any water uses not meeting the specified GA requirements are still subject to a detailed WULA process.

  With the water requirements for the operation of wind and solar PV facilities being low[2], and the most significant activity being the regular washing of solar panels, developments located in catchments not excluded from this GA and meeting the specified requirements will generally fall within the specified limits and be able to either proceed without any water registration and authorisation, or only require a GA process.

- *Non-consumptive GA:*

  GN 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 if the specified requirements are met. This GA does, however, not apply to any activities occurring within 500 m of a wetland or in the quaternary catchments specified as being excluded from this GA (see Map 6). Any water uses not meeting the specified GA requirements are still subject to a detailed WULA process.

[2] The following quantities of water were projected for a proposed 75 MW solar PV project: During the construction phase a total water usage of approximately 450 m^3 during a construction phase of 8 months (roughly 2 m^3/day); and during the operation phase (20 year life of the facility) a water usage of approximately 2 100 m^3 per year, or **5.75 m^3/day**.

In addition to the above, certain water-stressed catchments[3] have been identified for compulsory licensing. This is a process through which all water uses in a particular catchment are reviewed and verified, and water is re-allocated according to certain priorities, needs and requirements, in line with the national Water Allocation Reform (WAR) process. All new water users that are not Schedule 1 users must apply for a Water Use Licence, and so will need to follow the full WULA process. In terms of Section 6 of the NWA, strategic users are given high priority for water allocations as well as a high level of assurance of continued supply even during times of drought. 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. 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)). Map 7 illustrates all compulsory licensing catchments where all new water abstraction, storage and flow reduction uses that are not Schedule 1 (i.e. domestic) would be subject to a detailed WULA.

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

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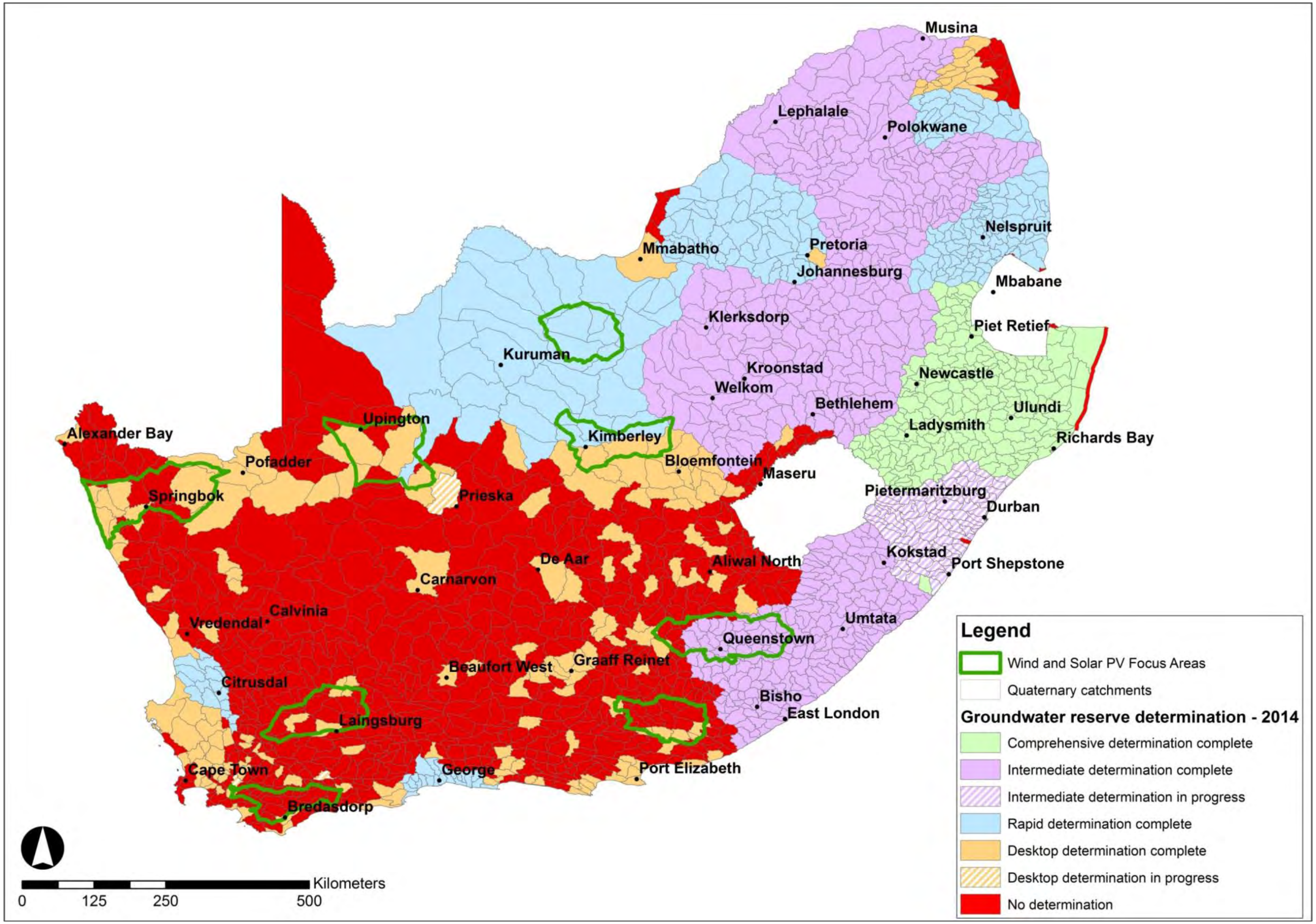
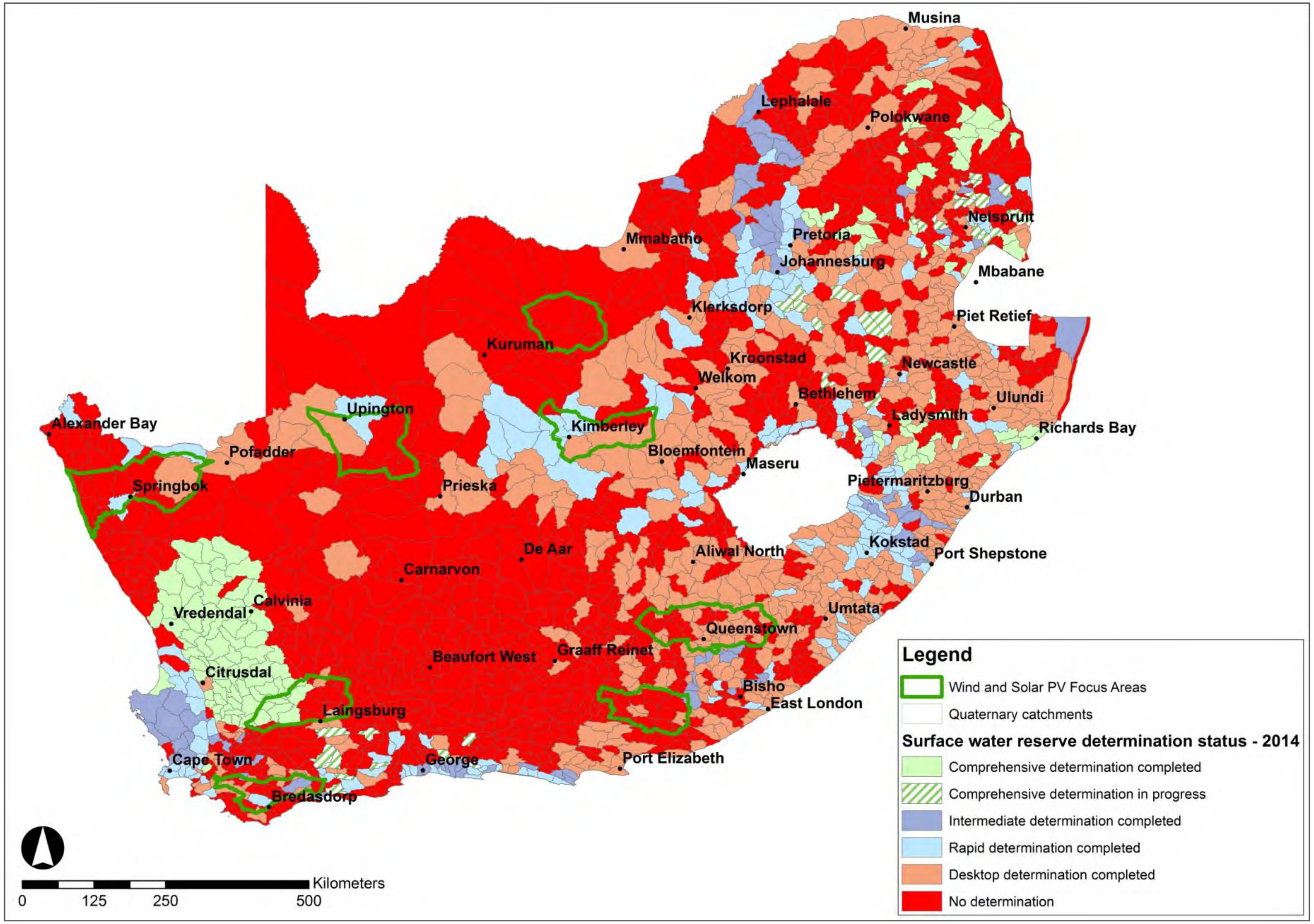
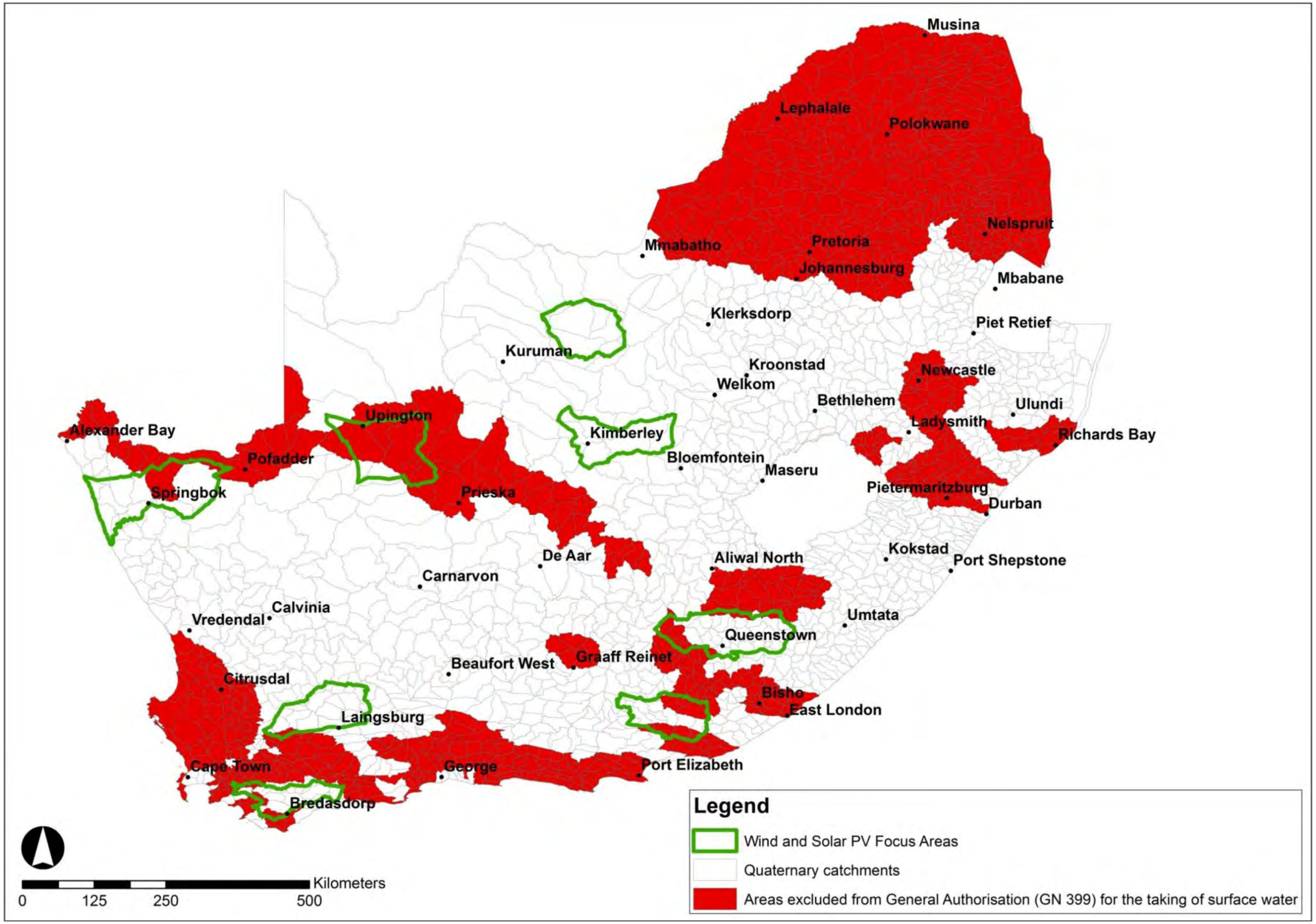


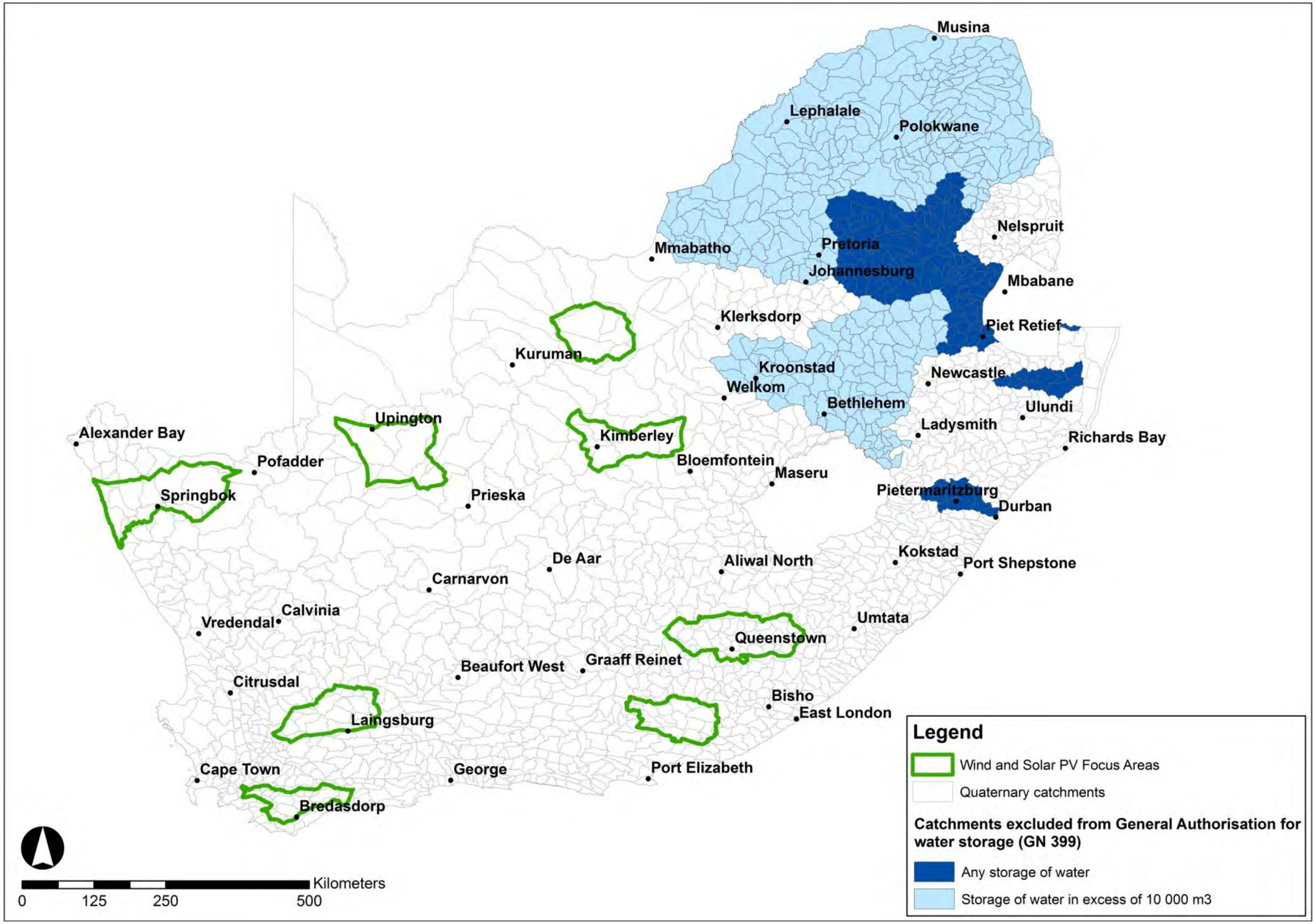
Map 1: Status of groundwater reserve determinations



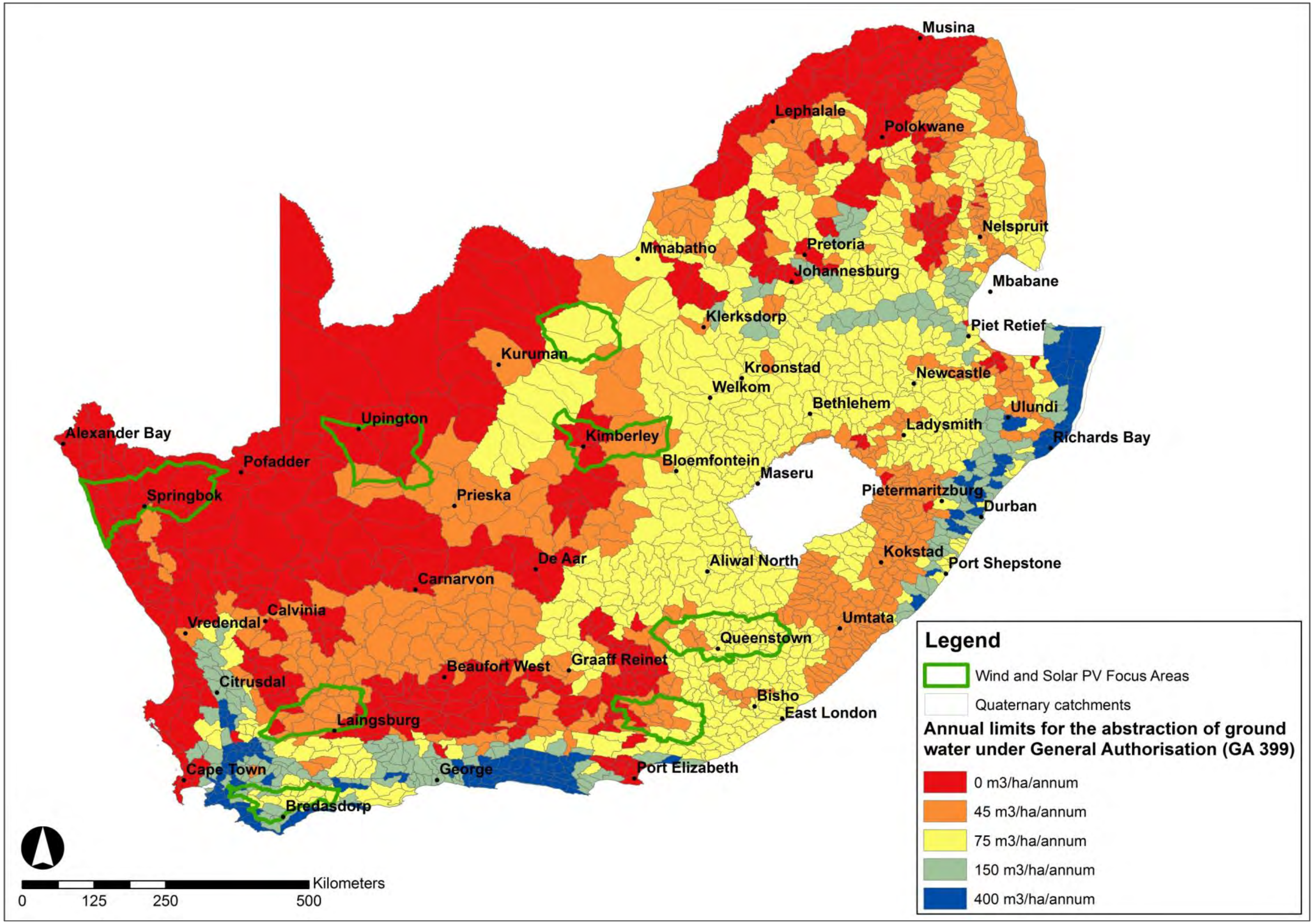
Map 2: Status of surface water reserve determinations



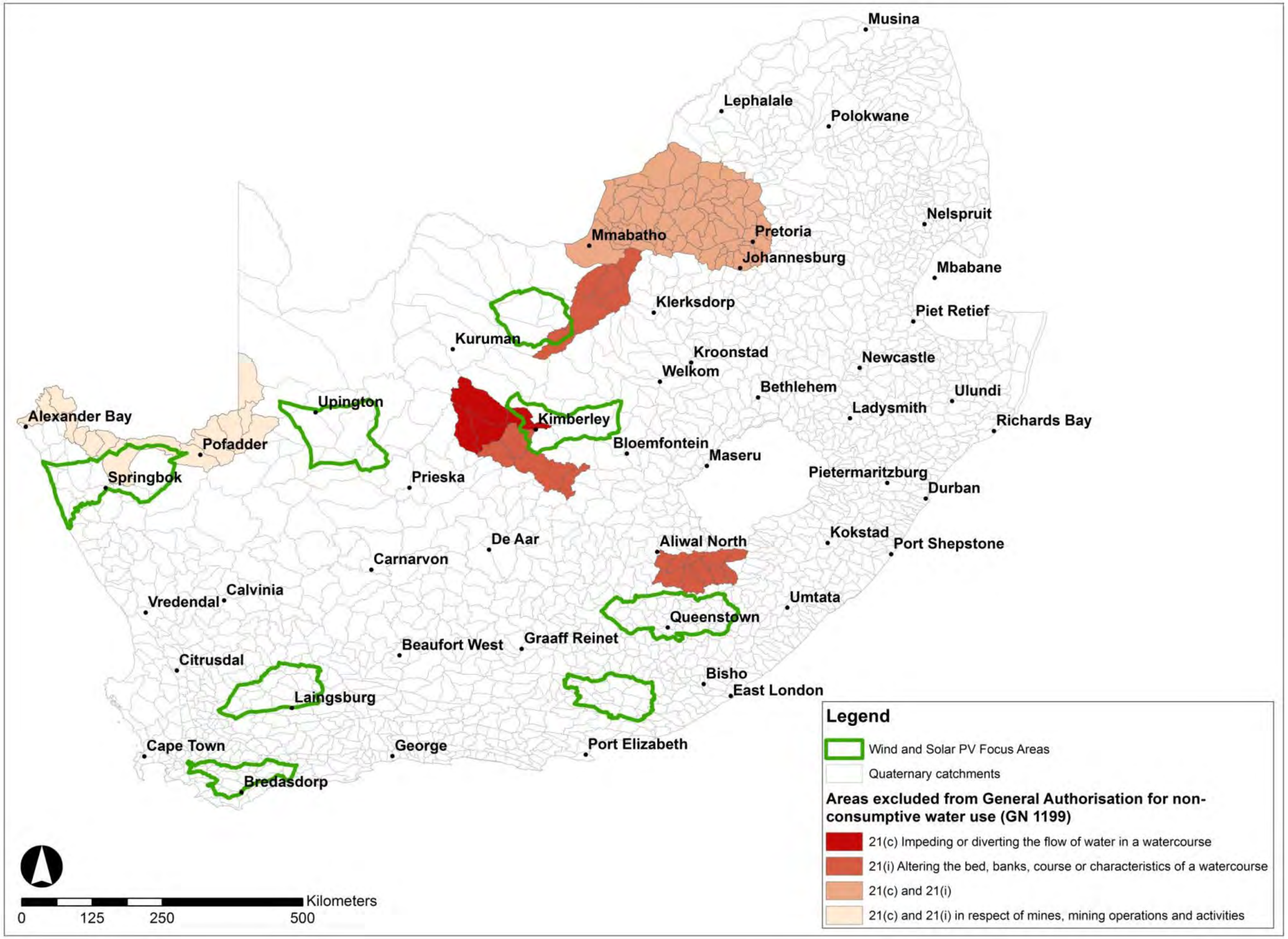
Map 3: Catchments excluded from GA for surface water abstraction under GN 399



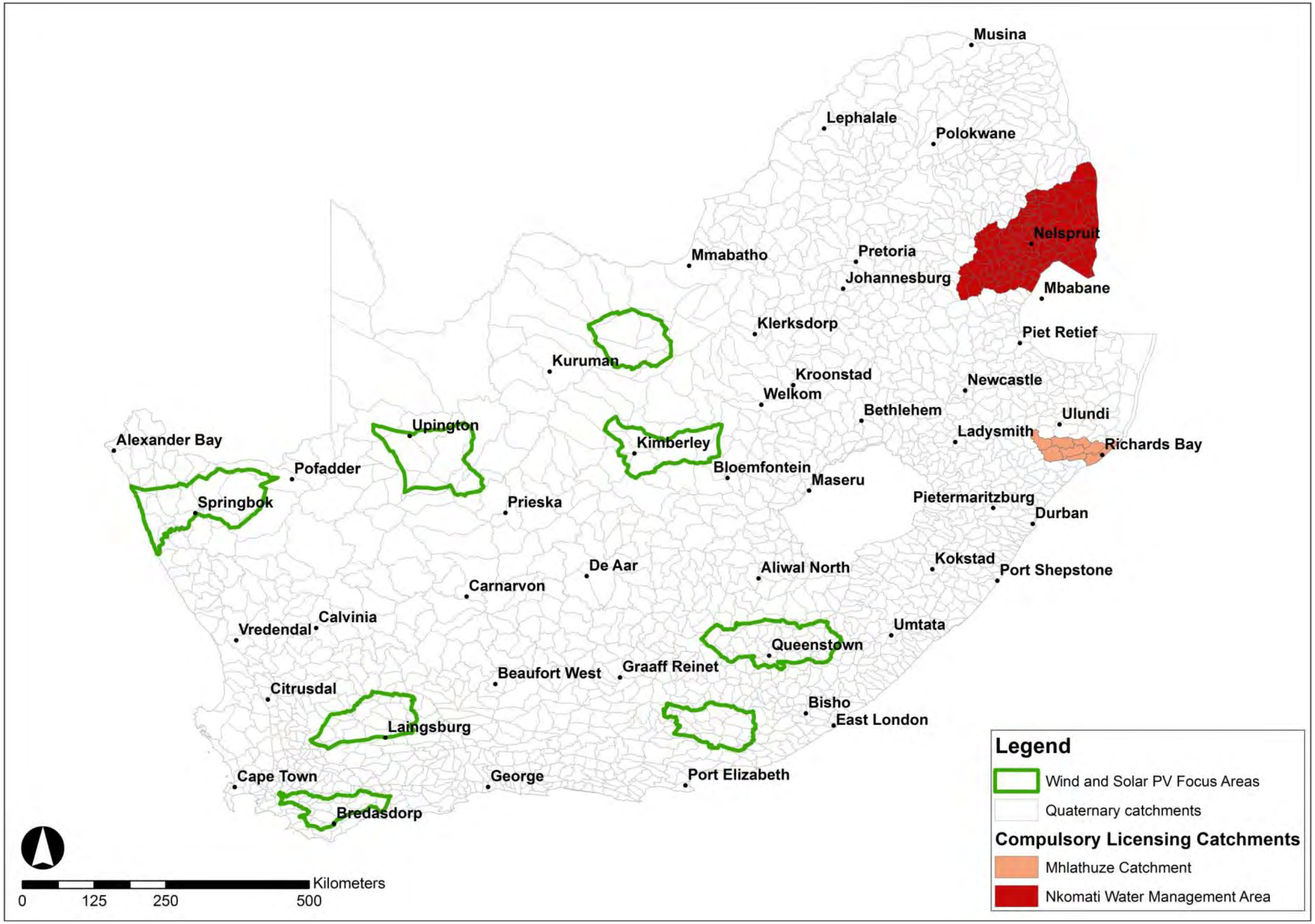
Map 4: Catchments excluded from GA for water storage under GN 399



Map 5: Annual groundwater abstraction limits for which GA is available under GN 399



Map 6: Catchments excluded from GA for specified non-consumptive water uses under GN 1199



Map 7: Compulsory licensing catchments

4.3 Sensitivity Mapping

4.3.1 Data Sources

In order to generate sensitivity maps, the data layers relevant to terrestrial and aquatic sensitivities (see Table 1) for each FA were collected and conditioned where required, and subsequently combined with a multi-criterion prioritisation system as described in Table 2. Based on specialist knowledge and following a scoring approach, all sensitivity features were allocated a score on a scale of 0 to 10, with 10 representing the highest sensitivity and 0 the lowest sensitivity value. Different combinations of layers were selected for each FA and subsequently summed to produce overall sensitivity scores. As describe in Table 2, and based on specialist knowledge, the scores of particular features were adjusted and/or the formula for combining feature scores was adapted to be relevant to the individual FAs.

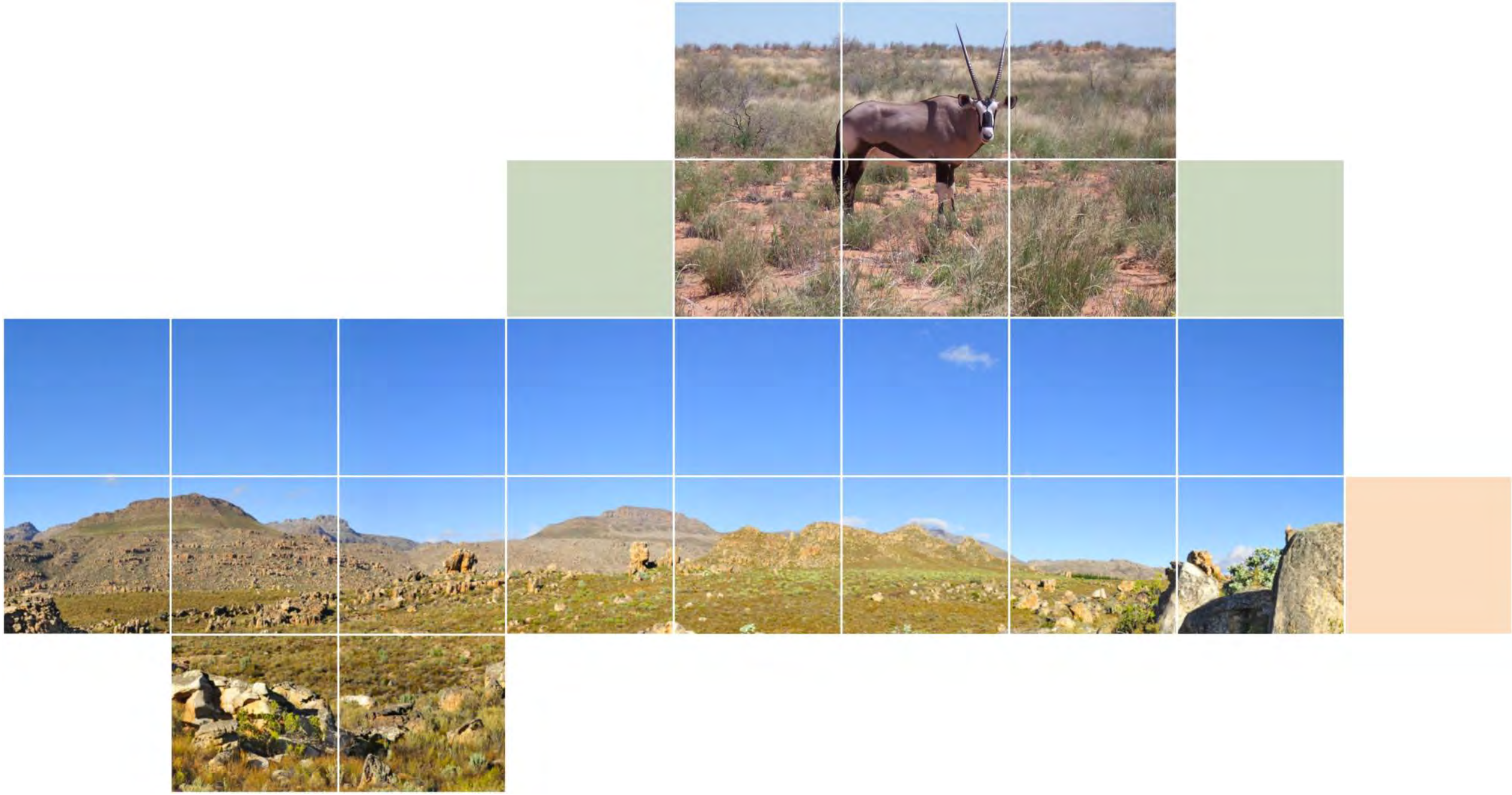


Table 1: Description and preparation of spatial data used in the terrestrial and aquatic biodiversity scoping assessment

Sensitivity Features	Data Source	Data Description and Preparation	Relevant FAs

Rivers and Wetlands	Nel, J.L., Driver, A., Strydom, W., Maherry, A., Petersen, C., Roux, D.J., Nienaber, S., Van Deventer, H., Smith-Adao, L.B. and Hill L. (2011). Atlas of Freshwater Ecosystem Priority Areas (FEPAs) in South Africa: Maps to support sustainable development of water resources. WRC Report No. TT 500/11, Water Research Commission, Pretoria
	
	Nel, J.L., Colvin, C., Le Maitre, D., Smith, J. and Haines, I. (2013). South Africa's Strategic Water Source Areas. CSIR
	
	Department of Land Affairs; Chief Directorate: National Geographic Information (CD-NGI)
		The National Freshwater Ecosystem Priority Area (NFEPA) wetlands and rivers data were used as the basis for the development of maps of freshwater ecosystems for each focus area. The NFEPA rivers layer was not edited, as it is considered to be a good representation of the important river systems of South Africa. However, due to significant under-mapping of isolated wetlands, such as depressions, seeps and flats, the NFEPA wetlands layer in the FAs was edited as follow:
		• Polygons misidentified as natural wetlands were deleted;
		• Wetland polygons that were mapped as the same wetland system but which have been split into slivers/multiple polygons (generally as a result of landform modelling), were merged;
		• Fringes around dams mapped as natural wetlands that were misidentified as wetlands were deleted, especially if wetland condition was modelled as "Z2"[4].
		• Artificial aquatic features (e.g. dams, wastewater treatment ponds) that have erroneously been mapped as natural wetlands were deleted.
		• "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[5]);
		• Azonal vegetation types mapped in the National Vegetation Map were added to the wetlands map. These included the following azonal types in the following FAs:
		  o Overberg FA 1: Cape Inland Salt Pans; Cape Lowland Freshwater Wetlands;
		  o Komsberg FA 2: Bushmandland Vloere;
		  o Cookhouse FA 3: Cape Inland Salt Pans; Southern Karoo Rivers;
		  o Kimberley FA 5: Highveld Salt Pans; Southern Kalahari Salt Pans;
		  o Vryburg FA 6: Southern Kalahari Salt Pans;
		  o Upington FA 7: Bushmanland Vloere, Southern Kalahari Salt Pans; and
		  o Springbok FA 8: Arid Estuarine Salt Marsh; Bushmanland Vloere, Namaqualand Salt Pans, Namaqualand Rivers.
		• "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 and condition were edited for a subset of wetlands within each FA. NFEPA wetland condition was generally found to be accurate across all FAs, but typing was approximately less than 50% accurate.
			All FAs

Land Cover	South African National Biodiversity Institute (SANBI); Land Cover unpublished beta version (2014) Skowno, A.L. and Holness, S.D. (2012) Addo Mainstreaming Project - Updated CBA maps & technical report. SANParks.	The SANBI land cover beta version 2014 was found to over-estimate transformation in arid sections of FA 2 and FA 5 (probably due to a remote sensing error which classifies natural bare ground as transformed), which was corrected manually. In the western portion of FA 3 the land cover from the Addo Mainstreaming Project 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	National Department of Environmental Affairs (DEA); South African Protected Areas Database (SAPAD) (2014) SANBI Protected Areas Database from 2011 National Biodiversity Assessment (NBA).	The DEA protected area database was compared with the SANBI protected area database and discrepancies were resolved. Protected areas were added to the DEA layer based on the SANBI layer in FA 8 and FA 6. In other FAs the DEA layer proved comprehensive.	All FAs

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

[5] Ollis, D.J., Snaddon, C.D., Job, N.M. and Mbona, N. 2013. Classification System for wetlands and other aquatic ecosystems in South Africa. User Manual: Inland Systems. SANBI Biodiversity Series 22. South African National Biodiversity Institute, Pretoria.

Sensitivity Features	Data Source	Data Description and Preparation	Relevant FAs
Biomes	Mucina, L. and 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).	All vegetation types falling into the forest and azonal biomes were judged to be particularly sensitive.	All FAs
Forest Patches	Berliner, D. (2005) Systematic conservation planning for the forest biome of South Africa. DAFF, Pretoria.	In FA 1, FA 3 and FA 4 all forest patches in the National Forests Coverage were included as sensitivities.	FA 1, FA 3 and FA 4
Terrestrial Threatened Ecosystems	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.	All the nationally listed threatened ecosystems were associated with the South African (SA) vegetation types which allowed for assigning the threat status of each type to the SA vegetation layer.	FA 1, FA 5, FA 6 and FA 7
Vegetation Type Endemism	Calculated by specialist team and based on: Mucina, L. and 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).	The vegetation types that intersect the FAs were selected and combined 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 calculated as a percentage and termed "regional endemism". This was categorised as follows. If more than 95 % of habitat type falls within the FA, the FA was considered as Endemic, and if between 95 % and 80 % of habitat type falls within the FA, the FA was considered Near Endemic. These steps allowed for the identification of vegetation types that need additional protection within the FA.	FA 1, FA 2, FA 3, FA 6 & FA 7
Additional Sensitive Vegetation Types	Calculated by specialist team and based on: Mucina, L. and 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).	Vegetation types judged to be particularly sensitive to disturbance were categorised as Very High or High Sensitivity. The SA vegetation map was used as a 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 FA 7 some additional patches of Lower Gariep Broken Veld were also mapped by Simon Todd as part of this study. The following vegetation types were identified as being of particular sensitivity: • FA 2: Central Mountain Shale Renosterveld, Roggeveld Shale Rensoterveld, Matjiesfontein Shale Renosterveld and Matjiesfontein Quartzite Fynbos. • FA 7: Lower Gariep Broken Veld and Lower Gariep Alluvial Vegetation • FA 8: 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 and Southern Richtersveld Scorpionstailveld.	FA 2, FA 7 and FA 8

Sensitivity Features	Data Source	Data Description and Preparation	Relevant FAs
Critical Biodiversity Areas (CBAs)	Kirkwood, D., Pence, G.Q., and 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 Skowno, A.L. and Holness, S.D. (2012) Addo Mainstreaming Project - Updated CBA maps & technical report. SANParks. Berliner, D. and Desmet, P. (2007). Eastern Cape Biodiversity Conservation Plan: Technical Report. Department of Water Affairs and Forestry Project No 2005-012, Pretoria. Desmet, P., Skowno, A.L. and Schaller, (2008) Biodiversity Assessment of North West, NWDACE. Desmet P. & Marsh A. (2009) Namakwa Biodiversity Sector Plan. Conservation International.	FAs 1, 2, 3, 4, 6 and 8 are covered by Critical Biodiversity Areas (CBA) maps based on systematic biodiversity assessments. These CBA maps use a range of classes, the more recent being Ecological Support Areas (ESA) and CBA. For FAs 1, 2, 8, and the western part of FA 3, the CBA map available required no modification. For FA 4 and the eastern portion of FA 3, the Eastern Cape Biodiversity Conservation Plan CBA map required reclassification as follows: CBA 1 was changed to CBA, CBA 2 was changed to ESA, and CBA 3 not was not utilised. For FA 6 the Northwest Biodiversity Assessment aquatic CBA class, which represented priority quaternary catchments, was not utilised as it covered large areas that in the specialist team's opinion is not considered sensitive.	FA 1, FA 2, FA 3, FA 4, FA 6 and FA 8
Succulent-Karoo Ecosystem Programme (SKEP) Expert Derived Priority Areas	Unpublished expert mapped priority areas for the Succulent-Karoo Ecosystem Programme (SKEP 2012), Conservation South Africa.	In FA 8 and FA 2 the updated Succulent-Karoo Ecosystem Programme (SKEP) expert areas (high priority, botanically sensitive areas), supplemented with expert mapping by Nick Helme were included. These areas were used to supplement the boundaries of the CBA features.	FA 8 and FA 2
Eastern Cape Protected Areas Expansion Strategy (EPAES) Priority Areas	Skowno, A., Holness, S., Jackelman, J. and Desmet, P. (2012) Eastern Cape Protected Area Expansion Strategy (EPEAS), Eastern Cape Parks and Tourism Agency, East London.	In FA 4, the Eastern Cape Protected Areas Expansion Strategy value grid was used to supplement the CBA layer. This includes climate change resilience and species level information that were not found in the 2008 CBA map.	FA 4
Pristine Thicket	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. and Wilson, S.L. (2003). A conservation assessment for the Subtropical Thicket Biome. Terrestrial Ecology Research Unit Report No 43. University of Port Elizabeth, South Africa.	In FA 3, the pristine thicket, as mapped for the STEP project, was categorised as High sensitivity.	FA 3
Renosterveld Clusters	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.	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.	FA 1
Riverine Rabbit Habitat	C.Bragg pers com.	The Groot River in FA 2 was buffered by 1000 m as it is a known Riverine Rabbit area.	FA 2

Sensitivity Features	Data Source	Data Description and Preparation	Relevant FAs
National Protected Areas Expansion Strategy (NPAES) Priority Areas	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.	Priority expansion areas outside of protected areas representing corridors of connectivity were used to supplement the CBA and ESA network in this region.	FA 2
Extra Features Derived from Digital Elevation Model (DEM)	NASA Land Processes Distributed Active Archive Center (LP DAAC). ASTER L1B. USGS/Earth Resources Observation and Science (EROS) Center, Sioux Falls, South Dakota. 2001.	The 30 m ASTER Digital Elevation Model (DEM) was used to identify Very high elevation areas (>1600 m), High elevation areas (100 -1600 m), areas with steep slopes (> 10 °) and the Sutherland plateau.	FA 2
Expert Features	Developed by specialist team as part of this study.	Mesic hill tops and associated altitudinal gradients with high vegetation type turnover were identified and categorised as Very High or High Sensitivity.	FA 3
		Dolerite hills and one known large camel thorn thicket in the western portion of FA 5 were mapped from aerial photographs and categorised as high sensitivity.	FA 5
		Additional portions of Lower Gariep Broken Veld were mapped from aerial photographs and categorised as high sensitivity.	FA 7

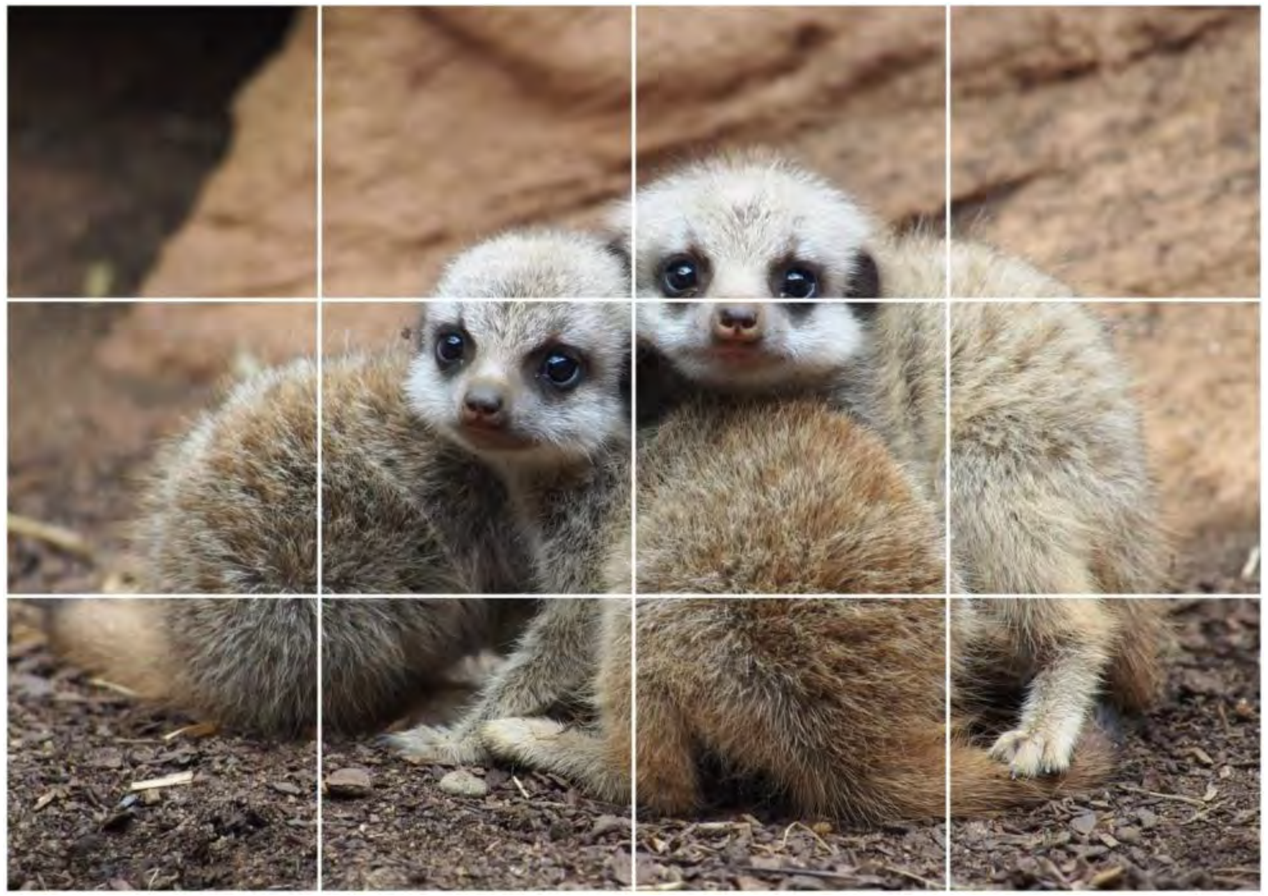


Table 2: Sensitivity scoring system applied by specialist team to calculate overall sensitivity scores

Focus Area	Feature	Attribute to which Sensitivity Score was added	Scoring
Overberg FA 1	Rivers and Wetlands	sc_AQBUFF	The sensitivity of freshwater ecosystems was scored based on their biodiversity and functional values. Relevant buffers ranging from 50 to 500 m were then assigned to individual freshwater features based on their sensitivity scores. In cases where the total size of a wetland is less than 1 ha the buffers were halved, and in cases where a river is an ephemeral system buffers were augmented by 20 m due to the greater sensitivity of these types of systems to changes in hydrological regime or water quality. Further details on the scoring and buffering system are available in the specialist report (see Appendix A4). **River and Wetland Features** with their relevant buffers were assigned a sensitivity score of **10**
	Land Cover	sc_LC4	**Transformed Areas** without any buffer were assigned a sensitivity score of **0** **Natural Areas** without any buffer were assigned a sensitivity score of **1**
	Protected Areas	sc_PA	**Formally Protected Areas** without any buffer were assigned a sensitivity score of **10**
	Forest Patches	sc_FOREST	**Forest Patches** without any buffers were assigned a sensitivity score of **10**
	Terrestrial Threatened Ecosystems	sc_THREAT	**Critically Endangered Vegetation** types without any buffers were assigned a sensitivity score of **10** **Endangered Vegetation** types without any buffers were assigned a sensitivity score of **8** **Vulnerable Vegetation** types without any buffers were assigned a sensitivity score of **6** Modifier: In **Transformed Areas** (i.e. sc_LC4 = 0) a sensitivity score of **0** was assigned.
	CBAs from Western Cape Biodiversity Framework	sc_CBA	**Critical Biodiversity Areas** (CBAs) without any buffers were assigned a sensitivity score of **7** **Ecological Support Areas** (ESAs) without any buffers were assigned a sensitivity score of **2** Modifier: In **Transformed Areas** (i.e. sc_LC4 = 0) a sensitivity score of **0** was assigned.
	Biomes	sc_ADDVEG	**Forest Biomes** without any buffers were assigned a sensitivity score of **8** **Azonal Biomes** without any buffers were assigned a sensitivity score of **6** Modifier: In **Transformed Areas** (i.e. sc_LC4 = 0) a sensitivity score of **0** was assigned.
	Vegetation Type Endemism	sc_ADDVEG	One **Regionally Near-Endemic Vegetation** type (Central Ruens Shale Renosterveld) without any buffers were assigned a sensitivity score of **4** Modifier: In **Transformed Areas** (i.e. sc_LC4 = 0) a sensitivity score of **0** was assigned.
	Renosterveld Clusters	sc_EXTRA	**Priority Lowland Renosterveld Clusters** without any buffers were assigned a sensitivity score of **2** Modifier: In **Transformed Areas** (i.e. sc_LC4 = 0) a sensitivity score of **0** was assigned
	Total Sensitivity Score was calculated as: sc_AQBUFF + sc_LC4 + sc_PA + sc_FOREST + sc_EXTRA + sc_CBA + sc_THREAT + sc_ADDVEG		

Focus Area	Feature	Attribute to which Sensitivity Score was added	Scoring
Komsberg FA 2[6]	Rivers and Wetlands	sc_AQBUFF	The sensitivity of freshwater ecosystems was scored based on their biodiversity and functional values. Relevant buffers ranging from 50 to 500 m were then assigned to individual freshwater features based on their sensitivity scores. In cases where the total size of a wetland is less than 1 ha the buffers were halved, and in cases where a river is an ephemeral systems buffers were augmented by 20 m. Further details on the scoring and buffering system are available in the specialist report (see Appendix A4). **River and Wetland Features** with their relevant buffers were assigned a sensitivity score of **10**
	Land Cover	sc_LC4	**Transformed Areas** without any buffer were assigned a sensitivity score of **0** **Natural Areas** without any buffer were assigned a sensitivity score of **1**
	Protected Areas	sc_PA	**Formally Protected Areas** without any buffer were assigned a sensitivity score of **10**
	SKEP Expert Derived Priority Areas	sc_EXTRA	**SKEP Priority Areas** without any buffer were assigned a sensitivity score of **7** Modifier: In **Transformed Areas** (i.e. sc_LC4 = 0) a sensitivity score of **0** was assigned.
	Riverine Rabbit Habitat	sc_EXTRA	**Riverine Rabbit Habitat** as a 1 km buffer along the Groot river was assigned a sensitivity score: **10** Modifier: In **Transformed Areas** a sensitivity score of **0** was assigned.
	Extra Features Derived from DEM	sc_EXTRA	**Very High Elevation Areas** (>1600 m) without any buffer were assigned a sensitivity score of **10** Modifier: In **Transformed Areas** (i.e. sc_LC4 = 0) a sensitivity score of **0** was assigned (i.e. if sc_LC4 = 0 then sensitivity score is 0) **High Elevation Areas** (100-1600 m) without any buffer were assigned a sensitivity score of **7** **Steep Slopes** (>10°) without any buffer were assigned a sensitivity score of **7** Modifier: In **Transformed Areas** (i.e. sc_LC4 = 0) or where **Other Extra Sensitivities** have already been identified (i.e. sc_EXTRA>7) a sensitivity score of **0** was assigned. **The Sutherland Plateau** without any buffer was assigned a sensitivity score of **5** Modifier: In **Transformed Areas** (i.e. sc_LC4 = 0) or where **Other Extra Sensitivities** have already been identified (i.e. sc_EXTRA>5) a sensitivity score of **0** was assigned.
	NPAES Priority Areas	sc_EXTRA	**NPAES Focus Areas** without any buffer were assigned a sensitivity score of **5** Modifier: In **Transformed Areas** (i.e. sc_LC4 = 0) or where **Other Extra Sensitivities** have already been identified (i.e. sc_EXTRA>5) a sensitivity score of **0** was assigned.
	Additional Sensitive Vegetation Types	sc_ADDVEG	Central Mountain Shale Renosterveld, Roggeveld Shale Rensoterveld, Matjiesfontein Shale Renosterveld, Matjiesfontein Quartzite Fynbos vegetation types were assigned a sensitivity score of **6** Modifier: In **Transformed Areas** (i.e. sc_LC4 = 0) or where **Other Extra Sensitivities** have already been identified (i.e. SC_EXTRA>6) a sensitivity score of **0** was assigned
	Vegetation Type Endemism	sc_ADDVEG	One **Regionally Endemic Vegetation** type (Central Mountain Shale Renosterveld) without any buffers were assigned a sensitivity score of **4** Modifier: In **Transformed Areas** (i.e. sc_LC4 = 0) or where **Other Extra Sensitivities** have already been identified (i.e. sc_EXTRA>4) a sensitivity score of **0** was assigned
	CBAs from Western Cape Biodiversity Framework & Namakwa Biodiversity Sector Plan	sc_CBA	**Critical Biodiversity Areas** (CBAs) without any buffers were assigned a sensitivity score of **7** Modifier: In **Transformed Areas** (i.e. sc_LC4 = 0) or where **Other Extra Sensitivities** have already been identified (i.e. sc_EXTRA>5) a sensitivity score of **0** was assigned **Ecological Support Areas** (ESAs) without any buffers were assigned a sensitivity score of **2** Modifier: In **Transformed Areas** (i.e. sc_LC4 = 0) or where **Other Extra Sensitivities** have already been identified (i.e. sc_EXTRA>2) a sensitivity score of **0** was assigned
	Total Sensitivity Score was calculated as: sc_AQBUFF + sc_LC4 + sc_PA + sc_EXTRA + ADDVEG + sc_CBA		

[6] For FA 2 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.

Focus Area	Feature	Attribute to which Sensitivity Score was added	Scoring
Cookhouse FA 3	Rivers and Wetlands	sc_AQBUFF	The sensitivity of freshwater ecosystems was scored based on their biodiversity and functional values. Relevant buffers ranging from 25 to 500 m were then assigned to individual freshwater features based on their sensitivity scores. In cases where the total size of a wetland is less than 1 ha the buffers were halved, and in cases where a river is an ephemeral systems buffers were augmented by 20 m. Further details on the scoring and buffering system are available in the specialist report (see Appendix A4). **River and Wetland Features** with their relevant buffers were assigned a sensitivity score of **10**
	Land Cover	sc_LC4	**Transformed Areas** without any buffer were assigned a sensitivity score of **0** **Natural Areas** without any buffer were assigned a sensitivity score of **1**
	Protected Areas	sc_PA	**Formally Protected Areas** without any buffer were assigned a sensitivity score of **10**
	Forest Patches	sc_FOREST	**Forest Patches** without any buffers were assigned a sensitivity score of **10**
	CBAs from Eastern Cape Biodiversity Conservation Plan & Addo Mainstreaming Project	sc_CBA	**Critical Biodiversity Areas** (CBAs) without any buffers were assigned a sensitivity score of **7** **Ecological Support Areas** (ESAs) without any buffers were assigned a sensitivity score of **2** Modifier: In **Transformed Areas** (i.e. sc_LC4 = 0) a sensitivity score of **0** was assigned.
	Biomes	sc_ADDVEG	**Forest Biomes** without any buffers were assigned a sensitivity score of **8** **Azonal Biomes** without any buffers were assigned a sensitivity score of **6** Modifier: In **Transformed Areas** (i.e. sc_LC4 = 0) a sensitivity score of **0** was assigned.
	Regional Endemism	sc_ADDVEG	Two **Regionally Near-Endemic Vegetation** types (Albany Broken Veld & Bedford Dry Grassland) without any buffers were assigned a sensitivity score of **4** Modifier: In **Transformed Areas** (i.e. sc_LC4 = 0) or where **Sensitive Biomes** have already been identified (i.e. sc_ADDVEG>4) a sensitivity score of **0** was assigned
	Expert Features	sc_EXPERT	**Mesic Areas** with very high habitat diversity and species richness without any buffers were assigned a sensitivity score of **7** **Mesic Areas** with high habitat diversity and species richness without any buffers were assigned a sensitivity score of **5** Modifier: In **Transformed Areas** (i.e. sc_LC4 = 0) a sensitivity score of **0** was assigned.
	Pristine Thicket	sc_THICKET	**Pristine Albany Thicket Patches** without any buffers were assigned a sensitivity score of **6** Modifier: In **Transformed Areas** (i.e. sc_LC4 = 0) a sensitivity score of **0** was assigned.
	Total Sensitivity Score was calculated as: sc_AQBUFF + sc_LC4 + sc_PA + sc_FOREST + sc_CBA + sc_ADDVEG + sc_EXPERT + sc_THICKET		

Focus Area	Feature	Attribute to which Sensitivity Score was added	Scoring
Stormberg FA 4	Rivers and Wetlands	sc_AQBUFF	The sensitivity of freshwater ecosystems was scored based on their biodiversity and functional values. Relevant buffers ranging from 50 to 500 m were then assigned to individual freshwater features based on their sensitivity scores. In cases where the total size of a wetland is less than 1 ha the buffers were halved, and in cases where a river is an ephemeral systems buffers were augmented by 20 m. Further details on the scoring and buffering system are available in the specialist report (see Appendix A4). **River and Wetland Features** with their relevant buffers were assigned a sensitivity score of **10**
	Land Cover	sc_LC4	**Transformed Areas** without any buffer were assigned a sensitivity score of **0** **Natural Areas** without any buffer were assigned a sensitivity score of **1**
	Protected Areas	sc_PA	**Formally Protected Areas** without any buffer were assigned a sensitivity score of **10**
	Forest Patches	sc_FOREST	**Forest Patches** without any buffers were assigned a sensitivity score of **10**
	Biomes	sc_ADDVEG	**Forest Biomes** without any buffers were assigned a sensitivity score of **8** **Azonal Biomes** without any buffers were assigned a sensitivity score of **6** Modifier: In **Transformed Areas** (i.e. sc_LC4 = 0) a sensitivity score of **0** was assigned.
	CBAs from Eastern Cape Biodiversity Conservation Plan & Eastern Cape Protected Area Expansion Strategy (ECPAES)	sc_CBA	**Critical Biodiversity Areas** (CBAs) without any buffers were assigned a sensitivity score of **7** **Ecological Support Areas** (ESAs) without any buffers were assigned a sensitivity score of **2** Modifier: In **Transformed Areas** (i.e. sc_LC4 = 0) a sensitivity score of **0** was assigned. Areas with **EPAES Values > 40** without any buffers were assigned a sensitivity score of **7** Areas with **EPAES Values between 25 and 40** without any buffers were assigned a sensitivity score of **4** Modifier: In **Transformed Areas** (i.e. sc_LC4 = 0) or areas that have already been identified as **CBAs** (i.e. CBA>0) a sensitivity score of **0** was assigned.
	Total Sensitivity Score was calculated as: sc_AQBUFF + sc_LC4 + sc_PA + sc_FOREST + sc_ADDVEG + sc_CBA		
Kimberley FA 5	Rivers and Wetlands	sc_AQBUFF	The sensitivity of freshwater ecosystems was scored based on their biodiversity and functional values. Relevant buffers ranging from 50 to 500 m were then assigned to individual freshwater features based on their sensitivity scores. In cases where the total size of a wetland is less than 1 ha the buffers were halved, and in cases where a river is an ephemeral systems buffers were augmented by 20 m. Further details on the scoring and buffering system are available in the specialist report (see Appendix A4). **River and Wetland Features** with their relevant buffers were assigned a sensitivity score of **10**
	Land Cover	sc_LC4	**Transformed Areas** without any buffer were assigned a sensitivity score of **0** **Natural Areas** without any buffer were assigned a sensitivity score of **1**
	Protected Areas	sc_PA	**Formally Protected Areas** without any buffer were assigned a sensitivity score of **10**
	Terrestrial Threatened Ecosystems	sc_THREAT	**Endangered Vegetation** types without any buffers were assigned a sensitivity score of **8** **Vulnerable Vegetation** types without any buffers were assigned a sensitivity score of **6** Modifier: In **Transformed Areas** (i.e. sc_LC4 = 0) a sensitivity score of **0** was assigned.
	Biomes	sc_ADDVEG	**Azonal Biomes** without any buffers were assigned a sensitivity score of **6** Modifier: In **Transformed Areas** (i.e. sc_LC4 = 0) a sensitivity score of **0** was assigned.
	Expert Features	sc_EXPERT	**Dolerite Hills, Koppies and Large Camel Thorn Forests** without any buffers were assigned a sensitivity score of **6** Modifier: In **Transformed Areas** (i.e. sc_LC4 = 0) a sensitivity score of **0** was assigned.
	Total Sensitivity Score was calculated as: sc_AQBUFF + sc_LC4 + sc_PA + sc_THREAT + sc_ADDVEG + sc_EXPERT		

Focus Area	Feature	Attribute to which Sensitivity Score was added	Scoring
Vryburg FA 6	Rivers and Wetlands	sc_AQBUFF	The sensitivity of freshwater ecosystems was scored based on their biodiversity and functional values. Relevant buffers ranging from 50 to 500 m were then assigned to individual freshwater features based on their sensitivity scores. In cases where the total size of a wetland is less than 1 ha the buffers were halved, and in cases where a river is an ephemeral systems buffers were augmented by 20 m. Further details on the scoring and buffering system are available in the specialist report (see Appendix A4). **River and Wetland Features** with their relevant buffers were assigned a sensitivity score of **10**
	Land Cover	sc_LC4	**Transformed Areas** without any buffer were assigned a sensitivity score of **0** **Natural Areas** without any buffer were assigned a sensitivity score of **1**
	Protected Areas	sc_PA	**Formally Protected Areas** without any buffer were assigned a sensitivity score of **10**
	Terrestrial Threatened Ecosystems	sc_THREAT	**Critically Endangered Vegetation** types without any buffers were assigned a sensitivity score of **10** **Endangered Vegetation** types without any buffers were assigned a sensitivity score of **8** **Vulnerable Vegetation** types without any buffers were assigned a sensitivity score of **6** Modifier: In **Transformed Areas** (i.e. sc_LC4 = 0) a sensitivity score of **0** was assigned.
	Biomes	sc_ADDVEG	**Azonal Biomes** without any buffers were assigned a sensitivity score of **6** Modifier: In **Transformed Areas** (i.e. sc_LC4 = 0) a sensitivity score of **0** was assigned.
	Vegetation Type Endemism	sc_ADDVEG	One **Regionally Near-Endemic Vegetation** type (Stella Bushveld) without any buffers were assigned a sensitivity score of **4** Modifier: In **Transformed Areas** (i.e. sc_LC4 = 0) or areas that have already been identified as being part of a **Sensitive Biomes** (i.e. sc_ADDVEG>4) a sensitivity score of **0** was assigned
	CBAs from North West Biodiversity Assessment	sc_CBA	**Critical Biodiversity Areas** (CBAs) without any buffers were assigned a sensitivity score of **7** **Ecological Support Areas** (ESAs) without any buffers were assigned a sensitivity score of **2** Modifier: In **Transformed Areas** (i.e. sc_LC4 = 0) a sensitivity score of **0** was assigned.
	Total Sensitivity Score was calculated as: sc_AQBUFF + sc_LC4 + sc_PA + sc_THREAT + sc_ADDVEG + sc_CBA		
Upington FA 7	Rivers and Wetlands	sc_AQBUFF	The sensitivity of freshwater ecosystems was scored based on their biodiversity and functional values. Relevant buffers ranging from 50 to 500 m were then assigned to individual freshwater features based on their sensitivity scores. In cases where the total size of a wetland is less than 1 ha the buffers were halved, and in cases where a river is an ephemeral systems buffers were augmented by 20 m. Further details on the scoring and buffering system are available in the specialist report (see Appendix A4). **River and Wetland Features** with their relevant buffers were assigned a sensitivity score of **10**
	Land Cover	sc_LC4	**Transformed Areas** without any buffer were assigned a sensitivity score of **0** **Natural Areas** without any buffer were assigned a sensitivity score of **1**
	Protected Areas	sc_PA	**Formally Protected Areas** without any buffer were assigned a sensitivity score of **10**

Focus Area	Feature	Attribute to which Sensitivity Score was added	Scoring
	Terrestrial Threatened Ecosystems	sc_THREAT	**Critically Endangered Vegetation** types without any buffers were assigned a sensitivity score of **10** **Endangered Vegetation** types without any buffers were assigned a sensitivity score of **8** **Vulnerable Vegetation** types without any buffers were assigned a sensitivity score of **6** Modifier: In **Transformed Areas** (i.e. sc_LC4 = 0) a sensitivity score of **0** was assigned.
	Biomes	sc_ADDVEG	**Azonal Biomes** without any buffers were assigned a sensitivity score of **6** Modifier: In **Transformed Areas** (i.e. sc_LC4 = 0) a sensitivity score of **0** was assigned.
	Expert Features	sc_EXTRA	Additional **Portions of Lower Gariep Broken Veld** without any buffers were assigned a sensitivity score of **6** Modifier: In **Transformed Areas** (i.e. sc_LC4 = 0) a sensitivity score of **0** was assigned.
	Additional Sensitive Vegetation Types	sc_ADDVEG	Based on very high sensitivity to disturbance, Lower Gariep Broken Veld and Lower Gariep Alluvial Vegetation without any buffers were assigned a sensitivity score of **7** Modifier: In **Transformed Areas** (i.e. sc_LC4 = 0) a sensitivity score of **0** was assigned.
	Total Sensitivity Score was calculated as: sc_AQBUFF + sc_LC4+ sc_PA + sc_THREAT + sc_ADDVEG + sc_EXTRA		
Springbok FA 8	Rivers and Wetlands	sc_AQBUFF	The sensitivity of freshwater ecosystems was scored based on their biodiversity and functional values. Relevant buffers ranging from 50 to 500 m were then assigned to individual freshwater features based on their sensitivity scores. In cases where the total size of a wetland is less than 1 ha the buffers were halved, and in cases where a river is an ephemeral systems buffers were augmented by 20 m. Further details on the scoring and buffering system are available in the specialist report (see Appendix A4). **River and Wetland Features** with their relevant buffers were assigned a sensitivity score of **10**
	Land Cover	sc_LC4	**Transformed Areas** without any buffer were assigned a sensitivity score of **0** **Natural Areas** without any buffer were assigned a sensitivity score of **1**
	Protected Areas	sc_PA	**Formally Protected Areas** without any buffer were assigned a sensitivity score of **10**
	Biomes	sc_ADDVEG	**Azonal Biomes** without any buffers were assigned a sensitivity score of **6** Modifier: In **Transformed Areas** (i.e. sc_LC4 = 0) a sensitivity score of **0** was assigned.
	Additional Sensitive Vegetation Types	sc_ADDVEG	Aggeneys Gravel Vygieveld, Arid Estuarine Salt Marshes, Bushmanland Inselberg Shrubland, Namaqualand Sand Fynbos[7] and Namaqualand Seashore vegetation types without any buffers were assigned a sensitivity score of **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 vegetation types without any buffers were assigned a sensitivity score of **4** Modifier: In **Transformed Areas** (i.e. sc_LC4 = 0) or areas that have already been identified as being part of a **Sensitive Biomes** (i.e. sc_ADDVEG>4) a sensitivity score of **0** was assigned
	Vegetation Type Endemism	sc_ADDVEG	Two **Regionally Near-Endemic Vegetation** types (Namaqualand Salt Pans & Namaqualand Shale Shrubland) without any buffers were assigned a sensitivity score of **4** Modifier: In **Transformed Areas** (i.e. sc_LC4 = 0) or where **Other Extra Sensitivities** have already been identified (i.e. sc_ADDVEG>4) a sensitivity score of **0** was assigned
	CBAs from Namakwa Biodiversity Sector Plan and SKEP expert priority areas	sc_CBA	**Critical Biodiversity Areas** (CBAs) without any buffers were assigned a sensitivity score of **7**[8] **Ecological Support Areas** (ESAs) without any buffers were assigned a sensitivity score of **2** Modifier: In **Transformed Areas** (i.e. sc_LC4 = 0) a sensitivity score of **0** was assigned.
	Total Sensitivity Score was calculated as: sc_AQBUFF + sc_LC4 + sc_PA + + sc_ADDVEG + sc_CBA		

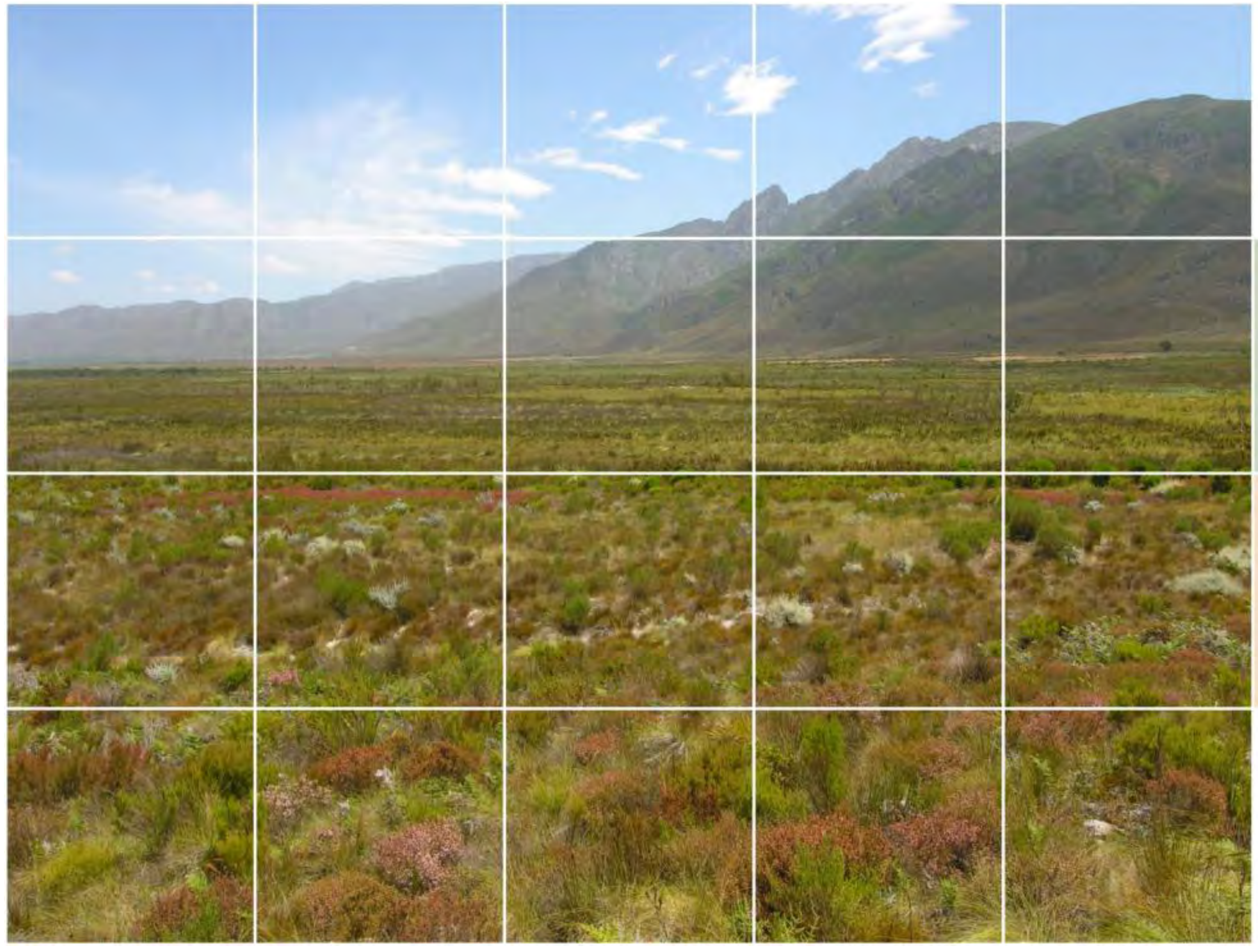
[7] Note: an unpublished fine scale map of Namakwa Sand Fynbos was used in conjunction with the SA veg map to identify this habitat (Source: Nick Helme and Philip Desmet - Expert Mapping for various mining companies).
[8] Note: the SKEP expert areas showed very high overlap with CBA areas in FA 8, to avoid double counting the SKEP areas were used to refine and expand CBA areas.

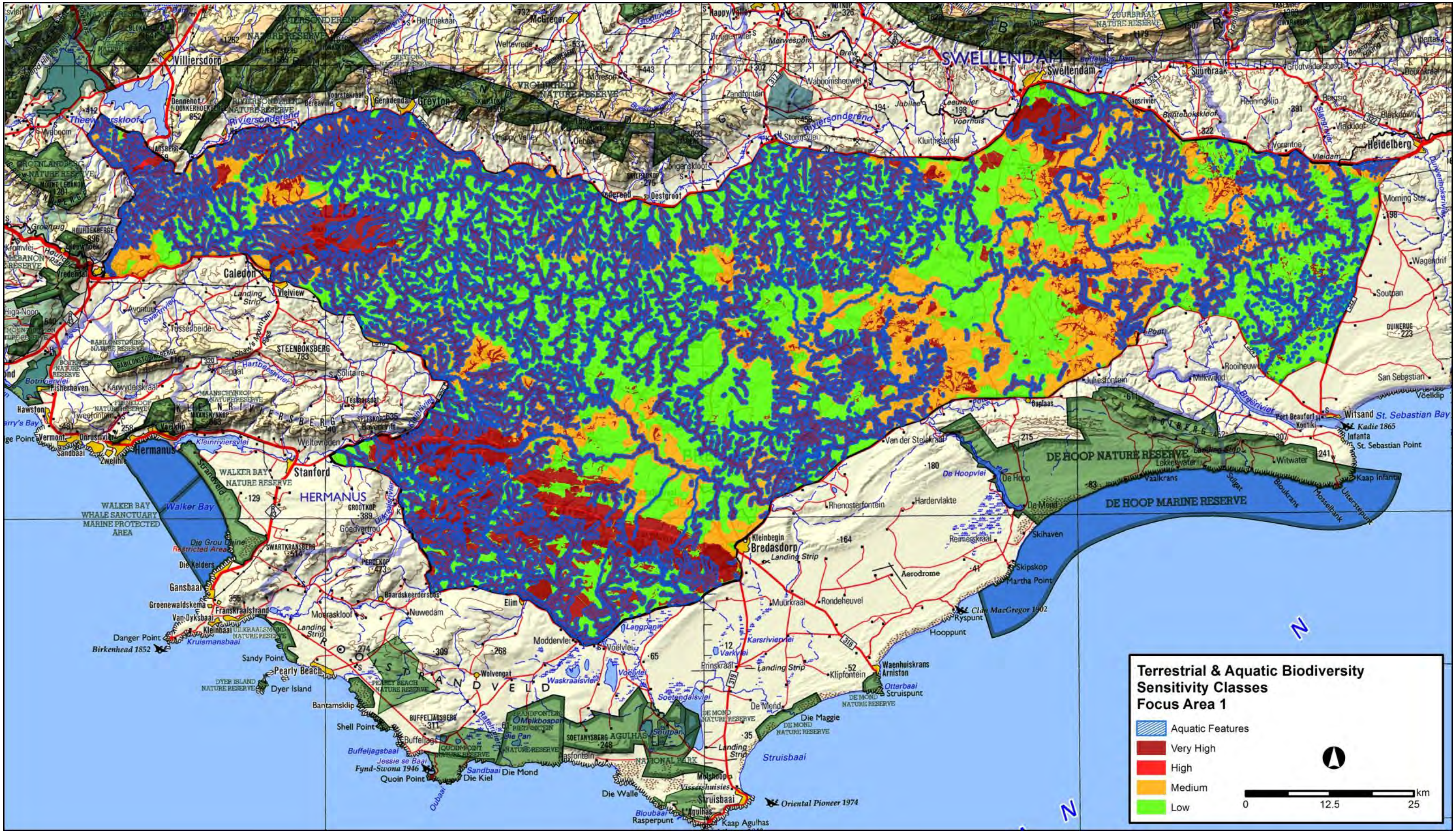
4.3.2 Sensitivity Maps

To convert the overall sensitivity scores to four tier comparative sensitivity maps, cut-offs for sensitivity ratings between the sensitivity tiers were established base on expert knowledge. 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 with their relevant buffers) all have overall sensitivity scores of 10 or higher. Areas with no natural habitat remaining are considered Low sensitivity and were usually assigned a score of 0, with exceptions where protected areas and certain aquatic feature buffers were assigned a score of 10 regardless of level of transformation. The cut-offs presented in Table 3 were thus used to develop the four tier comparative sensitivity maps (see Map 8 to 16).

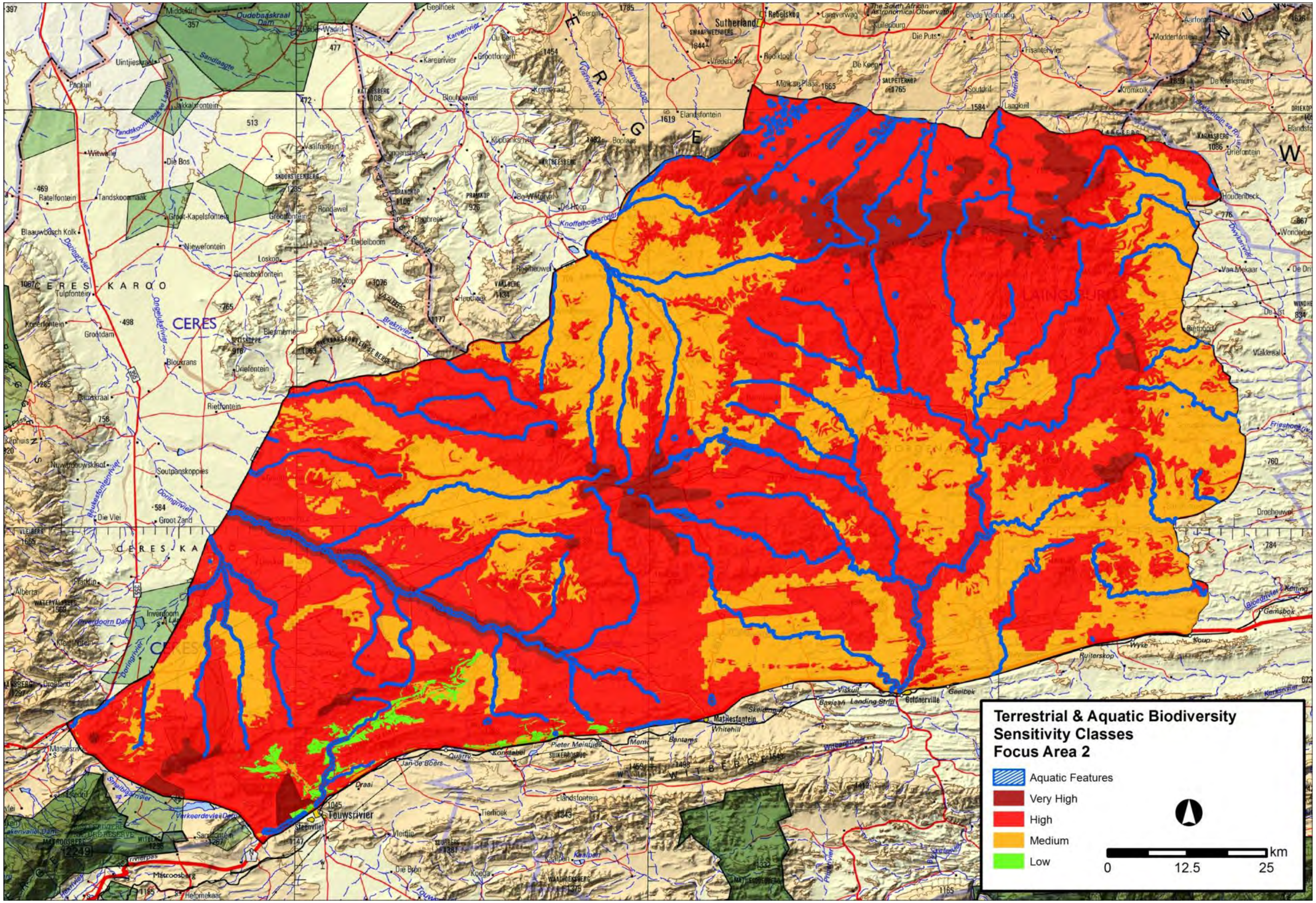
Table 3: Overall sensitivity score cut-offs used to develop 4 tier comparative sensitivity maps

Colour	Sensitivity	Total sensitivity score
	Very high	≥10
	High	6 to 9
	Medium	1 to 5
	Low	0

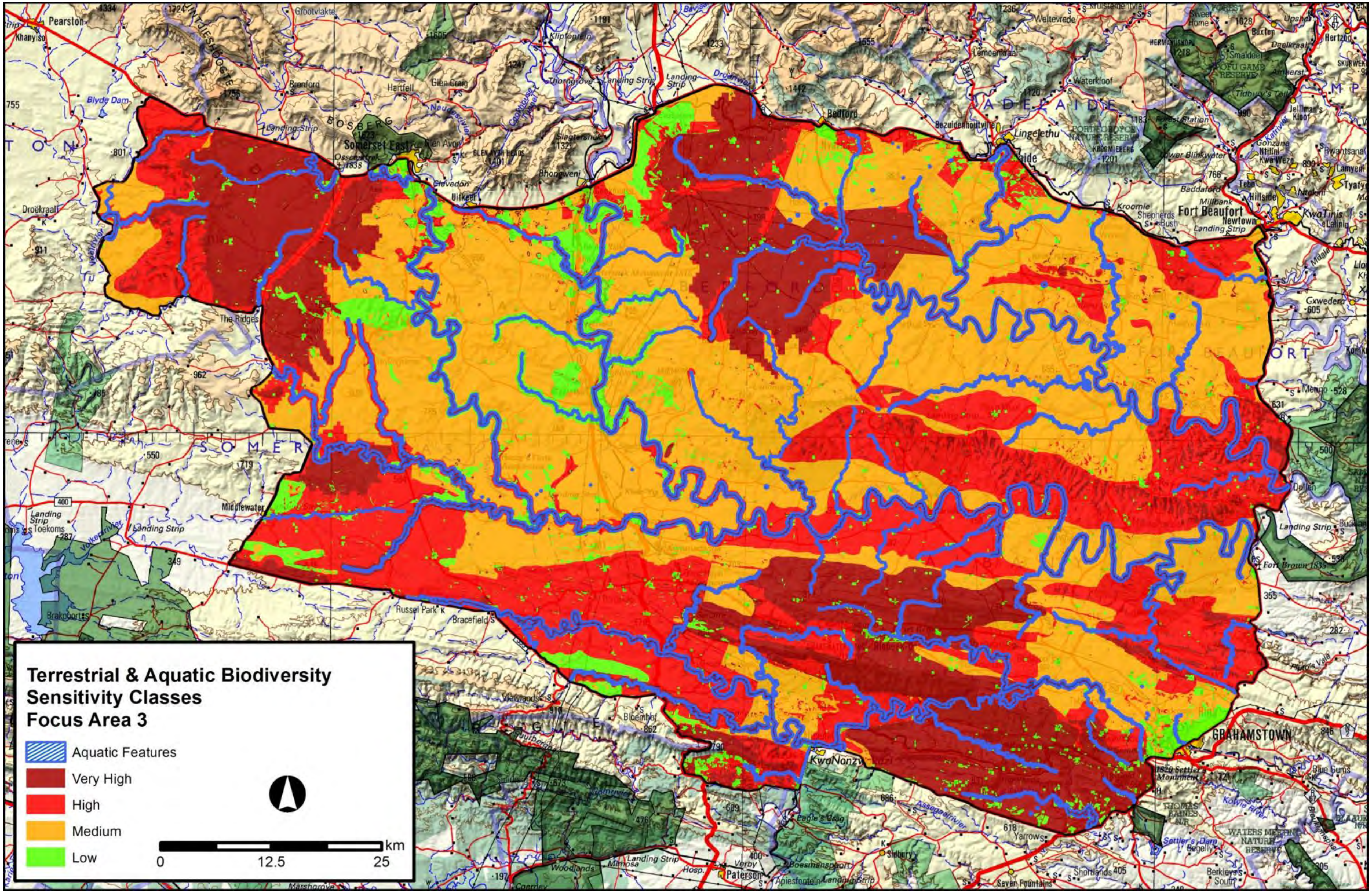




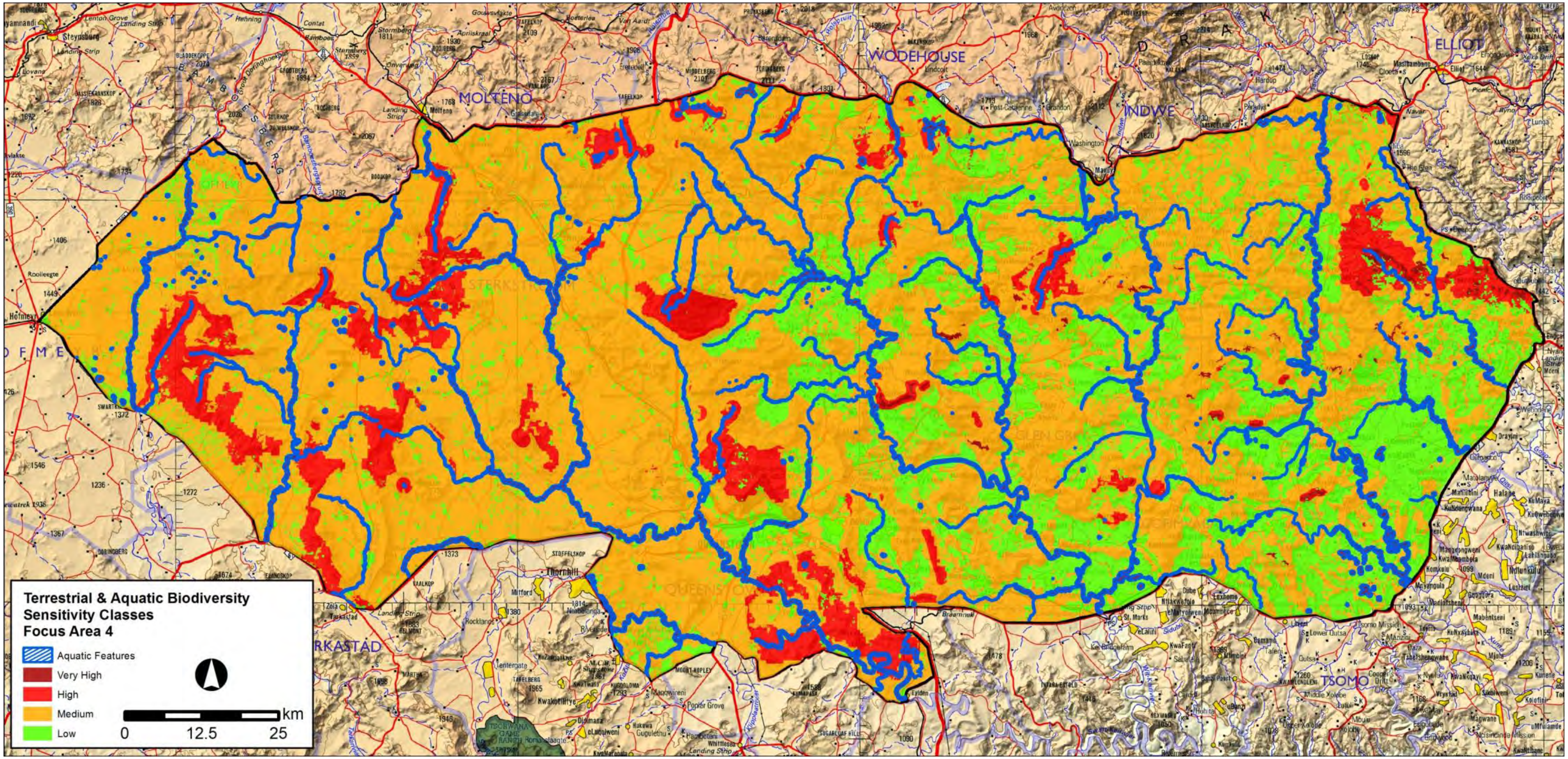
Map 8: Terrestrial and aquatic biodiversity sensitivity map for wind and solar PV development in the Overberg focus area (FA 1)



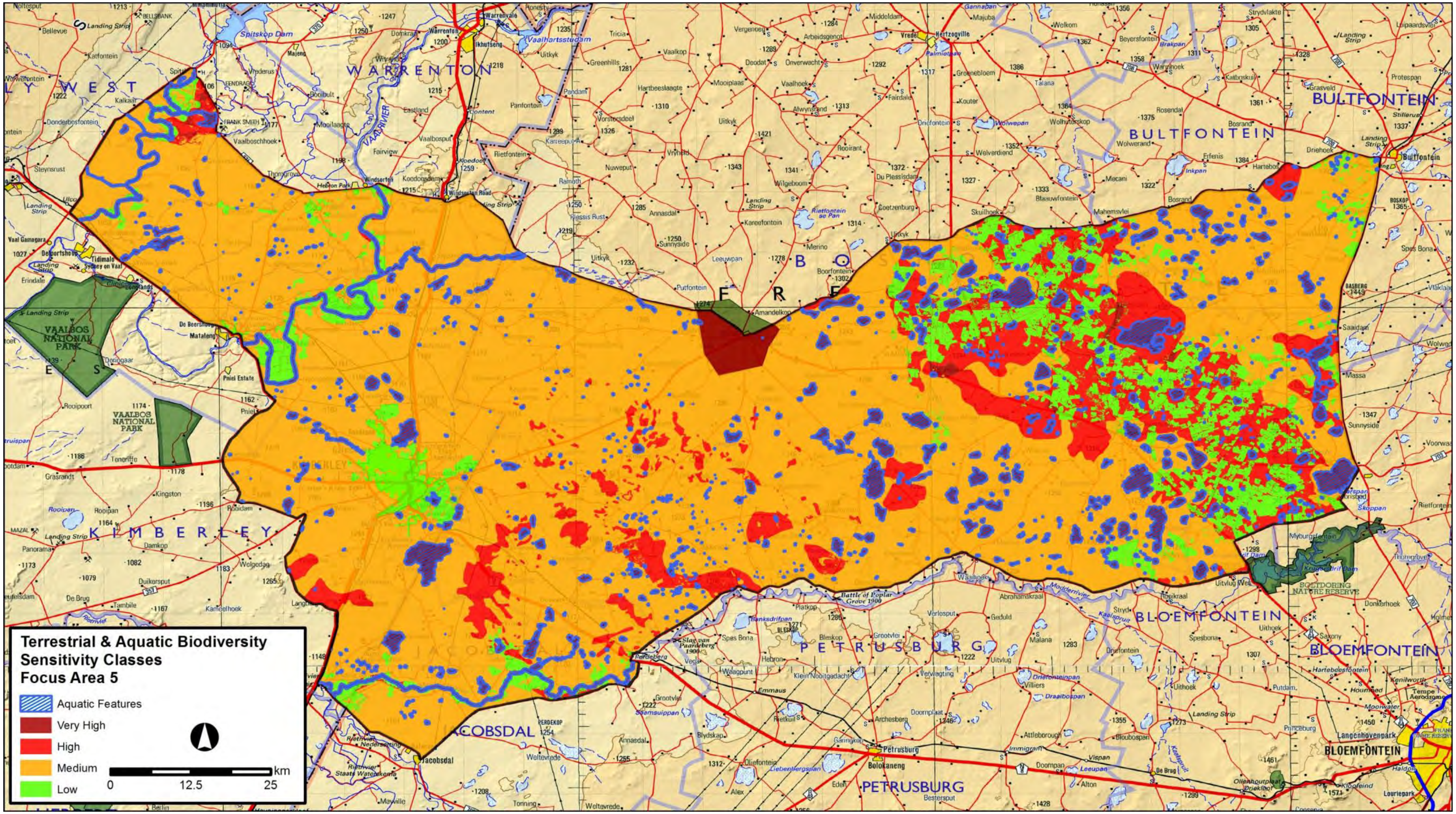
Map 9: Terrestrial and aquatic biodiversity sensitivity map for wind and solar PV development in the Komsberg focus area (FA 2)



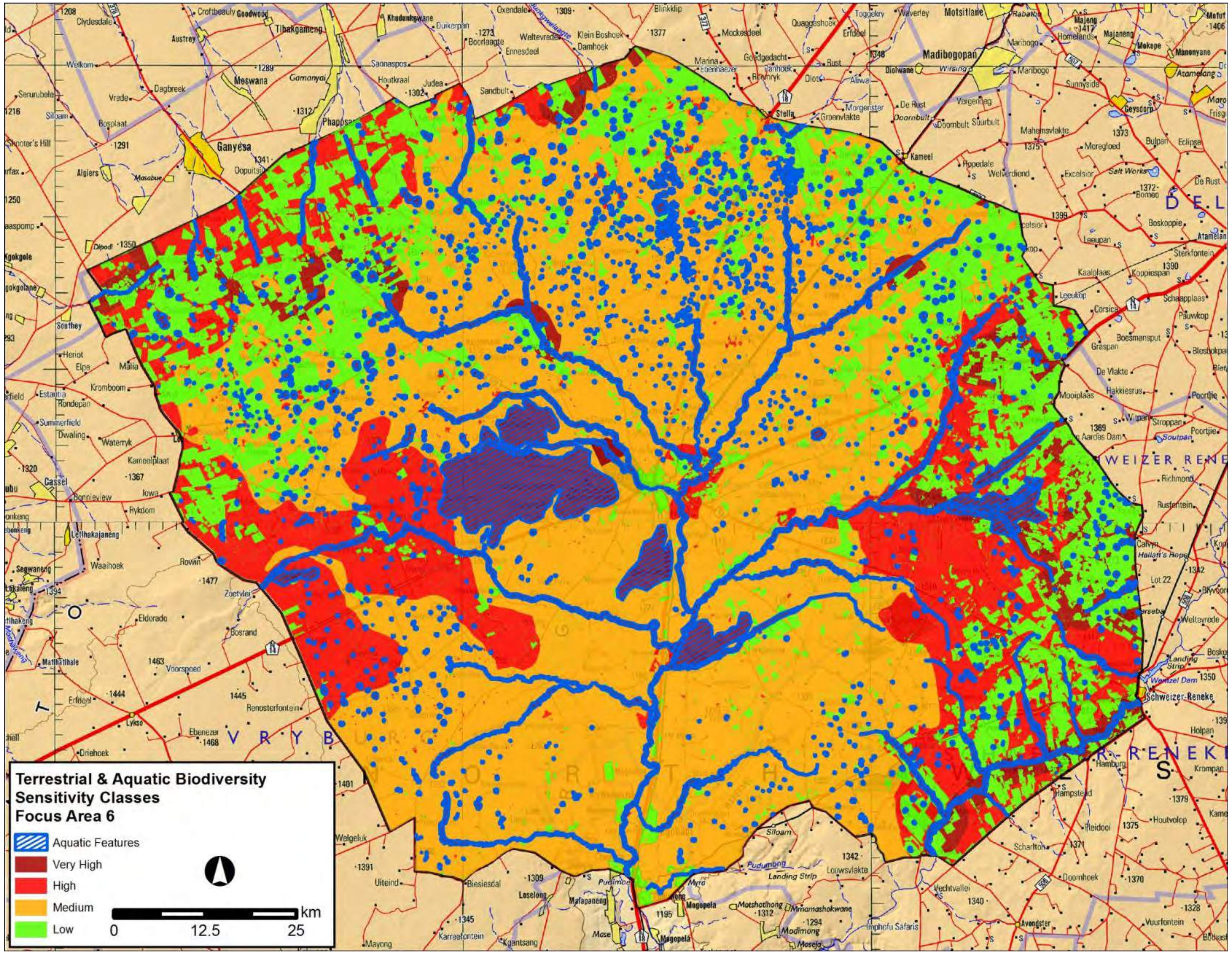
Map 10: Terrestrial and aquatic biodiversity sensitivity map for wind and solar PV development in the Cookhouse focus area (FA 3)



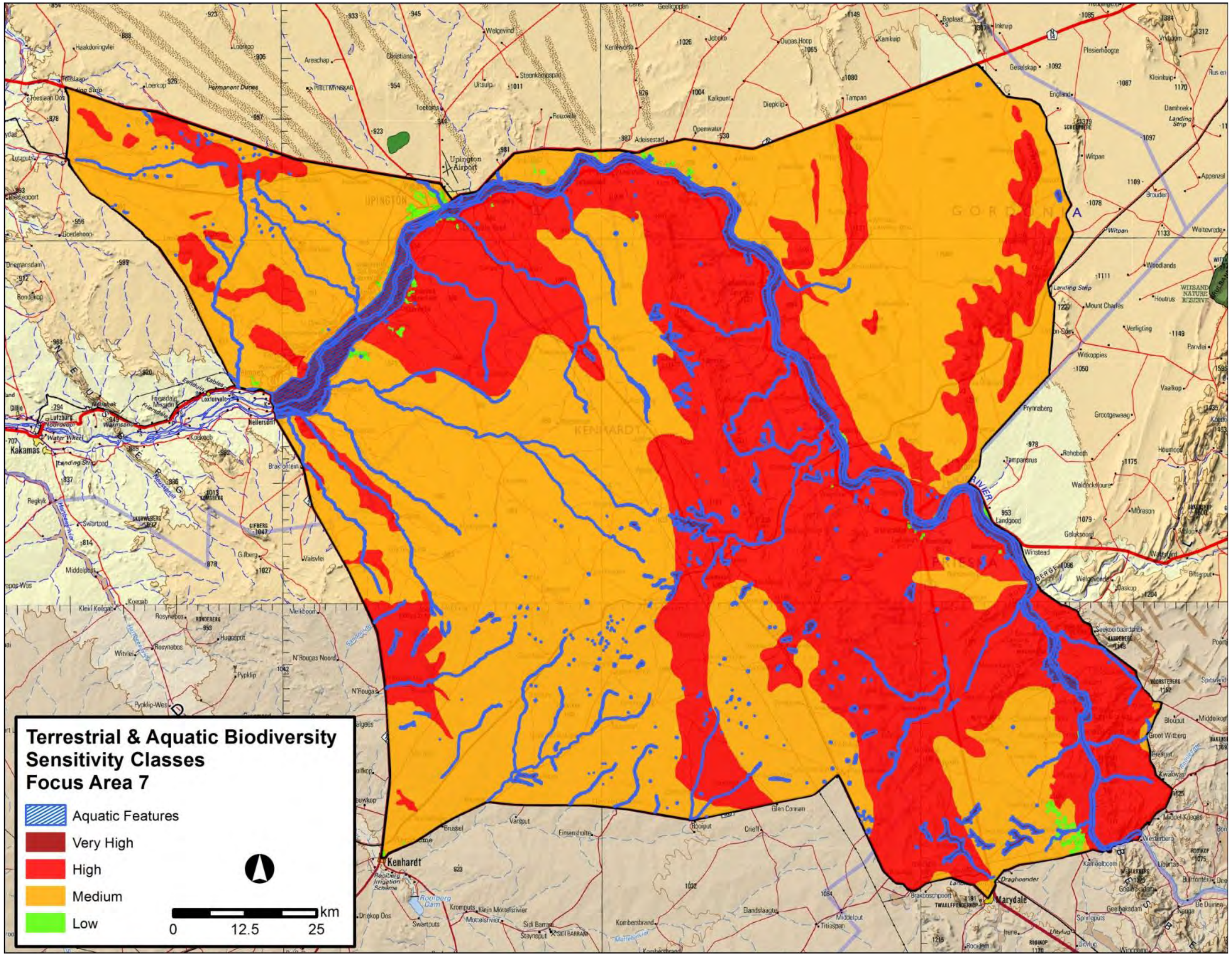
Map 11: Terrestrial and aquatic biodiversity sensitivity map for wind and solar PV development in the Stormberg focus area (FA 4)



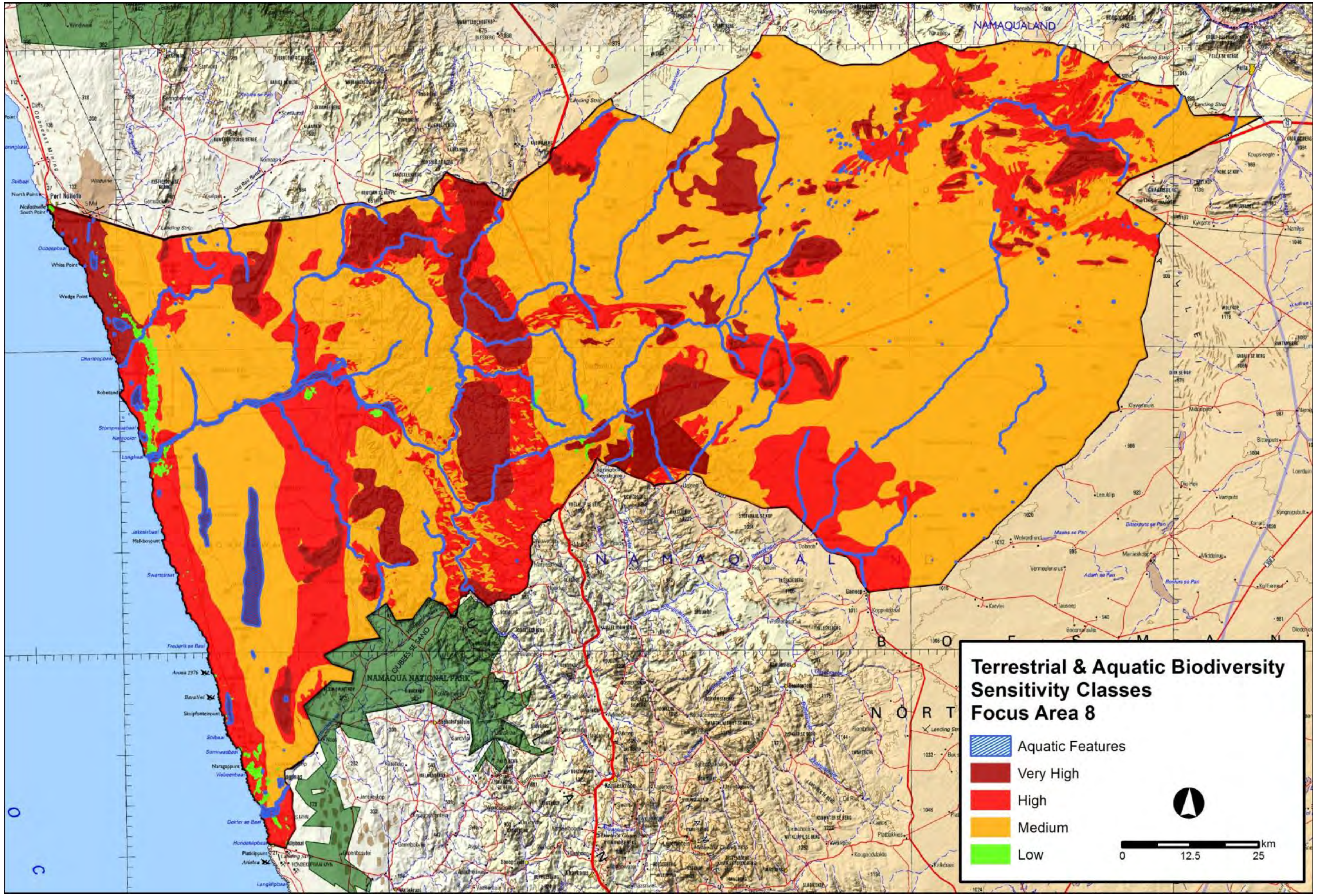
Map 12: Terrestrial and aquatic biodiversity sensitivity map for wind and solar PV development in the Kimberley focus area (FA 5)



Map 13: Terrestrial and aquatic biodiversity sensitivity map for wind and solar PV development in the Vryburg focus area (FA 6)



Map 14: Terrestrial and aquatic biodiversity sensitivity map for wind and solar PV development in the Upington focus area (FA 7)



Map 15: Terrestrial and aquatic biodiversity sensitivity map for wind and solar PV development in the Springbok focus area (FA 8)

4.4 Development Protocols

4.4.1 Terrestrial and Aquatic Biodiversity Specialist Study Requirements

The requirements for terrestrial and aquatic biodiversity specialist studies within the different tiers of sensitivity 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)[9] and De Villiers et al. (2005)[10]. Subsequent levels are less onerous with the aim of streamlining assessment without compromising on environmental protection. It is also important to note that it is incumbent upon the specialist to recommend a higher or lower level of study where it is justified. These are thus considered the guiding requirements for specialist studies within each tier of sensitivity but do not preclude or limit the possibility that a higher or lower level of detail may be required.

All mapped aquatic features and the buffers applied to them are considered to be Very High sensitivity areas. There may also be aquatic features, particularly wetlands, being present in the FAs that are not currently mapped. Any aquatic features encountered during further assessments are also to be considered Very High sensitivity areas, and a buffer must be applied according to the criteria set out in this study. Considering the limited confidence associated with the available maps of freshwater ecosystems, especially wetlands, all applications for wind or solar PV facilities, 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 competent aquatic specialist. The level of aquatic specialist input to the terrestrial and aquatic specialist study is dependent on whether aquatic features were detected through the desktop verification and whether the layout and proposed wind or solar PV facility will encroach on the relevant buffer areas. Should a proposed facility thus encroach on any aquatic feature or aquatic buffer detected through the verification, a Level 1 terrestrial and aquatic specialist assessment as described below would be triggered and a high level of involvement by a competent aquatic specialist would be required throughout the assessment. However, should aquatic features not be detected, or detected but avoided by the facility layout, then further assessment in terms of aquatic biodiversity may be avoided and no further inputs beyond the verification process required from a competent aquatic specialist.

[9] Brownlie, S. 2005. Guideline for involving biodiversity specialists in EIA processes: Edition 1. CSIR Report No ENV-S-C 2005 053 C. Republic of South Africa, Provincial Government of the Western Cape, Department of Environmental Affairs & Development Planning, Cape Town.

[10] De Villiers, C.C. Driver, A. Clark. B. Euston-Brown, D.I.W. Day, E.G. Job, N. Helme, N.A. Holmes, P.M. Brownlie, S. and Rebelo, A.B. 2005. Fynbos Forum Ecosystem Guidelines for Environmental Assessment in the Western Cape. Fynbos Forum and Botanical Society of South Africa, Kirstenbosch.

Level 1 Specialist Study

This highest level of assessment is reserved for any development where the project footprint exceeds1 ha within Very High Sensitivity Areas or 5 ha within High Sensitivity Areas, calculated on a cumulative basis as per the current National Environmental Management: Biodiversity Act (NEMBA) regulations. 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 requirements, site visits with detailed field assessment and associated sensitivity mapping are required.

Such a study must be undertaken by a competent terrestrial ecologist and, where the proposed footprint encroaches into the buffers of aquatic features, the extensive inputs of a competent aquatic specialist. In the case where the proposed footprint does encroach into an aquatic feature or its associated buffer as determined by this study, a water use authorisation will be required for which the aquatic specialist must provide the information specified in Table 4. Where the proposed footprint does not encroach on verified aquatic features or their associated buffers, only a map of verified aquatic features with appropriate buffers and a statement prepared by a competent aquatic specialist confirming no encroachment, is required as an input to the Level 1 study. The verification of aquatic features can be undertaken either at a desktop or on-the-ground level. The level of verification (i.e. desktop or on-the-ground) is up to the discretion of the aquatic specialist and may depend on the overall sensitivity of the area, existing knowledge that the aquatic specialist has of that area, as well as the quality of available data and aerial imagery.

<u>Guidelines for a Level 1 terrestrial and aquatic biodiversity specialist study:</u>

1. Details and relevant expertise of the **specialist/s** undertaking the assessment.
2. A general **overview of the affected area** in terms of connectivity, corridors, and ecological processes and viability of the affected area.
3. In terms of **biodiversity pattern**, identify or describe:
   a. Community and ecosystem patterns:
      - The main vegetation types, their spatial extent and interaction with neighbouring types, soils or topography;
      - Critical Biodiversity Areas, Ecological Support Areas, NFEPA Priority Catchments or NPAES Focus Areas within the site;
      - The types of plant communities or fine-scale habitats that occur within and in the vicinity of the site. This level of detail is not usually available and must be derived and mapped by the specialist in the field. It is not adequate to reproduce the existing national vegetation map, CBA maps or similar broad-scale products;
      - Threatened or vulnerable ecosystems, including Listed Ecosystems as well as locally important habitat types which may occur below the vegetation type level; and
      - The types of faunal communities known to be present and any areas or habitats which may be particularly important for fauna.
   b. Species patterns:
      - Red Data Book (RDB) species of fauna and flora and their potential distribution within the site;
      - The viability of and estimated population size of the RDB species that are present; and
      - The likelihood of other RDB species, or species of conservation concern, occurring in the vicinity.
   c. Other biodiversity pattern issues:
      - Any significant landscape features or rare or important vegetation/faunal associations such as seasonal wetlands, alluvium, seeps, quartz patches or salt marshes in the vicinity;
      - 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; and
      - The condition of the site in terms of current or previous land uses.
4. 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; and
   d. The condition and functioning of rivers and wetlands (if present) in terms of possible changes to the channel, flow regime (surface and groundwater) and naturally-occurring riparian vegetation.
5. Whether the site or neighbouring properties could 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?
6. 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 is fenced, then this will significantly impact the ability of the development to implement measures to mitigate a decline in landscape connectivity for fauna.

7. What is the significance of the **potential impact** of the proposed project, layout 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.
8. If it is likely that the development will have significant impacts 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.
9. Generate, based on the detailed plant community or habitat map, a **sensitivity map of the site** at the appropriate scale illustrating the sensitive areas in relation to:
    a. The area that would be impacted by the proposed development (i.e. project footprint, including supporting infrastructure, with a 50 m buffered development envelope);
    b. The location of vegetation, habitat and spatial components of ecological processes that should not be developed or otherwise transformed, including verified aquatic features with appropriate buffers; and
    c. 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.
10. 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.
11. 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.
12. Indicate how the proponent has taken biodiversity considerations into account in terms of **changes to the design and 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.
13. 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.
14. All relevant **legislation, permits and standards** that would apply to the development should be identified.
15. A clear and justified **opinion statement** by the specialist recommending whether the project should from a terrestrial and aquatic biodiversity perspective receive approval. If this statement is subject to any conditions these must also be clearly stated.
16. Where required, proposed management objectives and associated mitigation measures for inclusion in the **Environmental Management Programme (EMPr)** must be provided.

In the case of the proposed development requiring a **water use authorisation** due to the footprint encroaching into an aquatic feature or its associated buffers, the aquatic specialist must provide the additional information listed in Table 4 as inputs to a Level 1 terrestrial and aquatic specialist study.

Table 4: List of additional information to be provided by an aquatic specialist for a Level 1 terrestrial and aquatic specialist study and required for a WULA or GA

Present Ecological State	Describe within the context of the immediate catchment and ecosystem, the historic (reference) as well as Present Ecological State (PES) of the affected aquatic features with regards to the following characteristics: • Flow and sediment regimes; • Water quality; • Riparian and In stream Habitat; • Morphology (physical structure); • Vegetation; and • Biota.
Ecological Importance and Sensitivity	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.
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 how this will affect the PES and functionality of the aquatic ecosystem. Focus should be on: • The aquatic ecosystem and its characteristics; • Other water users; and • On the broader public and landscape.
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 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 DWS of incidents – ensure that these measures are appropriate in relation to the impacts, mitigation measures, status of the ecosystem, etc.

Level 2 Specialist Study

This is likely to be the most commonly required level of specialist study where proponents have managed to avoid the project footprint having a direct impact on High and Very High Sensitivity areas and where the footprint is concentrated within areas of medium biodiversity sensitivity not containing any known highly sensitive features.

The purpose of this level of specialist study is to ensure that there are locally sensitive features 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 visits and field assessments are required for producing sensitivity maps, but the requirements would be less onerous than that for a Level 1 Specialist Study.

Such a study must be undertaken by a competent terrestrial ecologist. Since this level of study is only possible if the proposed footprint does not encroach into aquatic features or their associated buffers, only a map of verified aquatic features with appropriate buffers and a statement prepared by a competent aquatic specialist confirming no encroachment is required as an input to the Level 2 study. The verification of aquatic features can be undertaken either at a desktop or on-the-ground level. The level of verification (i.e. desktop or on-the-ground verification) is up to the discretion of the aquatic specialist and may depend on the overall sensitivity of the area, existing knowledge that the aquatic specialist has of that area, as well as the quality of available data and aerial imagery.

Guidelines for a Level 2 terrestrial and aquatic biodiversity specialist study:

1. Details and relevant expertise of the **specialist/s** undertaking the assessment.
2. In terms of biodiversity **pattern and process**, identify or describe, based on a desktop-level study:
   a. The main vegetation types, their spatial 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 potentially present and any faunal species, areas or habitats present which may be particularly important for fauna; and
   e. Listed and threatened fauna and flora known from the area according to the available spatial databases such as the SANBI SIBIS11 database and the ADU's Virtual Museum[12].
3. 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 (i.e. project footprint, including supporting infrastructure, with a 50 m buffered development envelope); and
      - The location of vegetation, habitat and spatial components of ecological processes that should not be developed or otherwise transformed, including verified aquatic features with appropriate buffers.
   b. Identify or describe:
      - Any significant landscape features or rare or important vegetation/faunal associations such as seasonal wetlands, alluvium, seeps, quartz patches or salt marshes within or near the development footprint; and
      - The observed or likely presence of flora and fauna of conservation concern in or near the development footprint.
4. 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.
5. 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.
6. Indicate how the proponent has taken biodiversity considerations into account in terms of **changes to the design and 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.
7. 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.
8. All relevant **legislation, permits and standards** that would apply to the development should be identified.
9. A clear and justified **opinion statement** by the specialist recommending whether the project should from a terrestrial and

[11] http://sibis.sanbi.org
[12] http://*vmus.adu.org.za*

aquatic biodiversity perspective receive approval. If this statement is subject to any conditions these must also be clearly stated.

10. Where required, proposed management objectives and associated mitigation measures for inclusion in the **Environmental Management Programme (EMPr)** must be provided.

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 footprints within low sensitivity 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.

A statement letter from a competent terrestrial biodiversity specialist addressing the issues raised below should be sufficient to obtain authorisation. Since this level of study is only possible if the proposed footprint does not encroach into aquatic features or their associated buffers, only a map of verified aquatic features with appropriate buffers and a statement prepared by a competent aquatic specialist confirming no encroachment is required. The verification of aquatic features can be undertaken either at a desktop or on-the-ground level. The level of verification (i.e. desktop or on-the-ground verification) is up to the discretion of the aquatic specialist and may depend on the overall sensitivity of the area, existing knowledge that the aquatic specialist has of that area, as well as the quality of available data and aerial imagery.

<u>Guideline for a Level 3 terrestrial and aquatic biodiversity specialist statement:</u>

1. Details and relevant expertise of the **specialist/s** undertaking the assessment.
2. Generate a **sensitivity map** of the site at the appropriate scale illustrating the transformation status of the vegetation within the affected area by mapping:
   a. The area that would be impacted by the proposed development (i.e. project footprint, including supporting infrastructure, with a 50 m buffered development envelope); and
   b. The location of remaining sensitive vegetation and verified aquatic features with appropriate buffers set out in this study.
3. Where there is doubt as to the status of the vegetation, (for example CBA or land cover maps may indicate that certain transformed areas are intact), **photographs** or other supporting evidence can be included.
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. A clear and justified **opinion statement** by the specialist recommending whether the project should from a terrestrial and aquatic biodiversity perspective receive approval. If this statement is subject to any conditions these must also be clearly stated.
7. Where applicable, proposed management objectives and associated mitigation measures for inclusion in the **Environmental Management Programme (EMPr)** must be provided.

4.4.2 Approvals

In Table 5 below the current requirements for terrestrial and aquatic assessment for wind or solar PV developments are described.

In Table 6 the new terrestrial and aquatic biodiversity assessment requirements for wind and solar PV projects that will apply inside the FAs, once they have been adopted as REDZs, are described. These requirements are specific to sensitivity classes and are therefore related to the sensitivity maps in Section 4.3.

Table 5: Interpretation of terrestrial and aquatic biodiversity sensitivity and current assessment requirements

Assumed Sensitivity	Interpretation of the sensitivity	Current wind and solar PV assessment requirements	Current water use authorisation requirements
Any area is considered as potentially being of very high sensitivity.	In the absence of any pre-assessment it is assumed that any area is potentially highly sensitive to development from both a terrestrial and aquatic biodiversity perspective.	Proponents intending to develop a wind of solar PV facility that triggers an environmental impact assessment process must prove to the relevant competent authority that the proposed development will not have an unacceptable negative impact on terrestrial and aquatic biodiversity. In order to do so an assessment analogous to a Level 1 specialist study is required. With the potential for the proposed project footprint to encroach within 500 m of any aquatic feature, extensive input from a competent aquatic specialist is required. The study must be submitted to the relevant water authority for comment. Such comment, if provided within stipulated timeframes, will be considered by the relevant competent authority for decision making.	In terms of <u>non-consumptive water uses</u>, and since General Authorisation (GA) under GN 1199 does not apply to any activities occurring within 500 m of an aquatic feature, any footprint within 500 m of an aquatic feature triggers a full Water Use Licence Application (WULA). Some catchments are also excluded from specified non-consumptive water uses (see Map 6). Although a GA is in principle not available in certain catchments or within 500 m of an aquatic feature, a GA instead of a WULA process is considered by DWS on an *ad-hoc* basis if motivated for by a competent aquatic specialist. In terms of <u>consumptive water uses</u>, projects proposed in catchments not excluded or with lower specified limits under GN 399 (see Map 3 – 5), may abstract up to 50 m^3/day of surface water, or up to 10 m^3/day of groundwater, or have a combined water storage of up to 10 000 m^3 per property, without requiring any water use registration or authorisation. Through the GA process, and in catchments not excluded or with lower specified limits (see Map 3 – 5), projects can furthermore obtain authorisation and registration for surface water abstraction up to 15 litres per second and not exceeding 150 000 m^3 per annum, abstraction of groundwater below specified limits, and have storage of up to 50 000 m^3 of water. The consumptive GA does not apply to water abstraction from any wetlands. Any consumptive water uses not meeting the specified GA requirements are subject to a detailed WULA process. Projects proposed in compulsory licensing catchments (see Map 7) and requiring authorisation for any amount of water abstraction, water storage, and/or stream flow reduction, triggers a full WULA process. In these catchments priority must be given to such applications since power generation has been identified as a water use of strategic importance. A consumptive WULA can only be processed if the relevant (i.e. surface or groundwater) reserve determination has been undertaken for the catchment (see Maps 1 and 2).

Table 6: Interpretation of terrestrial and aquatic biodiversity sensitivity maps and associated new assessment requirements inside the REDZs

<table>
<tr><th>Colour</th><th>Sensitivity</th><th>Interpretation of the sensitivity</th><th>Further wind and solar PV assessment requirements</th><th>New water use authorisation requirements</th></tr>
<tr><td>Dark red</td><td>Very High</td><td>Very high sensitivity areas are potentially unsuited for development owing to their high ecological importance. The features identified to make these areas highly sensitive must be thoroughly assessed and effective mitigation or offsets developed before development can be considered in these areas.</td><td rowspan="2">Proponents intending to develop a wind or solar PV facility triggering an environmental impact assessment process with a footprint exceeding 1 ha within very high sensitivity areas, and 5 ha within high sensitivity areas inside an adopted REDZ must prove to the relevant competent authority that the proposed development will not have an unacceptable negative impact on terrestrial and aquatic biodiversity. In order to do so, a Level 1 specialist study is required. In order to meet the requirements, site visits with detailed field assessment and associated sensitivity mapping are required.

Such a study must be undertaken by a competent terrestrial ecologist and, where the proposed footprint encroaches into the buffers of aquatic features, the extensive inputs of a competent aquatic specialist. In the case where the proposed footprint does encroach into an aquatic feature or its associated buffer as determined by this study, a non-consumptive water use authorisation will be required and the aquatic specialist must provide the relevant information as inputs to the Level 1 terrestrial and aquatic biodiversity specialist study. The study must be submitted to the relevant water authority for comment. Such comment, if provided within stipulated timeframes, will be considered by the relevant competent authority for decision making.

Where the proposed footprint does not encroach on verified aquatic features or their associated buffers, only a map of verified aquatic features with appropriate buffers and a statement prepared by a competent aquatic specialist confirming no encroachment is required as an input to the level 1 study. The verification of aquatic features can be undertaken either at a desktop or on-the-ground level. The level of verification (i.e. desktop or on-the-ground) is up to the discretion of the aquatic specialist and may depend on the overall sensitivity of the area, existing knowledge that the aquatic specialist has of that area, as well as the quality of available data and aerial imagery. The verification must be submitted to the relevant water authority for comment. Such comment, if provided within stipulated timeframes, will be considered by the relevant competent authority for decision making.</td><td rowspan="4">In terms of <u>non-consumptive water uses</u> any wind or solar PV development proposed inside an adopted REDZ, and for which the project footprint (including supporting infrastructure) encroaches into verified aquatic features or their associated buffers, will require a General Authorisation (GA) in accordance with GN 1199. The information required for such an application will be provided by a competent aquatic specialist as part of a Level 1 terrestrial and aquatic specialist study.

Any wind and solar PV project proposed inside an adopted REDZs and for which the project footprint (including supporting infrastructure) does not encroach into any verified aquatic features with their associated buffers, will not require a non-consumptive water use authorisation or registration.

In terms of <u>consumptive water uses</u>, projects proposed in catchments not excluded or with lower specified limits under GN 399 (see Map 3 – 5), may abstract up to 50 m^3/day of surface water, or up to 10 m^3/day of groundwater, or have a combined water storage of up to 10 000 m^3 per property, without requiring any water use registration or authorisation. Through the GA process, and in catchments not excluded or with lower specified limits (see Map 3 – 5), projects can furthermore obtain authorisation and registration for surface water abstraction up to 15 litres per second and not exceeding 150 000 m^3 per annum, abstraction of groundwater below specified limits, and have storage of up to 50 000 m^3 of water. The consumptive GA does not apply to water abstraction from any wetlands. Any consumptive water uses not meeting the specified GA requirements are subject to a detailed WULA process.

Projects proposed in compulsory licensing catchments (see Map 7) and requiring authorisation for any amount of water abstraction, water storage, and/or stream flow reduction, triggers a full WULA process. In these catchments priority must be given to such applications since power generation has been identified as a water use of strategic importance.

A consumptive WULA can only be processed if the relevant (i.e. surface or groundwater) reserve determination has been undertaken for the catchment (see Maps 1 and 2).</td></tr>
<tr><td>Red</td><td>High</td><td>High sensitivity areas are likely to contain some sensitive ecological features or processes that need to be addressed before development can be considered.</td></tr>
<tr><td>Orange</td><td>Medium</td><td>Medium sensitivity areas are likely to contain natural vegetation without any known highly sensitive features. Sensitivities need to be assessed before development can be considered.</td><td>Proponents intending to develop a wind or solar PV facility triggering an environmental impact assessment process within medium sensitivity areas inside an adopted REDZ must prove to the relevant competent authority that there are no significantly sensitive features that will be impacted upon 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 to an unacceptable level by the development. In order to do so a Level 2 specialist study is required. Targeted site visit and field assessment are required for producing sensitivity maps, but the requirements are less onerous than that for a Level 1 Specialist Study.

Since this level of study is only possible if the proposed footprint does not encroach into aquatic features or their associated buffers as set out in this study, only a map of verified aquatic features with appropriate buffers and a statement prepared by a competent aquatic specialist confirming no encroachment is required as an input to the Level 2 specialist study. The verification of aquatic features can be undertaken either at a desktop or on-the-ground level. The level of verification (i.e. desktop or on-the-ground) is up to the discretion of the aquatic specialist and may depend on the overall sensitivity of the area, existing knowledge that the aquatic specialist has of that area, as well as the quality of available data and aerial imagery. The verification must be submitted to the relevant water authority for comment. Such comment, if provided within stipulated timeframes, will be considered by the relevant competent authority for decision making.</td></tr>
<tr><td>Green</td><td>Low</td><td>Low sensitivity areas are likely to be transformed with the risk of significant ecological impact being very low. The absence of sensitivities must be confirmed before development can be considered.</td><td>Proponents intending to develop a wind or solar PV facility triggering an environmental impact assessment process within low sensitivity areas inside an adopted REDZ must demonstrate or verify the low sensitivity of the affected area to the relevant competent authority. In order to do so a Level 3 specialist statement is required. Such a statement may be based on a desktop review of the available information, and a site visit being optional and at the discretion of the specialist.

Since this level of study is only possible if the proposed footprint does not encroach into aquatic features or their associated buffers, only a map of verified aquatic features with appropriate buffers and a statement prepared by a competent aquatic specialist confirming no encroachment is required as an input to the Level 3 statement. The verification of aquatic features can be undertaken either at a desktop or on-the-ground level. The level of verification (i.e. desktop or on-the-ground) is up to the discretion of the aquatic specialist and may depend on the overall sensitivity of the area, existing knowledge that the aquatic specialist has of that area, as well as the quality of available data and aerial imagery. The verification must be submitted to the relevant water authority for comment. Such comment, if provided within stipulated timeframes, will be considered by the relevant competent authority for decision making.</td></tr>
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SECTION 5

BIRDS

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PART 3. SCOPING ASSESSMENTS AND DEVELOPMENT PROTOCOLS

SECTION 5: BIRDS

The following section is informed by the scoping level specialist bird pre-assessment of the eight focus areas (FAs) for which the complete report is provided as Appendix A5. Due to the integrated and strategic nature of this Strategic Environmental Assessment (SEA), and based on consultation with relevant government departments and wider stakeholders, the final interpretation of sensitivities and development protocols presented in this section differ from those contained and recommended in the specialist report.

5.1 Renewable Energy and Birds

5.1.1 Wind Energy

Wind farming offers a renewable means to generate electricity but must be practiced responsibly in order to achieve environmental sustainability. 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:

- Disturbance of resident birds by the construction of the wind farm and the appearance and sound of the operating plant. This could result in the displacement of populations and depress feeding rates as well as breeding success at local nests;
- Habitat loss due 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
- 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.

While the nature and severity of wind farm impacts can be highly site and taxon-specific, they are simultaneously very difficult to predict. Poorly sited wind farms, or even just one or two badly-placed turbines, can have significant detrimental impacts on birds at a population level. These impacts can also threaten the regional, national or global conservation status of particularly impact susceptible species. 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 into construction.

Multiple factors influence the number of birds killed in collisions at wind energy facilities. These can be classified into three broad categories:

- Avian variables;
- Location variables; and
- Facility-related variables.

Although only one study[1] has so far shown a direct relationship between the abundance of birds in an area and the number of collisions, 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. Species-specific variations in behaviour, from general levels of activity to particular foraging or commuting strategies, also affect susceptibility to collision. There may also be seasonal and temporal differences in behaviour, for example breeding males engaging in aerial displays may be particularly at risk.

Collision-prone birds can generally be described as:

- Large species and species with high ratios of body weight to wing surface area (wing loading), which confers low manoeuvrability (e.g. cranes, bustards, vultures);
- Species which fly at high speeds (e.g. raptors, gamebirds, waterfowl, and aerial insectivores);
- Species which are distracted in flight, like predators or species with aerial displays (e.g. many raptors, aerial insectivores and some open country passerines);
- Species which habitually fly in low light conditions; and
- Species with narrow fields of forward binocular vision.

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. Exposure is greatest for:

- Species that are particularly aerial;
- Species inclined to make regular and long distance movements (e.g. migrants as well as any species with widely separated resource areas for food, water, roost and nest sites); and
- Species that regularly fly in flocks which increases the chances of incurring multiple fatalities in a single collision incident.

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[1] Everaert, J. 2003. Wind turbines and birds in Flanders: Preliminary study results and recommendations. *Natuur. Oriolus* 69: 145-155.

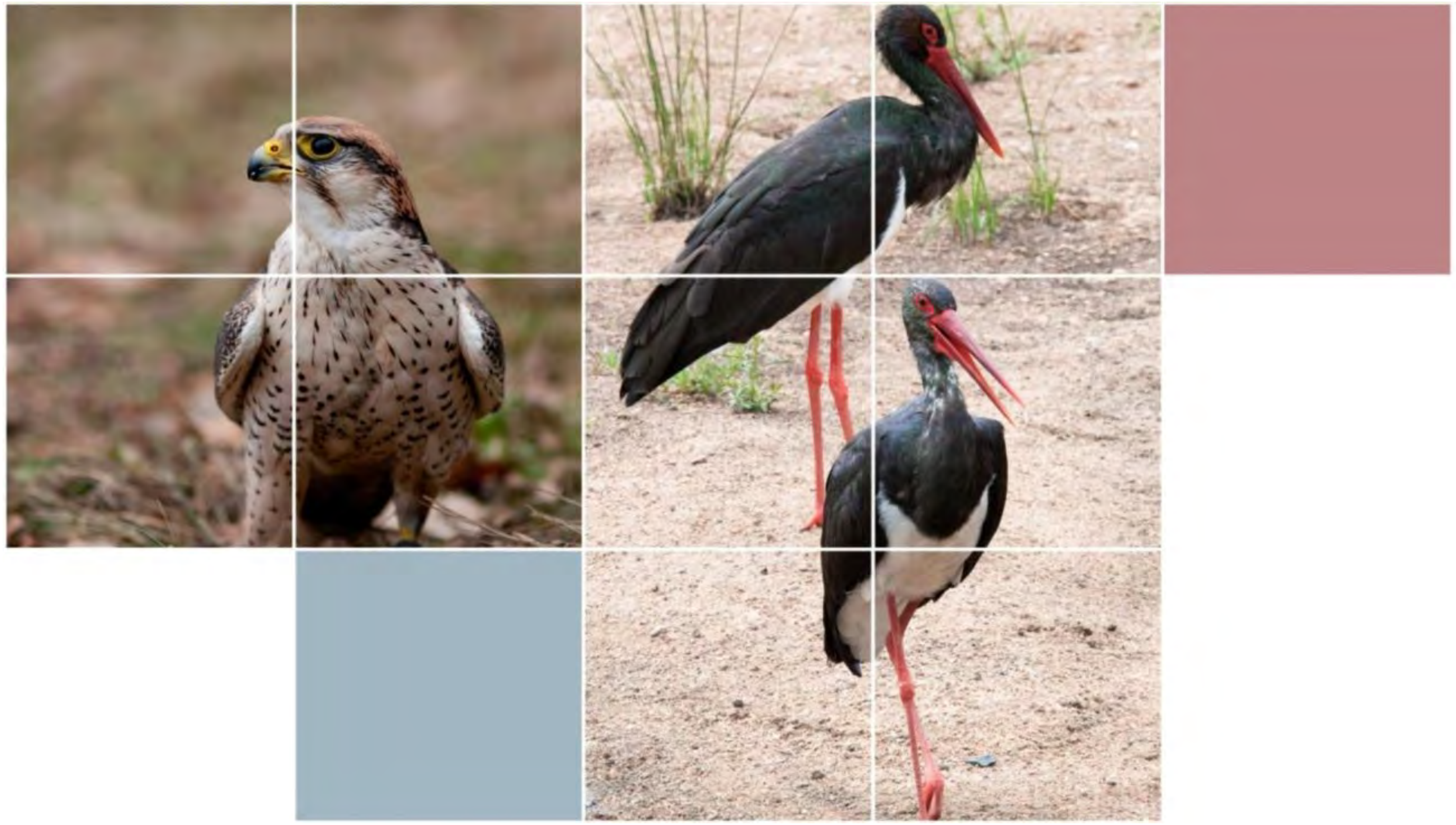
Soaring species may be particularly prone to colliding with wind turbines where they are placed along ridges to exploit the same updrafts favoured by such birds (e.g. vultures, storks, cranes and most raptors) for cross-country flying. Large soaring birds (e.g. many raptors and storks) depend heavily on external sources of energy for sustainable flight. 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 or differentially heated air (i.e. thermal soaring), or in the form of wind forced up over rises in the landscape and creating waves of rising turbulence (i.e. slope soaring). Certain species are morphologically specialised 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 include Cape Vulture *Gyps coprotheres*, Verreaux's Eagle *Aquila verreauxii*, Jackal Buzzard *Buteo rufofuscus*, Peregrine Falcon *Falco peregrinus*, Lanner Falcon *Falco biarmicus*, 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.

5.1.2 Solar PV Energy

The environmental impacts of solar photovoltaic (PV) developments globally have not been well-researched and the impacts of these plants on birds are poorly understood. Solar PV facilities cover large areas and in many cases require the complete removal of vegetation from the inclusive footprint of the installed plant. It is this tendency to destroy, degrade, fragment or otherwise displace birds from large areas of natural habitat that cause most concern with regard to avifauna impact from large-scale solar PV development, particularly in relation to species with restricted ranges and very specific habitat requirements. Other speculative impacts of solar PV farms which have not been well-researched include collision mortality impacts associated with collision trauma with the PV panels, noise and disturbance generated by construction and maintenance, attraction of novel species, and chemical pollution associated with certain products that can be used to keep the PV panels clean.

5.1.3 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. Overhead power lines also pose a collision and possibly an electrocution threat to certain species. 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 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. Power line collision risk affects a particular suite of susceptible species, mainly comprising large, heavy birds (e.g. bustards, cranes and large raptors), and smaller, fast-flying birds (e.g. gamebirds, waterfowl and small raptors). Electrocution risk is strongly influenced by the voltage and design of the power lines erected (generally occurring on lower voltage infrastructure where gaps between lines are relatively small), and mainly affects larger, perching species (e.g. vultures, eagles and storks) easily capable of spanning the spaces between energised components.



5.2 Sensitivity Mapping

5.2.1 Data Sources

Based predominantly on desk-top integration and interpretation of existing data, with dedicated on-site information only collected for the Springbok focus area (FA 8), avian impact sensitivities were mapped within the eight FAs. Sensitivity Maps 1 to 16 were generated based on the interpretation of spatial data as described in Table 1.

Table 1: Spatial data used for bird sensitivity mapping

Relevant Focus Area	Sensitivity Feature	Data Source	Sensitivity Mapping Application	
			Wind	Solar PV
All Focus Areas	**Wetlands with a surface area greater than 2 ha** · Waterbodies above the arbitrary threshold size of 200 m x 100 m (or 2 ha) are considered likely to support a greater diversity and number of waterbirds.	· Updated wetlands map produced as part of the Terrestrial and Aquatic Biodiversity specialist study undertaken as part of this SEA	· **Medium Sensitivity** within 2 km of major wetlands	· **Medium Sensitivity** within 1 km of major wetlands
All Focus Areas	**Protected Areas** · These areas are set aside for biodiversity and nature conservation.	· Department of Environmental Affairs (DEA). South African Protected Areas Database (SAPAD), 2014.	· **Very High Sensitivity** within 2 km of protected area	· **Very High Sensitivity** within 1 km of protected area
All Focus Areas	**Slopes steeper than 75°** · A Digital Elevation Model (DEM) was used to plot the distribution of cliffs (areas with slopes steeper than 75°) across each FA, in order to predict the distributions of threatened, impact-sensitive and cliff-nesting birds. This approach has 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 with wind facilities.	· 5 m DEM from the Department of Geography & Environmental Studies, Stellenbosch University	· **High Sensitivity** within 3 km of ≥ 75° slopes	· **High Sensitivity** within 1 km of ≥ 75° slopes
Overberg Focus Area 1	**Power lines equal to or greater than 132 kV** · Power line infrastructure can possibly be used by nesting Martial Eagles or other raptors.	· Eskom Networks, 2014	· **Medium Sensitivity** within 5 km of power line ≥ 132kV	· **Medium Sensitivity** within 2 km of power line ≥ 132kV
Overberg Focus Area 1	**Threatened Ecosystem Fragments greater than 100 ha** · Remaining threatened ecosystems are considered to be likely Black Harrier nesting areas.	· Remaining Threatened Ecosystems layer prepared by SANBI for this SEA, 2013	· **High Sensitivity** within 2 km of threatened ecosystems	· **High Sensitivity** within 1 km of threatened ecosystems
Overberg Focus Area 1	**Breede River** · Rivers are known avian fly-ways that support waterbirds and riparian communities.	· National Freshwater Ecosystem Priority Areas (NFEPA) Rivers layer, 2011	· **Very High Sensitivity** within 1 km of major rivers	· **Very High Sensitivity** within 500 m of major rivers

Relevant Focus Area	Sensitivity Feature	Data Source	Sensitivity Mapping Application	
			Wind	Solar PV
	Known Cape Vulture colonies[2]	· Kevin Shaw, CapeNature · Endangered Wildlife Trust (EWT) Knowledge Management Database · Birdlife South Africa (BLSA)	· **Very High Sensitivity** within 20 km of Colonies · **High Sensitivity** between 20 and 40 km from Colonies	· **Very High Sensitivity** within 5 km of Colonies
	Known Verreaux's Eagle nests	· L. Rodrigues Unpublished data · A.R. Jenkins Unpublished data	· **Very High Sensitivity** within 3 km of Verreaux's Eagle nests · **High Sensitivity** Between 3 and 5 km from Verreaux's Eagle nests	· **Very High Sensitivity** within 1 km of Verreaux's Eagle nests
	Known Peregrine Falcon nest sites	· A.R. Jenkins Unpublished data	· **Very High Sensitivity** within 1 km of Peregrine Falcon nests · **High Sensitivity** between 1 and 2 km from Peregrine Falcon nests	· **Very High Sensitivity** within 500 m of Peregrine Falcon nests
	Known Martial Eagle nest sites	· O. Curtis Pers. comm.	· **Very High Sensitivity** within 5 km of Martial Eagle nests	· **Very High Sensitivity** within 2 km of Martial Eagle nests
	Known African Fish-Eagle nest sites	· A. Welz, A.R. Jenkins Unpublished data	· **Very High Sensitivity** within 2 km of Fish-Eagle nests	· **Very High Sensitivity** within 1 km of Fish-Eagle nests
	Known Black Harrier nesting areas	· R.E. Simmons, O. Curtis, Unpublished data	· **Very High Sensitivity** within 2 km of Black Harrier nests	· **Very High Sensitivity** within 1 km of Black Harrier nests
	Known Blue Crane nesting areas	· EWT Knowledge Management Database · Kevin Shaw, CapeNature	· **Very High Sensitivity** within 150 m of known Blue Crane nests · **High Sensitivity** between 150 and 300 m from Blue Crane nests	· **Very High Sensitivity** within 150 m of known Blue Crane nests · **High Sensitivity** between 150 and 300 m from Blue Crane nests
	Selected Coordinated Waterbird Counts (CWAC) sites · Selected CWAC sites with high total counts, species diversities, and presence of Red-listed species	· Animal Demography Unit (ADU), University of Cape Town (UCT) ongoing wetland survey project started in 1992	· **Very High Sensitivity** within 2 km of selected CWAC sites	· **Very High Sensitivity** within 1 km of selected CWAC sites
	Past and possible future Lesser Kestrel roost site	· EWT Knowledge Management Database, · BLSA	· **High Sensitivity** within 5 km of possible future Lesser Kestrel roosts	· **High Sensitivity** within 1 km of possible future Lesser Kestrel roosts
	Other important wetlands	· O. Curtis Pers. comm.	· **High Sensitivity** within 2 km of important wetlands	· **High Sensitivity** within 2 km of important wetlands

[2] A vulture tracking study in the former Transkei (in the vicinity of Focus Areas 4) which aims to better inform wind energy sensitivity buffer distances for vultures, and is funded by the Eastern Cape Department of Economic Development, Environmental Affairs and Tourism, is underway at the time of preparing this report. Preliminary results from this tracking study indicate that there is potential for decreasing the conservative buffers used for this study.

Relevant Focus Area	Sensitivity Feature	Data Source	Sensitivity Mapping Application	
			Wind	Solar PV
Komsberg Focus Area 2	**Power lines equal to or greater than 132 kV** · Power line infrastructure can possibly be used by nesting Martial Eagles or other raptors.	· Eskom Networks, 2014	· **Medium Sensitivity** within 5 km of power line ≥ 132kV	· **Medium Sensitivity** within 2 km of power line ≥ 132kV
	Buffelsrivier as an avian fly-way	· NFEPA Rivers layer, 2011	· **Very High Sensitivity** within 1 km of major rivers	· **Very High Sensitivity** within 1 km of major rivers
	Known or predicted Verreaux's Eagle nests	· Lucia Rodrigues Unpublished data, · A.R Jenkins Unpublished data, · Suurplaats Wind Energy Facility (WEF) monitoring data	· **Very High Sensitivity** within 3 km of predicted Verreaux's Eagle nests · **High Sensitivity** between 3 and 5 km from predicted Verreaux's Eagle nests	· **Very High Sensitivity** within 3 km of predicted Verreaux's Eagle nests
	Known Booted Eagle nest sites	· Suurplaats WEF monitoring data	· **Very High Sensitivity** within 1 km of Booted Eagle nests · **High Sensitivity** between 1 and 2 km from Booted Eagle nests	· **Very High Sensitivity** within 500 m of Booted Eagle nests
	Known Peregrine Falcon nest sites	· Suurplaats WEF monitoring data	· **Very High Sensitivity** within 1 km of Peregrine Falcon nests · **High Sensitivity** between 1 and 2 km from Peregrine Falcon nests	· **Very High Sensitivity** within 500 m of Peregrine Falcon nests
	Known Jackal Buzzard nest sites	· Suurplaats WEF monitoring data	· **Very High Sensitivity** within 1 km of Jackal Buzzard nests · **High Sensitivity** between 1 and 2 km from Jackal Buzzard nests	· **Very High Sensitivity** within 500 m of Jackal Buzzard nests
	Known Martial Eagle nest	· Jenkins et al. 2013[3], · Koos de Goede Unpublished data	· **Very High Sensitivity** within 5 km of Martial Eagle nests	· **Very High Sensitivity** within 2 km of Martial Eagle nests
	Known Black Harrier nesting area	· A.R. Jenkins Unpublished data	· **Very High Sensitivity** within 2 km of Black Harrier nesting areas	· **Very High Sensitivity** within 1 km of Black Harrier nesting areas
	Selected Coordinated Waterbird Counts (CWAC) sites · Selected CWAC sites with high total counts, species diversities, and presence of Red-listed species	· ADU, UCT	· **Very High Sensitivity** within 2 km of selected CWAS sites	· **Very High Sensitivity** within 1 km of selected CWAS sites
	Important wetlands located just outside FA	· Identified using the South African Bird Atlas Project 2 (SABAP2) flamingo data	· **High Sensitivity** within 2 km of important wetlands	· **High Sensitivity** within 1 km of important wetlands
	Area of high topographic relief · Areas of high topographic relief are considered likely to be used extensively by slope soaring birds, including threatened and sensitive raptors and storks. Such areas include the Roggeveld escarpment and ridges to the south.	· This study	· **Medium Sensitivity** only area of high topographic relief	· N/A

[3] Jenkins, A.R., de Goede, J.H., Sebele, L. & Diamond, M. 2013. Brokering a settlement between eagles and industry: sustainable management of large raptors nesting on power infrastructure. Bird Conservation International 23: 232-246.

Relevant Focus Area	Sensitivity Feature	Data Source	Sensitivity Mapping Application	
			Wind	Solar PV
Cookhouse Focus Area 3	**Power lines equal to or greater than 132 kV** · Power line infrastructure can possibly be used by roosting Cape Vultures and nesting large eagles, buzzards and falcons.	· Eskom Networks, 2014	· **Medium Sensitivity** within 5 km of power line ≥ 132kV	· **Medium Sensitivity** within 2 km of power line ≥ 132kV
	Great Fish, Little Fish and Koonap Rivers as an avian fly-way	· NFEPA Rivers layer, 2011	· **Very High Sensitivity** within 1 km of major river	· **Very High Sensitivity** within 500 m of major rivers
	Selected Coordinated Waterbird Counts (CWAC) sites Selected CWAC sites with high total counts, species diversities, and presence of Red-listed species	· ADU, UCT	· **Very High Sensitivity** within 2 km of selected CWAC sites	· **Very High Sensitivity** within 1 km of selected CWAC sites
	Known Cape Vulture roost sites[2]	· EWT Knowledge Management Database · BLSA · Boshoff et al. 2009 a[4] & b[5]	· **Very High Sensitivity** within 20 km of known Cape Vulture roost sites · **High Sensitivity** between 20 and 40 km from Cape Vulture roost sites	· **Very High Sensitivity** within 4 km of known Cape Vulture roost sites
	Known Blue Crane nesting areas	· EWT Knowledge Management Database	· **Very High Sensitivity** within 150 m of known Blue Crane nests · **High Sensitivity** between 150 and 300 m from Blue Crane nests	· **Very High Sensitivity** within 150 m of known Blue Crane nests · **High Sensitivity** between 150 and 300 m from Blue Crane nests
	Past and possible future migrating kestrel roost site	· EWT Knowledge Management Database · BLSA	· **High Sensitivity** within 5 km of possible Kestrel roost sites	· **High Sensitivity** within 1 km of possible Kestrel roost sites
	Known Lanner Falcon nest sites	· A. Stephenson Unpublished data, · Jenkins et al. 2012[6], 2013[7]	· **Very High Sensitivity** within 1 km of Lanner Falcon nest sites · **High Sensitivity** between 1 and 5 km from Lanner Falcon nest sites	· **Very High Sensitivity** within 500 m of Lanner Falcon nest sites
	Presence data for a suite of threatened, impact susceptible large terrestrial birds	· SABAP2	· **Medium Sensitivity** areas where susceptible large terrestrial birds were found to be present	· **Medium Sensitivity** areas where susceptible large terrestrial birds were found to be present

[4] Boshoff, A., Piper, S. & Michael, M. 2009a. On the distribution and breeding status of the Cape Griffon *Gyps coprotheres* in the Eastern Cape, province, South Africa. Ostrich 80: 85-92.
[5] Boshoff, A., Barkhuysen, A., Brown, G. & Michael, M. 2009b. Evidence of partial migratory behavior by the Cape Griffon *Gyps coprotheres*. Ostrich 80: 129-133.
[6] Jenkins, A.R., du Plessis, J., Colyn, R., Cooke, P-J, & Benn, G. 2012. Amakahla Emoyeni Wind Energy Facility: avian impact risk assessment and mitigation scheme. Report to Windlab Developments South Africa (Pty) Ltd.
[7] Jenkins, A.R., du Plessis, J., Colyn, R., Cooke, P-J, & Benn, G. 2013. Msenge Emoyeni Wind Energy Facility: avian impact risk assessment and mitigation scheme. Report to Windlab Developments South Africa (Pty) Ltd.

Relevant Focus Area	Sensitivity Feature	Data Source	Sensitivity Mapping Application	
			Wind	Solar PV
Stormberg Focus Area 4	**Power lines equal to or greater than 132 kV** · Power line infrastructure can possibly be used by roosting Cape Vultures and nesting large eagles, buzzards and falcons.	· Eskom Networks, 2014	· **Medium Sensitivity** within 5 km of power line ≥ 132kV	· **Medium Sensitivity** within 2 km of power line ≥ 132kV
	Known Cape Vulture colony cliff and roost sites[2]	· EWT Knowledge Management Database · BLSA · Boshoff et al. 2009a[4] & b[5] · K. Webster Pers. Comm. · A.R. Jenkins Unpublished data	· **Very High Sensitivity** within 20 km of known Cape Vulture cliff and roost sites · **High Sensitivity** between 20 and 40 km from known Cape Vulture cliff and roost sites	· **Very High Sensitivity** within 4 km of known Cape Vulture cliff and roost sites
	Artificial vulture feeding sites (Vulture Restaurants)[2]	· EWT Knowledge Management Database · Kerri Wolter VulPro · K. Webster Pers. comm. · Elliot WEF bird monitoring data	· **Very High Sensitivity** within 10 km of artificial vulture feeding sites · **Medium Sensitivity** between 10 and 20 km from artificial vulture feeding sites	· **Very High Sensitivity** within 1 km of artificial vulture feeding sites
	Area of relatively pristine grassland · Area of relatively pristine grassland around the top of Penhoek Pass with SABAP1 records for threatened endemic passerines, especially Rudd's Lark and Yellow-breasted Pipit.	· Smallie 2013[8] · Whyte 2013[9]	· **Very High Sensitivity** within 5 km of pristine grassland on Penhoek Pass	· **Very High Sensitivity** within 5 km of pristine grassland on Penhoek Pass
	Known Grey-crowned and Blue Crane nesting areas	· EWT Knowledge Management Database	· **Very High Sensitivity** within 150 m of known Grey-crowned and Blue Crane nests · **High Sensitivity** between 150 and 300 m from known Grey-crowned and Blue Crane nests	· **Very High Sensitivity** within 150 m of known Grey-crowned and Blue Crane nests · **High Sensitivity** between 150 and 300 m from known Grey-crowned and Blue Crane nests
	Known migrating kestrel (Amur Falcon) roost sites	· EWT Knowledge Management Database · BLSA	· **Very High Sensitivity** within 5 km of kestrel roost sites · **Medium Sensitivity** between 5 and 10 km from kestrel roost sites	· **Very High Sensitivity** within 1 km of kestrel roost sites
	Known Verreaux's Eagle nest sites	· Dorper WEF monitoring data	· **Very High Sensitivity** within 3 km of Verreaux's Eagle nests · **High Sensitivity** Between 3 and 5 km from Verreaux's Eagle nests	· **Very High Sensitivity** within 1 km of Verreaux's Eagle nests
	Probable Cape Vulture roost[2]	· Whyte 2013[9]	· **Very High Sensitivity** within 10 km of probable Cape Vulture roosts	· **Very High Sensitivity** within 2 km of probable Cape Vulture roosts
	Presence data for a suite of threatened, impact susceptible large terrestrial birds	· SABAP2, corroborated by the Coordinated Avian Roadcounts (CAR) data, which includes records for Southern Bald Ibis	· **Medium Sensitivity** areas where susceptible large terrestrial birds were found to be present	· N/A

[8] Smallie, J. 2013. Stormberg Renewable Energy Project: wind and solar facilities, Eastern Cape: Avifaunal Impact Assessment – Scoping Phase. Unpublished report to Savannah Environmental.

[9] Whyte, I. 2013. Stormberg Renewable Energy Project, Eastern Cape: report on an on-site field survey examining the potential conflict between the proposed development of wind and solar energy facilities and local bird species, their behavioural characteristics and habitats, with particular focus on red data grassland species. Report to Savannah Environmental.

Relevant Focus Area	Sensitivity Feature	Data Source	Sensitivity Mapping Application	
			Wind	Solar PV
Kimberley Focus Area 5	**Power lines greater than 132 kV** · Power line infrastructure can possibly be used by nesting White-backed Vultures, Martial or Tawny Eagles.	· Eskom Networks, 2014	· **Medium Sensitivity** within 5 km of power line ≥ 132kV	· **Medium Sensitivity** within 2 km of power line ≥ 132kV
	Grootkop-Kimberley 132 kV power line · This power line supports >20 White-backed Vulture nests and 2 Martial Eagle nests somewhere along its length	· Anderson & Hohne 2007[10]	· **High Sensitivity** within 5 km of power line ≥ 132kV	· **High Sensitivity** within 2 km of power line ≥ 132kV
	Important Bird Areas (IBA)	· BLSA	· **Very High Sensitivity** within 2 km of IBA	· **Very High Sensitivity** within 1 km of IBA
	Kamfers Dam IBA · The Kamfers Dam IBA supports up to 40 000 flamingos, including breeding Lesser Flamingo.	· BLSA · Anderson & Anderson 2010[11]	· **Very High Sensitivity** within 5 km of Kamfers Dam IBA	· **Very High Sensitivity** within 5 km of Kamfers Dam IBA
	Vaal and Modder Rivers as an avian fly-way	· NFEPA Rivers layer, 2011	· **Very High Sensitivity** within 1 km of major river	· **Very High Sensitivity** within 500 m of major river
	Selected Coordinated Waterbird Counts (CWAC) sites · Selected CWAC sites with high total counts, species diversities, and presence of Red-listed species	· ADU - UCT	· **Very High Sensitivity** within 3 km of selected CWAC sites	· **Very High Sensitivity** within 1 km of selected CWAC sites
	Known White-backed Vulture colonies/nest sites	· C. Murn Unpublished data · Anderson, A. Maritz Unpublished data · R. Visagie Unpublished data · Murn et al. 2007[12] · Murn & Anderson 2008[13]	· **Very High Sensitivity** within 5 km of known White-backed Vulture colonies/nest sites	· **Very High Sensitivity** within 2 km of known White-backed Vulture colonies/nest sites
	Artificial vulture feeding sites (Vulture Restaurants)[2]	· EWT, · Kerri Wolter, VulPro	· **Very High Sensitivity** within 10 km of artificial vulture feeding sites · **Medium Sensitivity** between 10 and 20 km from artificial vulture feeding sites	· **Very High Sensitivity** within 1 km of artificial vulture feeding sites
	Known African Fish-Eagle nest sites	· M. Anderson Unpublished data	· **Very High Sensitivity** within 2 km of known African Fish-Eagle nest sites	· **Very High Sensitivity** within 1 km of known African Fish-Eagle nest sites
	Known migrating kestrel roost sites	· EWT Knowledge Management database, · BLSA	· **Very High Sensitivity** within 5 km of known kestrel roost sites · **High Sensitivity** between 5 and 10 km from known kestrel roost sites	· **Very High Sensitivity** within 1 km of known kestrel roost sites
	Langleg Pan · Lanleg Pan is a known aggregation point and possible nesting site for Lesser Flamingos	· M. Anderson Pers. comm.	· **Very High Sensitivity** within 5 km of Langleg Pan	· **Very High Sensitivity** within 5 km of Langleg Pan

[10] Anderson, M.D. & Hohne, P. 2007. African White-backed Vultures nesting on electricity pylons in the Kimberley area, Northern Cape and Free State provinces, South Africa. *Vulture News* 57: 44-50

[11] Anderson, M.D. & Anderson, T.A. 2010. A breeding island for lesser flamingos *Phoeniconaias minor* at Kamfers Dam, Kimberley, South Africa. *Bulletin of the African Bird Club* (2) 225-228. September 2010.

[12] Murn, C., Anderson, M.D. & Anthony, A. 2007. Aerial survey of African White-backed Vulture colonies around Kimberley, Northern Cape and Free State provinces. *South African Journal of Wildlife Research* 32: 145-152.

[13] Murn, C. & Anderson, M.D. 2008. Activity patterns African White-backed Vultures *Gyps africanus* in relation to different land-use practices and food availability. *Ostrich* 79: 191-198.

Relevant Focus Area	Sensitivity Feature	Data Source	Sensitivity Mapping Application	
			Wind	Solar PV
	Flamingo tracking data showing movement patterns into and out of Kamfers Dam · Flamingo tracking data show movement patterns into and out of Kamfers Dam	· McCulloch et al. 2003[14] · G. McCulloch Unpublished data	· **High Sensitivity** within 2.5 km of route	· **High Sensitivity** within 2.5 km of route
Vryburg Focus Area 6	**Power lines equal to or greater than 88 kV** · Power line infrastructure can possibly be used by nesting White-backed Vultures or other large raptors	· Eskom Networks, 2014	· **Medium Sensitivity** within 5 km of power line ≥ 88kV	· **Medium Sensitivity** within 2 km of power line ≥ 88kV
	Known migrating kestrel roost sites	· EWT Knowledge Management database, · BLSA	· **Very High Sensitivity** within 5 km of known kestrel roost sites · **Medium Sensitivity** between 5 and 10 km from kestrel roost sites	· **Very High Sensitivity** within 1 km of known kestrel roost sites
	Presence data for a suite of threatened, impact susceptible large savannah raptors	· SABAP2, ADU	· **High Sensitivity** areas where susceptible large savannah raptors were found to be present	· **High Sensitivity** areas where susceptible large savannah raptors were found to be present
Upington Focus Area 7	**Power lines equal to or greater than 132 kV** · Power line infrastructure can possibly be used by nesting Martial or Tawny Eagles.	· Eskom Networks, 2014	· **Medium Sensitivity** within 5 km of power line ≥ 132 kV	· **Medium Sensitivity** within 2 km of power line ≥ 132 kV
	Orange River as an avian fly-way	· NFEPA Rivers layer, 2011	· **Very High Sensitivity** within 1 km of major river	· **Very High Sensitivity** within 500 m of major river
	Known White-backed Vulture colonies/nest sites	· A. Maritz Unpublished. data · R. Visagie Unpublished data	· **Very High Sensitivity** within 5 km of known White-backed Vulture colonies of nests	· **Very High Sensitivity** within 2 km of known White-backed Vulture colonies of nests
	Known Verreaux's Eagle nests on cliffs or communication towers, or predicted sites on the basis of spacing and habitat	· A. Maritz Unpublished data · R. Visagie Unpublished data · Jenkins & du Plessis 2013[15]	· **Very High Sensitivity** within 3 km of known or predicted Verreaux's Eagle nests · **High Sensitivity** between 3 and 5 km from known or predicted Verreaux's Eagle nests	· **Very High Sensitivity** within 1 km of known or predicted Verreaux's Eagle nests
	Known Martial Eagle nest sites	· A. Maritz Unpublished data · R. Visagie Unpublished data · Jenkins & du Plessis 2013[15]	· **Very High Sensitivity** within 5 km of known Martial Eagle nests	· **Very High Sensitivity** within 2 km of known Martial Eagle nests
	Known African Fish-Eagle nest sites	· R. de Klerk Pers. comm.	· **Very High Sensitivity** within 2 km of known African Fish-Eagle nests	· **Very High Sensitivity** within 1 km of known African Fish-Eagle nests
	Presence data for a suite of threatened, impact susceptible large savannah raptors	· SABAP2, ADU	· **High Sensitivity** areas where susceptible large savannah raptors were found to be present	· **High Sensitivity** areas where susceptible large savannah raptors were found to be present

[14] McCulloch, G., Aebischer, A., & Irvine, K. 2003. Satellite tracking of flamingos in southern Africa: the importance of small wetlands for management and conservation. *Oryx* 37: 480-483.

[15] Jenkins, A.R. & du Plessis, J. 2013. Proposed hydropower station and associated infrastructure at Boegoeberg Dam on the Orange River, Northern Cape: Avian impact assessment. Report to Aurecon South Africa (Pty) Ltd.

Relevant Focus Area	Sensitivity Feature	Data Source	Sensitivity Mapping Application	
			Wind	Solar PV
Springbok Focus Area 8	**Power lines equal to or greater than 132 kV** · Power line infrastructure can possibly be used by nesting Martial Eagles	· Eskom Networks, 2014	· **Medium Sensitivity** within 5 km of power line ≥ 132 kV	· **Medium Sensitivity** within 2 km of power line ≥ 132 kV
	Important Bird Areas (IBA)	· BLSA	· **Very High Sensitivity** within 2 km of IBA	· **Very High Sensitivity** IBA only
	Buffels River as an avian fly-way	· NFEPA Rivers layer, 2011	· **Very High Sensitivity** within 1 km of major river	· **Very High Sensitivity** within 500 m of major river
	Coastline	· Surveyor General (2006) 1:50 000 topographical maps	· **Very High Sensitivity** within 1 km of coastline	· **Very High Sensitivity** within 500 m of coastline
	Surveyed cliffs with signs of occupation by breeding raptors Lanner Falcon, Jackal Buzzard, Cape Eagle-Owl but not confirmed	· This study	· **Very High Sensitivity** within 1 km of unconfirmed raptor breeding areas	· **High Sensitivity** within 500 m of unconfirmed raptor breeding areas
	Known Verreaux's Eagle nests, or predicted sites on the basis of spacing and habitat	· L. Rodrigues Unpublished data · M. Mostert Unpublished data · A. Maritz Unpublished. data · R. Visagie Unpublished data · This study	· **Very High Sensitivity** within 3 km of known of predicted Verreaux's Eagles nests	· **Very High Sensitivity** within 1 km of known of predicted Verreaux's Eagles nests
	Areas with high topographic relief · Areas with high topographic relief (ridgelines & koppies) are considered likely to be used extensively by slope soaring birds, including threatened and sensitive raptors; these areas include the high-lying areas around Springbok, Concordia and Steinkopf, and the surrounds of the Aggenysberg.	· This study	· **Medium Sensitivity** only areas with high topographic relief	· N/A
	Known or suspected Martial Eagle nest sites on power lines	· M. Mostert Unpublished data · A. Maritz Unpublished. data · R. Visagie Unpublished data · This study	· **Very High Sensitivity** within 5 km of known Martial Eagle nests	· **Very High Sensitivity** within 2 km of known Martial Eagle nests
	Known Lanner Falcon nest sites	· This study · A.R. Jenkins Unpublished data	· **Very High Sensitivity** within 1 km of Lanner Falcon nest sites · **High Sensitivity** between 1 and 3 km from Lanner Falcon nest sites	· **Very High Sensitivity** within 500 m of Lanner Falcon nest sites
	Known Jackal Buzzard nest sites	· This study · Kleinzee WEF monitoring data	· **Very High Sensitivity** within 1 km of known Jackal Buzzard nest sites · **High Sensitivity** between 1 and 2 km from known Jackal Buzzard nest sites	· **Very High Sensitivity** within 500 m of known Jackal Buzzard nest sites
	Known Black Harrier nesting areas	· Kleinzee WEF monitoring data	· **Very High Sensitivity** within 2 km of known Black Harrier nest sites	· **Very High Sensitivity** within 1 km of known Black Harrier nest sites
	Probable core of Red Lark distribution along Koa River Valley	· SABAP2, ADU · Bio32013[16] · Pretorius 2014[17] · Dean et al. 1991[18] · This study	· **Very High Sensitivity** probable core of red lark distribution	· **Very High Sensitivity** probable core of red lark distribution

[16] Bio3. 2013. Kangnas Wind Energy Facility, Northern Cape Province – Bird monitoring: Final report (Pre-construction Phase). Report to Savannah Environmental.

[17] Pretorius, M. 2014. Proposed 75 MW AES photovoltaic installation near Aggenys, Northern Cape Province: Avifaunal Impact Assessment. Unpublished report to Alternative Energy Solutions.

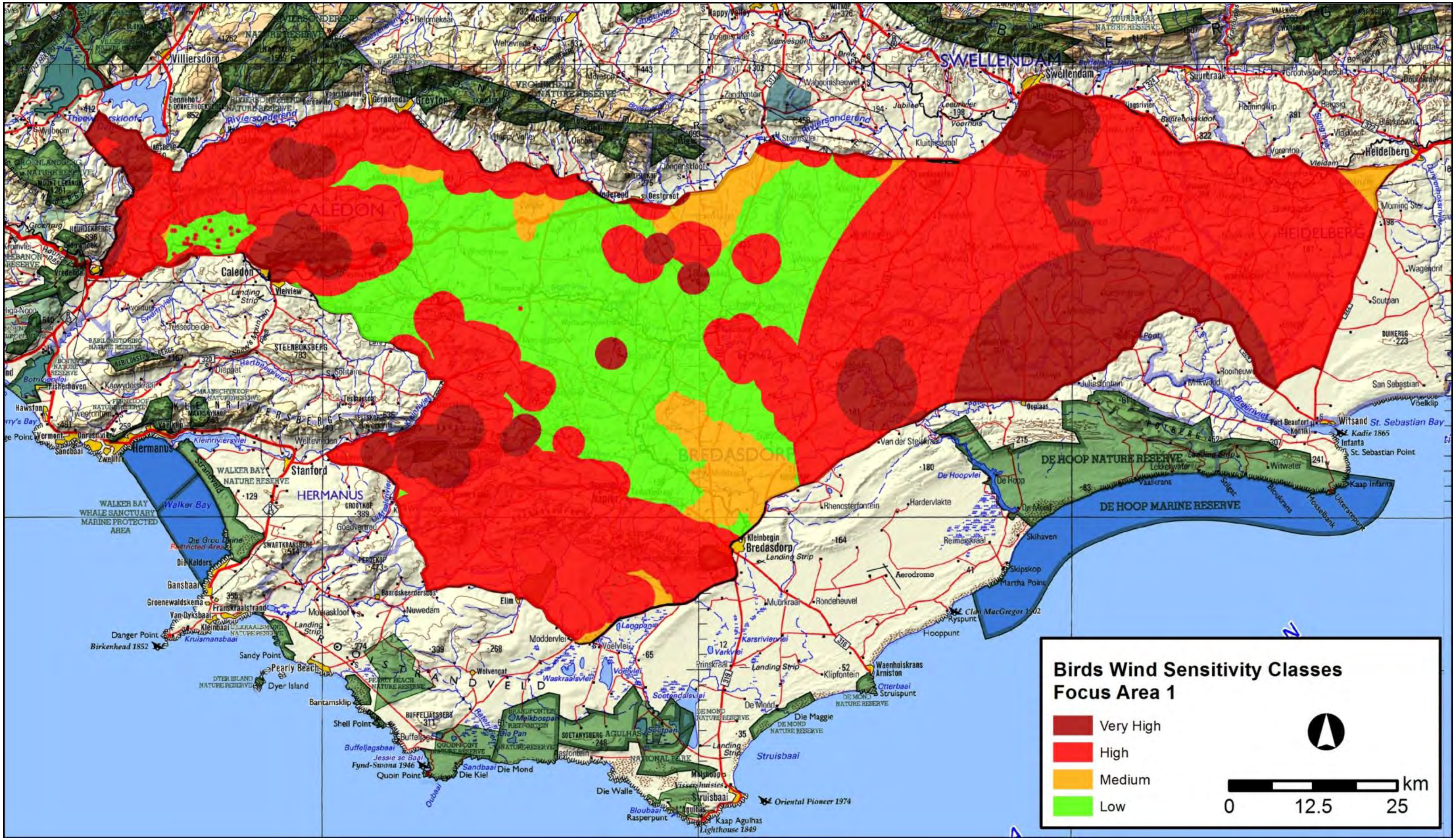
[18] Dean, W.R.J., Milton, S.J., Watkeys, M.J. & Hockey, P.A.R. 1991. Distribution, habitat preferences and conservation status of the Red Lark *Certhilauda burra*. *Biological Conservation* 58: 257-274.

Relevant Focus Area	Sensitivity Feature	Data Source	Sensitivity Mapping Application	
			Wind	Solar PV
	Other presence data for Red Lark	· SABAP1, ADU · SABAP2, ADU · Bio32013 · Pretorius 2014 · Dean et al. 1991 · This study	· **Medium Sensitivity** areas where Red Larks were found to be present	· **Medium Sensitivity** areas where Red Larks were found to be present
	Presence data for Barlow's Lark	· SABAP2, ADU	· **Medium Sensitivity** areas where Barlow's Larks were found to be present	· **Medium Sensitivity** areas where Barlow's Larks were found to be present
	Salt pan known to support breeding Damara Terns	· Barnes 1998[19] · SABAP2	· **Very High Sensitivity** within 5 km of salt pan that supports breeding Damara Terns	· **Very High Sensitivity** within 1 km of salt pan that supports breeding Damara Terns
	Presence data for threatened, impact susceptible large terrestrial birds	· SABAP2, ADU	· **Medium Sensitivity** areas where susceptible large terrestrial birds were found to be present	· **Medium Sensitivity** areas where susceptible large terrestrial birds were found to be present

5.2.2 Sensitivity Maps

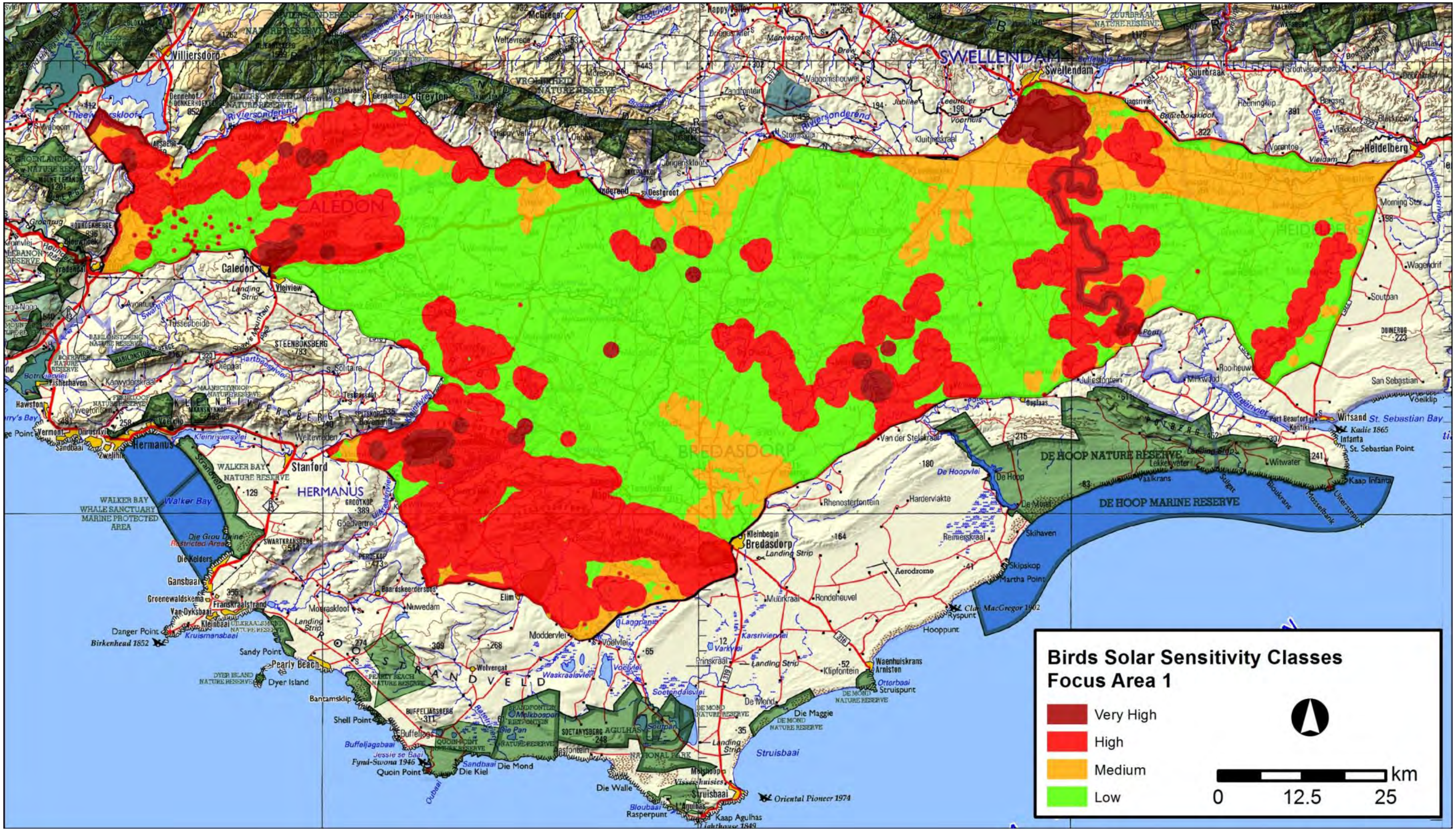
Wind and solar PV sensitivity maps were produced for each FA according to the criteria set out in Table 1 to classify bird sensitivities spatially into four tiers of Very High, High, Medium and Low (see Maps 1 to 16).

19 Barnes, K.N. (ed.) 1998. The Important Bird Areas of southern Africa. BirdLife South Africa, Johannesburg.

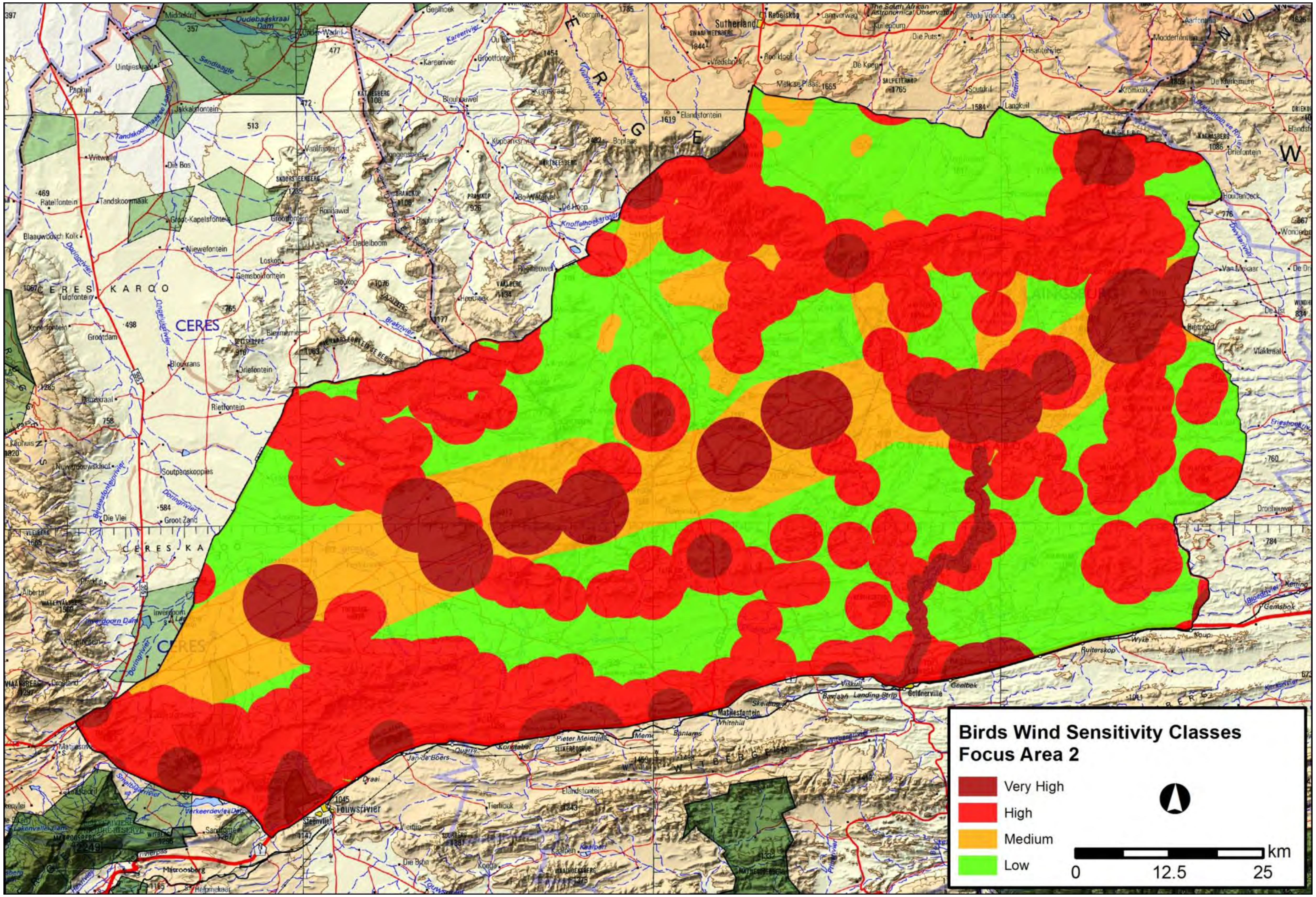


Map 1: Bird sensitivity map for Wind development in the Overberg focus area (FA 1)

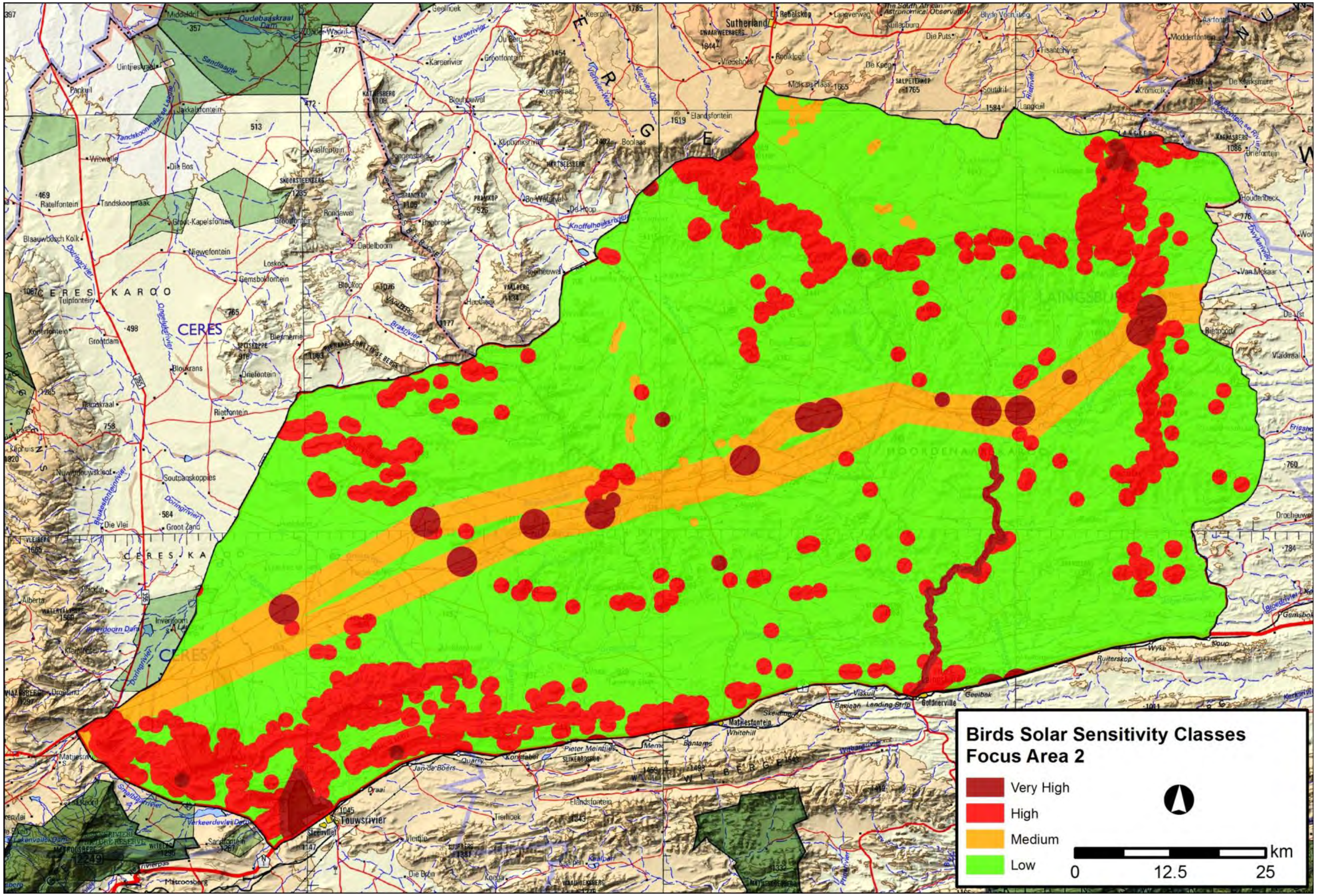
Note to map: A vulture tracking study in the former Transkei (in the vicinity of Focus Areas 4) which aims to better inform wind energy sensitivity buffer distances for vultures, and is funded by the Eastern Cape Department of Economic Development, Environmental Affairs and Tourism, is underway at the time of preparing this report. Preliminary results from this tracking study indicate that there is potential for decreasing the conservative buffers used for the preparation of this map.



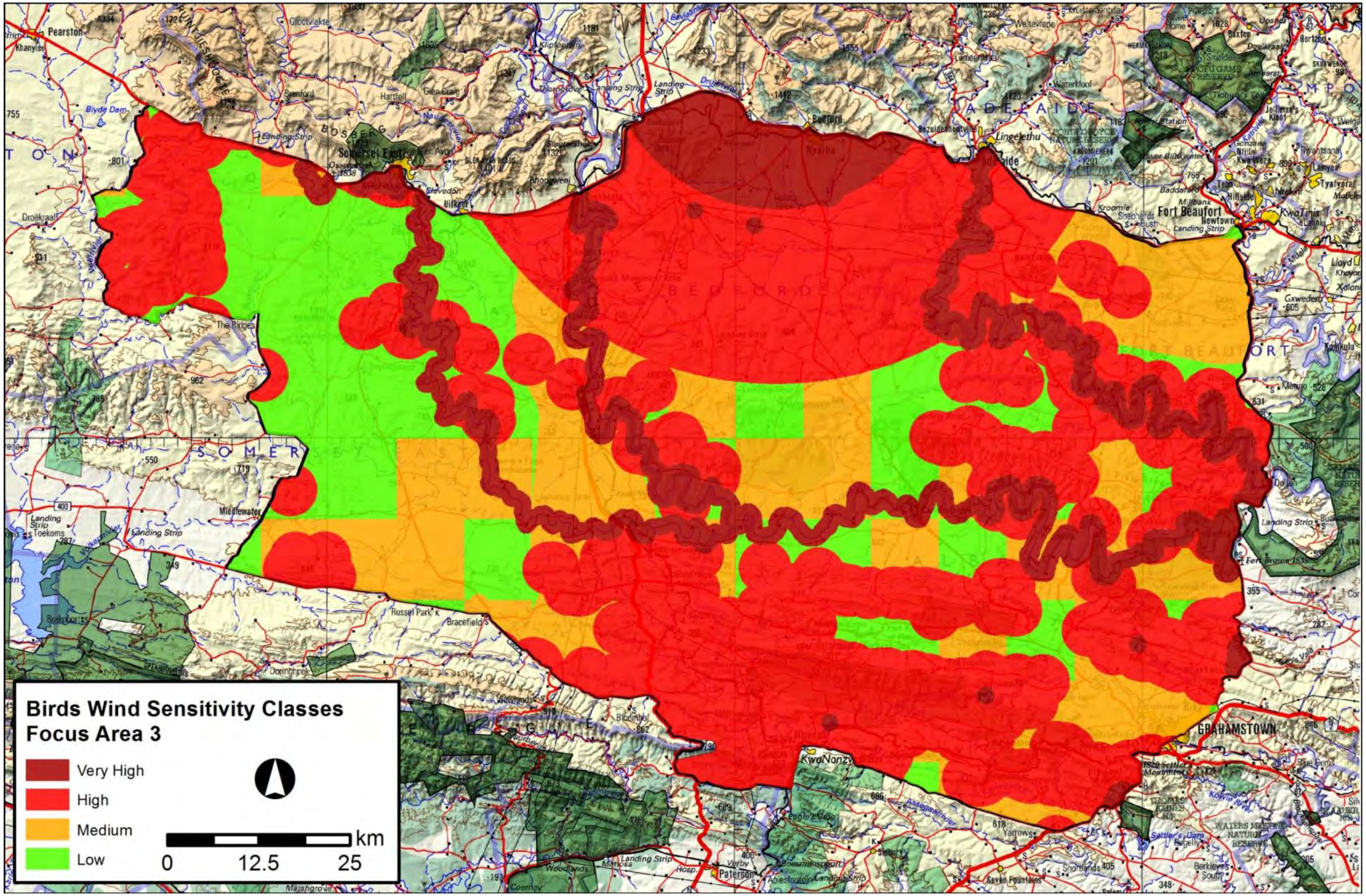
Map 2: Bird sensitivity map for Solar PV development in the Overberg focus area (FA 1)



Map 3: Bird sensitivity map for Wind development in the Komsberg focus area (FA 2)

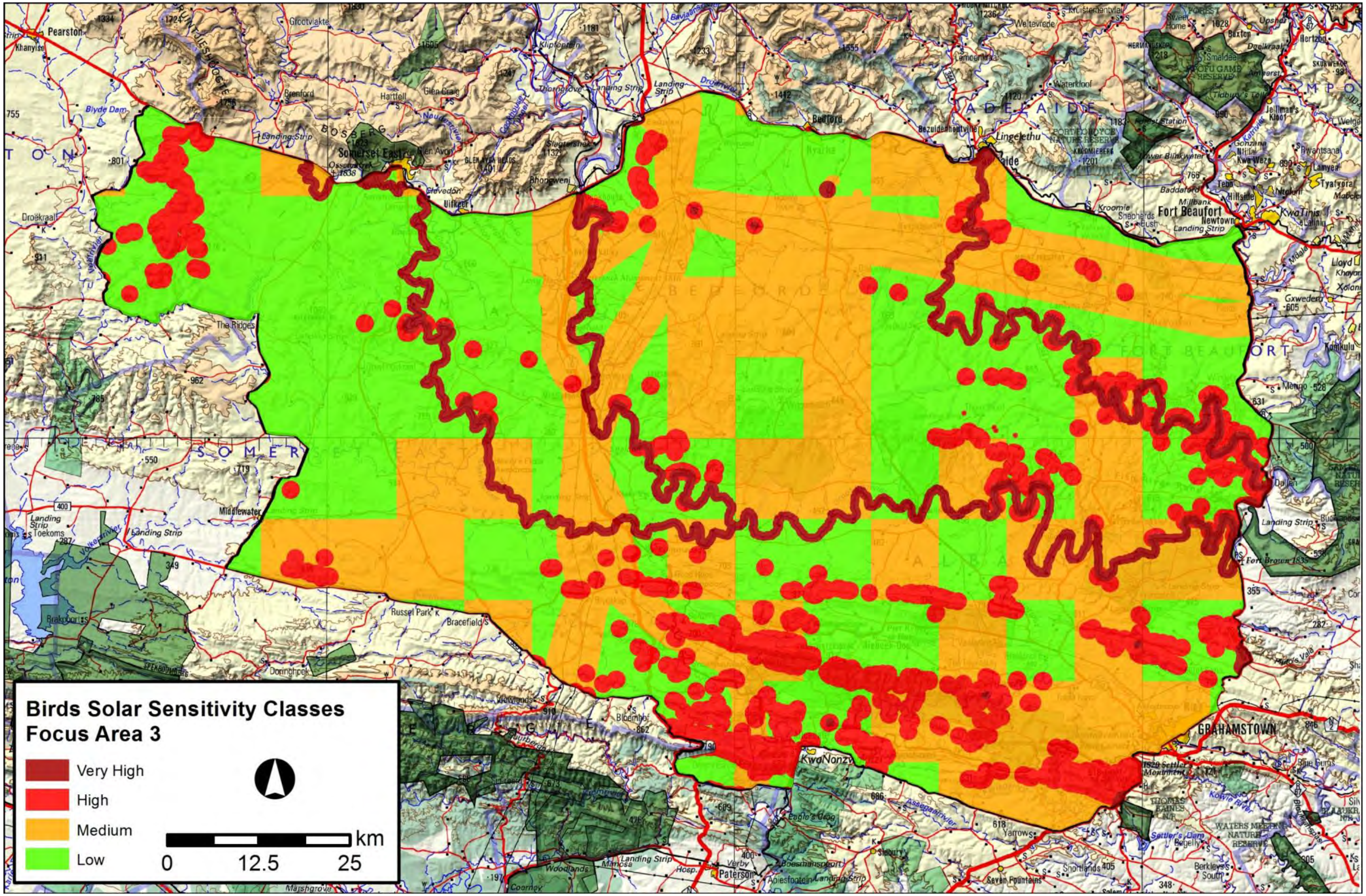


Map 4: Bird sensitivity map for Solar PV development in the Komsberg focus area (FA 2)

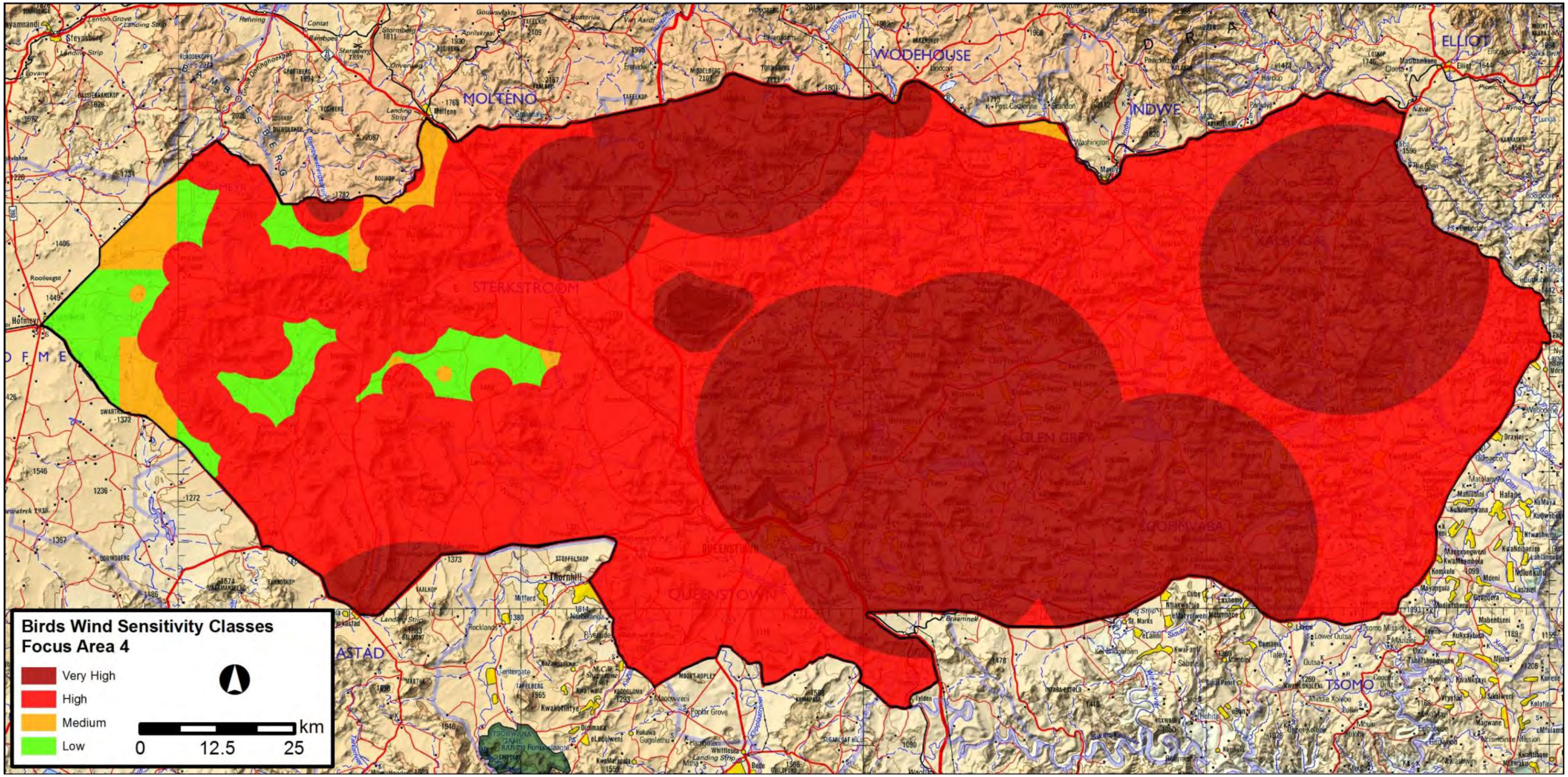


Map 5: Bird sensitivity map for Wind development in the Cookhouse focus area (FA 3)

Note to map: A vulture tracking study in the former Transkei (in the vicinity of Focus Areas 4) which aims to better inform wind energy sensitivity buffer distances for vultures, and is funded by the Eastern Cape Department of Economic Development, Environmental Affairs and Tourism, is underway at the time of preparing this report. Preliminary results from this tracking study indicate that there is potential for decreasing the conservative buffers used for the preparation of this map.

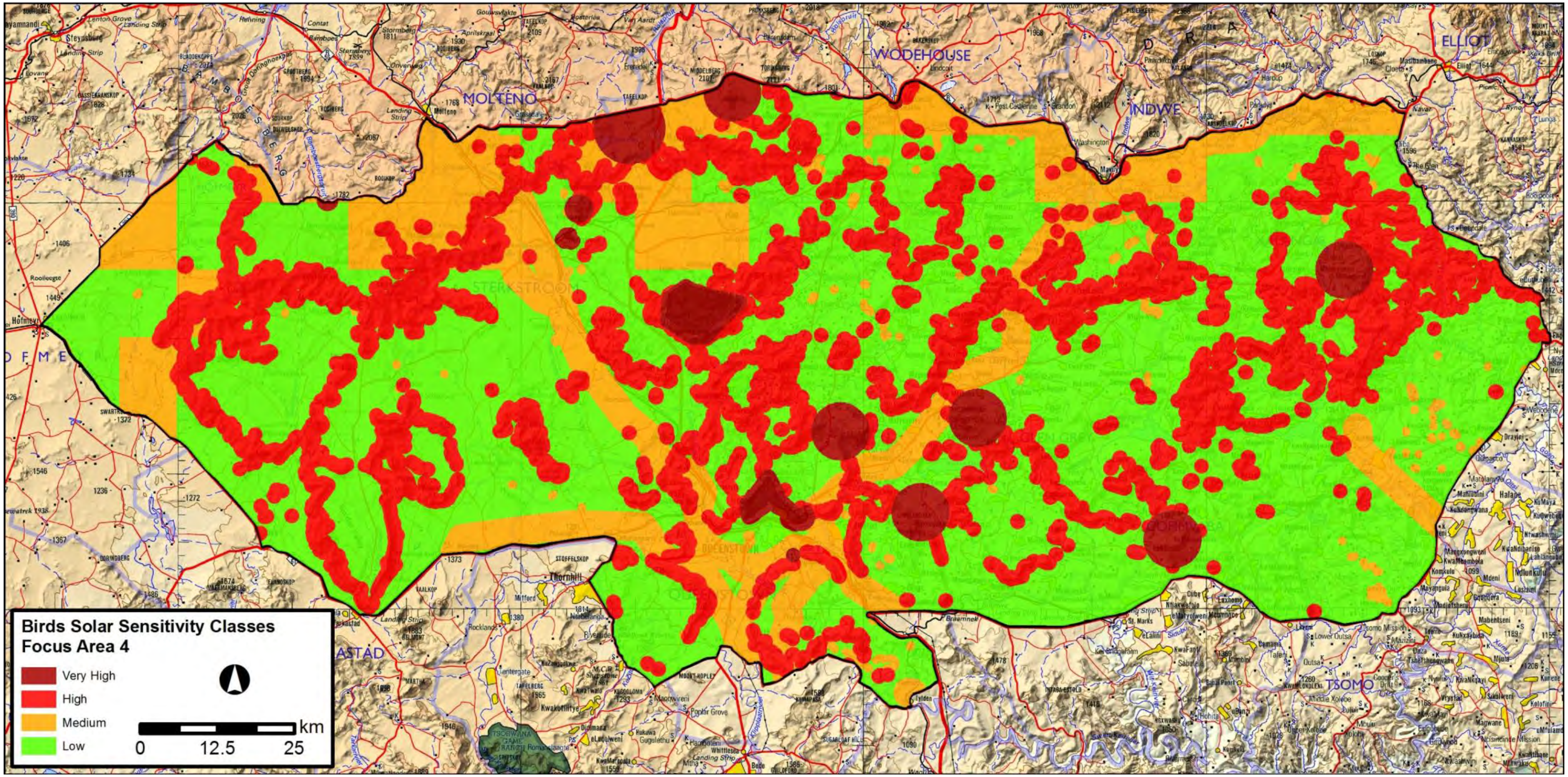


Map 6: Bird sensitivity map for Solar PV development in the Cookhouse focus area (FA 3)

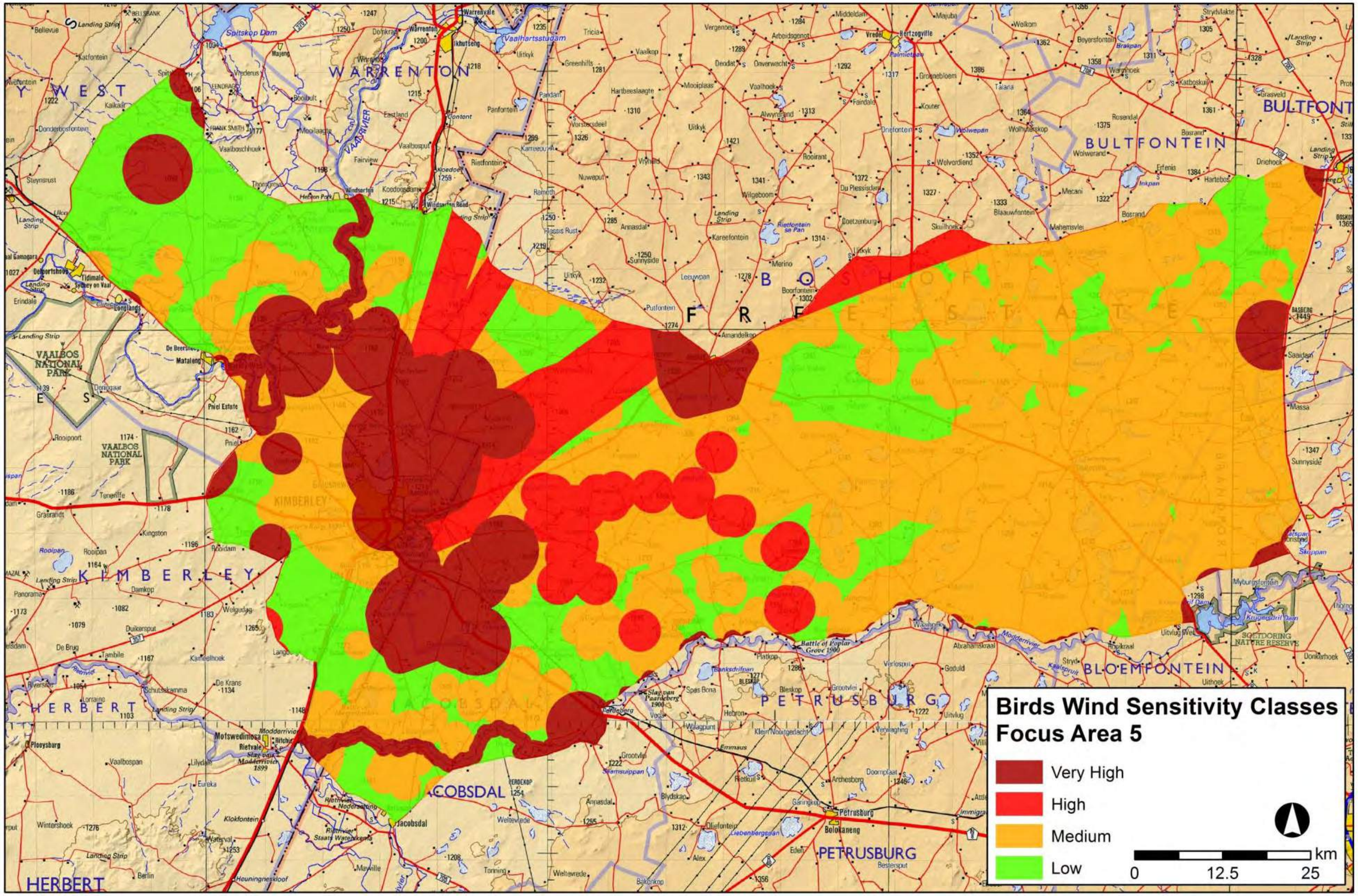


Map 7: Bird sensitivity map for Wind development in the Stormberg focus area (FA 4)

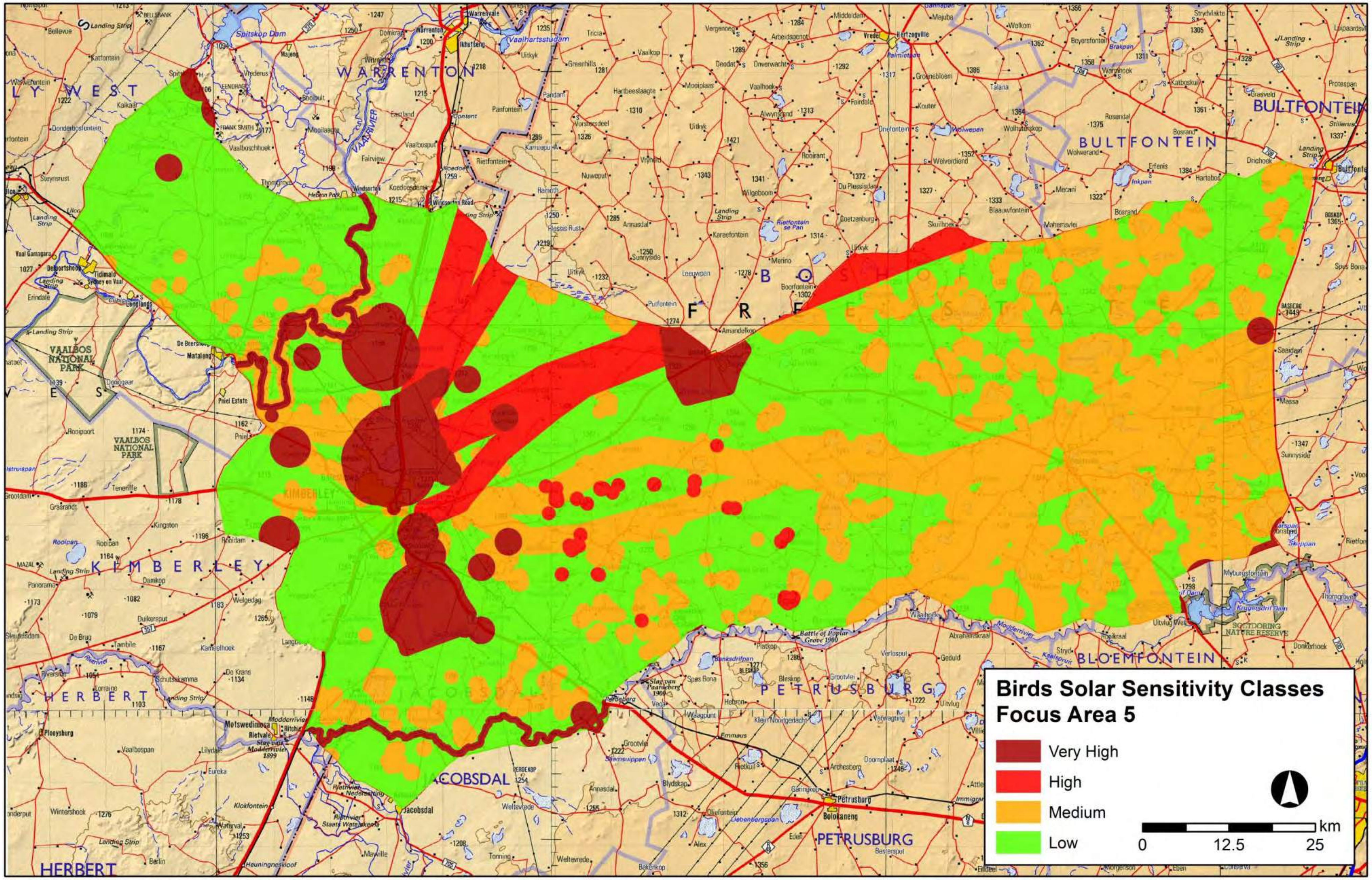
Note to map: A vulture tracking study in the former Transkei (in the vicinity of Focus Areas 4) which aims to better inform wind energy sensitivity buffer distances for vultures, and is funded by the Eastern Cape Department of Economic Development, Environmental Affairs and Tourism, is underway at the time of preparing this report. Preliminary results from this tracking study indicate that there is potential for decreasing the conservative buffers used for the preparation of this map.



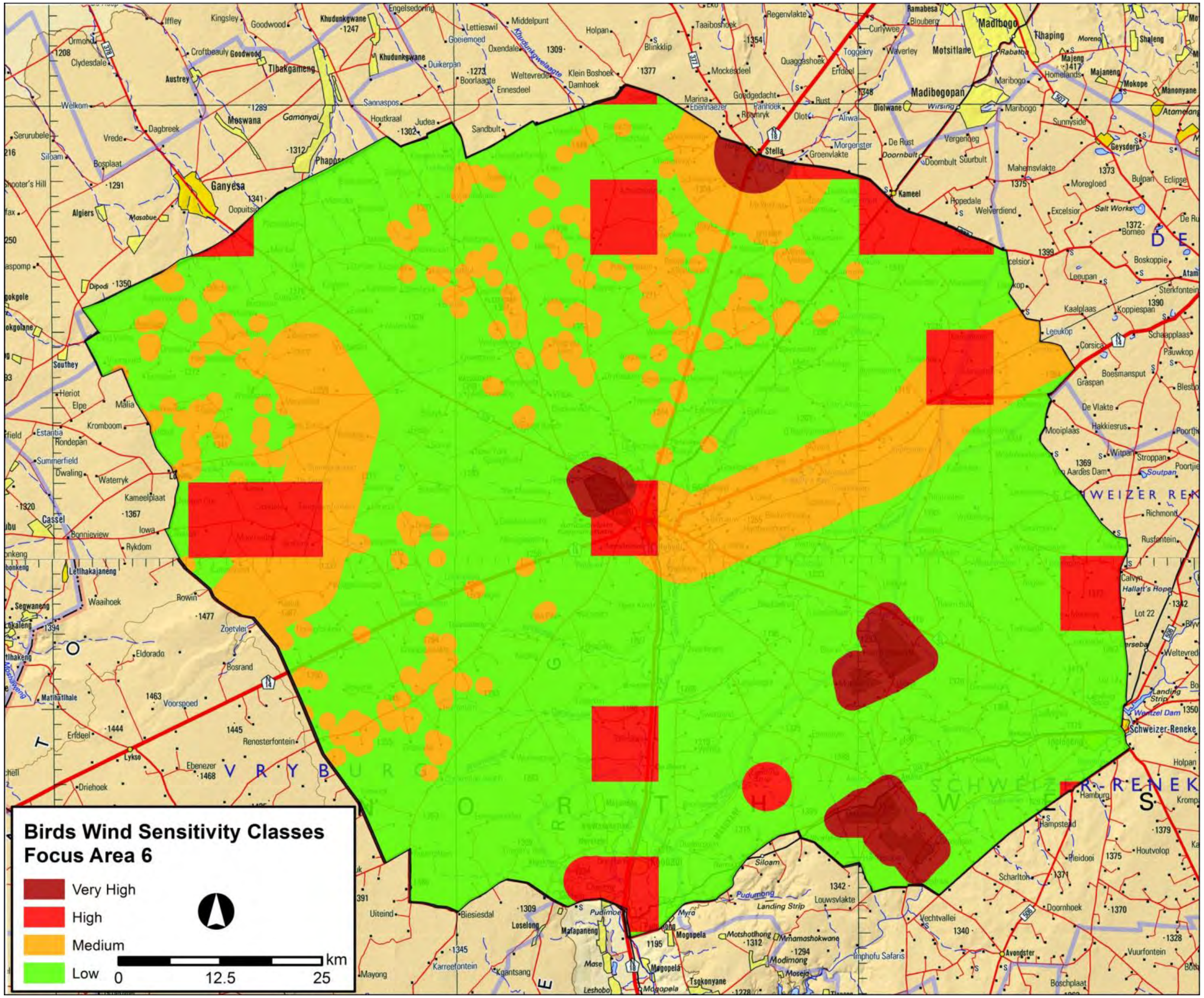
Map 8: Bird sensitivity map for Solar PV development in the Stormberg focus area (FA 4)



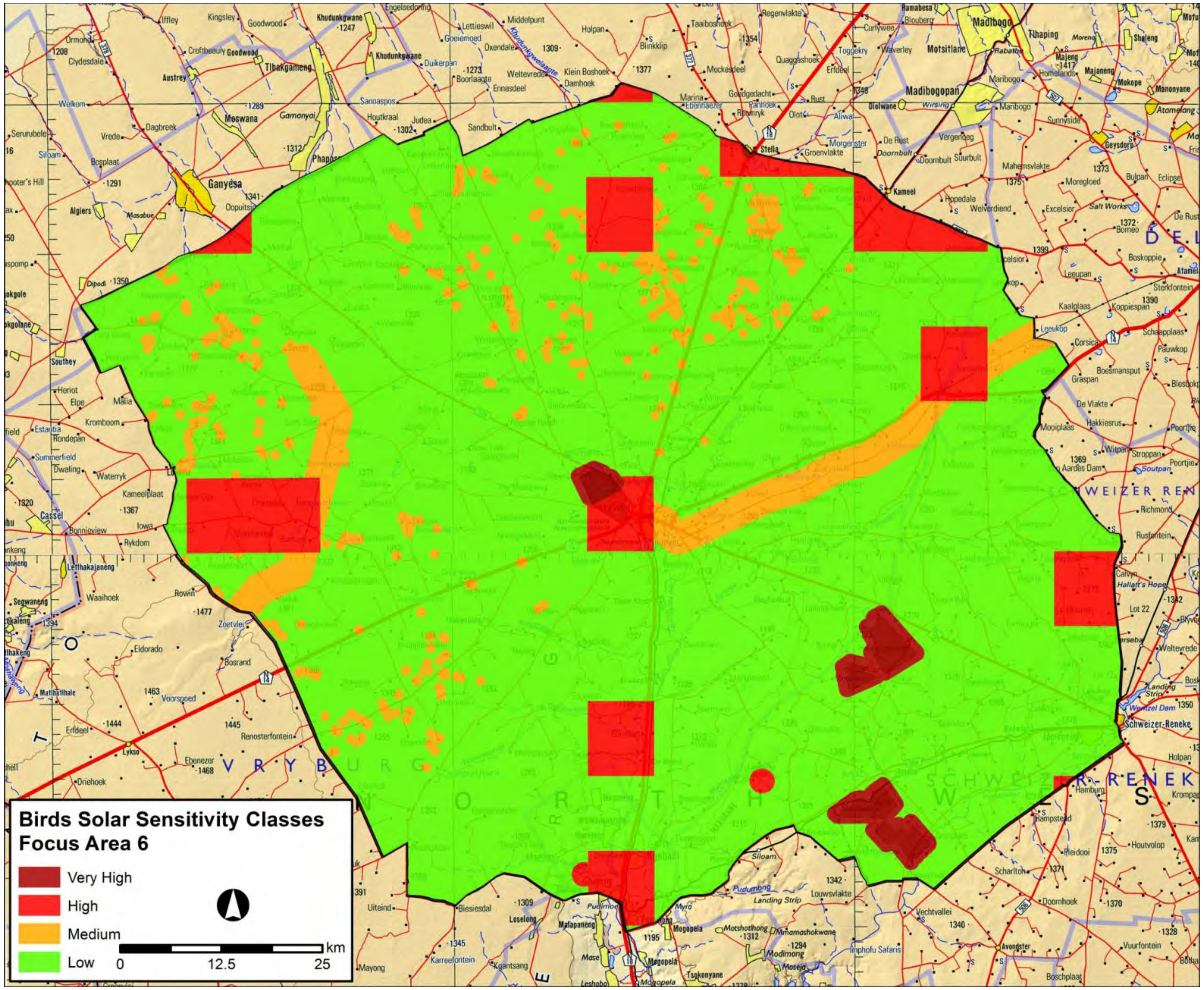
Map 9: Bird sensitivity map for Wind development in the Kimberley focus area (FA 5)



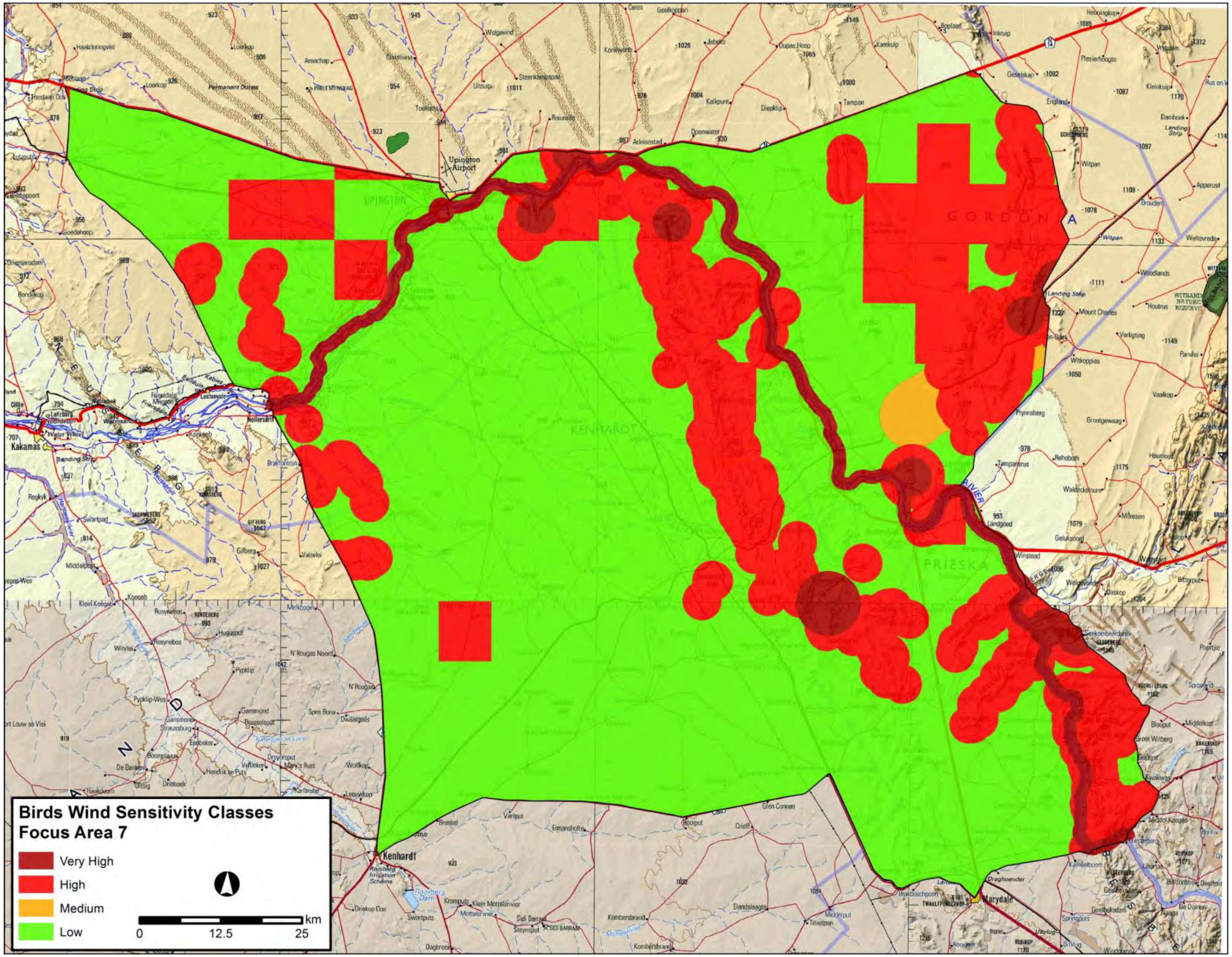
Map 10: Bird sensitivity map for Solar PV development in the Kimberley focus area (FA 5)



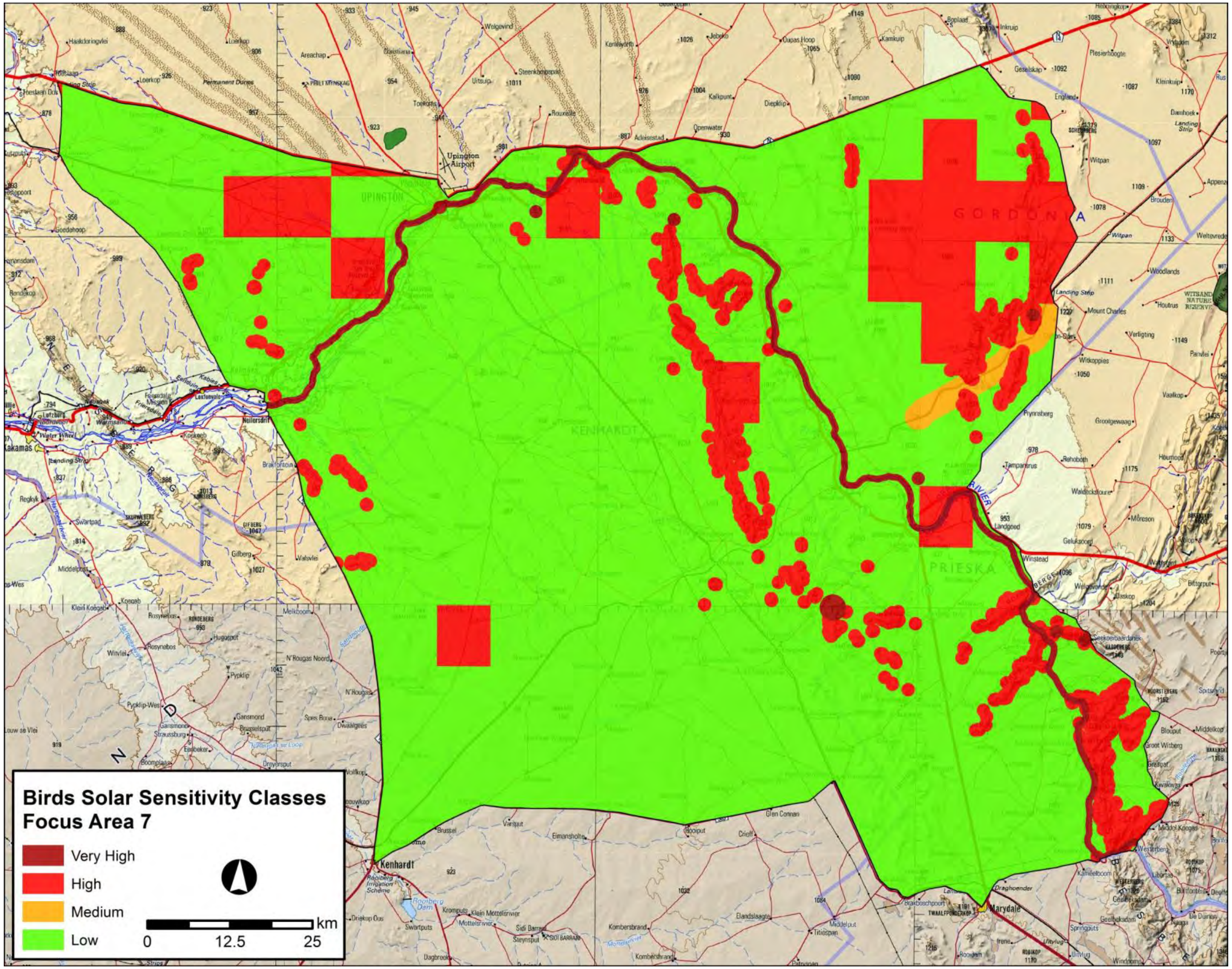
Map 11: Bird sensitivity map for Wind development in the Vryburg focus area (FA 6)



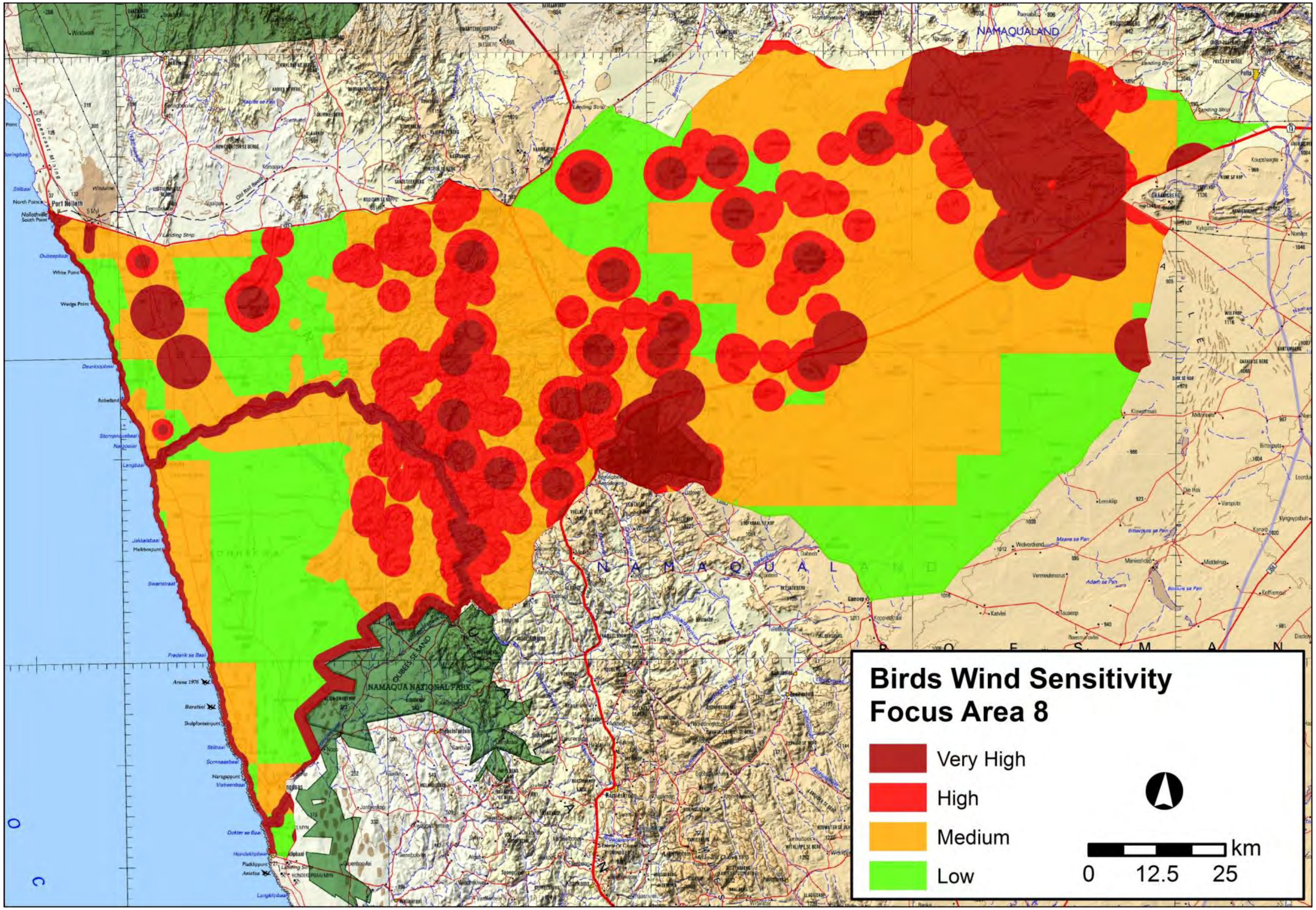
Map 12: Bird sensitivity map for Solar PV development in the Vryburg focus area (FA 6)



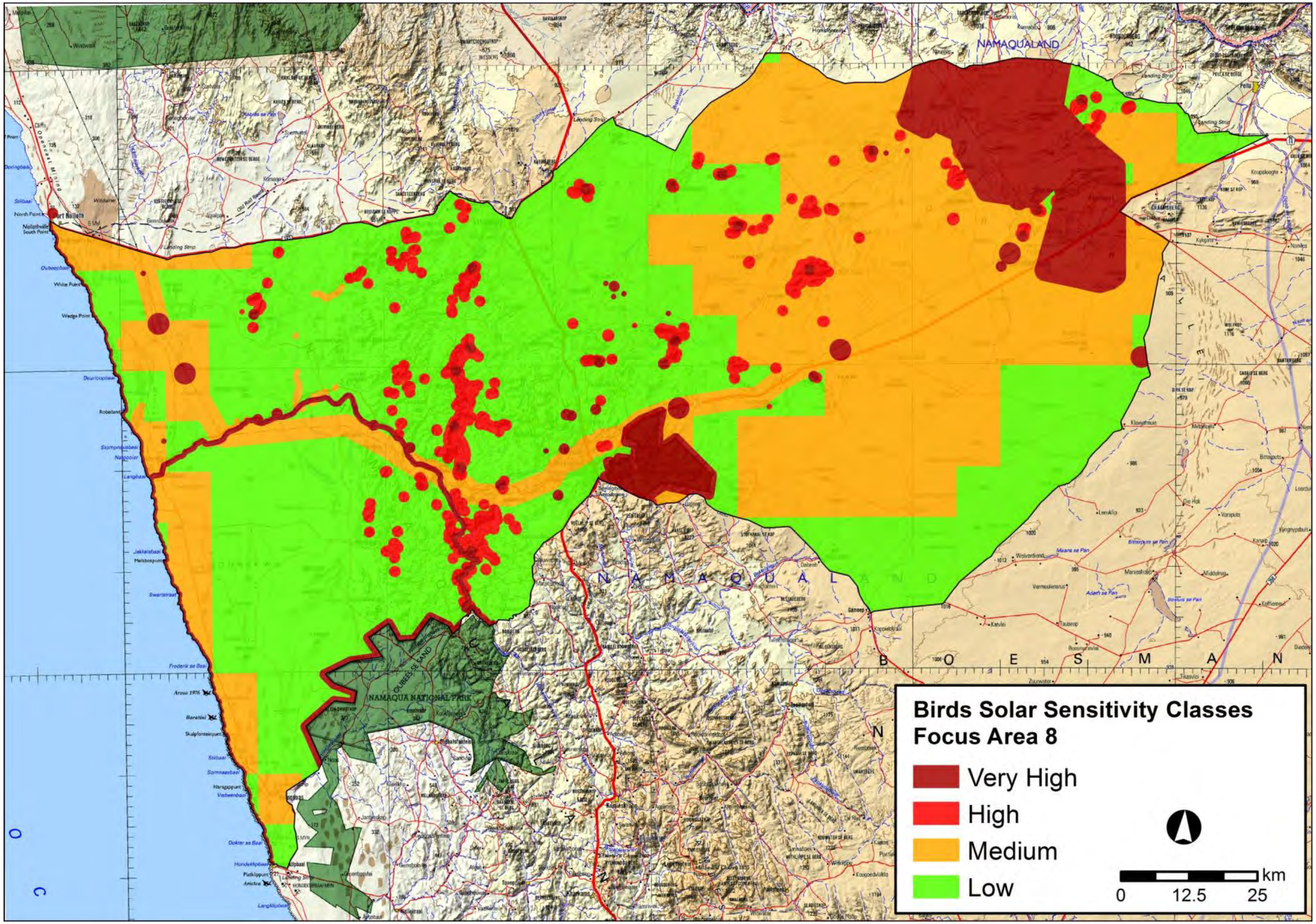
Map 13: Bird sensitivity map for Wind development in the Upington focus area (FA 7)



Map 14: Bird sensitivity map for Solar PV development in the Upington focus area (FA 7)



Map 15: Bird sensitivity map for Wind development in the Springbok focus area (FA 8)



Map 16: Bird sensitivity map for Solar PV development in the Springbok focus area (FA 8)

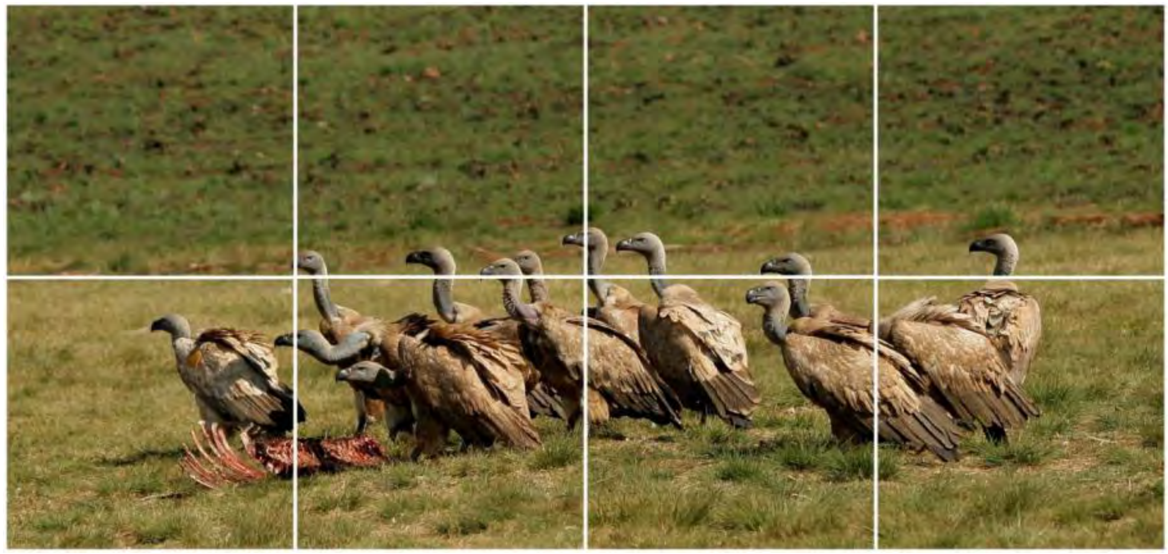
5.3 Development Protocols

The main objective of the bird study was to examine and map avian impact sensitivities within the eight FAs in order to allow for some abbreviation or streamlining of the current assessment requirements in less sensitive areas. With the study being based predominantly on desk-top integration and interpretation of existing data, the quality of available data limited the possibility of reducing the duration and scope of baseline fieldwork required to inform individual development applications within the majority of the FAs. This constraint does not apply to the Springbok focus area (FA 8) where time was spent gathering new, dedicated field information which permitted greater confidence in risk prediction, and the opportunity to relax baseline monitoring requirements.

In Table 2 below the current requirements for bird assessment are described. In Table 3 the new bird assessment requirements for wind and solar PV projects that will apply inside the FAs, once they have been adopted as REDZs, are described. These requirements are tailored to specific sensitivity classes and thus related to the above bird sensitivity maps.

Table 2: Interpretation of bird sensitivity and current assessment requirements

Assumed Sensitivity	Interpretation of the sensitivity	Current assessment requirements
Any area is considered as potentially being of very high sensitivity.	In the absence of any pre-assessment it is assumed that any area is potentially highly sensitive to development from a bird perspective due to the possible presence of important populations of threatened or impact susceptible species.	Proponents intending on developing a wind or solar PV facility triggering an environmental assessment process must prove to the relevant competent authority that the proposed development will not have an unacceptable negative impact on bird populations, both locally and regionally. To do so, a **comprehensive Bird Impact Assessment** undertaken by a competent bird specialist is required for wind farms and a **desktop study** and fieldtrip (if necessary) is required for solar PV projects. These studies must be conducted in accordance with NEMA regulations pertaining to specialist reports and impact assessment. Such an assessment must include: **Wind**: 12 months of bird monitoring undertaken in accordance with best practice guidelines[20]. If such a body exists, quarterly progress and final reports and recommendations must be peer reviewed by a body of bird specialists (e.g. Birdlife South Africa). If comment from such a body is received within stipulated timeframes it will be considered by the relevant competent authority for decision making. **Solar PV:** Desktop assessment and, if necessary, a field visit in accordance with best practice guidelines[21]. If such a body exists, quarterly progress and final reports and recommendations must be peer reviewed by a body of bird specialists (e.g. Birdlife South Africa). If comment from such a body is received within stipulated timeframes it will be considered by the relevant competent authority for decision making.



[20] Jenkins, A.R., Van Rooyen, C.S, Smallie, J.J., Anderson, M.D. and Smit, H.A. (2011) Best practice guidelines for monitoring and impact mitigation at wind energy development sites in southern Africa. Endangered Wildlife Trust/BirdLife South Africa, Johannesburg.

[21] Smit, H.A. 2011. Guidelines to minimise the impact on birds of solar facilities and associated infrastructure in South Africa. BirdLife South Africa, Johannesburg.

Table 3: Interpretation of bird sensitivity maps and associated new assessment requirements inside REDZs

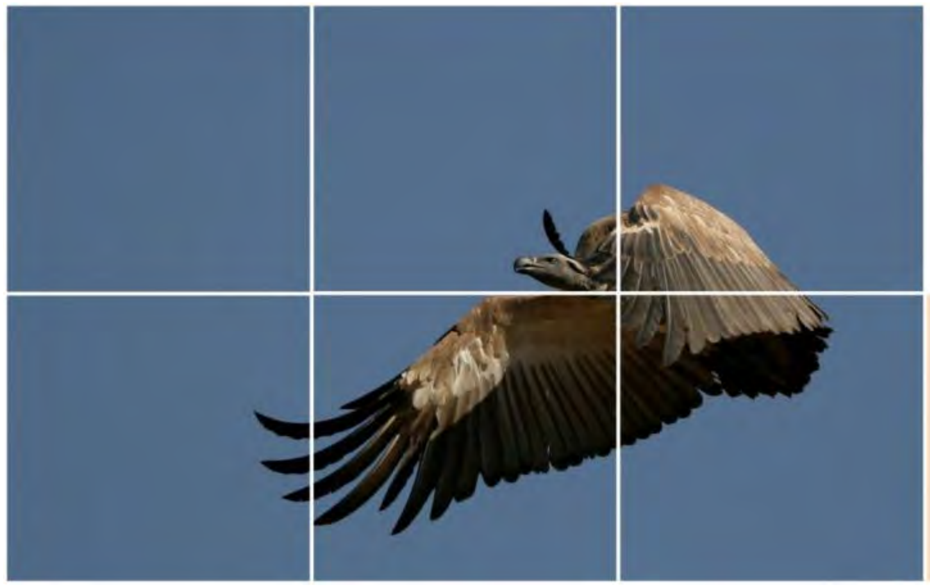
<table>
<tr><th>Colour</th><th>Sensitivity</th><th>Interpretation of the sensitivity</th><th>Further solar PV assessment requirement</th><th>Further Wind assessment requirements</th></tr>
<tr><td>Dark red</td><td>Very High</td><td>Very high sensitivity areas are likely to support important populations of threatened species that are susceptible to impacts. These areas are potentially not suitable for development and the identified sensitivities will require assessment before development can be considered in these areas.</td><td rowspan="4">Proponents intending to develop a solar PV facility that triggers an environmental assessment process in an adopted REDZ must prove to the relevant competent authority that the proposed development will not have an unacceptable negative impact on bird populations. Features identified as making these areas sensitive must be confirmed by a competent bird specialist in the form of an impact statement that has been informed by desktop review and a field visit (where required) in accordance with best practice guidelines[21]. If such a body exists, reports and recommendations must be submitted to a body of bird specialists (e.g. Birdlife South Africa). If comment from such a body is received within stipulated timeframes it will be considered by the relevant competent authority for decision making.

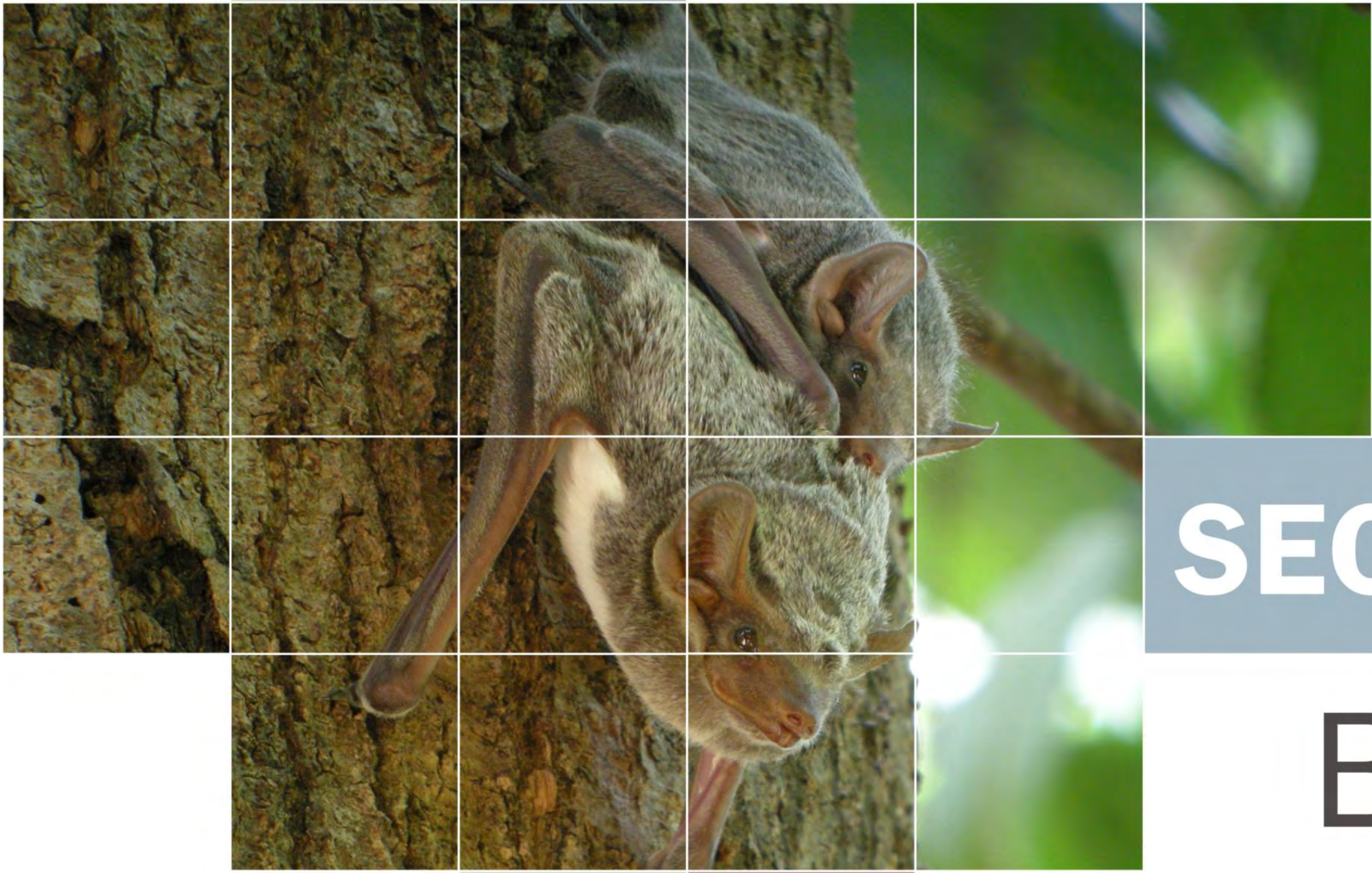
The minimum requirements for the impact statement are:
details and relevant expertise of the specialist preparing the statement;
project footprint (including supporting infrastructure) with a 50 m buffered development envelope, overlaid on a sensitivity map prepared in accordance with the sensitivity criteria set out in this study;
a clear and justified opinion statement by the specialist recommending whether the project should from a bird perspective receive approval. If this statement is subject to any conditions these must also be clearly stated; and
where required, proposed mitigation measures for inclusion in the Environmental Management Programme (EMPr).</td><td rowspan="4">Proponents intending to develop a wind facility that triggers an environmental assessment process in an adopted REDZ must prove to the relevant competent authority that the proposed development will not have a detrimental impact on bird populations. To do so, a Bird Impact Assessment undertaken by a competent bird specialist, and in accordance with NEMA regulations pertaining to specialist reports and impact assessment, is required. Such an assessment must include 12* months of bird monitoring undertaken in accordance with best practice guidelines[200]. If such a body exists, reports and recommendations must be submitted to a body of bird specialists (e.g. Birdlife South Africa). If comment from such a body is received within stipulated timeframes it will be considered by the relevant competent authority for decision making. Pre- and post-construction monitoring data must be shared on appropriate available databases (e.g. SANBI bird and bat database once it is operational).

In addition to the NEMA requirements a bird impact assessment report must contain:
project footprint (including supporting infrastructure) with a 50 m buffered development envelope, overlaid on a sensitivity map prepared in accordance with the sensitivity criteria set out in this study;
a clear and justified opinion statement by the specialist recommending whether the project should from a bird perspective receive approval. If this statement is subject to any conditions these must also be clearly stated; and
where required, proposed mitigation measures for inclusion in the EMPr.</td></tr>
<tr><td>Red</td><td>High</td><td>High sensitivity areas potentially support important populations of threatened species that are susceptible to impacts. These areas are potentially sensitive for development and the identified sensitivities will require assessment before any development can be considered in these areas</td></tr>
<tr><td>Orange</td><td>Medium</td><td>Medium sensitivity areas have limited potential for supporting important populations of threatened species that are susceptible to impacts. These areas are potentially suitable for development if identified sensitivities are fully investigated and effective mitigation measures identified.</td></tr>
<tr><td>Green</td><td>Low</td><td>Low sensitivity areas possibly do not support important populations of threatened species that are susceptible to impacts. These areas are probably suitable for development, but present levels of knowledge preclude confident predictions on the sustainability of impacts.</td></tr>
</table>

Notes:

* Due to fieldwork undertaken as part of this study resulting in greater confidence in the Springbok REDZ (8), the pre-construction bird monitoring requirements for wind facilities in the Low sensitivity (green) areas of this REDZ is reduced to 6 months, with provision for it to be extended should any unforeseen sensitivities emerge during this period. In all other REDZs a relaxation of monitoring requirements can be allowed by the relevant competent authority in Low sensitivity (green) areas if results from initial monitoring in terms of the best practice guidelines support such a relaxation.

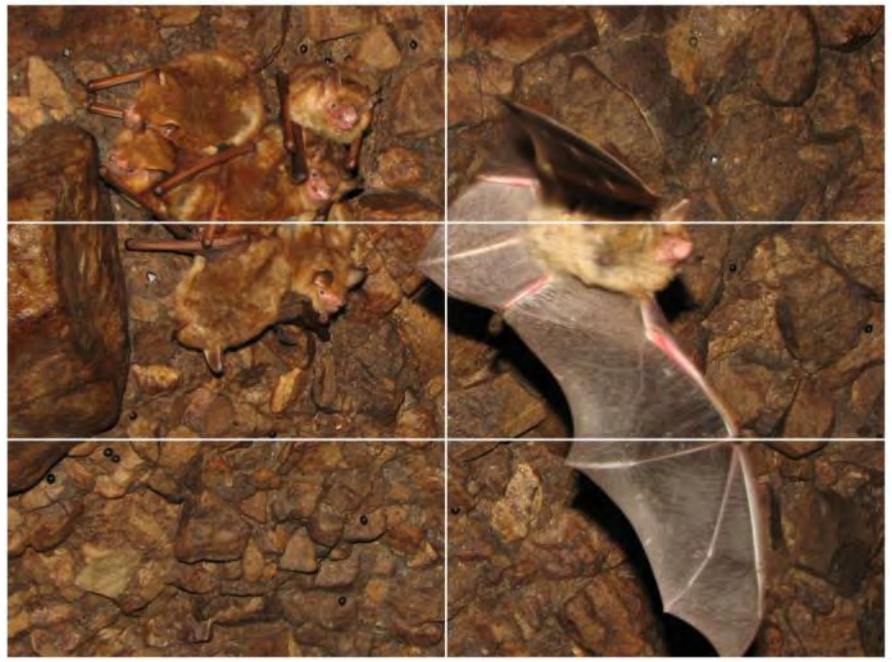




SECTION 6

BATS

contents



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PART 3. SCOPING ASSESSMENTS AND DEVELOPMENT PROTOCOLS

SECTION 6: BATS

The following section is informed by the scoping level specialist bat pre-assessment of the eight Focus Areas (FAs) for which the complete report is provided as Appendix A6. Due to the integrated and strategic nature of this Strategic Environmental Assessment (SEA), and based on consultation with relevant government departments and wider stakeholders, the final interpretation of sensitivities and development protocols presented in this section differ from those contained and recommended in the specialist report.

6.1 Renewable Energy and Bats

6.1.1 Wind Energy

The key impacts of wind energy facilities on bats are barotrauma and direct collision, in particular for open-air foraging bat species. Certain bat species are at a higher risk of fatality by wind turbines due to their specific flight behaviour. High flying, open-air foraging species, such as the free-tailed bats (family Molossidae), as well as 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*) migrating in potentially large groups, are of particular concern in terms of mass fatalities. However, many other families such as 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 thus far been found dead under South African turbines.

Published research from the Coega Industrial Development Zone in the Eastern Cape reports 18 bat collisions leading to 17 fatalities for a single 1.8 MW turbine over a 12 month period[1]. This study was based on 154 site inspections and the 18 collisions were of two bat species, both high-flying and insectivorous. Considering that some facilities in SA will have 40 to 60 turbines, the annual fatalities at these facilities are likely to be significant. Whilst at the time of preparing this report this is the only published account of a 12 month post-construction study in SA, more intensive post-construction bat monitoring studies will in future provide a better understanding on the South African reality of bat fatalities at wind facilities.

Further suspected direct and indirect impacts which need to be investigated at national and international levels in further detail include:

- Disturbance to or loss of roost sites;
- Loss or alteration of foraging habitat;
- Alteration of bat species composition due to artificial light; and
- Barrier or fragmentation effect to dispersing or migrating bats.

Several hypotheses relating to potential attraction factors (e.g. insects, heat, visual, sound, and roosting opportunities) at wind turbines have been proposed[2]. The hypothesized causes of bat fatalities at turbines fall into two general categories, namely proximate and ultimate[3]. Proximate causes explain the direct means by which bats die at turbines and include collision with towers and rotating blades as well as 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 speculative hypothesis is emerging – bats mistaking the smooth surfaces of the turbines as water. As an extension to previous work conducted[4], one study speculates that bats may be attracted to wind turbines because they perceive the smooth surfaces as water[5]. 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, with on-going research focused on bat fatalities at wind turbines being critical to the understanding of the issue and effective mitigation.

6.1.2 Solar PV Energy

Solar photovoltaic (PV) developments are implemented worldwide since 1970 and large facilities require detailed environmental impact assessments and monitoring studies in most European countries and American states. To date, these developments have not been found to present a significant direct impact on bat populations. Consequently, in South Africa, such projects have generally received environmental

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[1] 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.

[2] 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.

[3] Cryan, P.M., & Barclay, R.M.R. (2009). Causes of Bat Fatalities at Wind Turbines: Hypotheses & Predictions. *Journal of Mammalogy*, 90(6):1330–1340

[4] Greif, S. and Siemers, B.M. (2010). Innate recognition of water bodies in echolocating bats. *Nature Communications* 1:107

[5] 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.

authorisation without requiring bat baseline monitoring or specialist studies.

Nonetheless, several secondary and speculative impacts are mentioned in international scientific publications which deserve consideration and should be further investigated. These potential impacts include the disturbance of bat communities through land clearance and the potential collision of bats with panels in the unlikely event that a bat would confuse the hard surface of the solar panel with the smooth water surface and dive into the panel. As bats have an innate ability to echolocate water by recognising the echo from water surfaces, it should be further investigated if the surfaces of solar panels could be confused with water surfaces. In the event that a Solar PV facility is constructed near bat roosting habitats, such as trees, buildings or caves, there may thus be a disturbance and displacement impact, especially due to the land on which the development is sited remaining relatively sterile for the life of the facility.

6.1.3 Power Lines

The potential impacts on bats during the construction of power lines could include roost disturbance and foraging habitat loss associated with clearing the right of way and sensory disturbance due to increased levels of noise and dust associated with 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. 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 for certain species. Electromagnetic radiation may also have behavioural effects on bats[6]. The suggested impacts may be compounded if power lines are erected along bat migration routes.

6.2 Sensitivity Mapping

6.2.1 Key Environmental Considerations

Several environmental factors can influence bat species distribution at a regional scale, such as elevation, climate, land use, vegetation, habitat heterogeneity and geology, 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, while the sensitivity mapping took various additional factors into consideration as described in Table 1.

[6] 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

6.2.1.1 Terrestrial Ecoregions

Ecoregions are large units of land containing a geographically distinct assemblage of species, natural communities, and environmental conditions. The Ecoregion concept is similar to the Biome concept, incorporating both vegetation communities and climate. The nine Biomes of South Africa are broader scale than the more detailed 15 Ecoregions. There is evidence to suggest that bats might adapt to local environmental conditions at a Biome level. Based on long-term bat monitoring data from 11 wind facilities between 2011 and 2013 in the Western, Northern and Eastern Cape provinces, bat activity levels have been found to vary between the different Ecoregions.

6.2.1.2 Geology

Geology is a significant environmental parameter for bats, as many South African bats are crevice or hollow-roosting species. Crevice roosting bats utilizing rock cracks, bridge expansion joints, 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 carbonate rocks such as limestone and dolomite. Although there is not much known about the migration routes of bats in South Africa, it is known that three cave dwelling species undertake seasonal migrations. In Gauteng, Limpopo and the Western Cape[7], it has been reported that *Miniopterus natalensis* (Natal long-fingered bat) migrates up to 260 km [8] 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. One frugivorous bat species, *Rousettus aegyptiacus* (Egyptian rousette) is a gregarious cave-dweller also known to migrate distances of 50 to 500 km [9].

[7] 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

[8] 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.

[9] Kunz, T.H., Murray, S.W., & Fuller, N.W., (2012). Bats. Encyclopedia of Caves Second Edition (2012) 45–54 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.

6.2.1.3 Land use

Bat sensitivities are affected by land use 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.

6.2.2 Data Sources

While various environmental parameters and spatial data sources can be considered for the bat sensitivity spatial mapping exercise, only those parameters considered important for bats, as either important for roosting or foraging, were used for this study. Sensitivity maps were developed for the 8 FAs based on bat habitat features with appropriate sensitivity buffers as contained in Table 1. The study was based predominantly on desktop information and limited field verification visits to eight key cave-type roosts in the three Cape provinces.

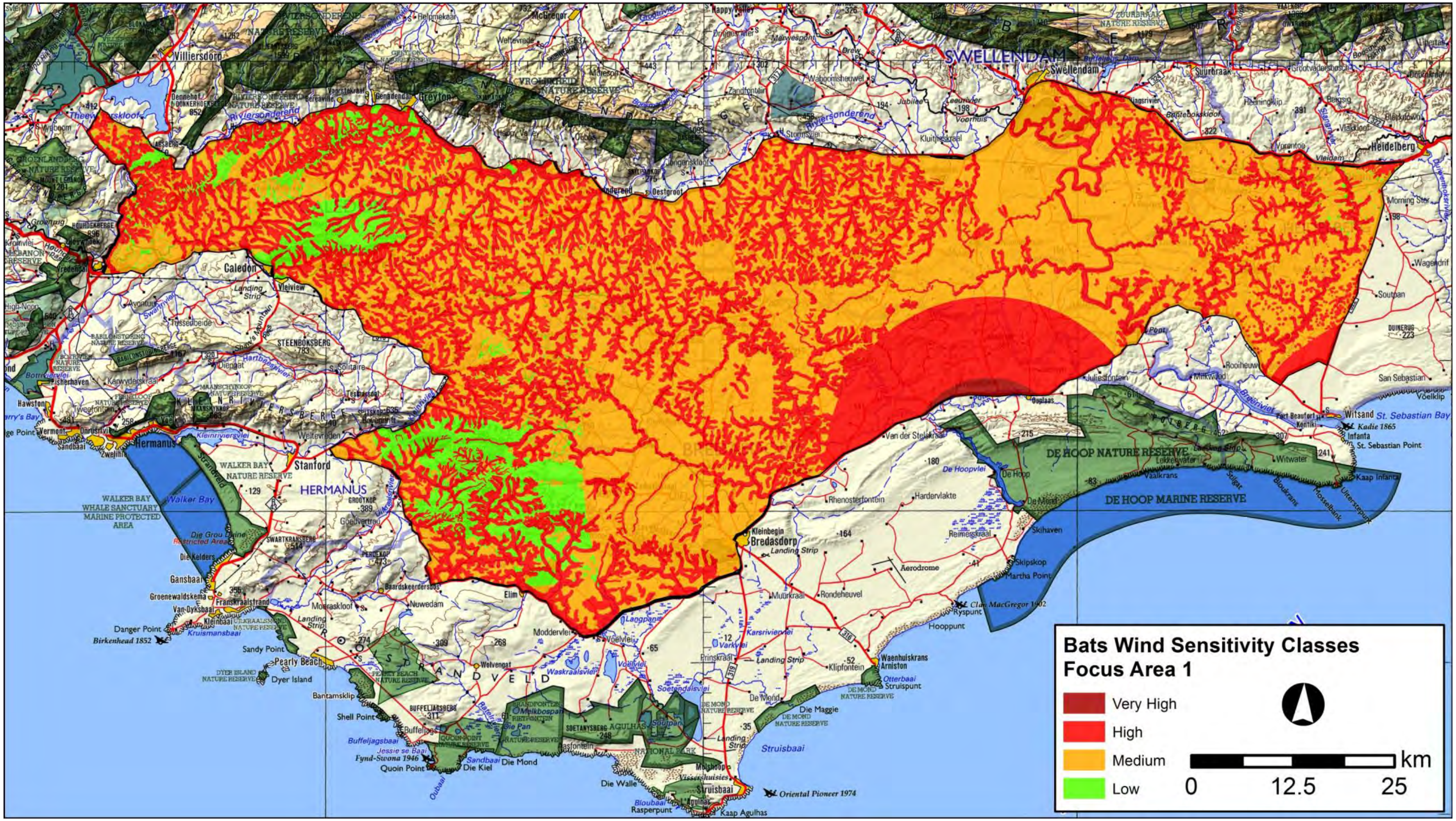
Table 1: Spatial data used in the bat sensitivity mapping

Sensitivity Feature	Data Source	Sensitivity Mapping Application	
		Wind	Solar PV
Rivers and Wetlands · There is strong support for the importance of rivers and riparian areas for bats.	· National Freshwater Ecosystem Priority Areas (NFEPA) (2011) updated by wetland specialist as part of Terrestrial and Biodiversity assessment of this study	· **High Sensitivity** within sensitivity distances varying between 25 and 500 m as determined by wetland specialist based on wetland/river attributes	· **High Sensitivity** within sensitivity distances varying between 25 and 500 m as determined by wetland specialist based on wetland/river attributes
Dolomite and Limestone · Geological features in the form of rock crevices and caves are essential roosting habitats for many bats species.	· Geology: SA Council for Geoscience	· **High Sensitivity** dolomite and limestone outcrops	· **High Sensitivity** dolomite and limestone outcrops
Forests · Forests provide a favourable habitat for bats.	· Mucina, L. & Rutherford, M.C. (2006). The vegetation map of South Africa, Lesotho and Swaziland.	· **High Sensitivity** forest habitats	· **High Sensitivity** forest habitats
Croplands · Irrigated crop areas provide valuable foraging habitat for insectivorous bats, while bats can also provide natural crop pest control to farmers.	· Field Crop Boundaries - Department of Agriculture, Forestry and Fisheries (2013)	· **Medium Sensitivity** croplands	· **Medium Sensitivity** croplands
Coastline · The unique costal habitat provides several foraging and rousting opportunities.	· Surveyor General (2006) 1:50 000 topographical maps	· **Very High Sensitivity** within 5 km of coastline · **High Sensitivity** between 5 and 10 km from coastline · **Medium Sensitivity** between 10 and 20 km from coastline	· **Very High Sensitivity** within 1 km of coastline · **Medium Sensitivity** between 1 and 5 km from coastline
Confirmed Small Cave Roosts · Less than 500 bats	Various sources and field verifications	· **Very High Sensitivity** within 2.5 km of roost · **High Sensitivity** between 2.5 and 5 km from roost · **Medium Sensitivity** between 5 and 10 km from roost	· **Very High Sensitivity** within 500 m of roost
Confirmed Medium Cave Roosts · Between 500 and 2000 bats	Various sources and field verifications	· **Very High Sensitivity** within 5 km of roost · **High Sensitivity** between 5 and 10 km from roost · **Medium Sensitivity** between 10 and 20 km from roost	· **Very High Sensitivity** within 500 m from roost · **Medium Sensitivity** between 500 and 2 500 m from roost

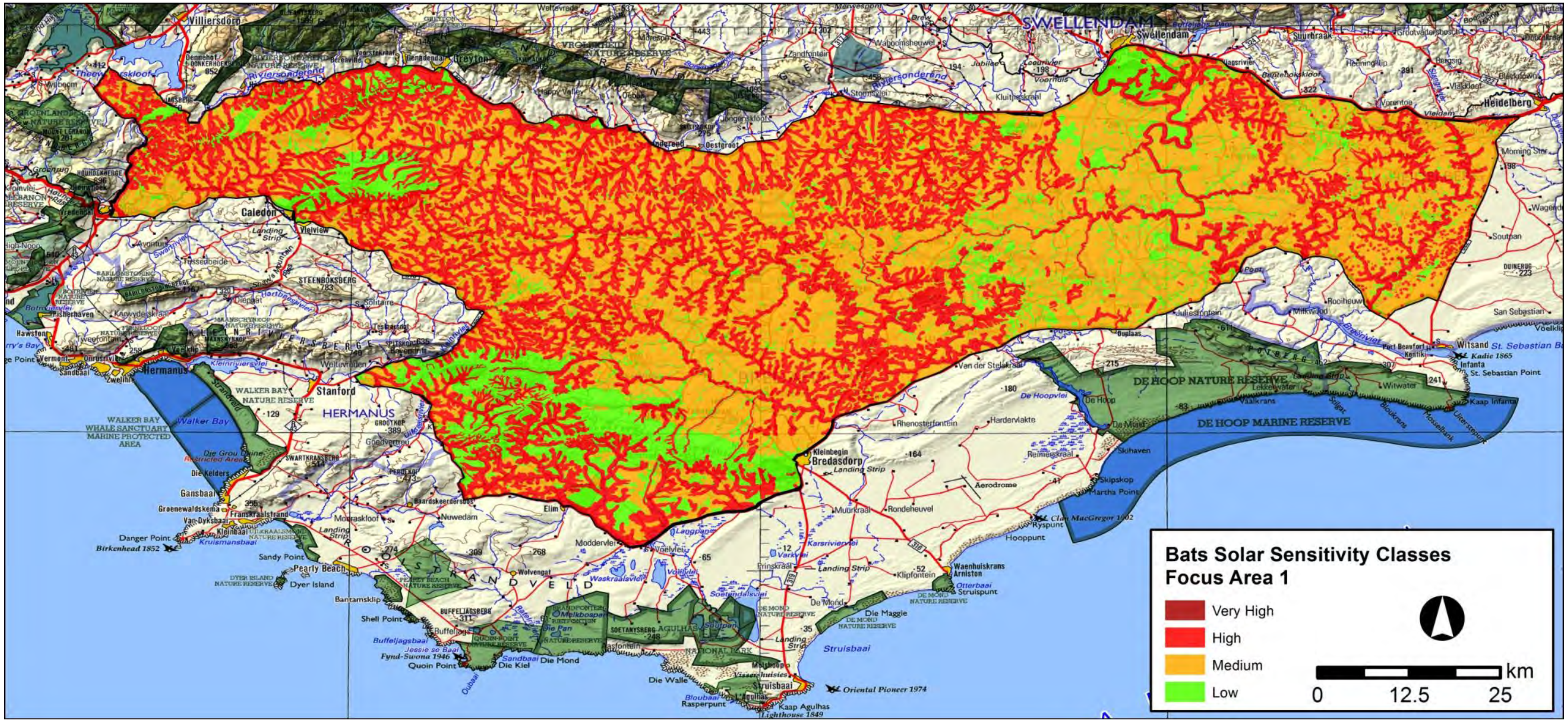
Sensitivity Feature	Data Source	Sensitivity Mapping Application	
		Wind	Solar PV
Confirmed Large Cave Roosts · More than 2000 bats	Various sources and field verifications	· **Very High Sensitivity** within 10 km of roost · **High Sensitivity** between 10 and 20 km from roost · **Medium Sensitivity** between 20 and 50 km from roost	· **Very High Sensitivity** within 1 km of roost · **Medium Sensitivity** between 1 and 5 from roost
Unconfirmed Cave Roosts - These roosts are unconfirmed and need to be verified before applicable buffers are applied	Various sources and field verifications	· **Medium Sensitivity** within 10 km of roost	· **Medium Sensitivity** within 1 km of roost

6.2.3 Sensitivity Maps

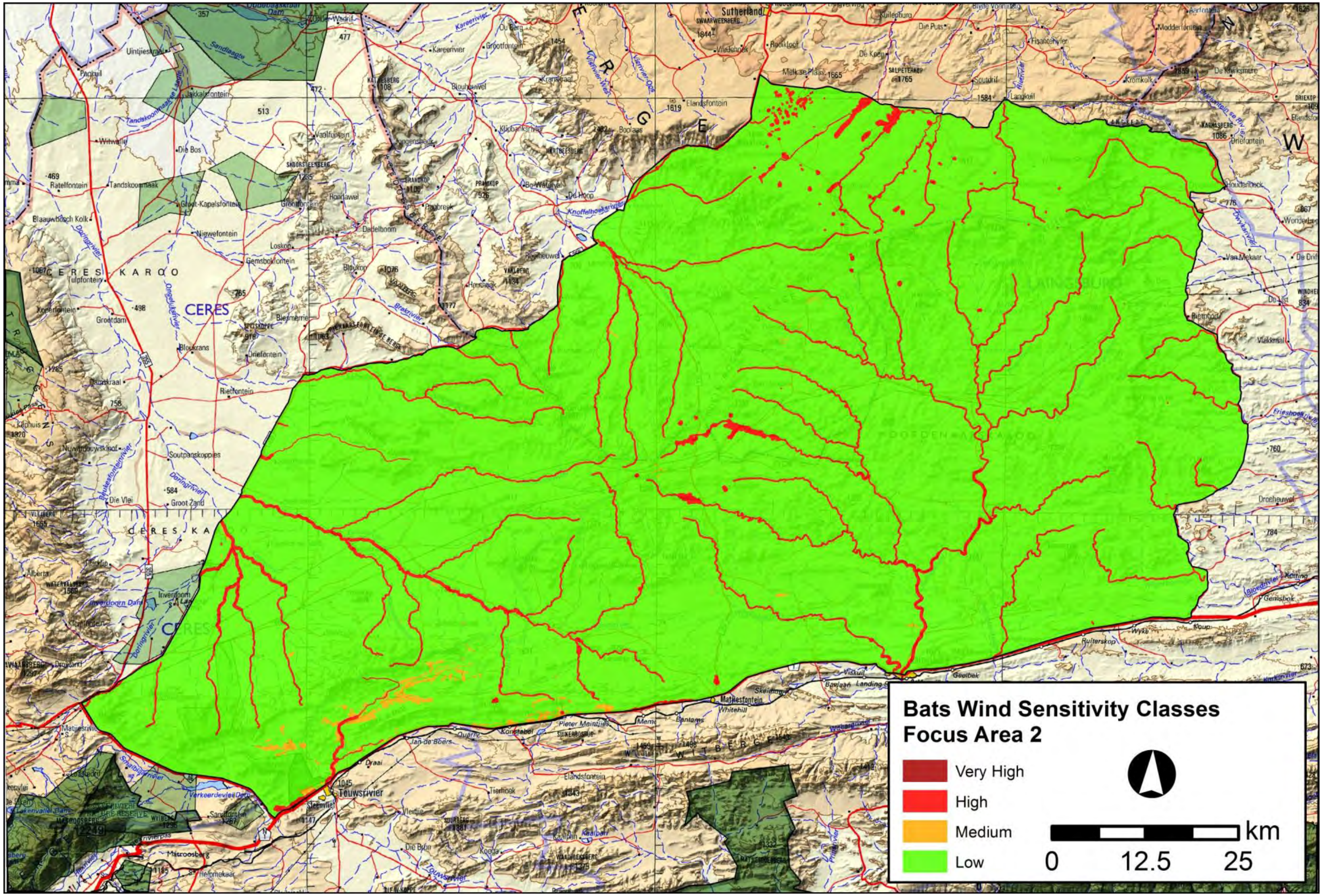
Sensitivity Maps 1 – 16 below classify bat sensitivities spatially into four tiers of Very High, High, Medium and Low. These were produced for each focus area according to the criteria set out in Table 1.



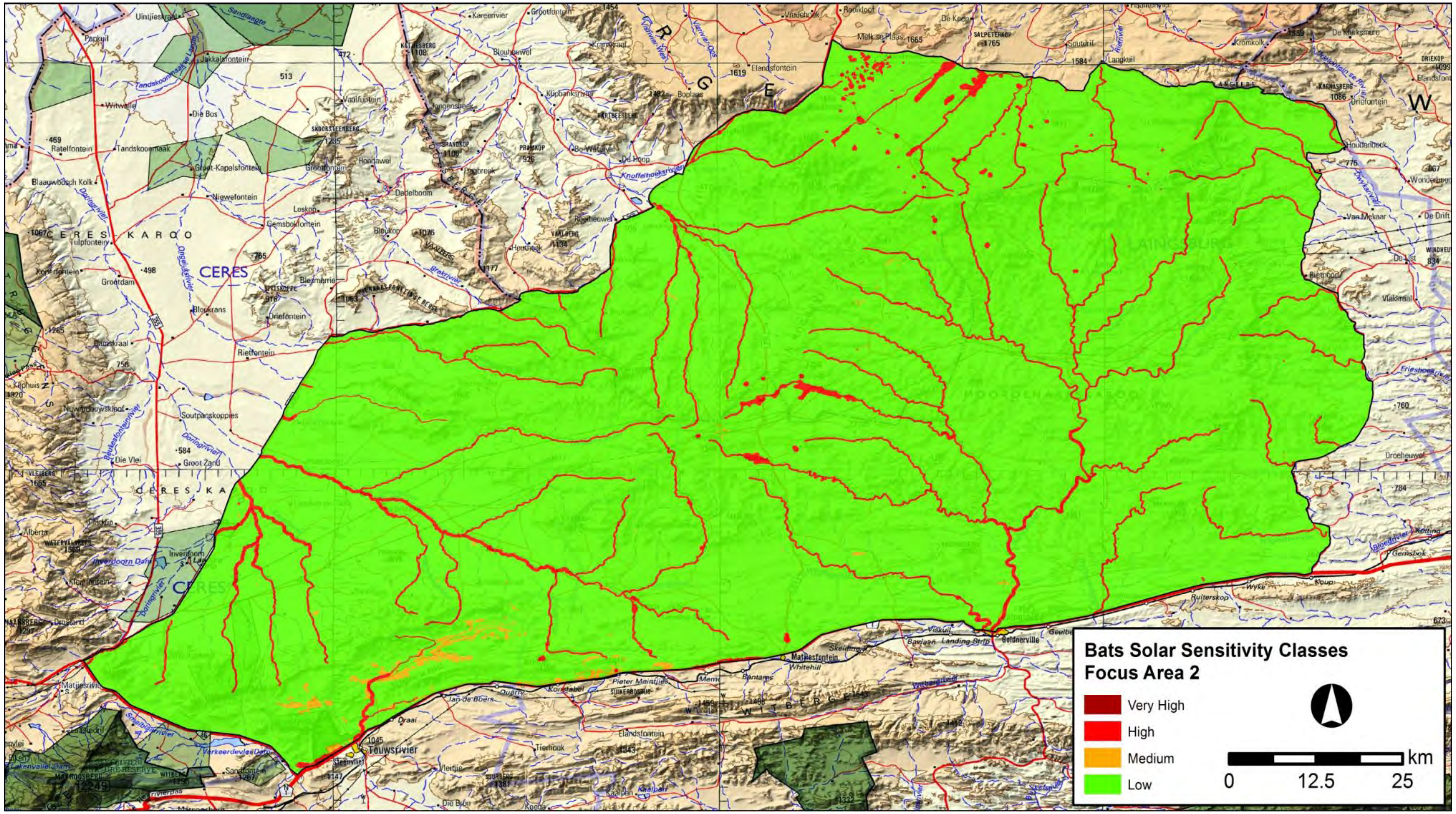
Map 1: Bat sensitivity map for Wind development in the Overberg focus area (FA 1)



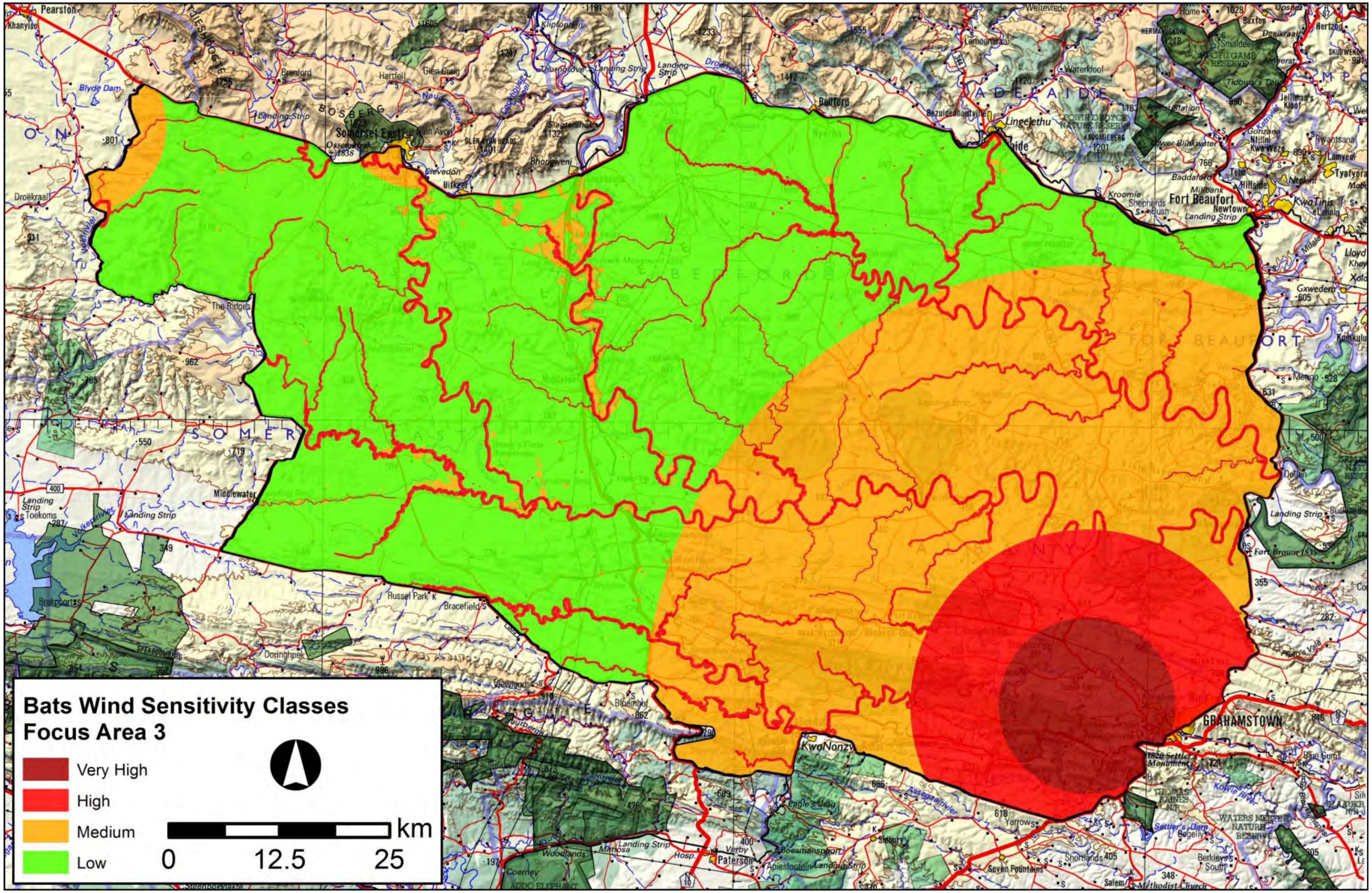
Map 2: Bat sensitivity map for Solar PV development in the Overberg focus area (FA 1)



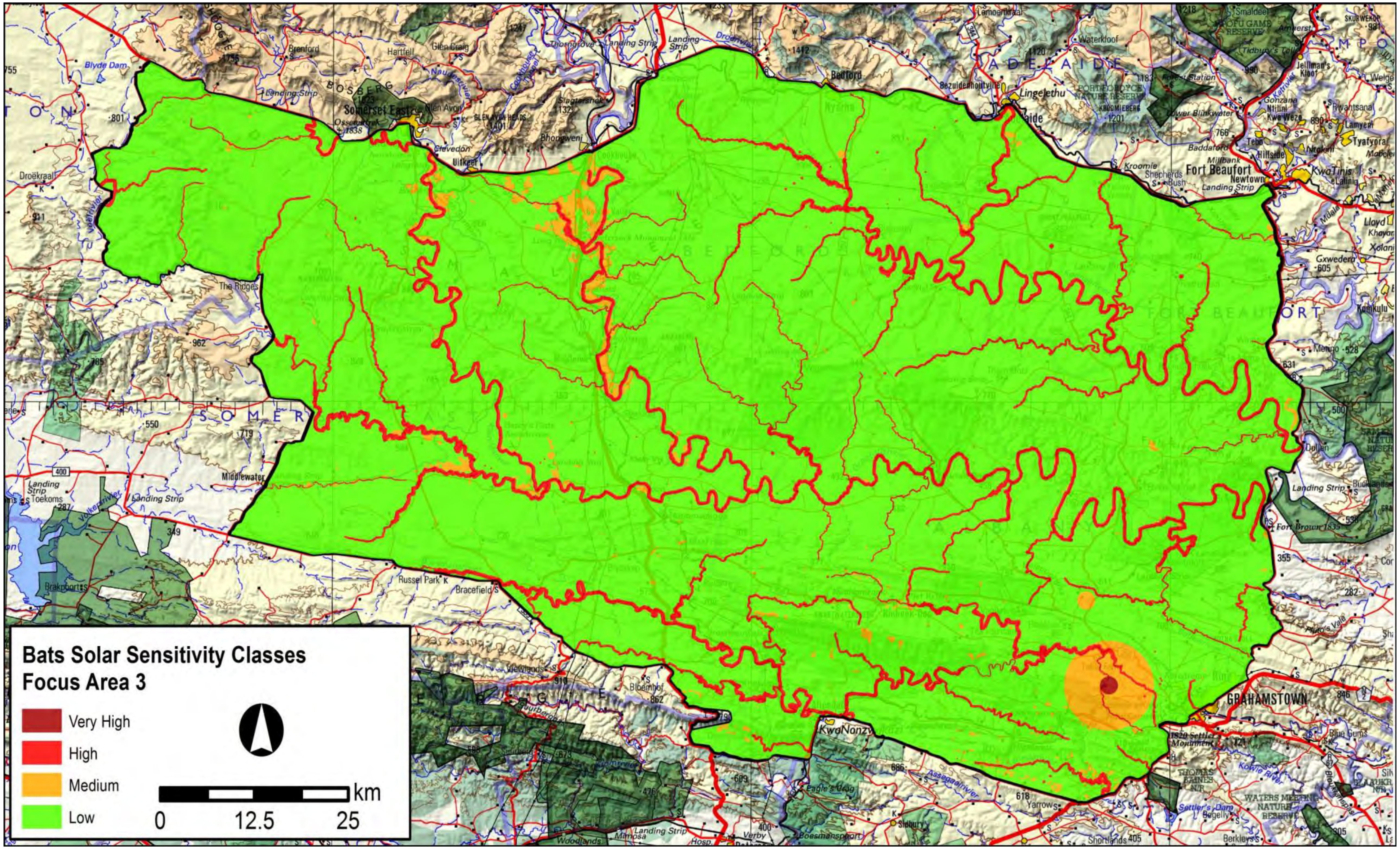
Map 3: Bat sensitivity map for Wind development in the Komsberg focus area (FA 2)



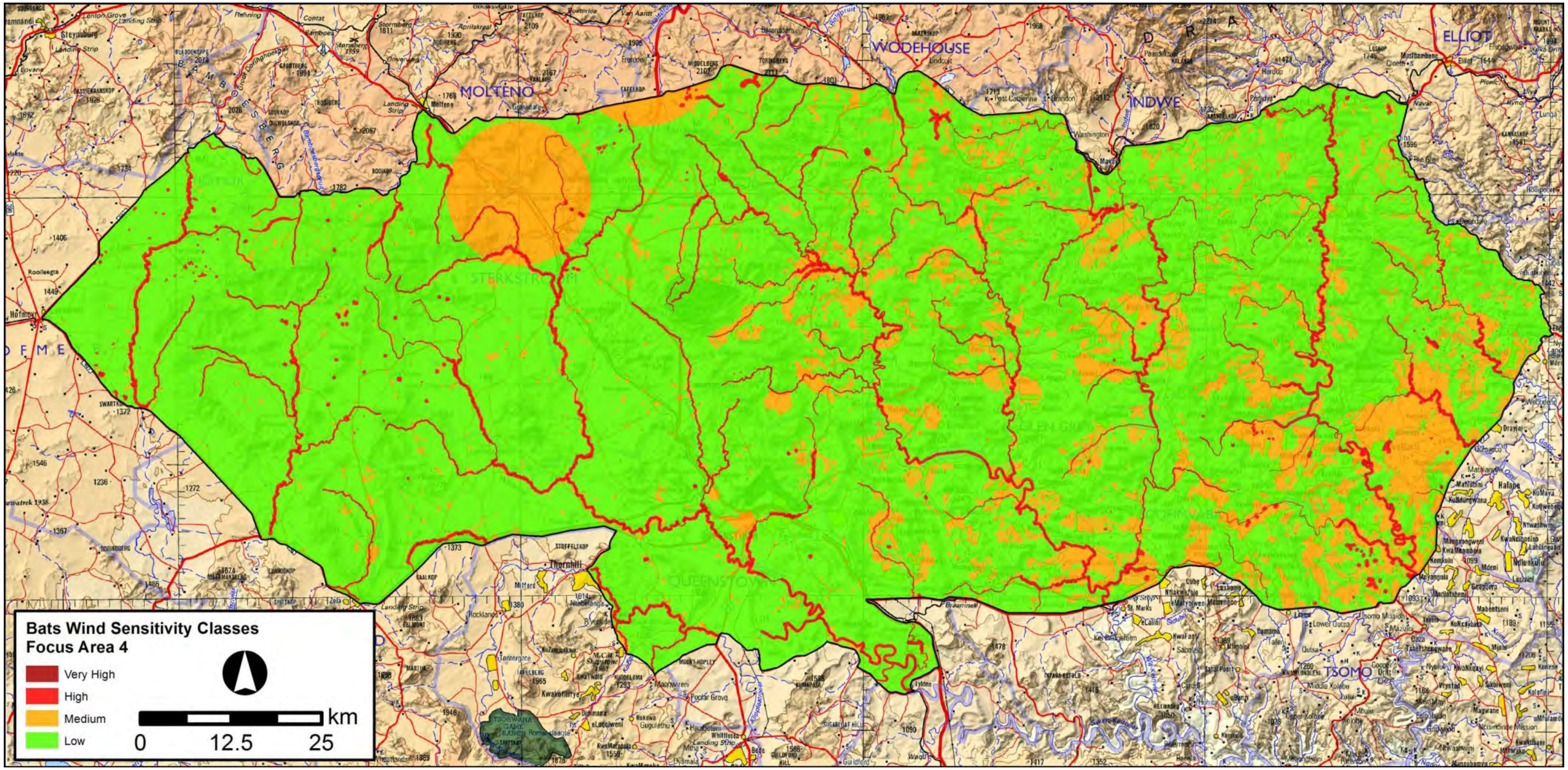
Map 4: Bat sensitivity map for Solar PV development in the Komsberg focus area (FA 2)



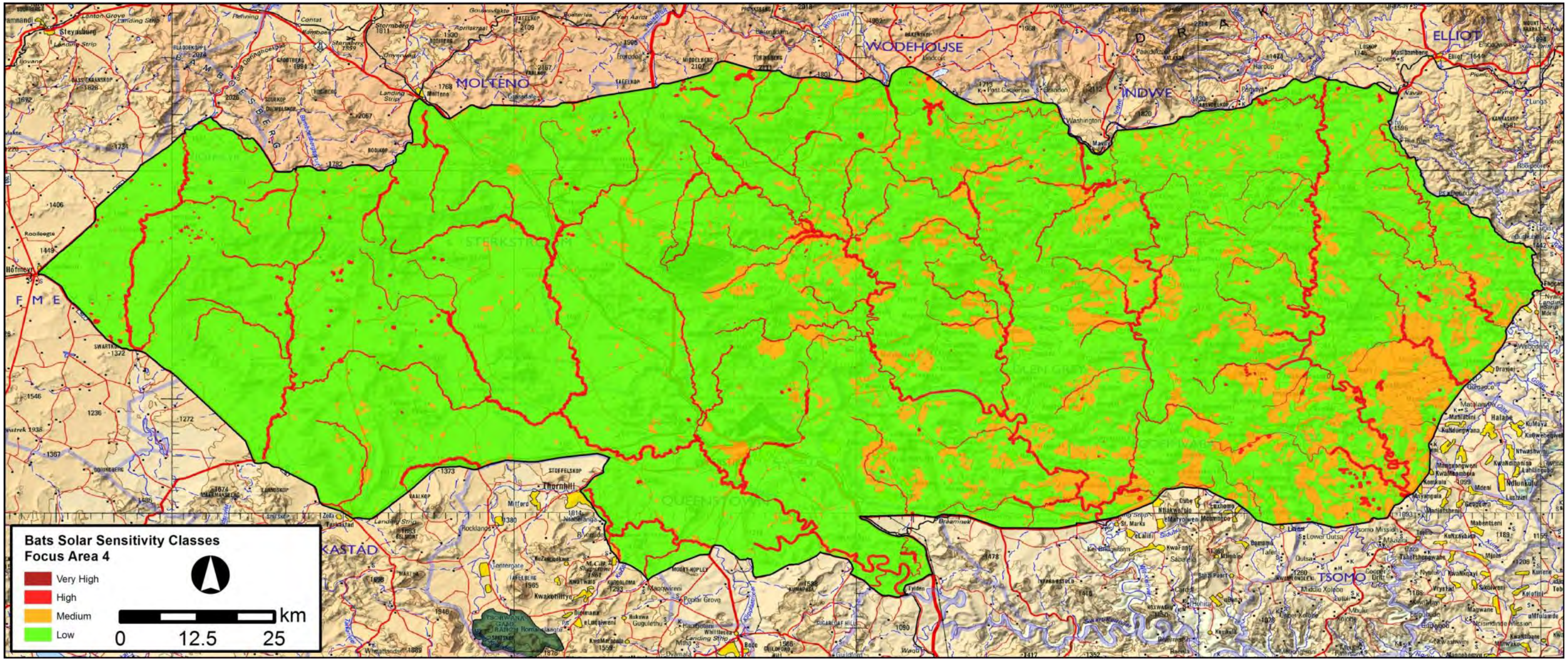
Map 5: Bat sensitivity map for Wind development in the Cookhouse focus area (FA 3)



Map 6: Bat sensitivity map for Solar PV development in the Cookhouse focus area (FA 3)



Map 7: Bat sensitivity map for Wind development in the Stormberg focus area (FA 4)



Map 8: Bat sensitivity map for Solar PV development in the Stormberg focus area (FA 4)

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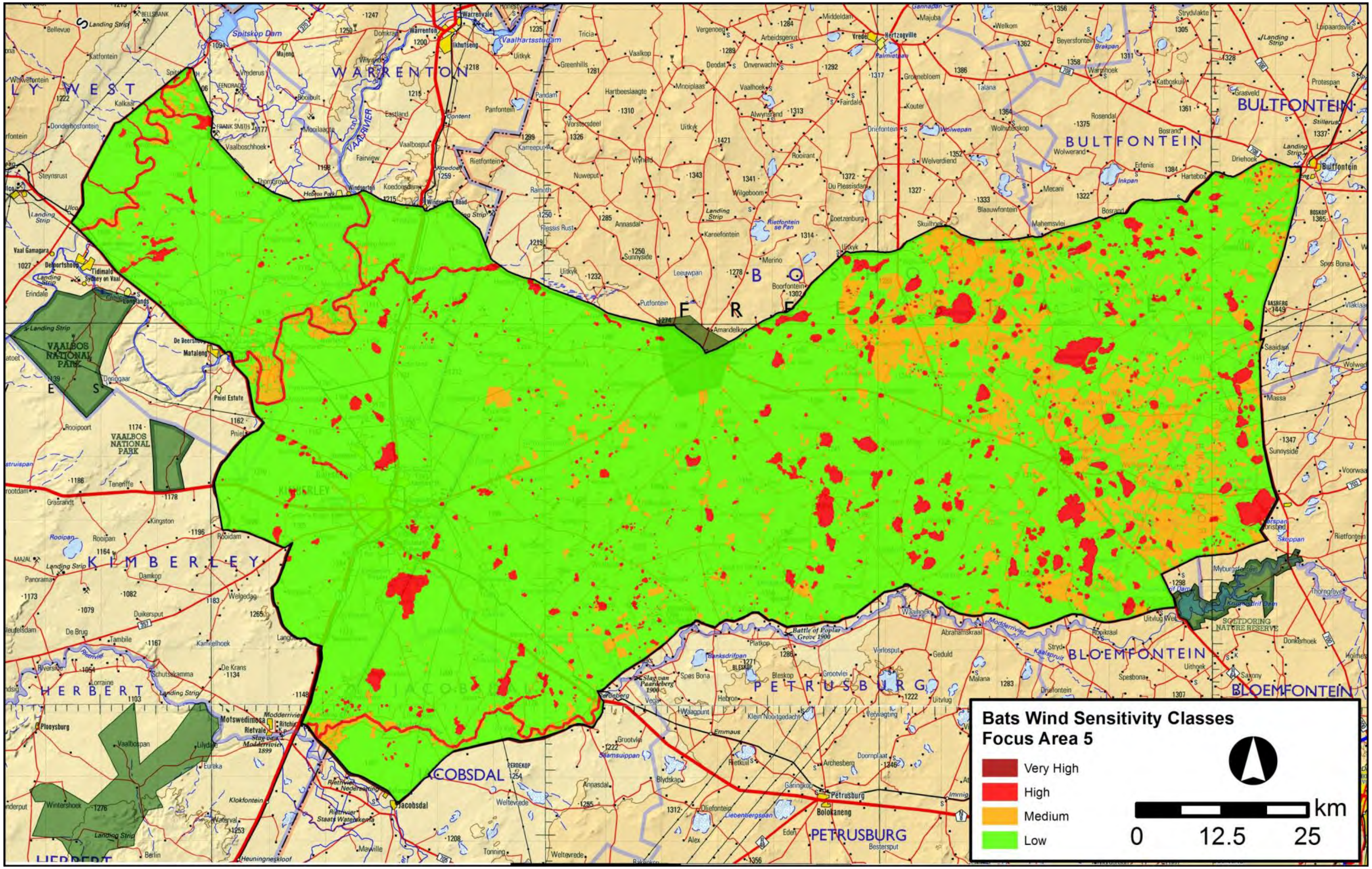
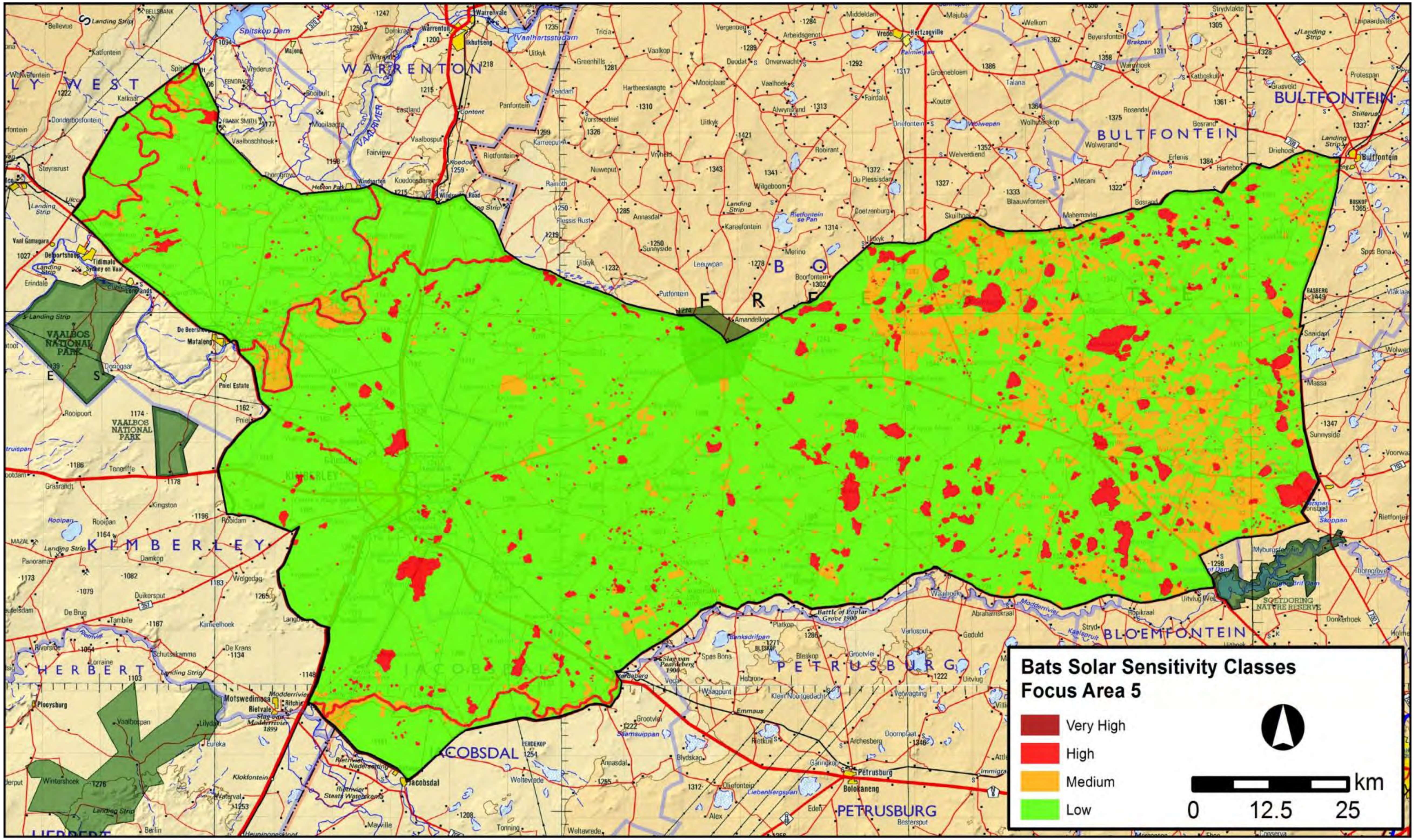
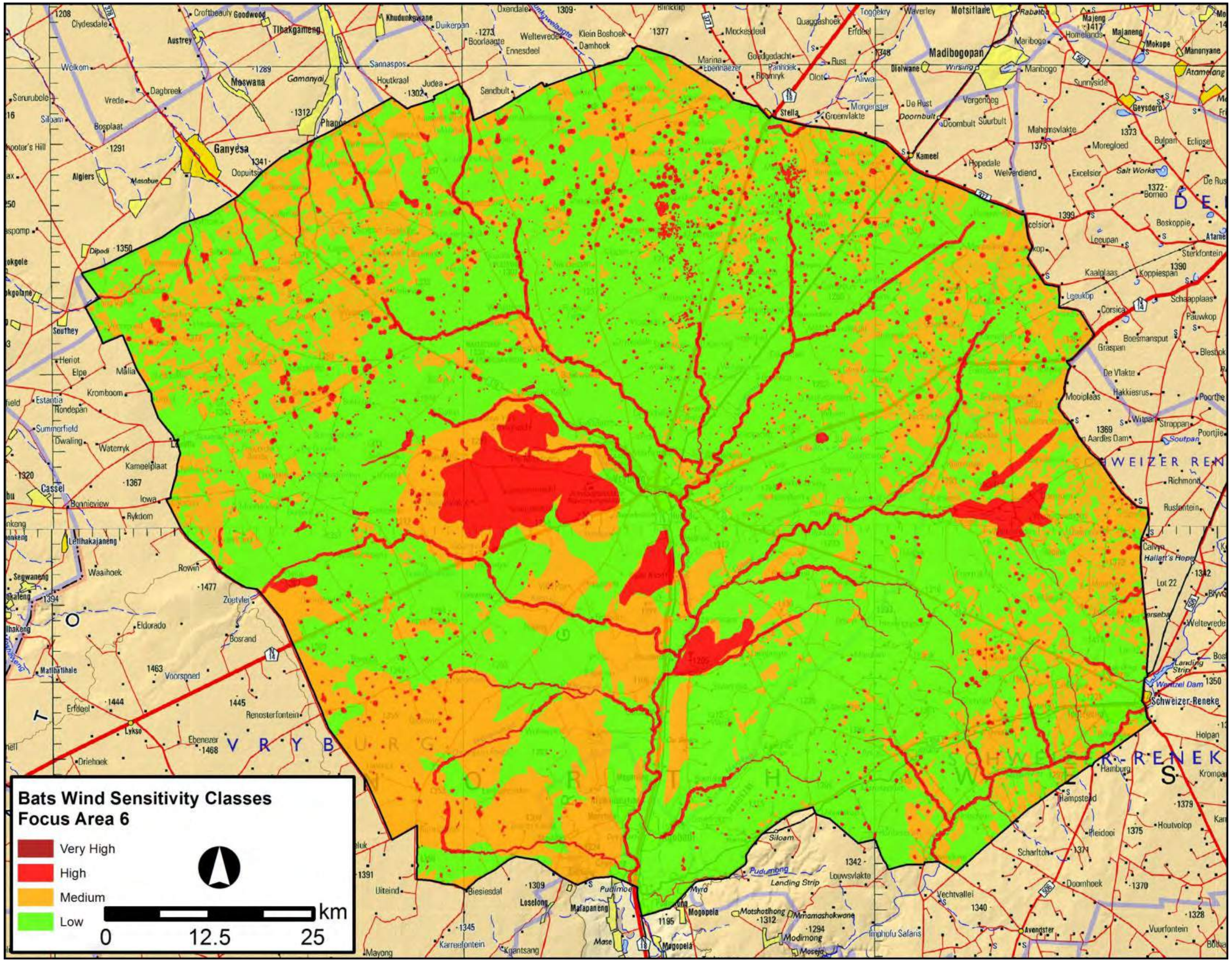


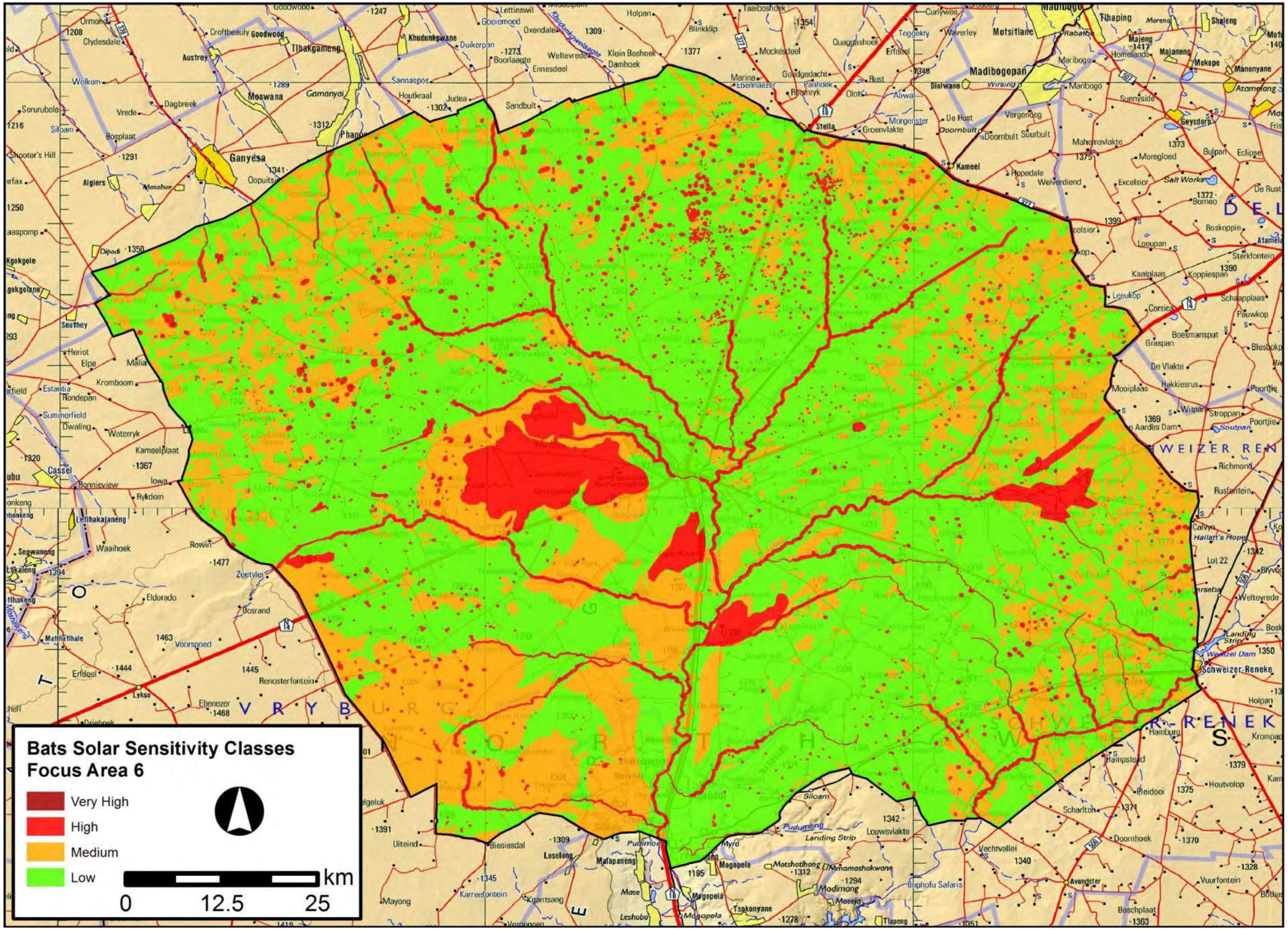
Map 9: Bat sensitivity map for Wind development in the Kimberley focus area (FA 5)



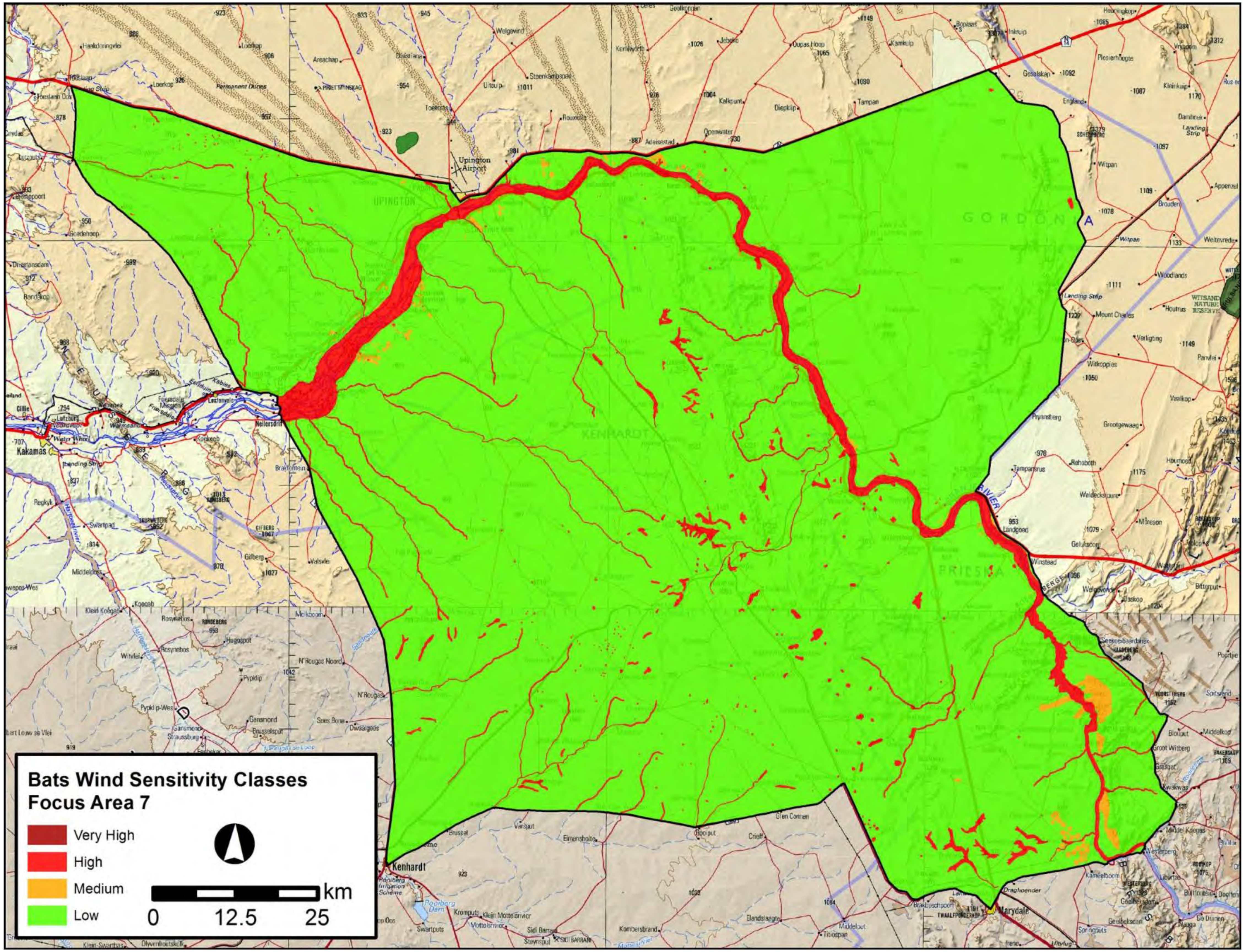
Map 10: Bat sensitivity map for Solar PV development in the Kimberley focus area (FA 5)



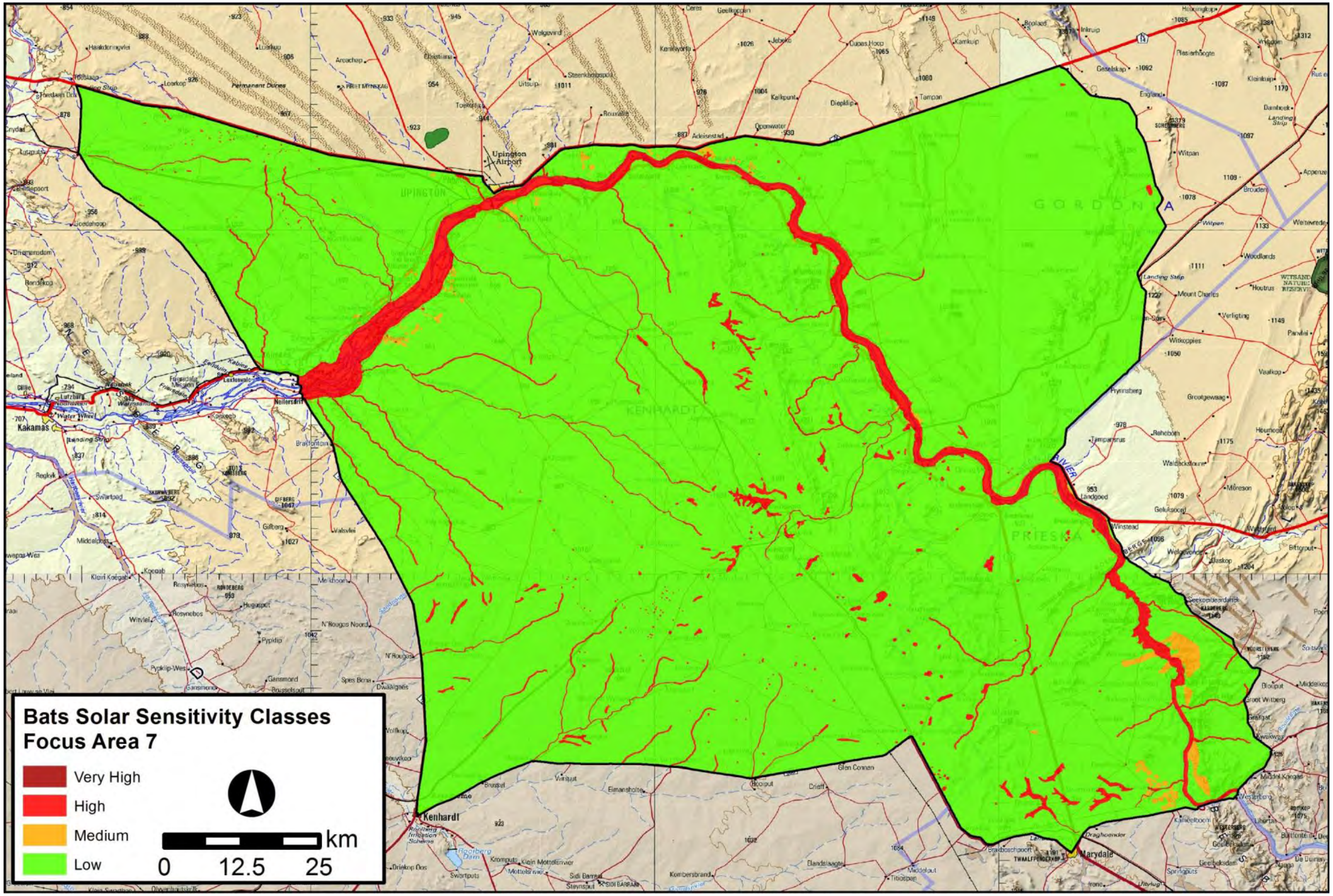
Map 11: Bat sensitivity map for Wind development in the Vryburg focus area (FA 6)



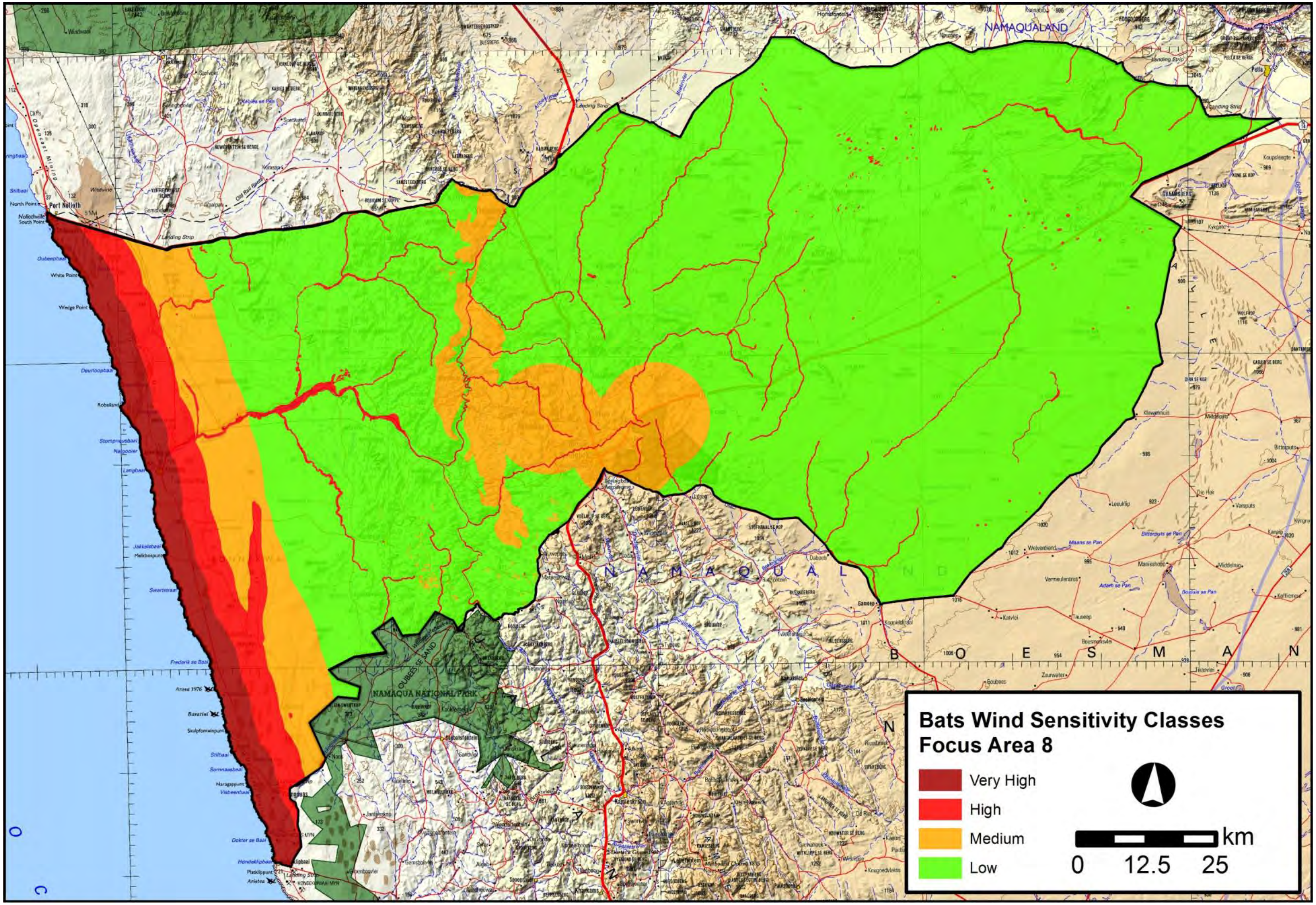
Map 12: Bat sensitivity map for Solar PV development in the Vryburg focus area (FA 6)



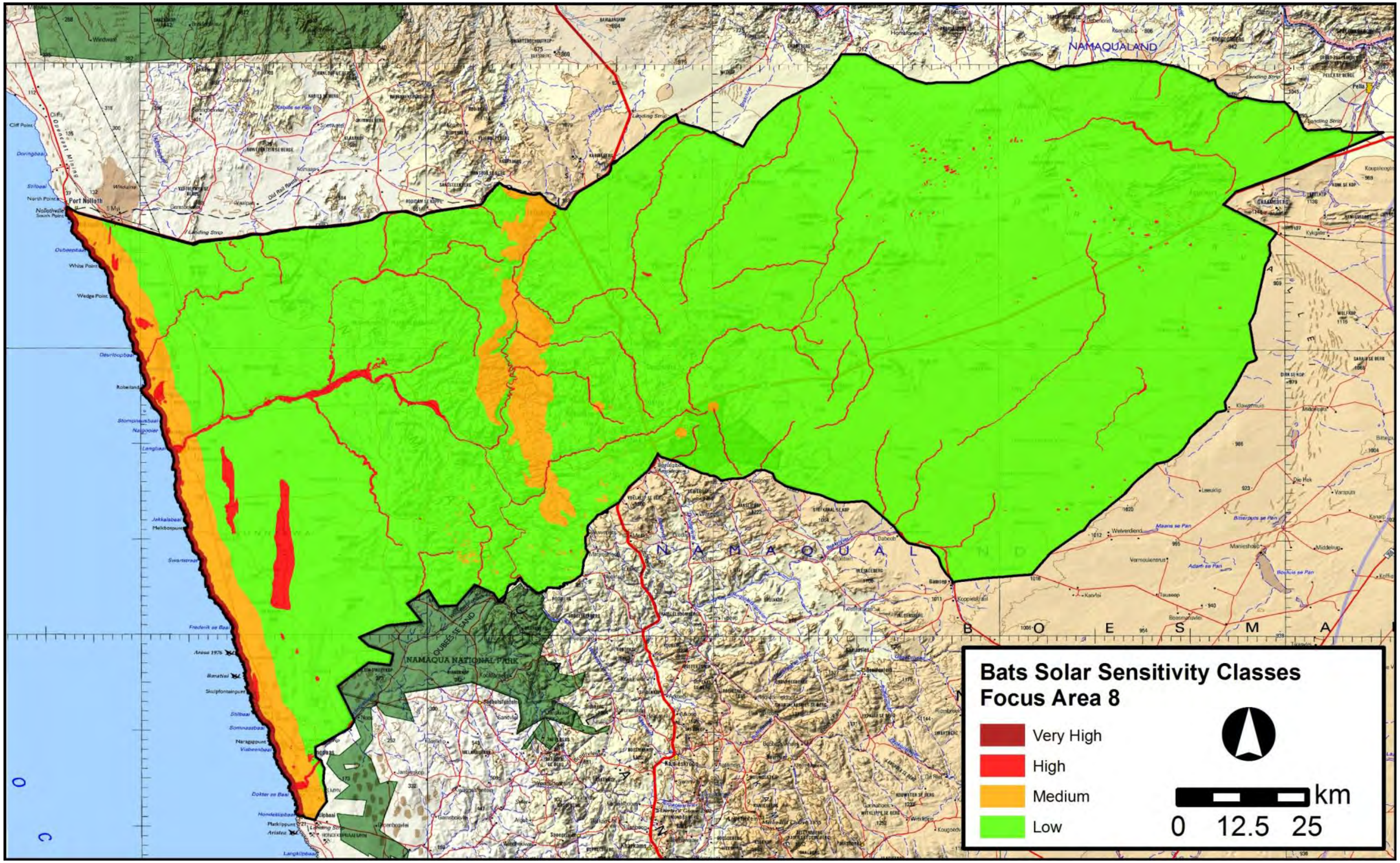
Map 13: Bat sensitivity map for Wind development in the Upington focus area (FA 7)



Map 14: Bat sensitivity map for Solar PV development in the Upington focus area (FA 7)



Map 15: Bat sensitivity map for Wind development in the Springbok focus area (FA 8)



Map 16: Bat sensitivity map for Solar PV development in the Springbok focus area (FA 8)

6.3 Development Protocols

The main objective of the bat study was to examine and map the bat sensitivities within the eight FAs in order to allow for some abbreviation or streamlining of the current assessment requirements in less sensitive areas. With the study being based predominantly on desk-top integration and interpretation of existing data, the quality of the available data limited the possibility for reducing the assessments required to inform individual development applications within the FAs.

In Table 2 below, the current requirements for bat assessment are described. In Table 3 the new bat assessment requirements for wind and solar PV projects that will apply in the FAs, once they have been adopted as REDZs, are described. These requirements are specific to sensitivity classes and are therefore related to the sensitivity maps above.

Table 2: Interpretation of bat sensitivity and current assessment requirements

Assumed Sensitivity	Interpretation of the sensitivity	Current assessment requirements	
		Wind	Solar PV
Any area is considered as potentially being of very high sensitivity.	In the absence of any pre-assessment it is assumed that any area is potentially highly sensitivity to development from a bat perspective, either due to the presence of roosting or foraging habitat.	Proponents intending to develop a wind facility triggering an environmental assessment process must prove to the relevant competent authority that the proposed development will not have an unacceptable negative impact on bat populations, both locally and regionally. To do so, a **comprehensive Bat Impact Assessment** undertaken by a competent bat specialist, and in accordance with the National Environmental Management Act (NEMA) regulations pertaining to specialist reports and impact assessment, is required. Such an assessment must include 12 months of pre-construction bat monitoring undertaken in accordance with best practice guidelines[10]. If such a body exists, quarterly progress and final reports and recommendations must be peer reviewed by a body of bat specialists (e.g. the South African Bat Assessment Advisory Panel). Comments from such a body, if provided within stipulated timeframes, will be considered by the relevant competent authority for decision making.	Proponents intending to develop a solar PV facility that triggers an environmental impact assessment process must prove to the relevant competent authority that the proposed development will not have an unacceptable negative impact on bat populations, both locally and regionally. To do so, a competent general ecologist must consider significant bat impacts (if any) **as part of the terrestrial and ecological biodiversity assessment**. In the case that any significant bat sensitivities are identified, a competent bat specialist should be involved to assess the impacts in accordance with the NEMA regulations pertaining to specialist reports and impact assessment. If such a body exists, final reports and recommendations prepared for significant bat sensitivities must be peer reviewed by a body of bat specialists (e.g. the South African Bat Assessment Advisory Panel). Comments from such a body, if provided within stipulated timeframes, will be considered by the relevant competent authority for decision making.

10 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

Table 3: Interpretation of bat sensitivity maps and associated new assessment requirements in REDZs

<table>
<tr><th rowspan="2">Colour</th><th rowspan="2">Sensitivity</th><th rowspan="2">Interpretation of the sensitivity</th><th colspan="2">Further onsite assessment requirement</th></tr>
<tr><th>Wind</th><th>Solar PV</th></tr>
<tr><td>Dark red</td><td>Very High</td><td>Very high sensitivity areas are likely to support important populations of threatened species that are susceptible to impacts. These areas are potentially not suitable for development and the identified sensitivities will require extensive assessment before any development can be considered.</td><td rowspan="4">Proponents intending to develop a wind facility that triggers an environmental impact assessment process in an adopted REDZ must prove to the relevant competent authority that the proposed development will not have an unacceptable negative impact on bat populations, both locally and regionally. To do so, a comprehensive Bat Impact Assessment undertaken by a competent bat specialist, and in accordance with NEMA regulations pertaining to specialist reports and impact assessment, is required. Such an assessment must include 12 months* of bat monitoring undertaken in accordance with the best practice guidelines[10]. If such a body exists, reports and recommendations must be submitted to a body of bat specialists (e.g. the South African Bat Assessment Advisory Panel). Comments from such bodies, if provided within stipulated timeframes, will be considered by the relevant competent authority for decision making. Pre- and post-construction monitoring data must be shared on appropriate available databases (e.g. SANBI bird and bat database once it is operational).

In addition to the NEMA requirements the bat impact assessment report must contain:
project footprint (including supporting infrastructure) with a 50 m buffered development envelope, overlaid on a sensitivity map prepared in accordance with the sensitivity criteria set out in this study;
a clear and justified opinion statement by the specialist recommending whether the project should from a bird perspective receive approval. If this statement is subject to any conditions these must also be clearly stated; and
where required, proposed mitigation measures for inclusion in the Environmental Management Programme (EMPr).</td><td rowspan="4">Proponents intending to develop a solar PV facility that triggers an environmental impact assessment process in an adopted REDZ must prove to the relevant competent authority that the proposed development will not have an unacceptable negative impact on bat populations, both locally and regionally. To do so a competent general ecologist must consider significant bat impacts (if any) as part of the terrestrial and ecological biodiversity assessment. In the case that any significant bat sensitivities are identified a competent bat specialist should be involved to assess the impacts in accordance with the NEMA regulations pertaining to specialist reports and impact assessment. If such a body exists, reports and recommendations prepared for significant bat sensitivities must be submitted to a body of bat specialists (e.g. the South African Bat Assessment Advisory Panel). Comments from such a body, if provided within stipulated timeframes, will be considered by the relevant competent authority for decision making.

In the case that a competent bat specialist is appointed to conduct an assessment of potential impacts on bats, the following requirements should be considered in addition to the NEMA requirements:
project footprint (including supporting infrastructure) with a 50 m buffered development envelope, overlaid on a sensitivity map prepared in accordance with the sensitivity criteria set out in this study;
a clear and justified opinion statement by the specialist recommending whether the project should from a bird perspective receive approval. If this statement is subject to any conditions these must also be clearly stated; and
where required, proposed mitigation measures for inclusion in the EMPr.</td></tr>
<tr><td>Red</td><td>High</td><td>High sensitivity areas potentially support important populations of threatened species that are susceptible to impacts. These areas are potentially sensitive for development and the identified sensitivities will require assessment before any development can be considered.</td></tr>
<tr><td>Orange</td><td>Medium</td><td>Medium sensitivity areas have limited potential for supporting important populations of threatened species that are susceptible to impacts. These areas are potentially suitable for development if identified sensitivities are fully investigated and effective mitigation measures identified.</td></tr>
<tr><td>Green</td><td>Low</td><td>Low sensitivity areas possibly do not support important populations of threatened species that are susceptible to impacts. These areas are probably suitable for development, but present levels of knowledge preclude confident predictions on the sustainability of impacts.</td></tr>
<tr><td colspan="5">Notes:
* In all REDZs a relaxation of monitoring requirements can be allowed by the relevant competent authority in Low sensitivity areas if results from initial monitoring in terms of the best practice guidelines support such a relaxation.</td></tr>
</table>

SECTION 7

CIVIL AVIATION

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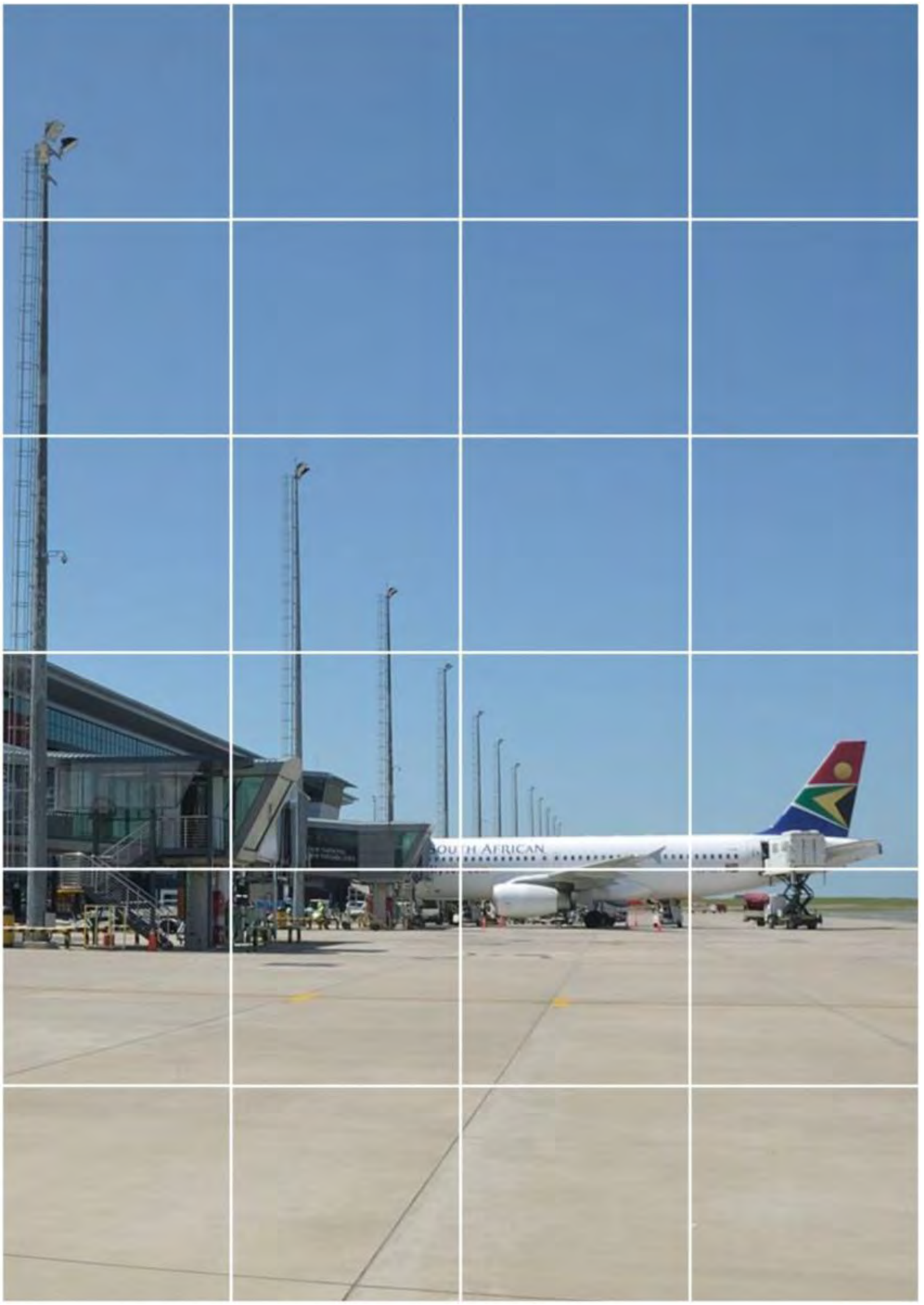


PART 3. SCOPING ASSESSMENTS AND DEVELOPMENT PROTOCOLS

SECTION 7: CIVIL AVIATION

Civil aviation in South Africa is governed by the Civil Aviation Act, 2009 (Act 13 of 2009). This Act provides for the establishment of a stand-alone authority mandated with controlling, promoting, regulating, supporting, developing, enforcing and continuously improving levels of safety and security throughout the civil aviation industry. This mandate is fulfilled by the South African Civil Aviation Authority (SA CAA) as an agency of the Department of Transport (DoT). The SA CAA achieves the objectives set out in the Act by complying with the Standards and Recommended Practices (SARPs) of the International Civil Aviation Organisation (ICAO), while considering the local context when issuing the South African Civil Aviation Regulations (SA CARs). All proposed developments or activities in South Africa that potentially could affect civil aviation must thus be assessed by SACAA in terms of the SA CARs and South African Civil Aviation Technical Standards (SA CATS) in order to ensure aviation safety.

The Obstacle Evaluation Committee (OEC) which consists of members from both the SA CAA and South African Air Force (SAAF) fulfils the role of streamlining and coordinating the assessment and approvals of proposed developments or activities that have the potential to affect civil aviation, military aviation, or military areas of interest. With both being national and international priorities, the OEC is responsible for facilitating the coexistence of aviation and renewable energy development, without compromising aviation safety.

This section focuses only on potential impacts of wind and solar photovoltaic (PV) development on civil aviation, while the following section (Section 8: Defence) deals with military aviation and areas of interest.

7.1 Renewable Energy and Civil Aviation

Wind turbines potentially can have a variety of negative impacts on civil aviation. Key potential impacts include turbines presenting a physical obstacle to aviation and adversely affecting the overall performance of navigation and surveillance equipment. Moreover, the greatest risk to aviation is linked to the cumulative effects of large scale developments in areas that are sensitive in terms of aviation.

According to international (ICAO) and local (SA CARs) standards, aviation operations may be conducted at a height of 150 m (500 feet) above ground level, and lower if these can be carried out without being a hazard or nuisance to persons or property on the ground. Any obstacle protruding above this height is thus considered a danger to aviation.

In South Africa all structures higher than 15 metres above ground level must be assessed and registered as potential obstacles to aviation in the Electronic Terrain and Obstacle Database (eTOD). With wind turbines potentially protruding beyond 150 m above ground level, they present a real danger to aviation, especially if sited in close proximity to aerodromes. It is for this reason that the safeguarding of the areas around aerodromes is important and that specific safety requirements (e.g. lighting and markings) are applicable to all wind turbines.

The potential impacts of wind turbines on surveillance and navigation equipment are predominantly caused by the energy transmitted by the radar and returned by the turbines. The returned energy can result in the false detection of aircraft (i.e. clutter) or create blind spots behind wind facilities. In severe cases the amount of returned energy can saturate the radar receiver and result in the radar system not being able to make any further detection. In terms of civil aviation this impact is most pronounced on the primary radar systems at major aerodromes. Such systems can be affected by any development in radio line of sight (which is generally 20% further than optical line of sight) and is thus dependent on the height of the turbine and the terrain. The size (i.e. rotor diameter) and distance from the radar station further determines the magnitude of the impact. It is generally unlikely for this impact to occur if development is further than 35 km from the radar station.

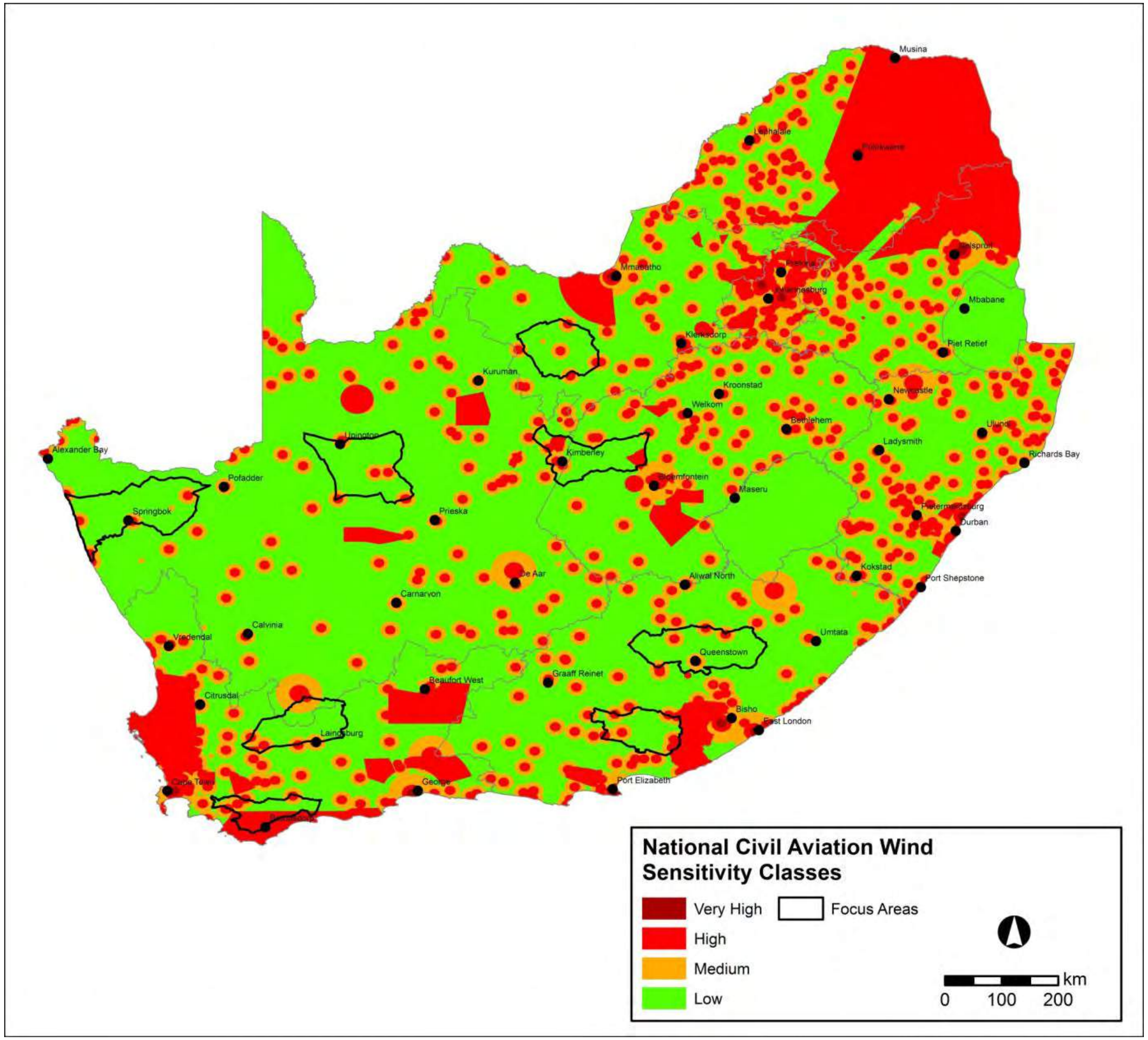
In terms of solar PV development the impact on aviation is limited and internationally there is a growing interest for airports to install this technology in order to reduce operating cost and show a commitment to sustainable development. The main potential impact of PV development on civil aviation would be the height and routing of power lines in the vicinity of aerodromes, especially where these may cross through the approach or departure path. Another potential impact is the reflection from solar PV panels dazzling pilots. Considering the fact that reflected light from a solar panel is unlikely to be greater than that from an open water body, this impact is, however, unlikely to be severe.

7.2 Sensitivity Mapping

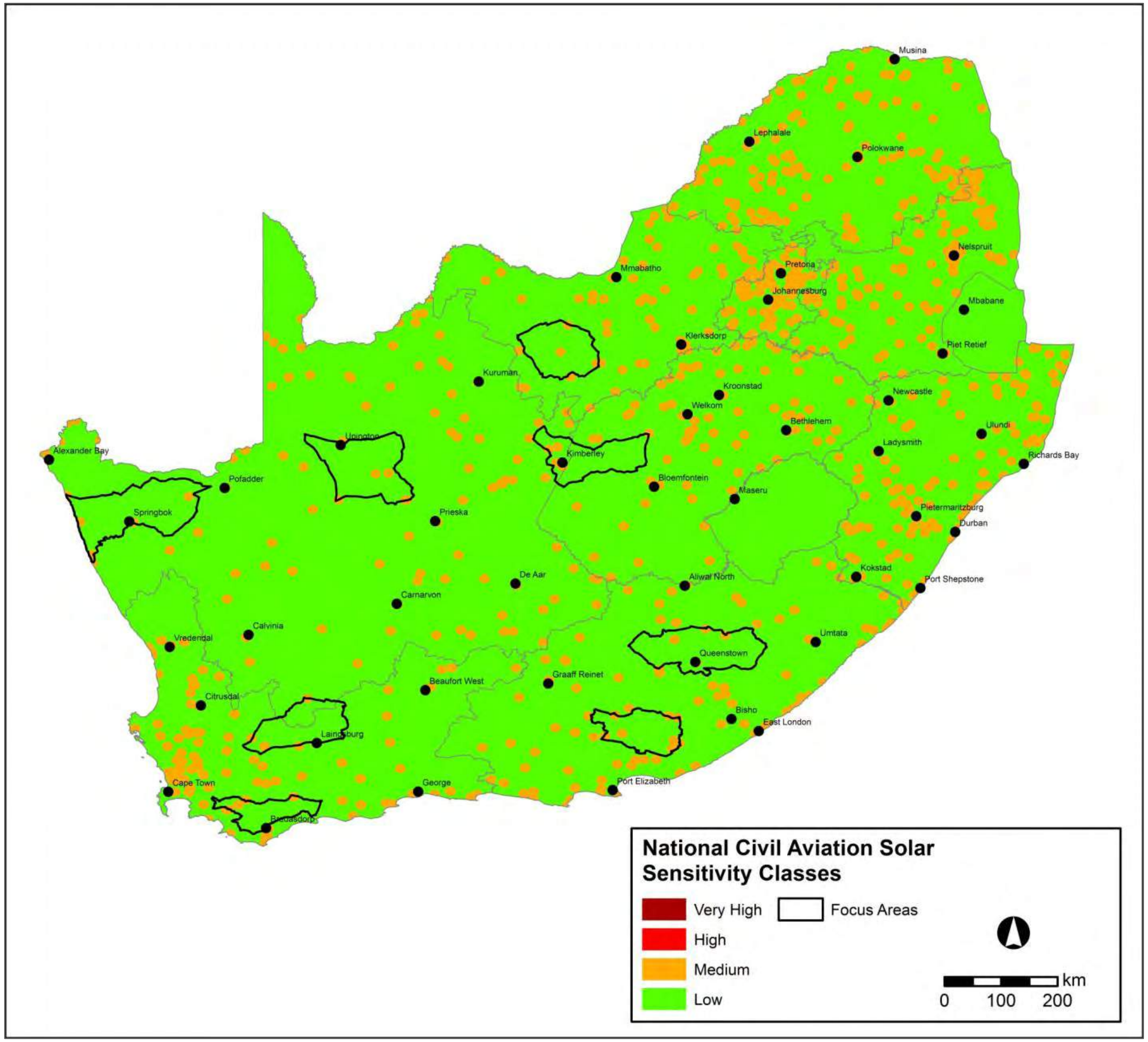
In accordance with submissions by the SACAA and the Air Traffic and Navigation Control Services (ATNS), civil aviation sensitivities with appropriate buffers were mapped as per Table 1. The sensitivity data were available at a national scale and used to produce national wind and solar PV sensitivity maps (see Maps 1 and 2). Sensitivities were also mapped for each FA (see Maps 3 – 18).

Table 1: Civil aviation sensitivity criteria.

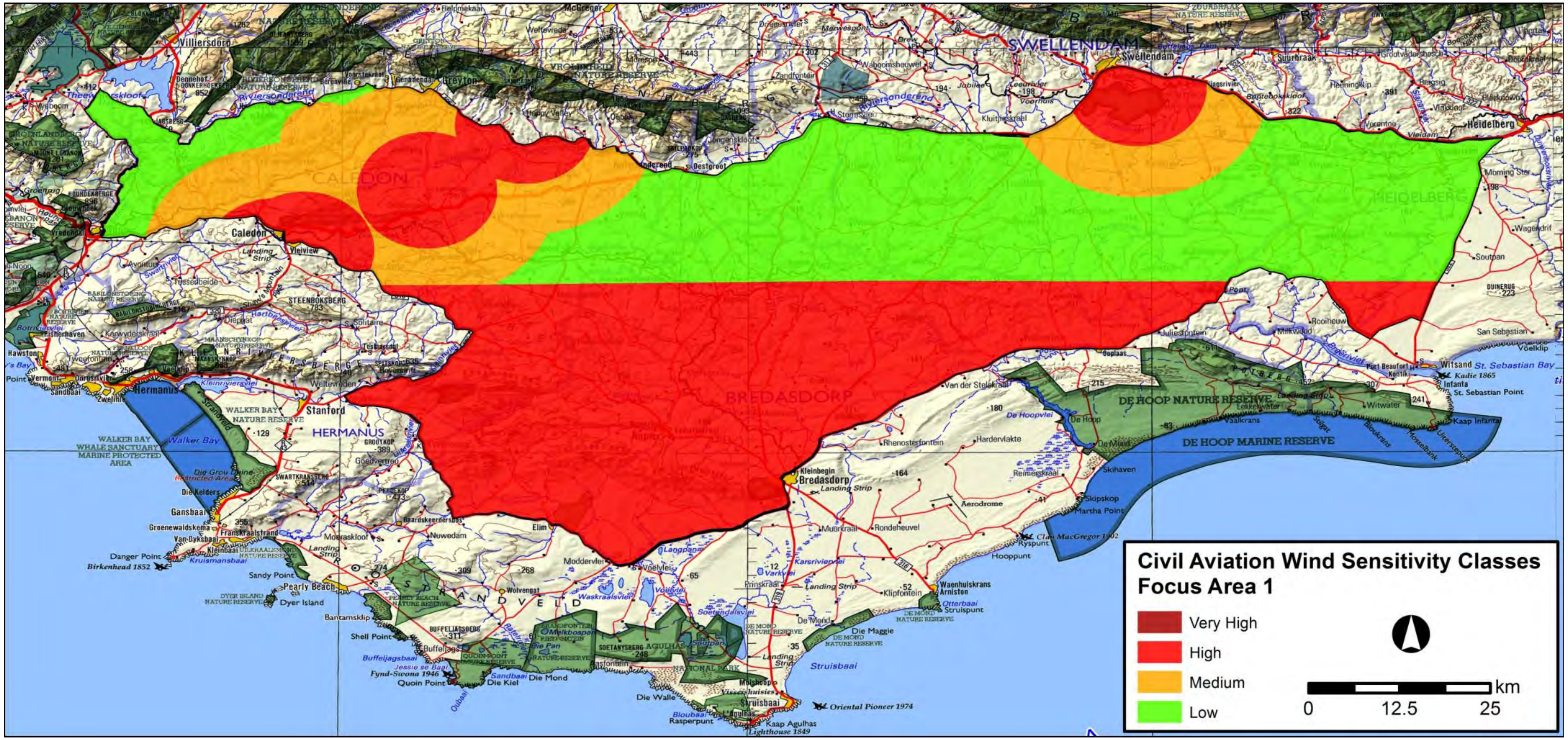
Sensitivity Feature	Data Source	Sensitivity Mapping Application	
		Wind	Solar PV
Major Civil Aviation Aerodromes	- SA CAA	- **Very high sensitivity** within 8 km - **High sensitivity** between 8 and 15 km - **Medium sensitivity** between 15 and 35 km	- **Medium sensitivity** within 8 km
Other Civil Aviation Aerodromes	- SA CAA	- **High sensitivity** within 8 km - **Medium sensitivity** between 8 and 15 km	- **Medium sensitivity** within 8 km
Civil Aviation Radars	- SA CAA	- **High sensitivity** within 15 km - **Medium sensitivity** between 15 and 35 km	N/A
Air Traffic Control and Navigation Sites	- ATNS	- **Medium sensitivity** within 5 km	N/A
Danger and Restricted Airspace	- SA CAA	- **High sensitivity** as demarcated	N/A



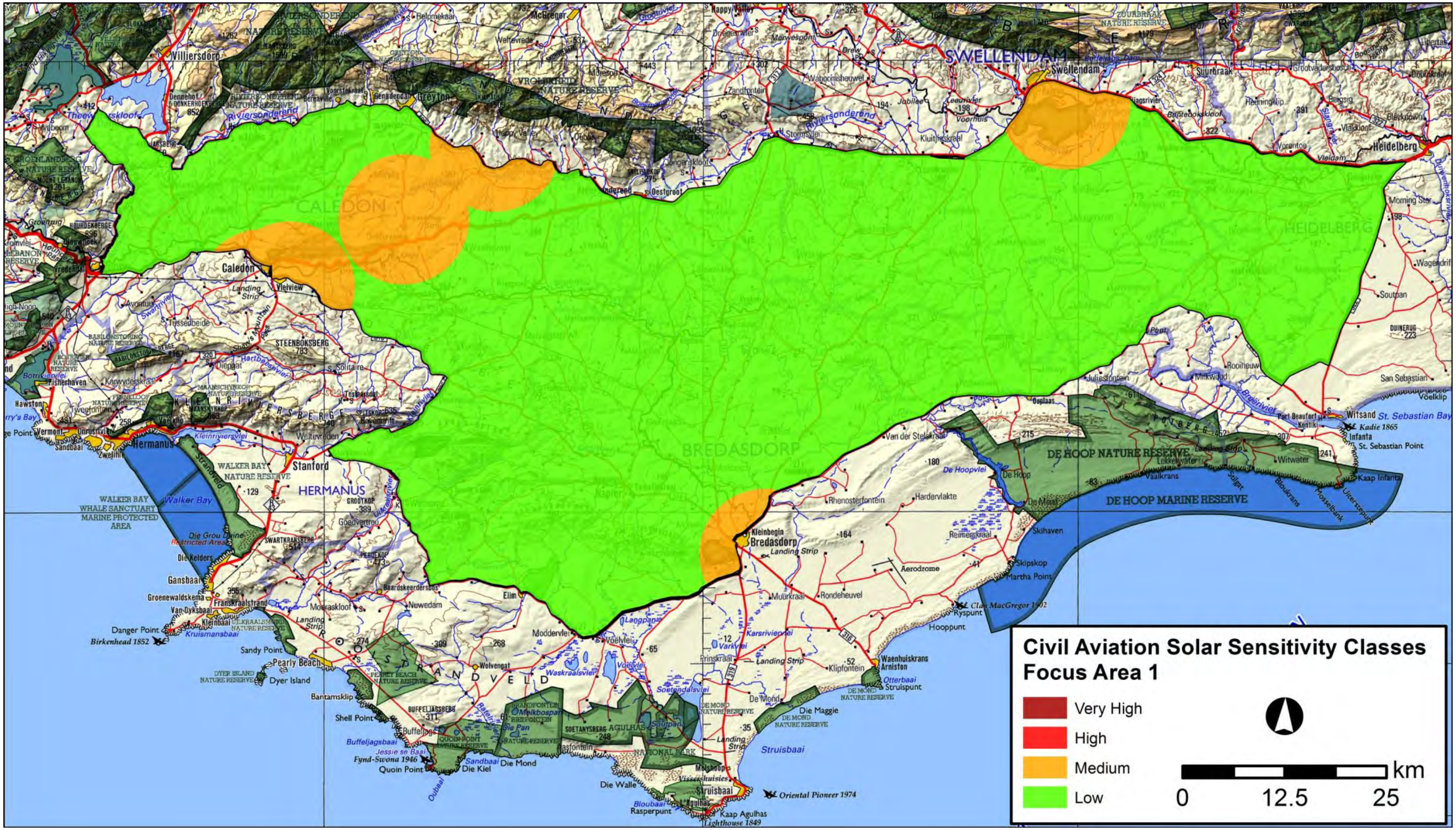
Map 1: National civil aviation sensitivity map for wind development



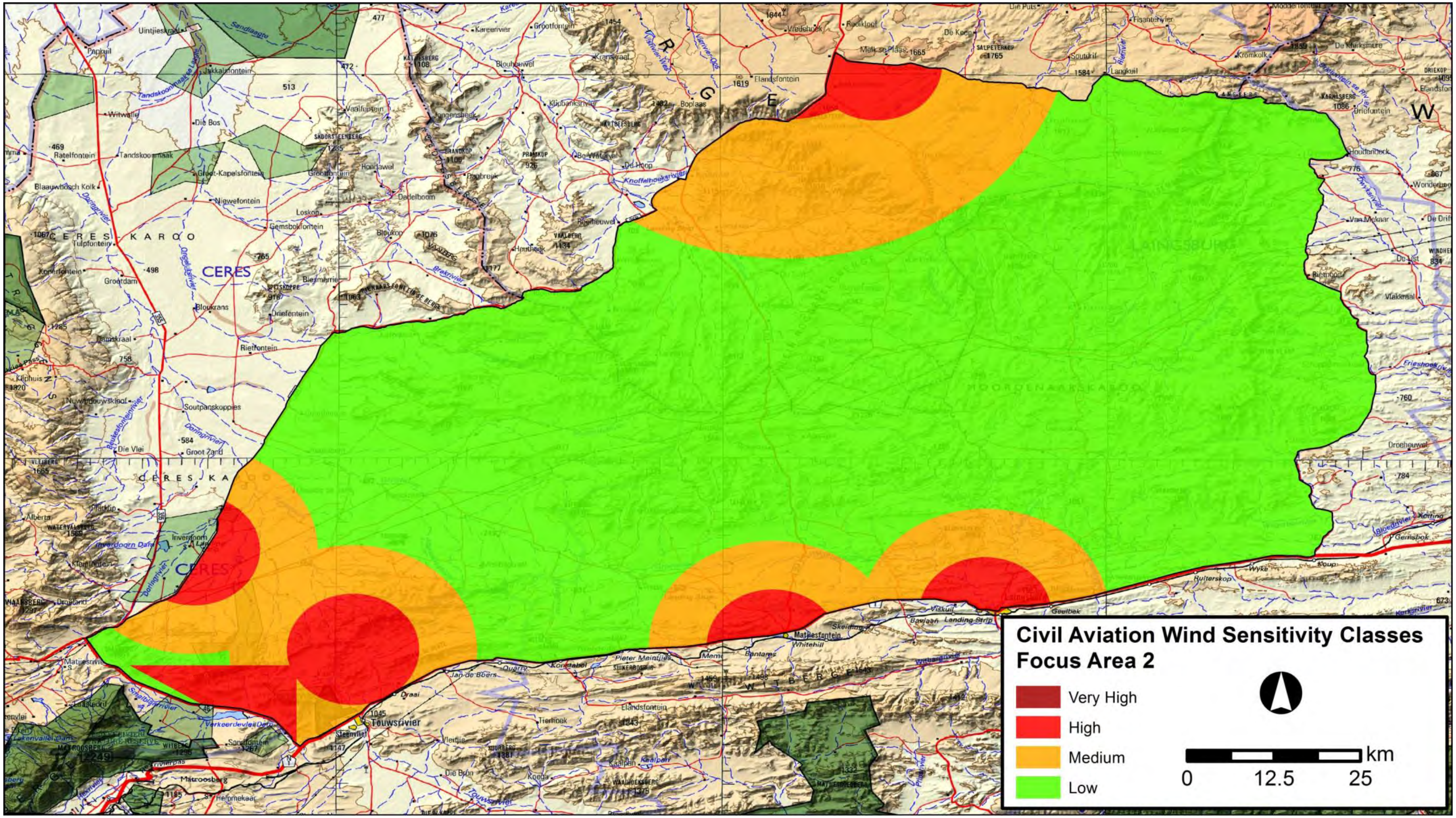
Map 2: National civil aviation sensitivity map for solar PV development



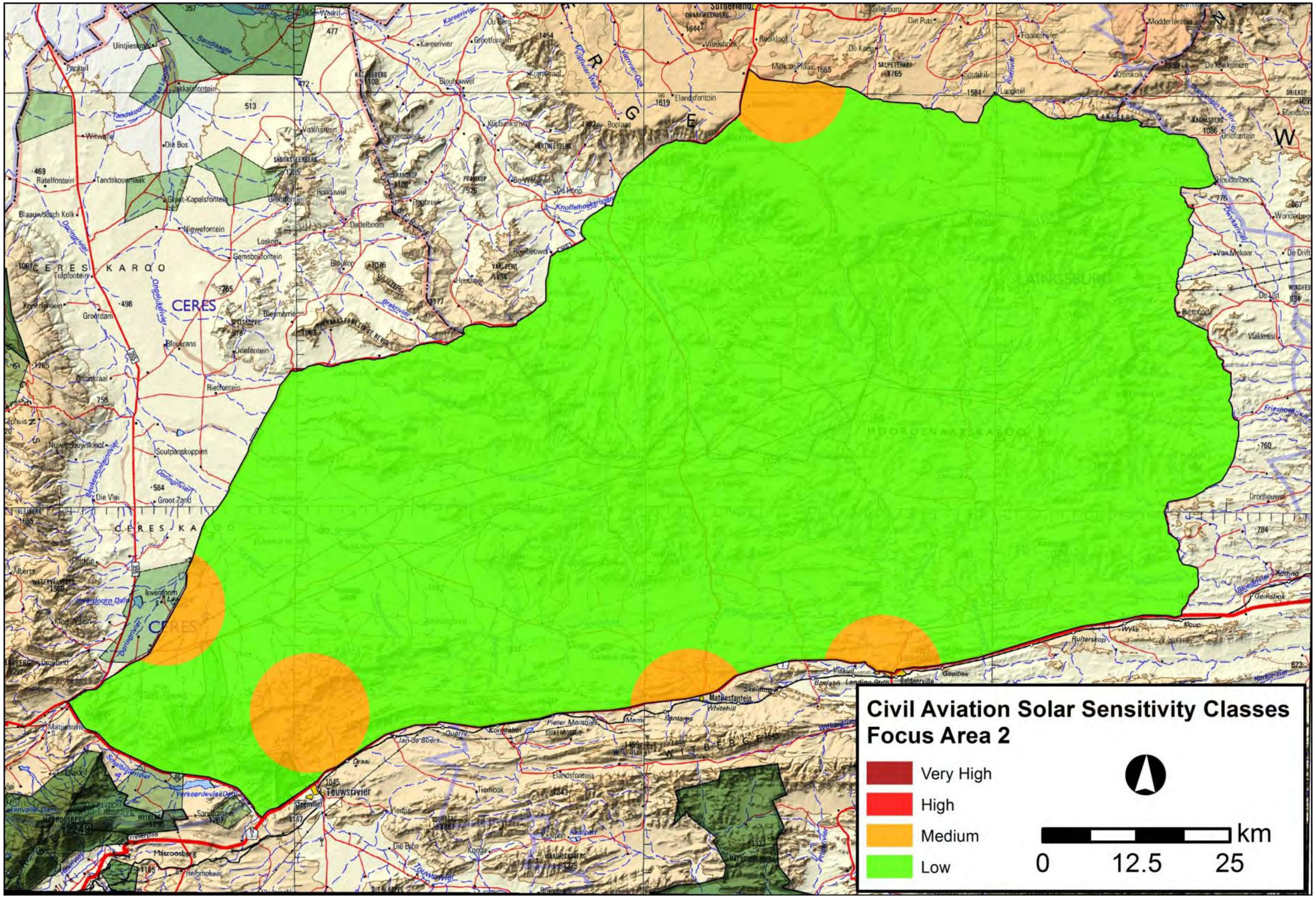
Map 3: Civil aviation sensitivity for wind energy development in the Overberg focus area (FA 1)



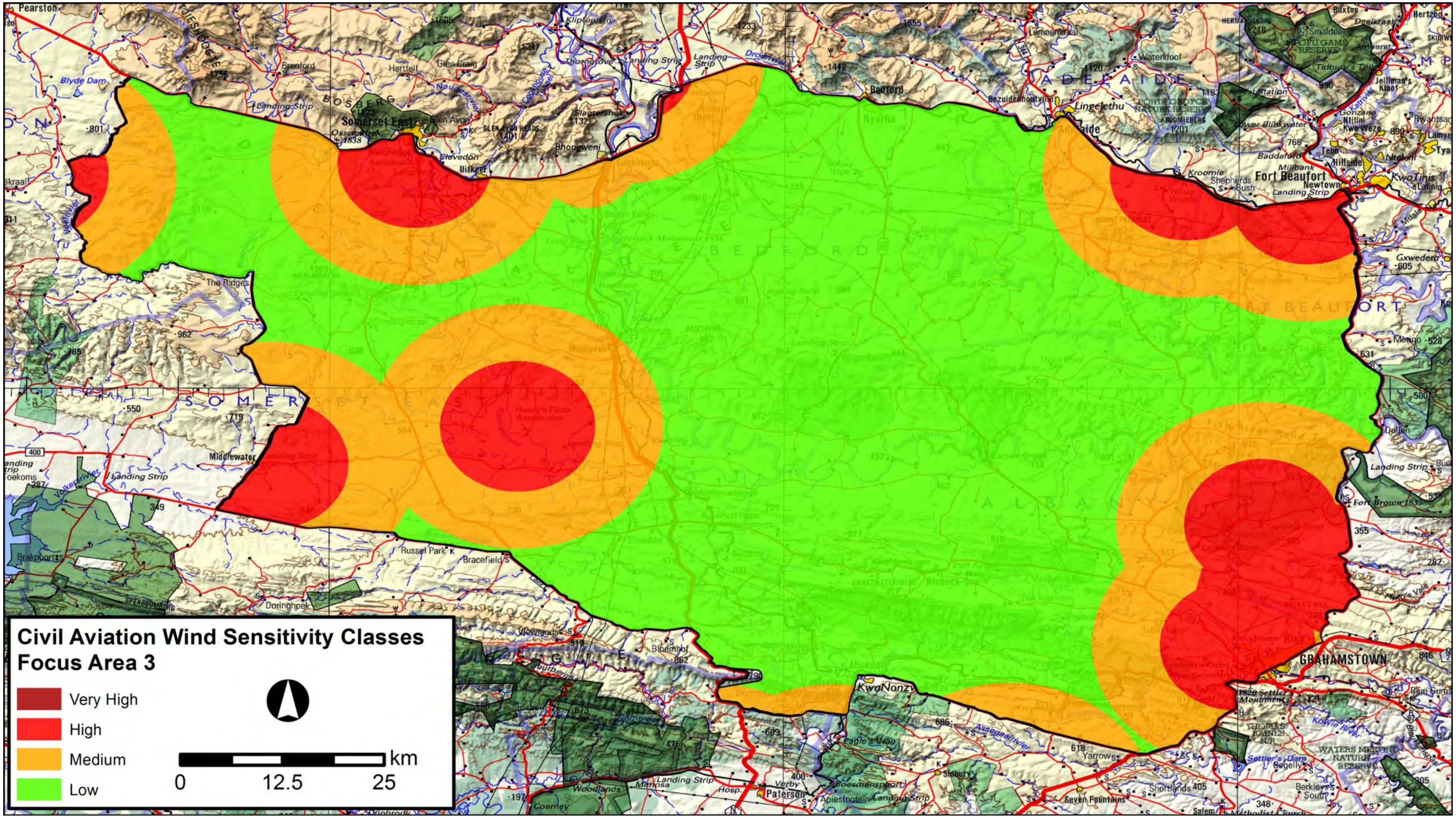
Map 4: Civil aviation sensitivity for solar PV energy development in the Overberg focus area (FA 1)



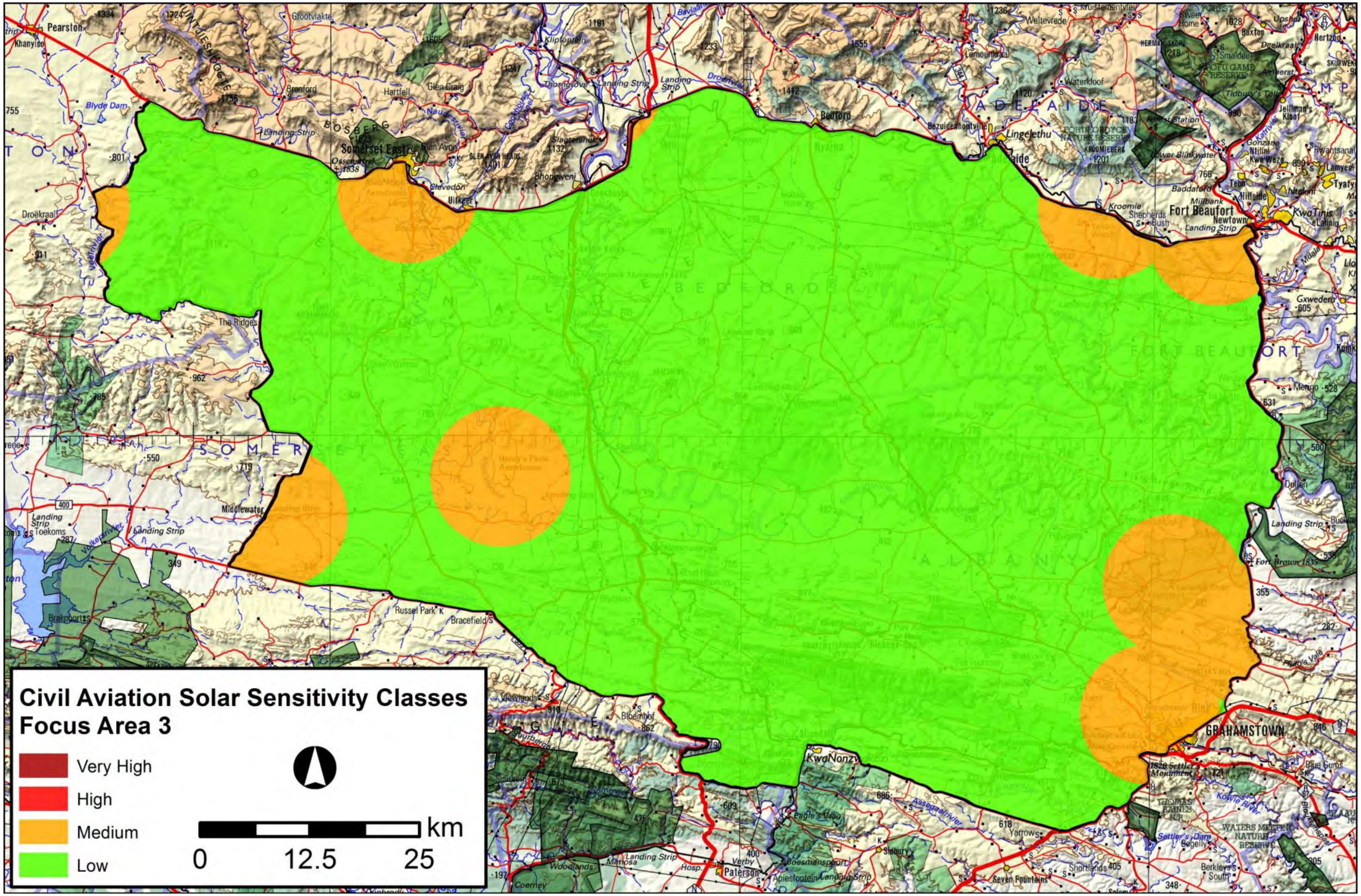
Map 5: Civil aviation sensitivity for wind energy development in the Komsberg focus area (FA 2)



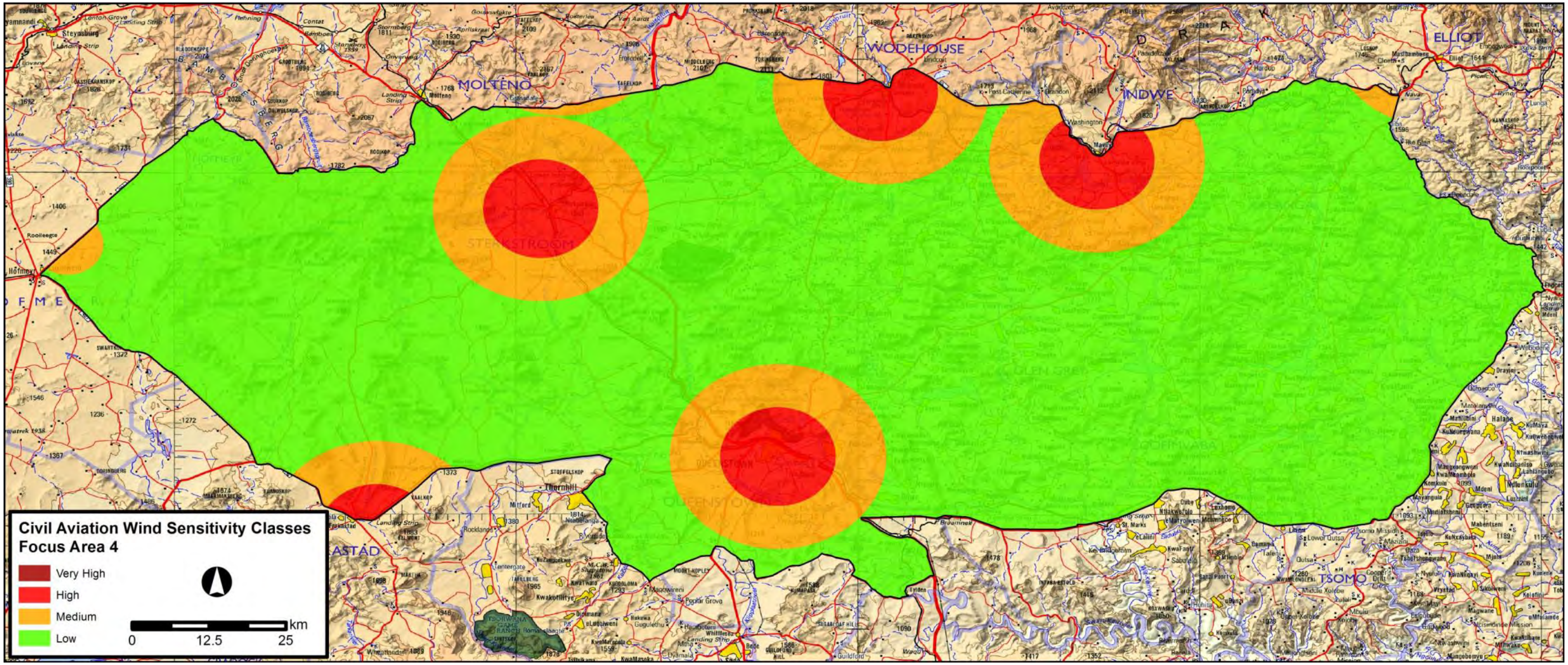
Map 6: Civil aviation sensitivity for solar PV energy development in the Komsberg focus area (FA 2)



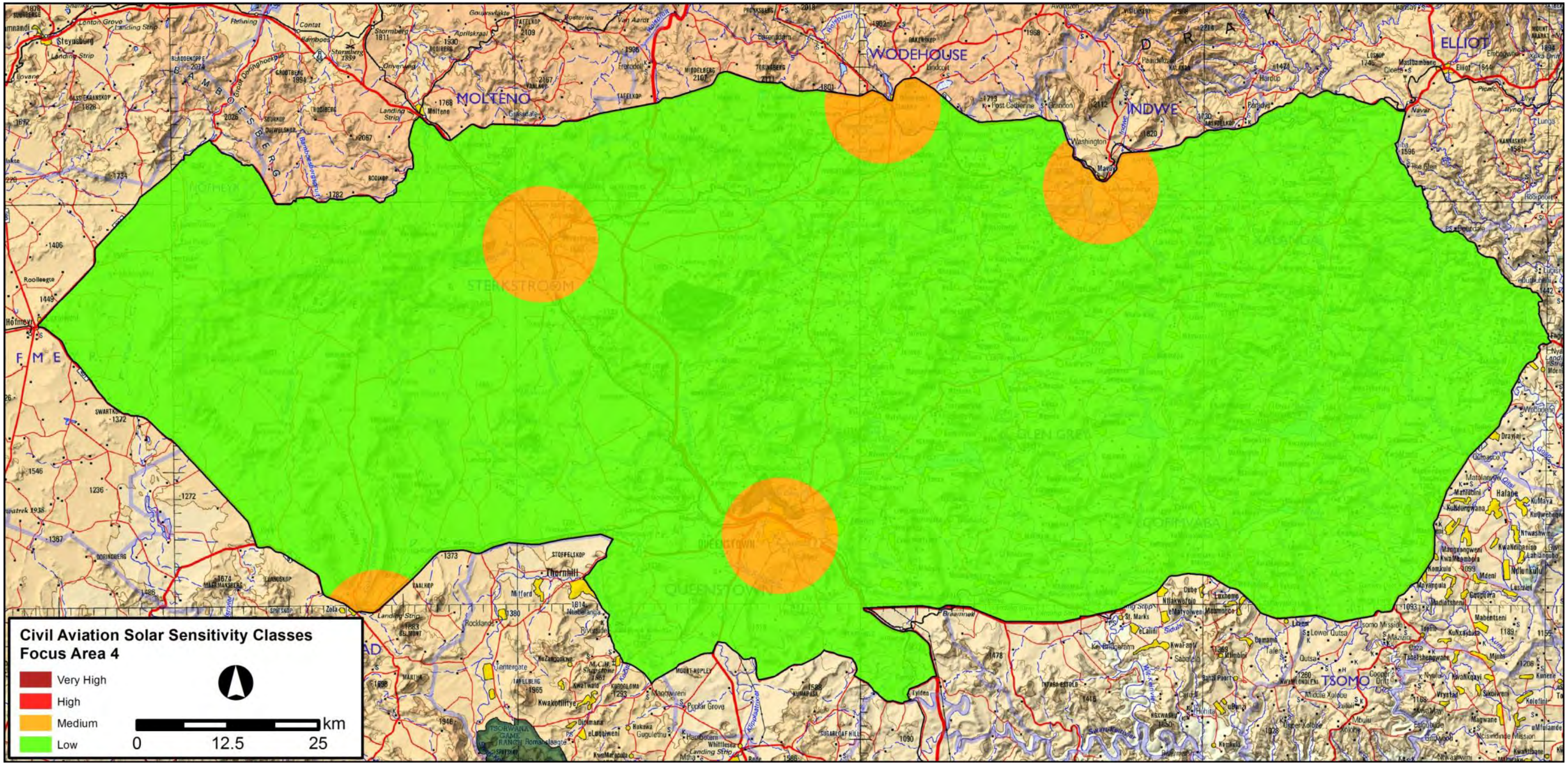
Map 7: Civil aviation sensitivity for wind energy development in the Cookhouse focus area (FA 3)



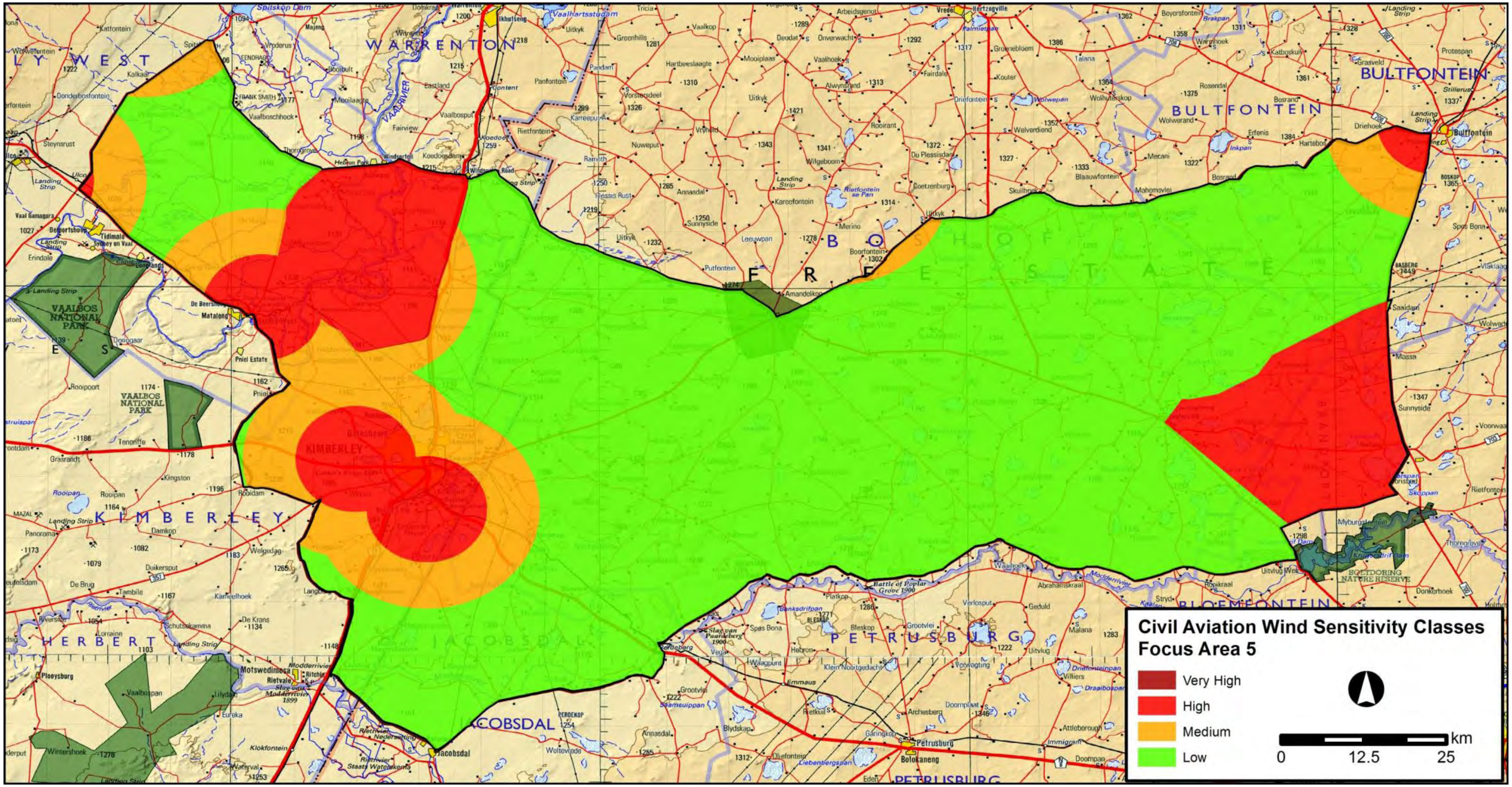
Map 8: Civil aviation sensitivity for solar PV energy development in the Cookhouse focus area (FA 3)



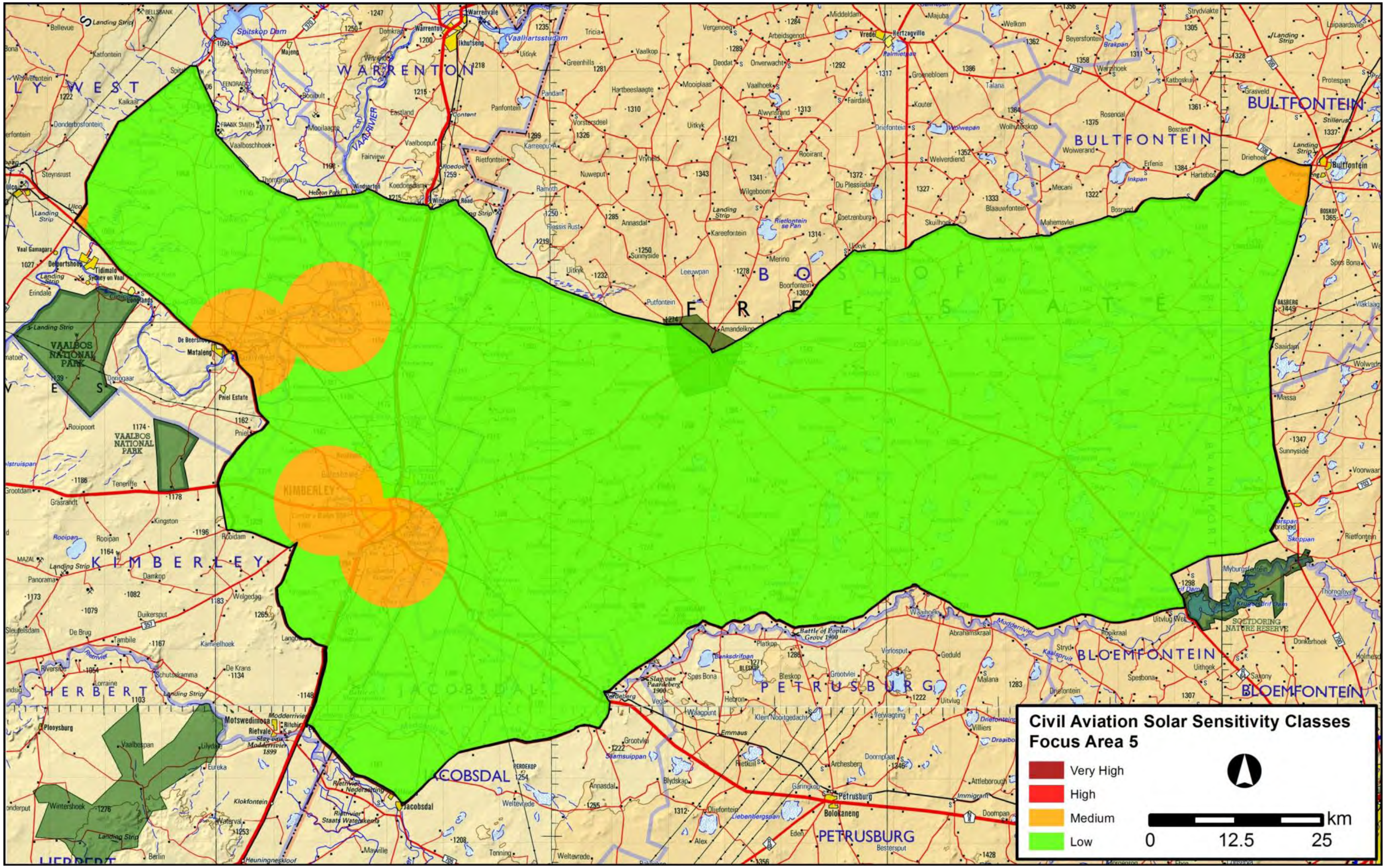
Map 9: Civil aviation sensitivity for wind energy development in the Stormberg focus area (FA 4)



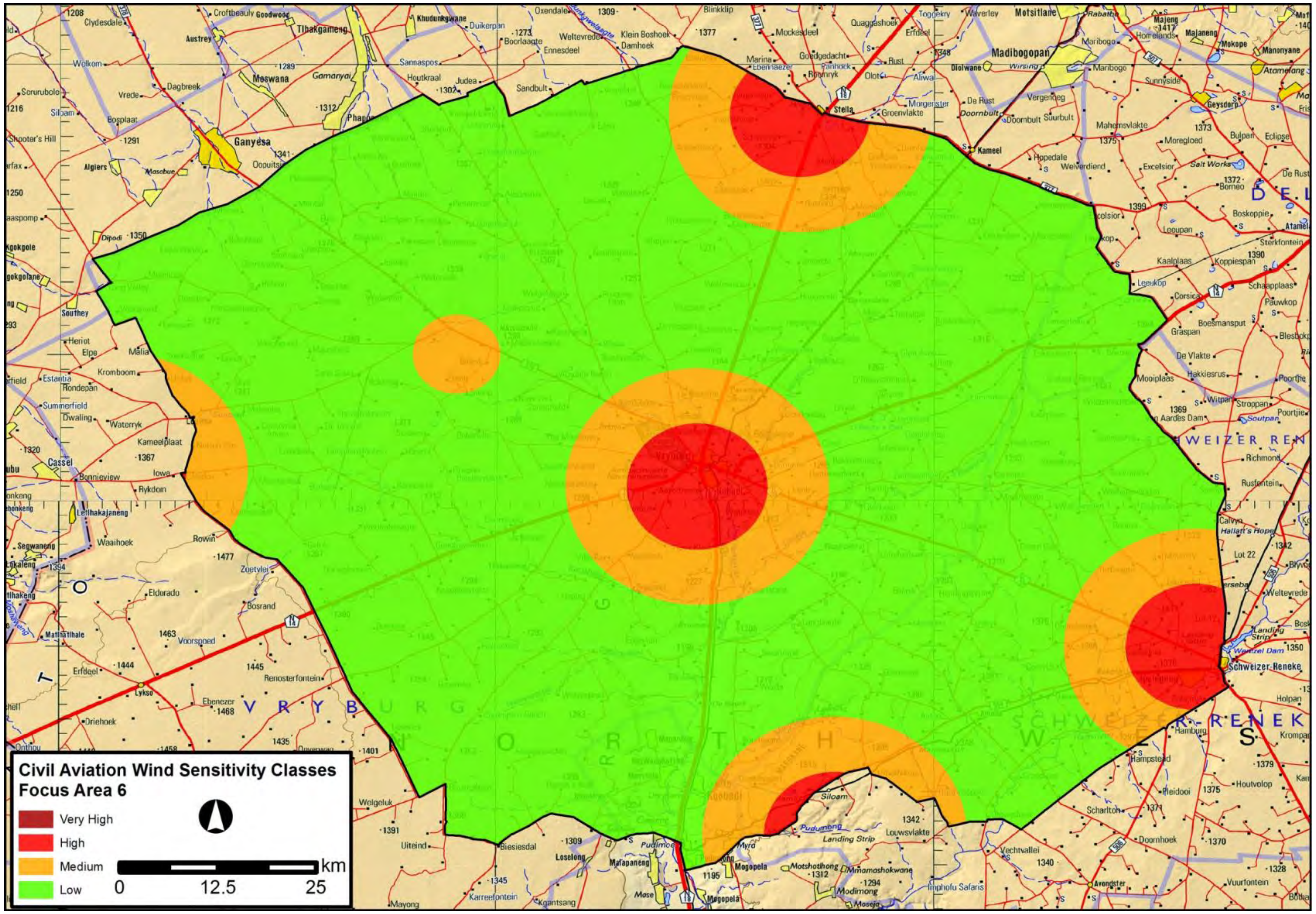
Map 10: Civil aviation sensitivity for solar PV energy development in the Stormberg focus area (FA 4)



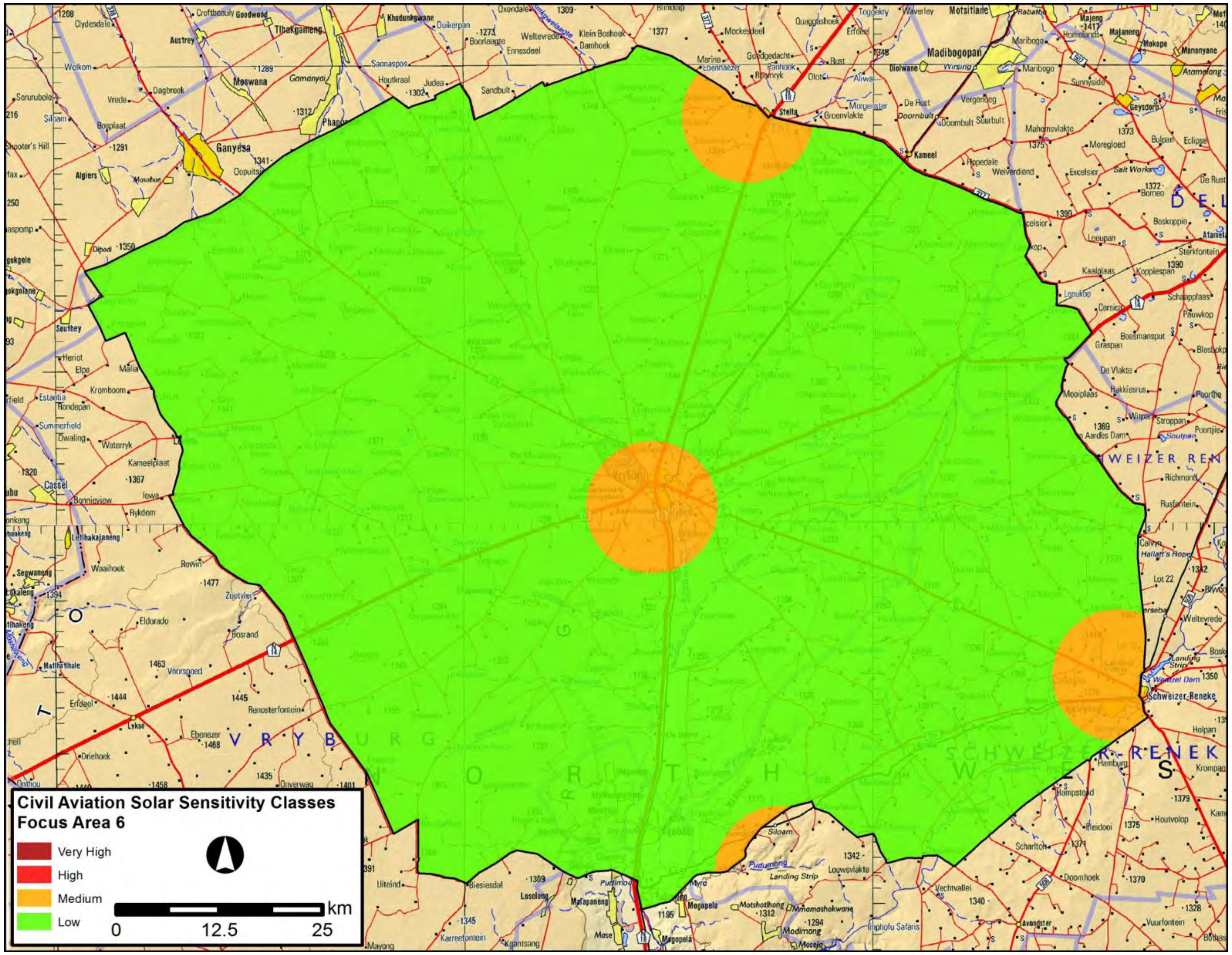
Map 11: Civil aviation sensitivity for wind energy development in the Kimberley focus area (FA 5)



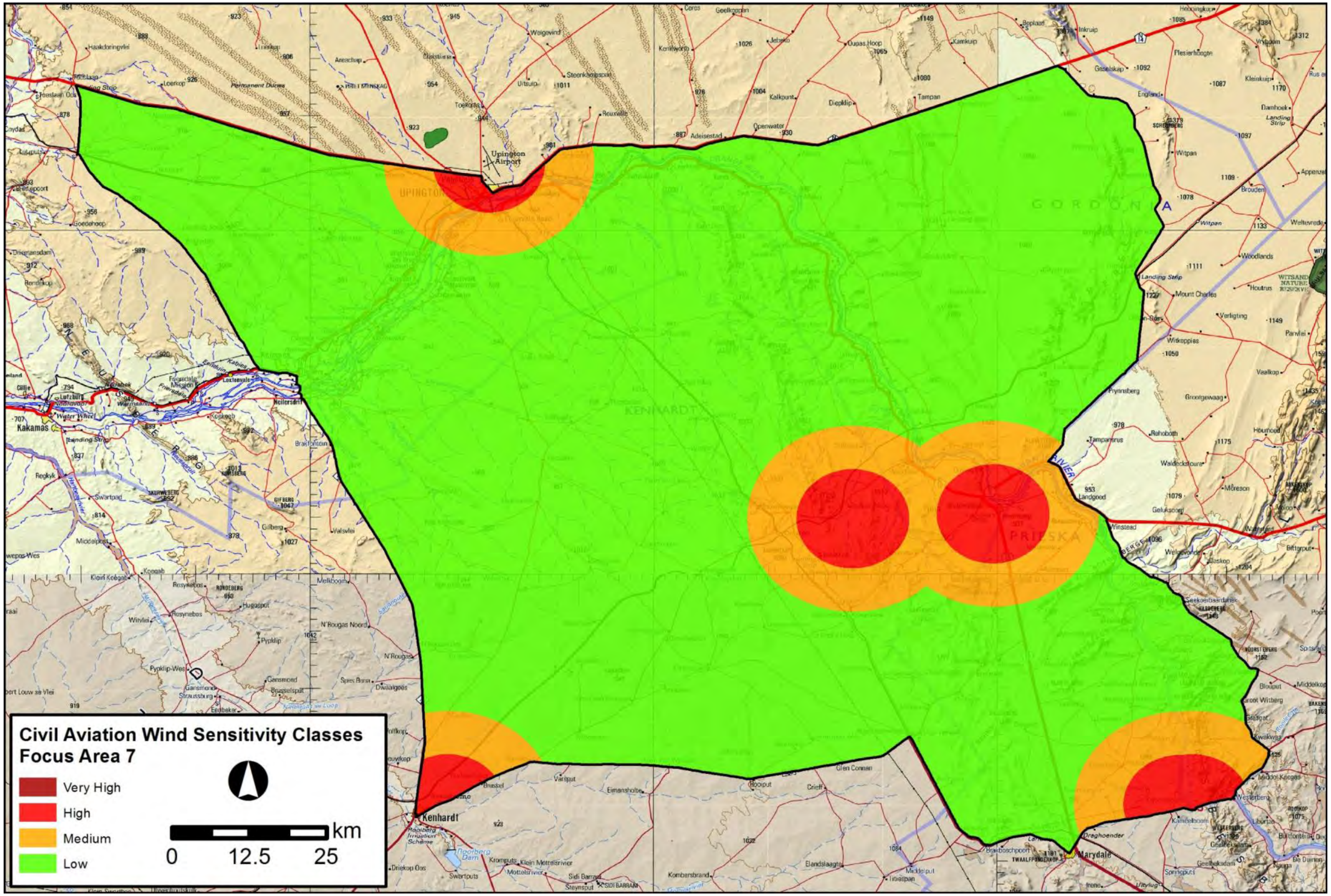
Map 12: Civil aviation sensitivity for solar PV energy development in the Kimberley focus area (FA 5)



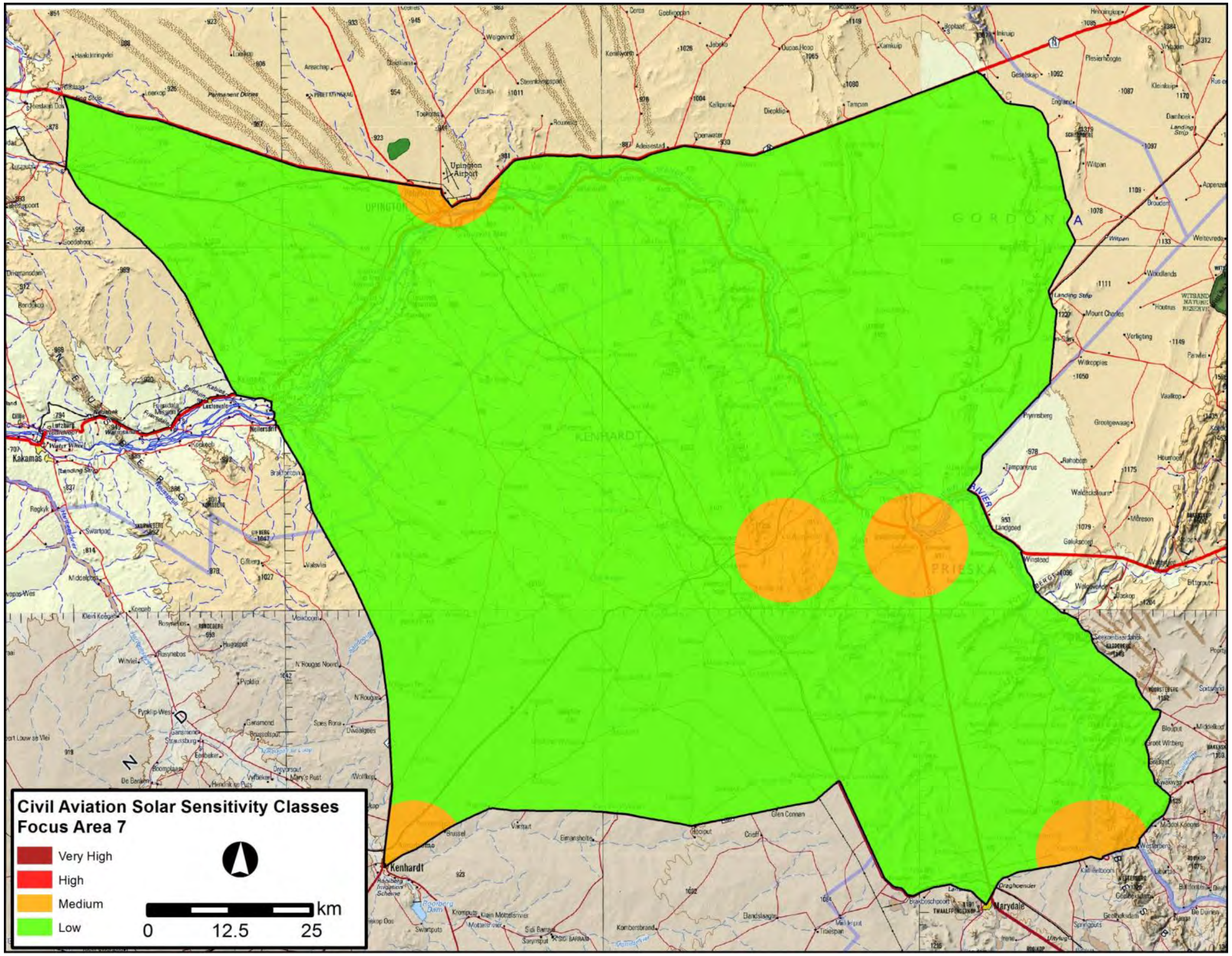
Map 13: Civil aviation sensitivity for wind energy development in the Vryburg focus area (FA 6)



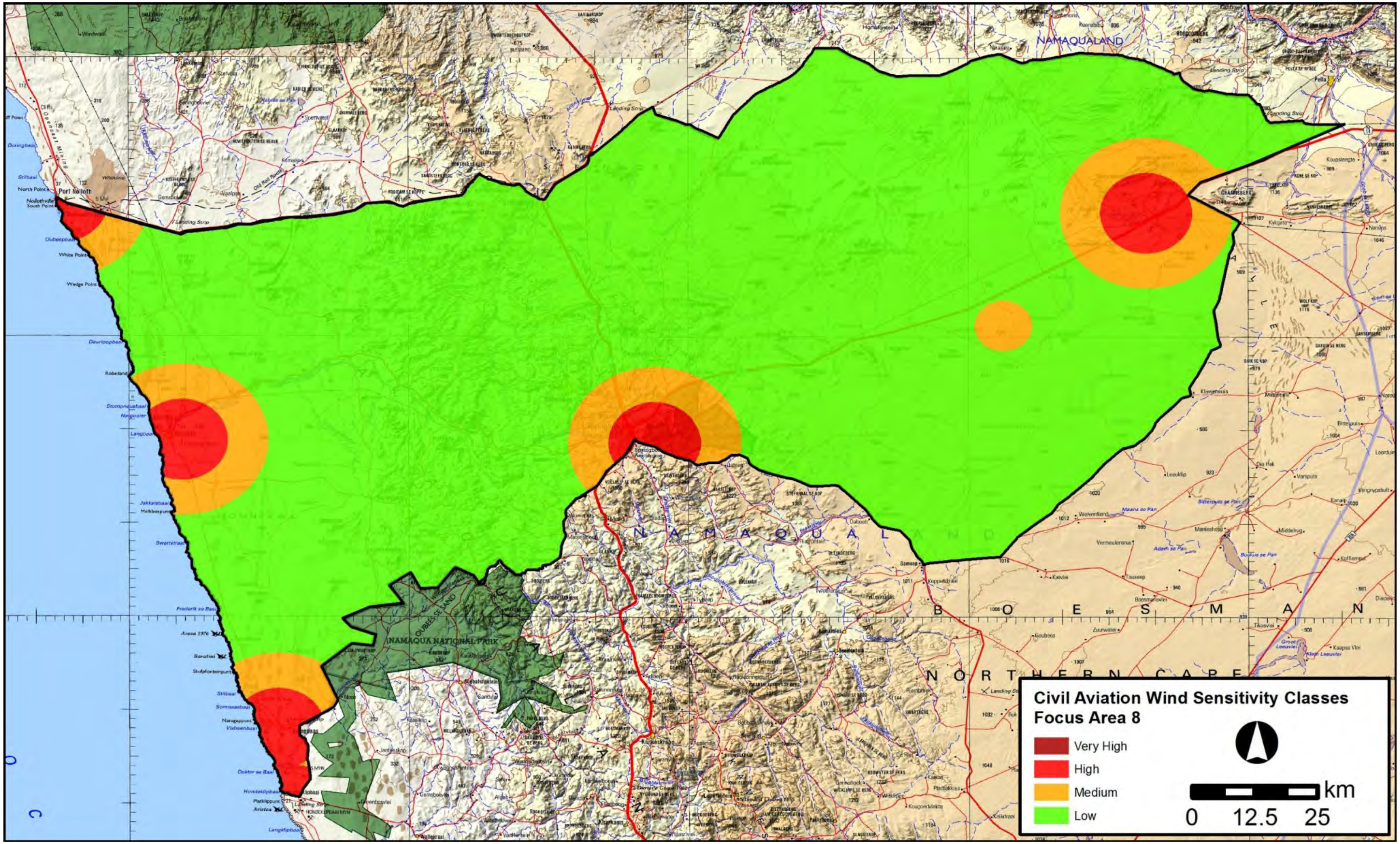
Map 14: Civil aviation sensitivity for solar PV energy development in the Vryburg focus area (FA 6)



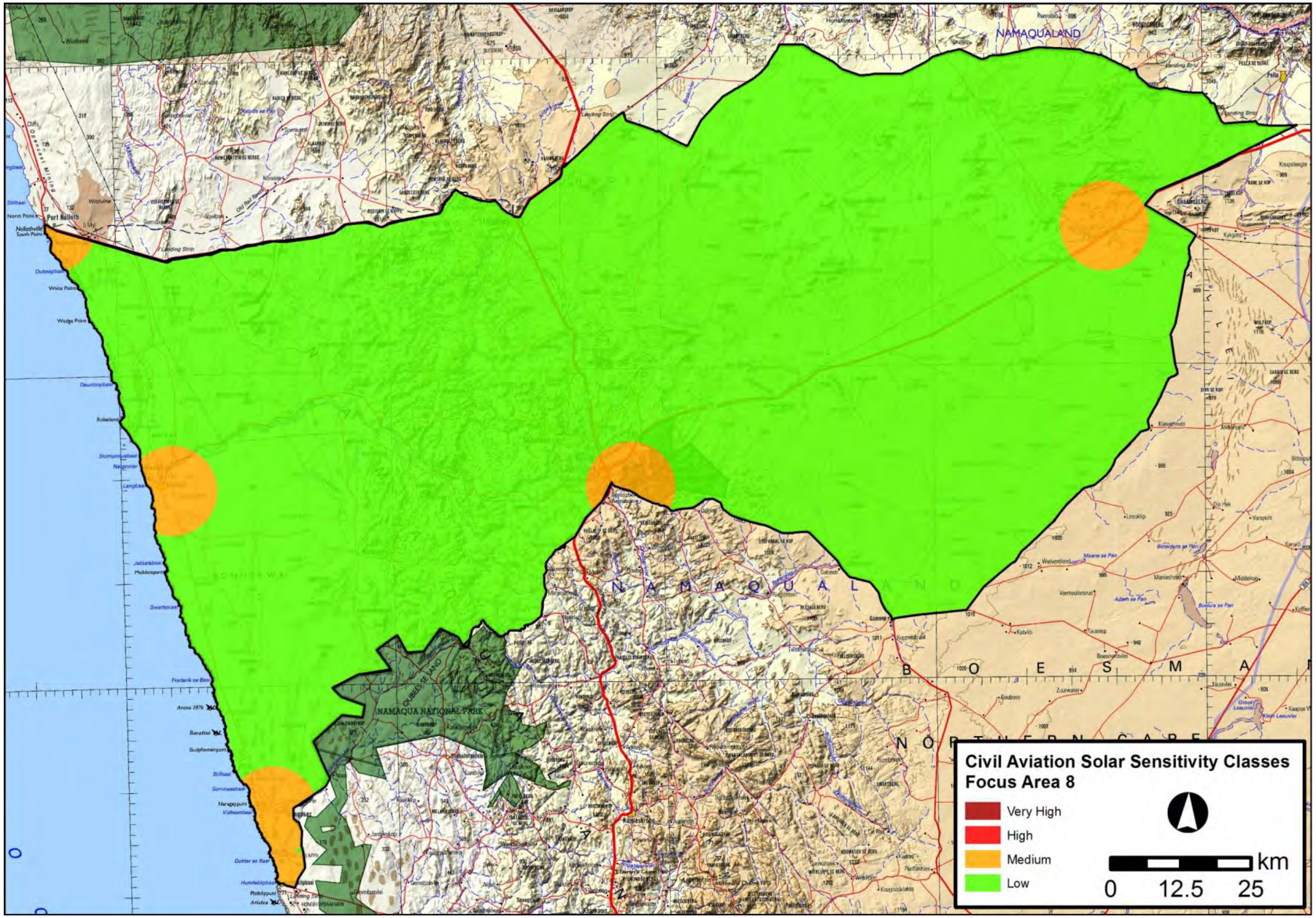
Map 15: Civil aviation sensitivity for wind energy development in the Upington focus area (FA 7)



Map 16: Civil aviation sensitivity for solar PV energy development in the Upington focus area (FA 7)



Map 17: Civil aviation sensitivity for wind energy development in the Springbok focus area (FA 8)



Map 18: Civil aviation sensitivity for solar PV energy development in the Springbok focus area (FA 8)

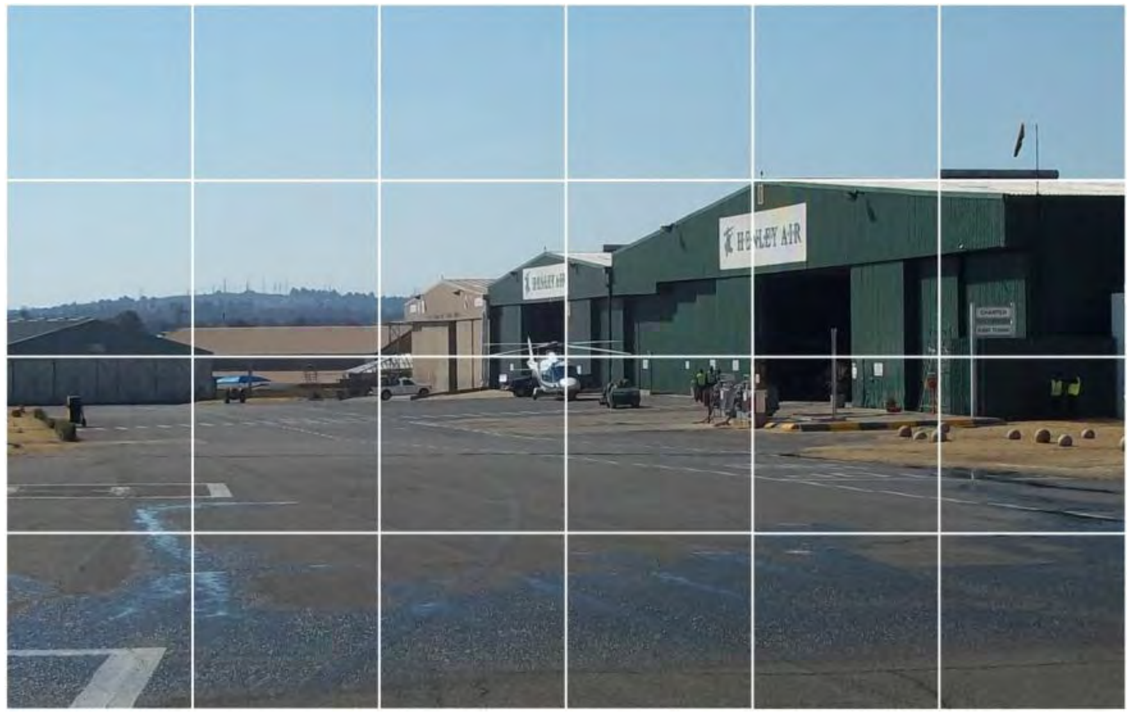
7.3 Development Protocols

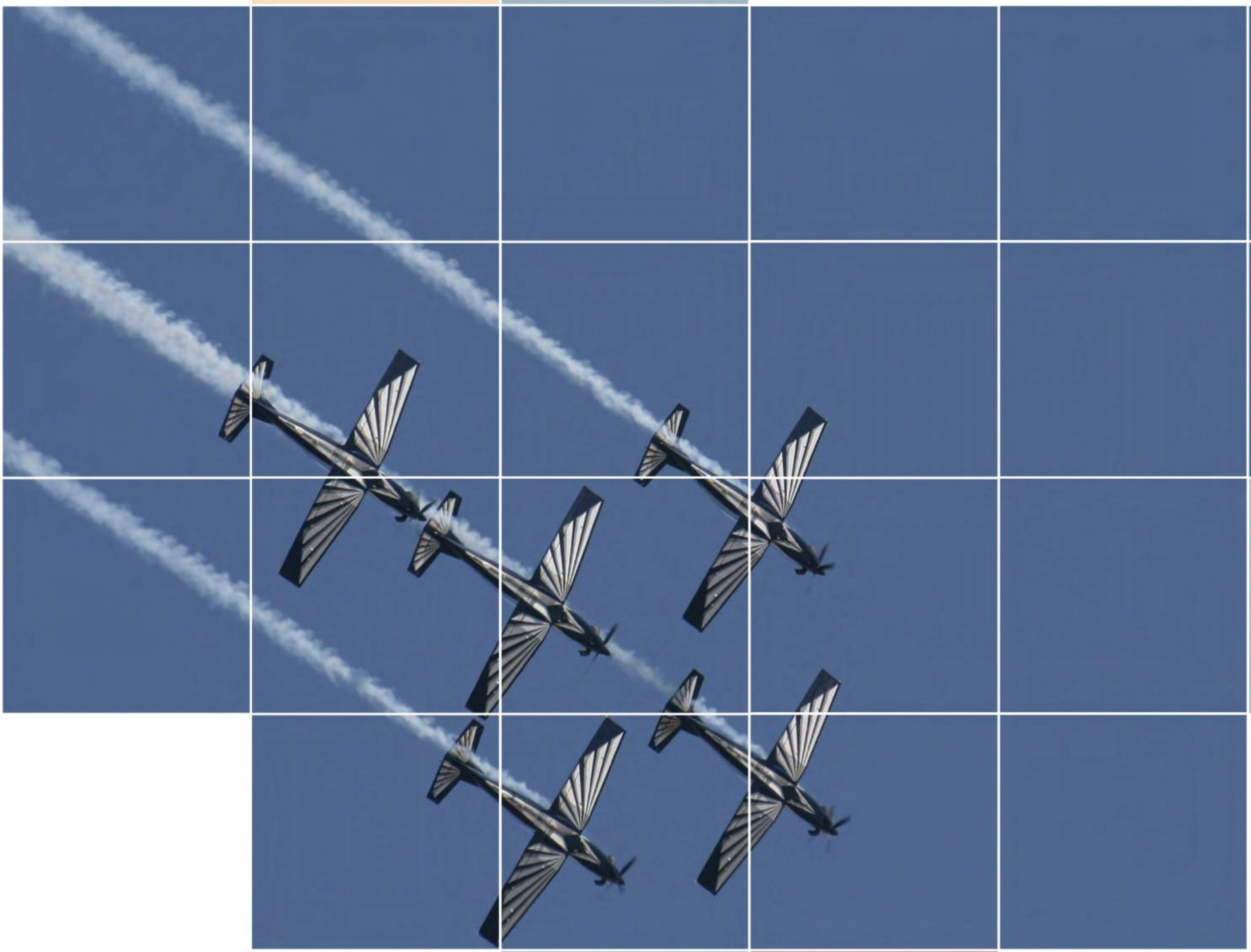
Due to the complexity of impacts potentially posed by obstacles to aviation, surveillance, communication, and other civil aviation activities, all proposed wind and solar PV facilities must be evaluated by the OEC. Even in the case where the distance from the nearest areas of aviation interest may seem to be sufficient to prevent any impact, there is still potential for interference with aviation services.

Without being able to guarantee that any development will not be found to have an unacceptable impact on civil aviation by the OEC, the main objective of this section is to clarify the levels of potential sensitivity of wind and solar PV developments in this regard. In Table 2, sensitivity classes for wind and solar PV developments are interpreted and assessment requirements clarified. These requirements are specific to the sensitivity classes and are therefore related to the sensitivity maps in sub-Section 7.2. These requirements will be applicable to developments proposed both inside and outside the FAs, once these areas have been adopted as Renewable Energy Development Zones (REDZs).

Table 2: Interpretation of civil aviation sensitivity maps and associated assessment requirements

<table>
<tr><th>Colour</th><th>Sensitivity</th><th>Interpretation of the sensitivity</th><th>Further wind and solar PV assessment requirements</th></tr>
<tr><td>Dark red</td><td>Very High</td><td>In very high sensitivity areas there is a high likelihood for significant negative impacts that cannot be mitigated. In-depth assessment of the potential impacts and mitigation measures is likely to be required before development can be considered in these areas.</td><td rowspan="4">Proponents intending to develop a wind or solar PV facility anywhere in South Africa that triggers the need for an environmental assessment process must prove to the relevant competent authority that the proposed development will not have an unacceptable negative impact on civil aviation activities. In order to do so, the proponent must request a comment from SACAA. Such a comment, which may include inputs from the OEC if appropriate, will be considered by the competent authority for decision making if it is received within stipulated timeframes.</td></tr>
<tr><td>Red</td><td>High</td><td>In high sensitivity areas there is potential for negative impacts that can potentially be mitigated. Further assessment may be required to investigate potential impacts and mitigation measures.</td></tr>
<tr><td>Orange</td><td>Medium</td><td>In medium sensitivity areas there is a low potential for negative impacts, and if there are impacts there is a high likelihood of mitigation. Further assessment of the potential impacts may not be required.</td></tr>
<tr><td>Green</td><td>Low</td><td>No significant impacts are expected in low sensitivity areas. It is unlikely for further assessment and mitigation measures to be required.</td></tr>
</table>





SECTION 8

DEFENCE

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SECTION 8: DEFENCE

The South African National Defence Force (SANDF) uses an extensive system of military airspace and land assets in order to equip and train combat-ready forces. Furthermore, the SANDF also operates radar systems designed to protect the sovereignty of the national borders and to detect threats to national security. The SANDF falls under the Department of Defence (DoD) and comprises four armed services, namely: the Army, the Air Force, the Navy and the Military Health Service. The structure of the SANDF is depicted in Figure 1.

8.1 Renewable Energy and Defence

Impacts of renewable energy development on defence activities could ensue from an interference with surveillance radars and communication systems, or if any structures associated with the development constitute potential obstacles for military aviation or ground activities.

The impacts of solar photovoltaic (PV) facilities on defence activities are minimal as far as initial research and interaction with users and developers indicate. These facilities and their supporting infrastructure are generally no higher than 15 m above ground level [which is the official height of obstacles that need to be registered in the Electronic Terrain and Obstacle Database (eTOD) for aviation purposes] and pose little risk as obstacles that could physically block communication or surveillance signals. With little reflection risks, due to these facilities being designed to absorb as much as possible energy, solar PV facilities are also unlikely to be a nuisance to pilots. There is also no significant increase in heat signature surrounding such facilities that might affect heat seeking instrumentation or weapons. The minimal electromagnetic emissions from these facilities are also unlikely to create any signal interference with communication and surveillance instrumentation. Solar PV developments do, however, have large footprints and can impact on air to ground and ground training activities if located inside military training areas.

Wind development on the other hand potentially could pose significant risks to military activities and operations if not sited appropriately. The size of wind turbines, sometimes protruding beyond 150 m above ground level (which is the height at which aviation airspace officially commences), poses a physical obstacle risk for aviation, especially in the Air Force's low flying areas. The size and nature of turbines may furthermore lead to the blocking and cluttering of surveillance and communication signals. Any interference with SANDF surveillance radar would compromise the safeguarding of coastlines, national borders, military airspace or other sensitive areas. The heat signature generated by the mechanical components of a wind turbine also has the potential of attracting heat seeking weapons and interfering with other instrumentation.

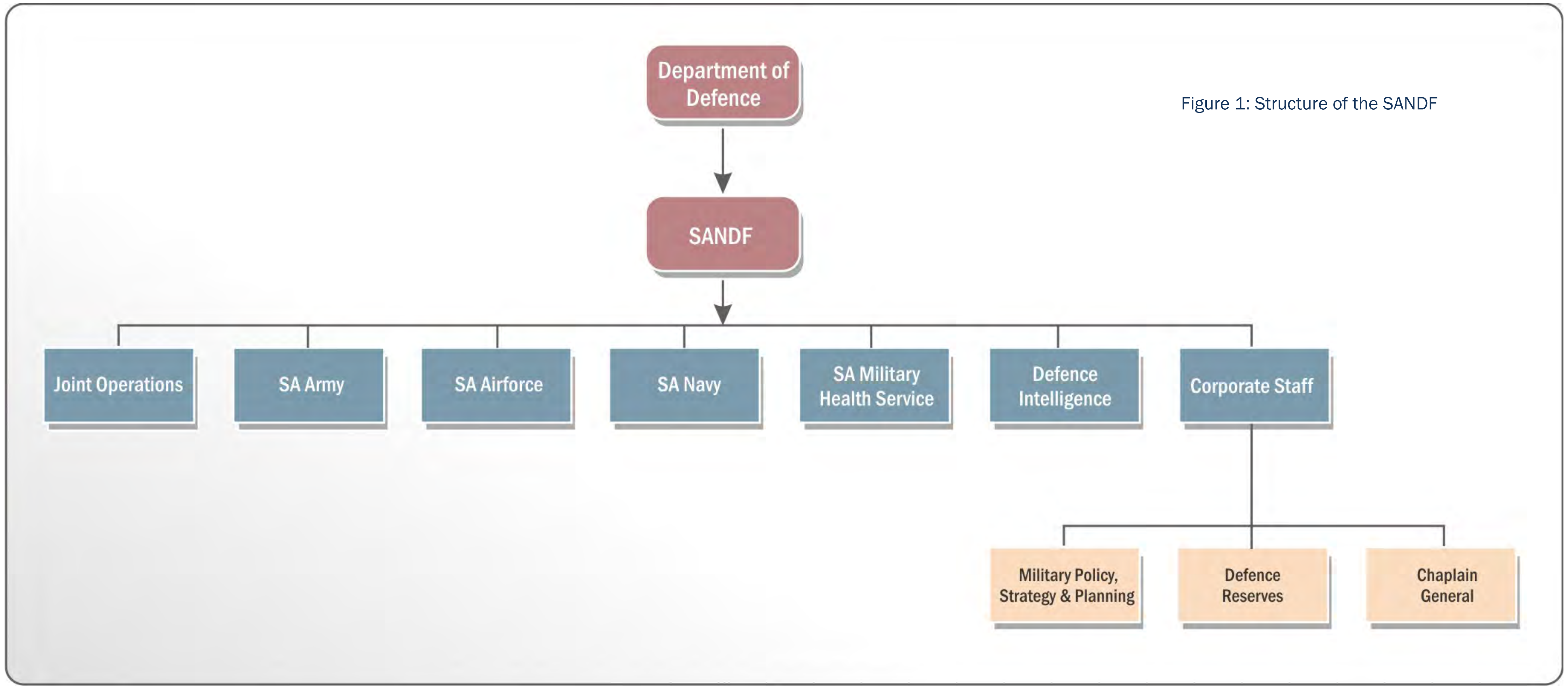


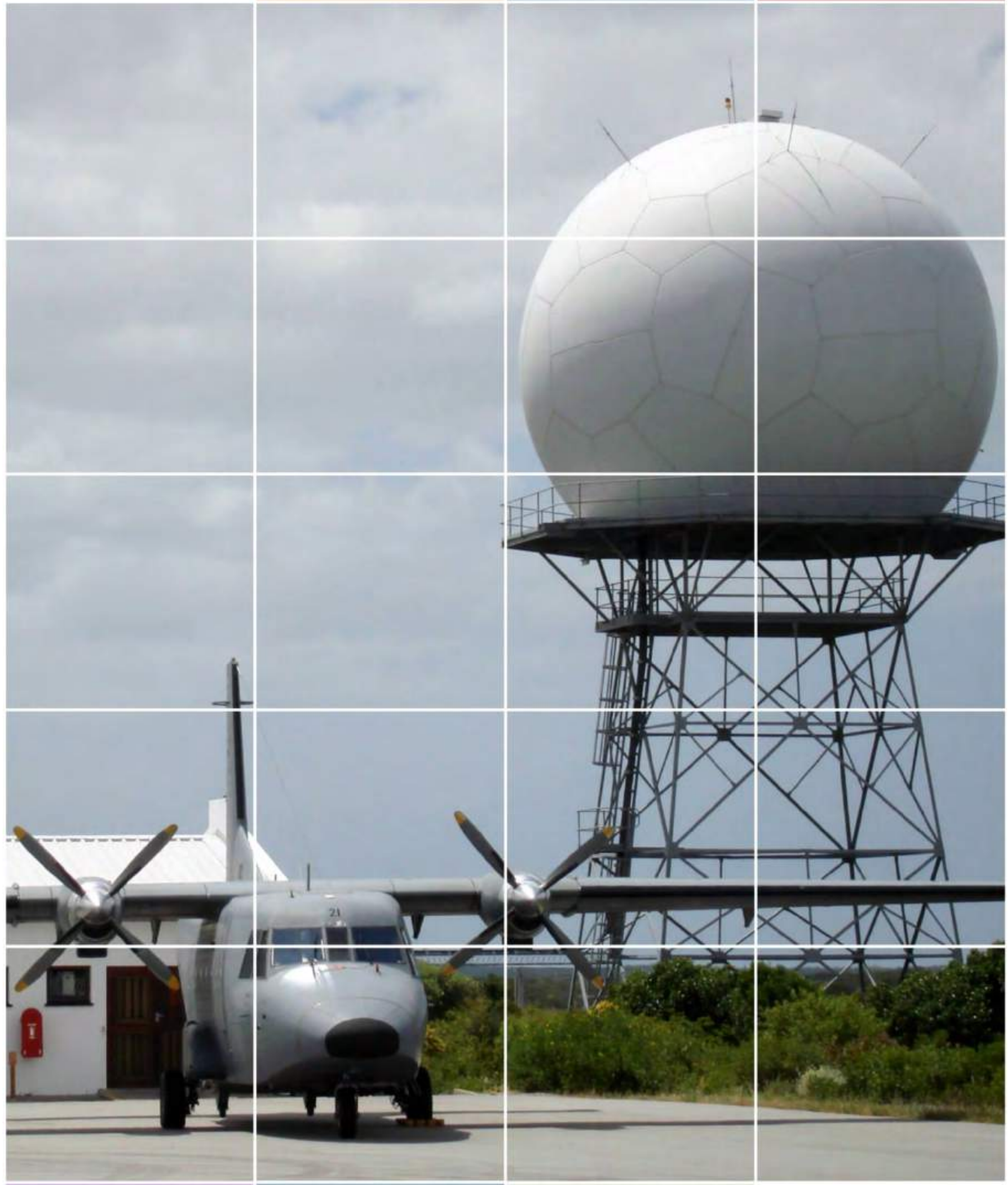
Figure 1: Structure of the SANDF

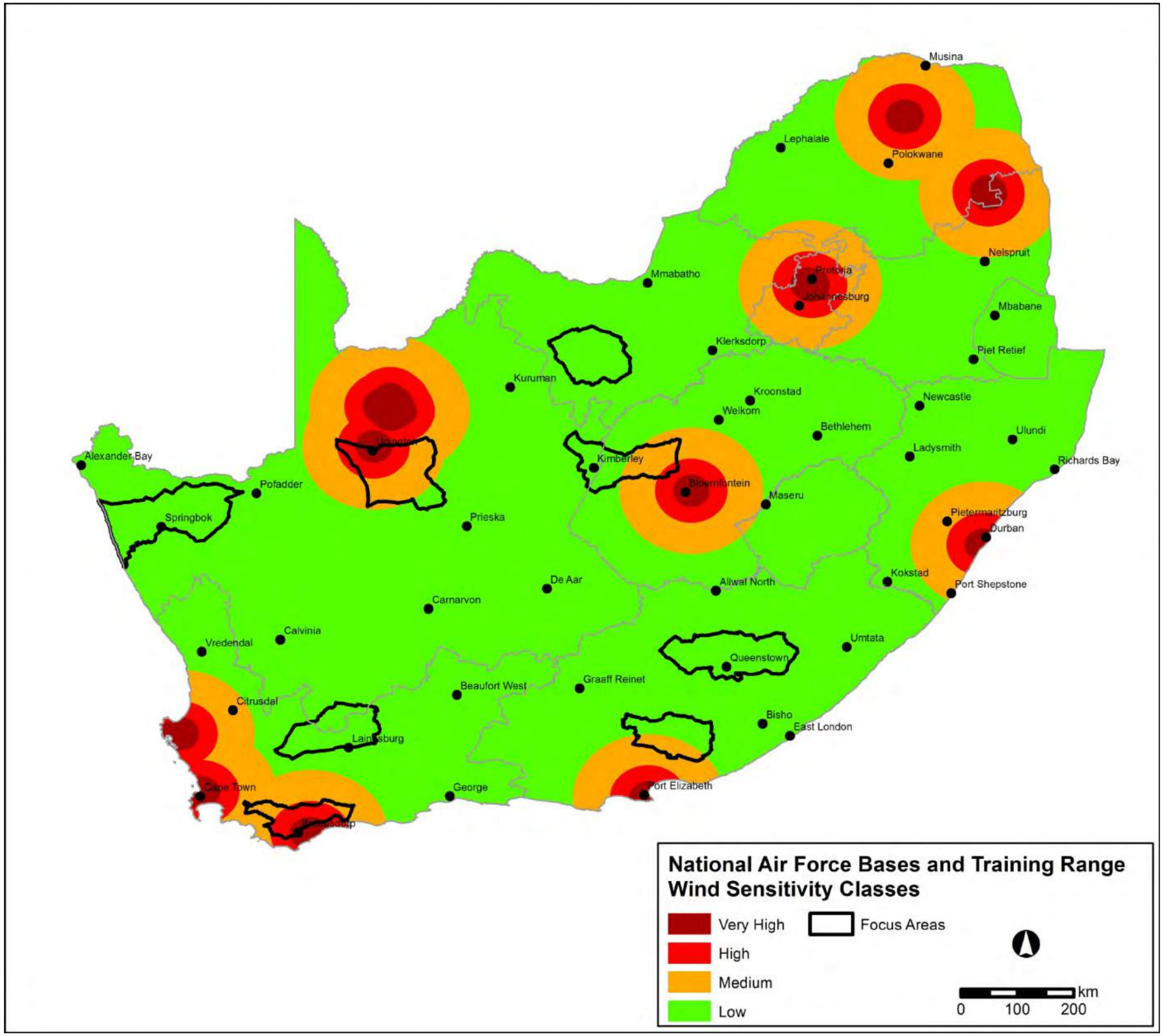
8.2 Sensitivity Mapping

As per Appendix B the Military Health Services, Navy and Joint Operations Divisions of the SANDF all indicated that large scale wind and solar PV development in the focus areas (FAs) will not impact on their operations. Included in Appendix B are responses from the Army, highlighting specific military bases and training areas in the FAs which could be affected, and the Air Force indicating that their inputs will be submitted. In accordance with these submissions the military areas of interest were mapped and appropriately buffered as per Table 1. Data for Air Force bases and training ranges were available at a national scale and used to produce a national sensitivity map (see Maps 1 and 2). Other military areas of interest were only available inside the FAs. All sensitivities were combined to create sensitivity maps for each FA (see Maps 3 – 19).

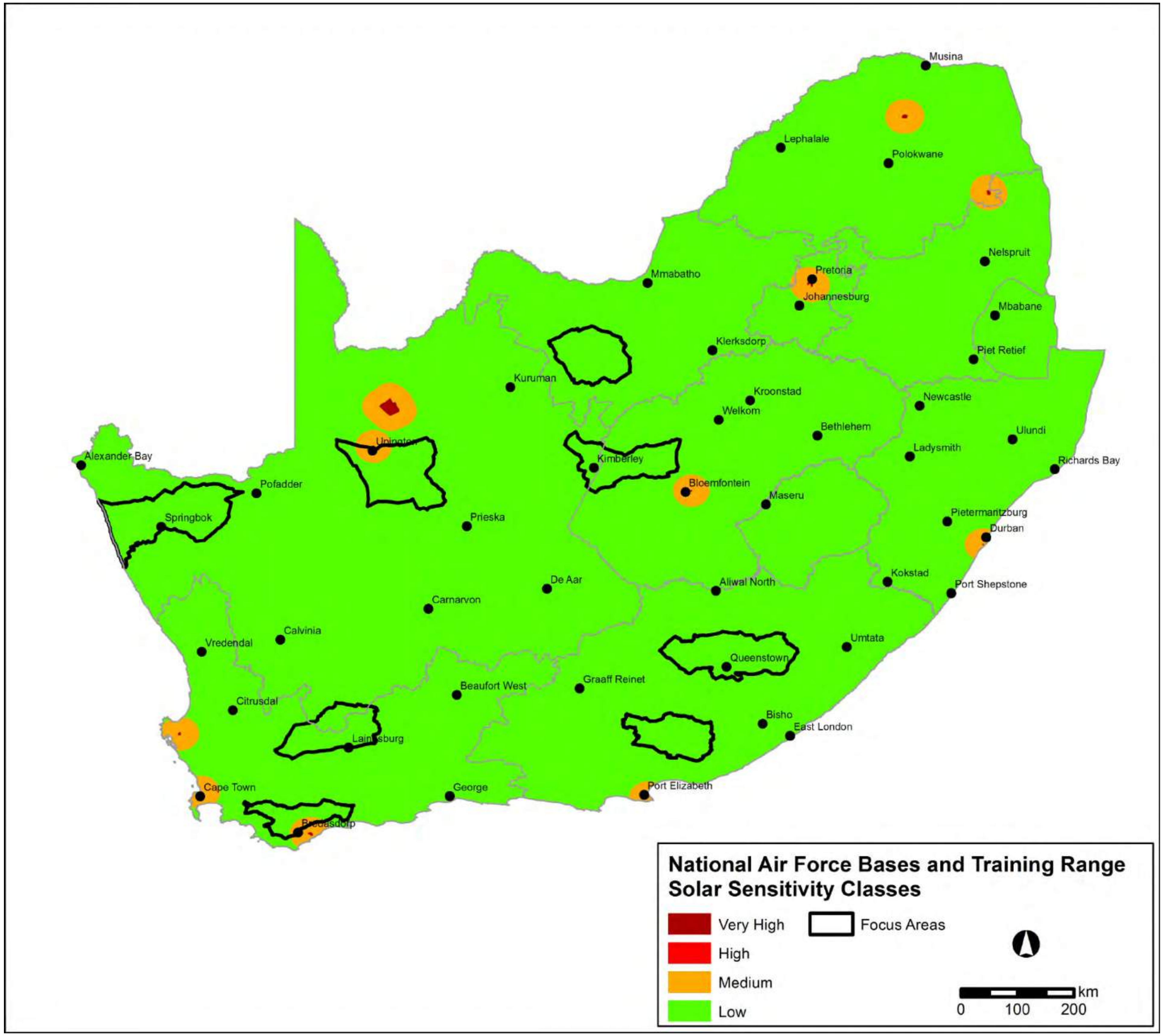
Table 1: Military areas of interest sensitivity criteria.

Sensitivity Feature	Sensitivity Mapping Application	
	Wind	Solar PV
Air Force Bases - Including air force training ranges	- Very High Sensitivity 28 km - High Sensitivity 56 km - Medium Sensitivity 111 km	- Very High Sensitivity 1 km - Medium Sensitivity 28 km
High Sites - High elevation sites used for the placing of communication or surveillance equipment	- Very High Sensitivity 1 km	- Very High Sensitivity 1 km
Military Bases	- Very High Sensitivity 1 km - High Sensitivity 10 km	- Very High Sensitivity 1 km
Operational Military Facilities	- Very High Sensitivity 1 km - High Sensitivity 10 km	- Very High Sensitivity 1 km
Shooting Ranges	- Very High Sensitivity 1 km - High Sensitivity 10 km	- Very High Sensitivity 1 km
Military Training Areas	- Very High Sensitivity 1 km - High Sensitivity 10 km	- Very High Sensitivity 1 km
Ammunition Depots	- Very High Sensitivity 10 km	- Very High Sensitivity 10 km
Forward Airfield - Other airfields used by the Air Force	- Very High Sensitivity 10 km	- Very High Sensitivity 1 km - Medium Sensitivity 10 km

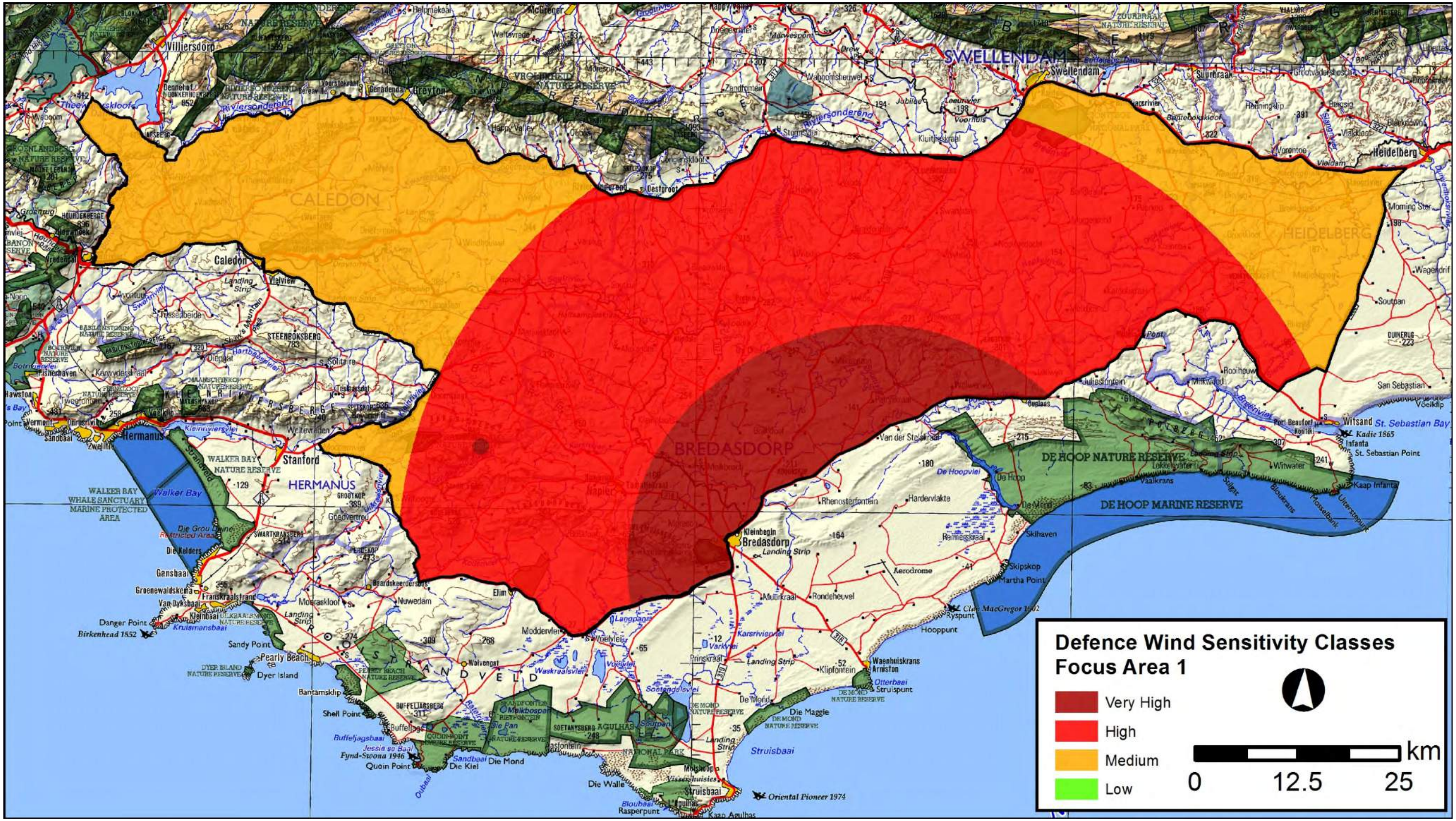




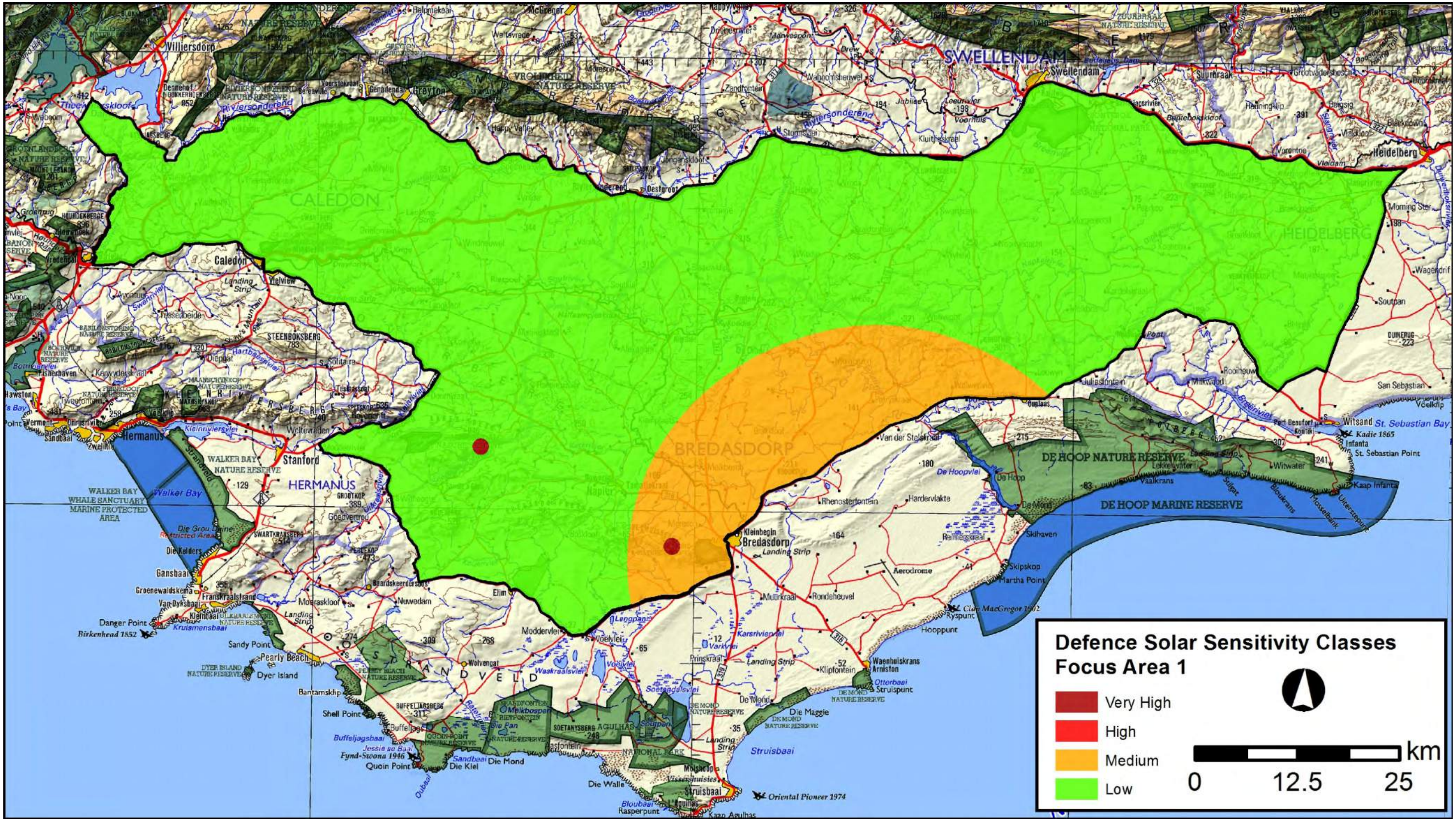
Map 1: National Air Force bases and training range sensitivity map for wind development



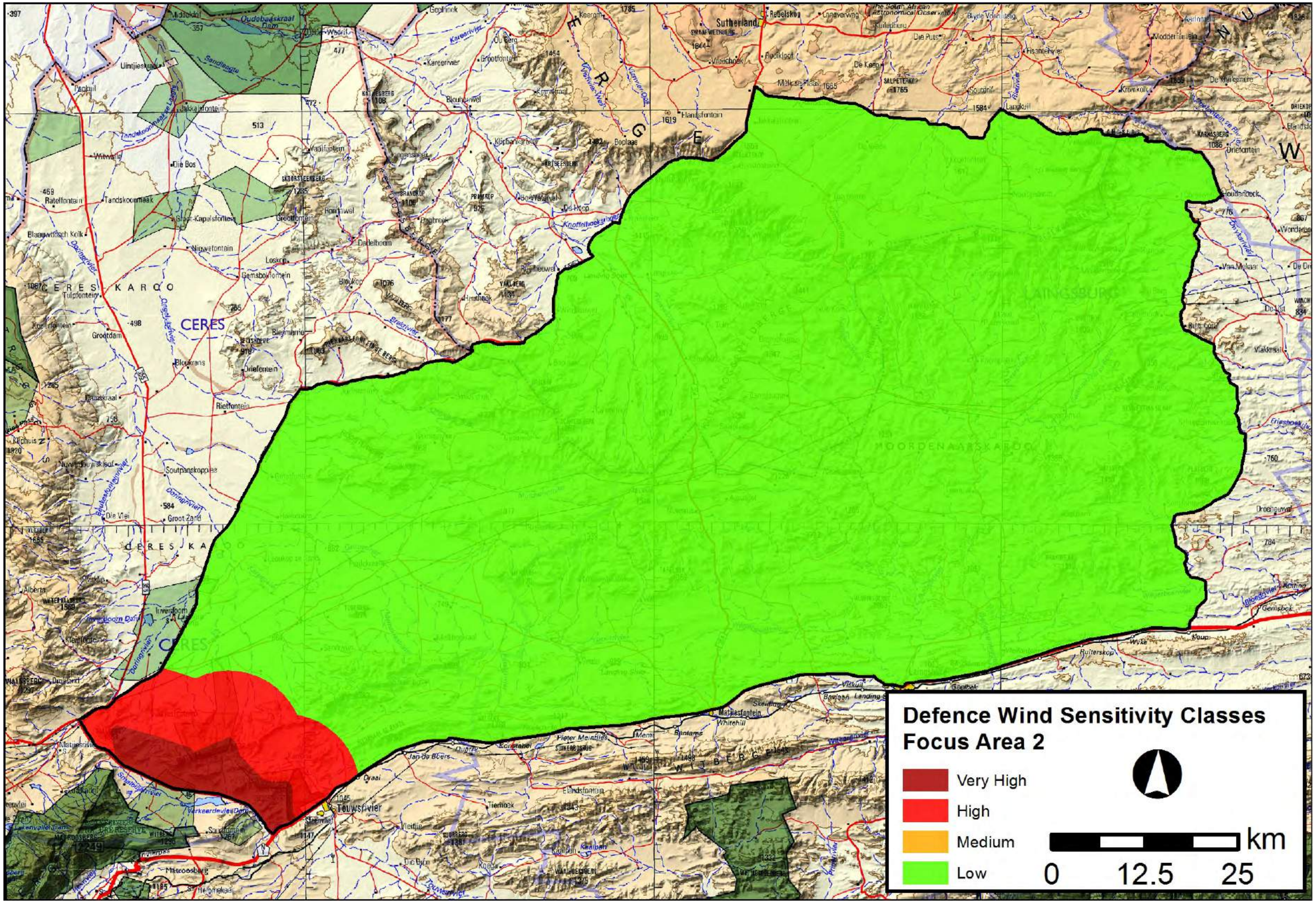
Map 2: National Air Force base and training range sensitivity map for solar PV development



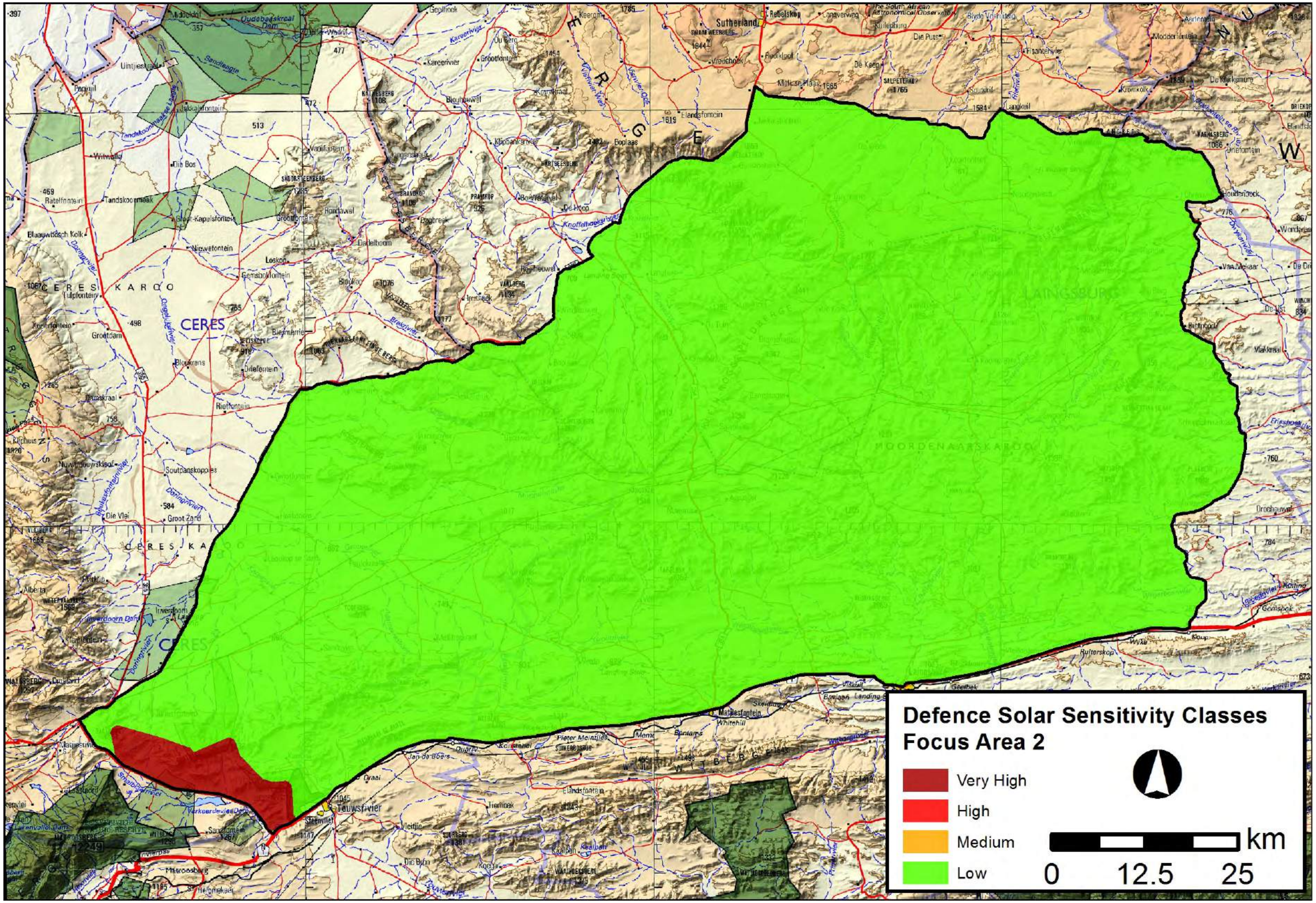
Map 3: Military sensitivity for wind energy development in the Overberg focus area (FA 1)



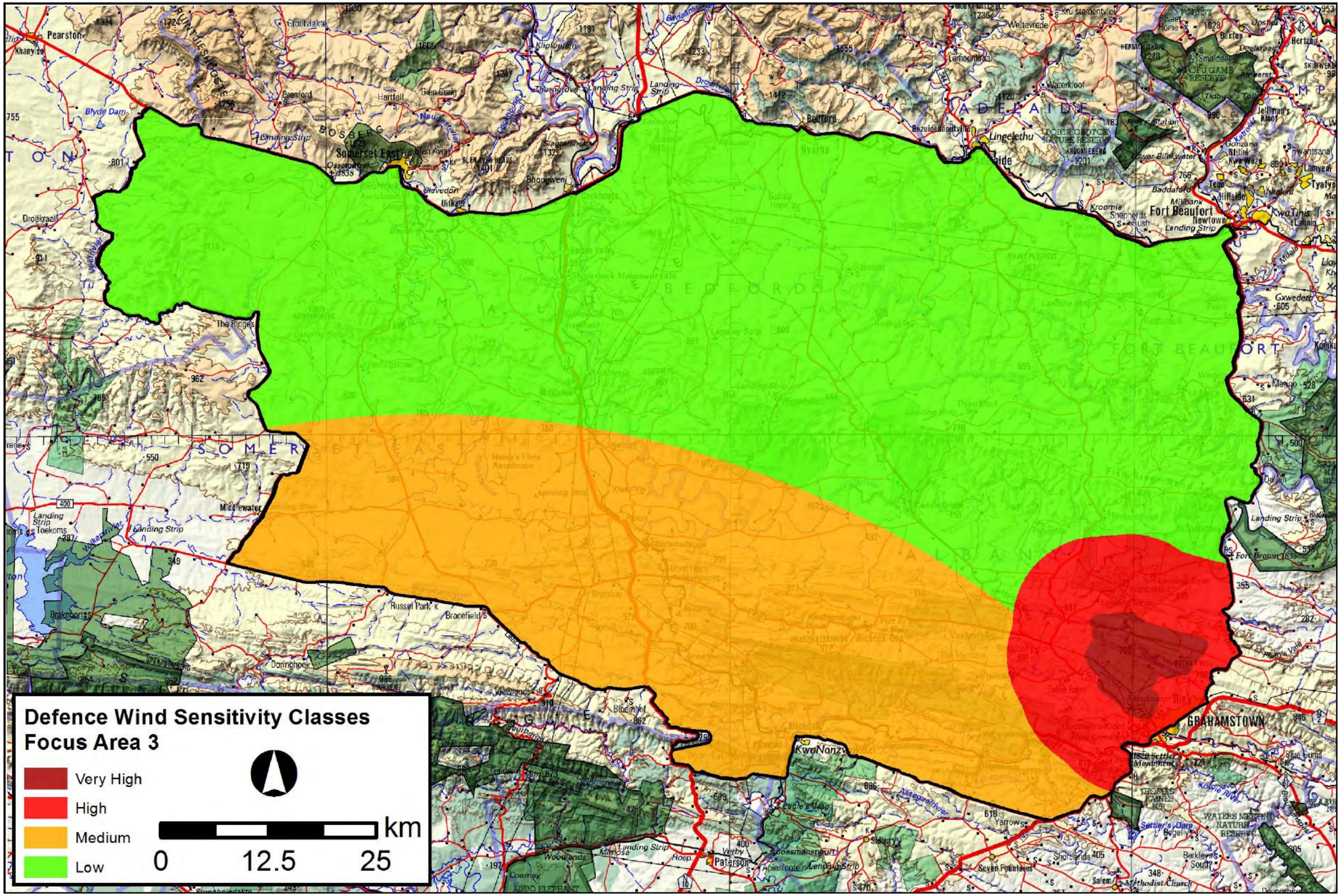
Map 4: Military sensitivity for solar PV energy development in the Overberg focus area (FA 1)



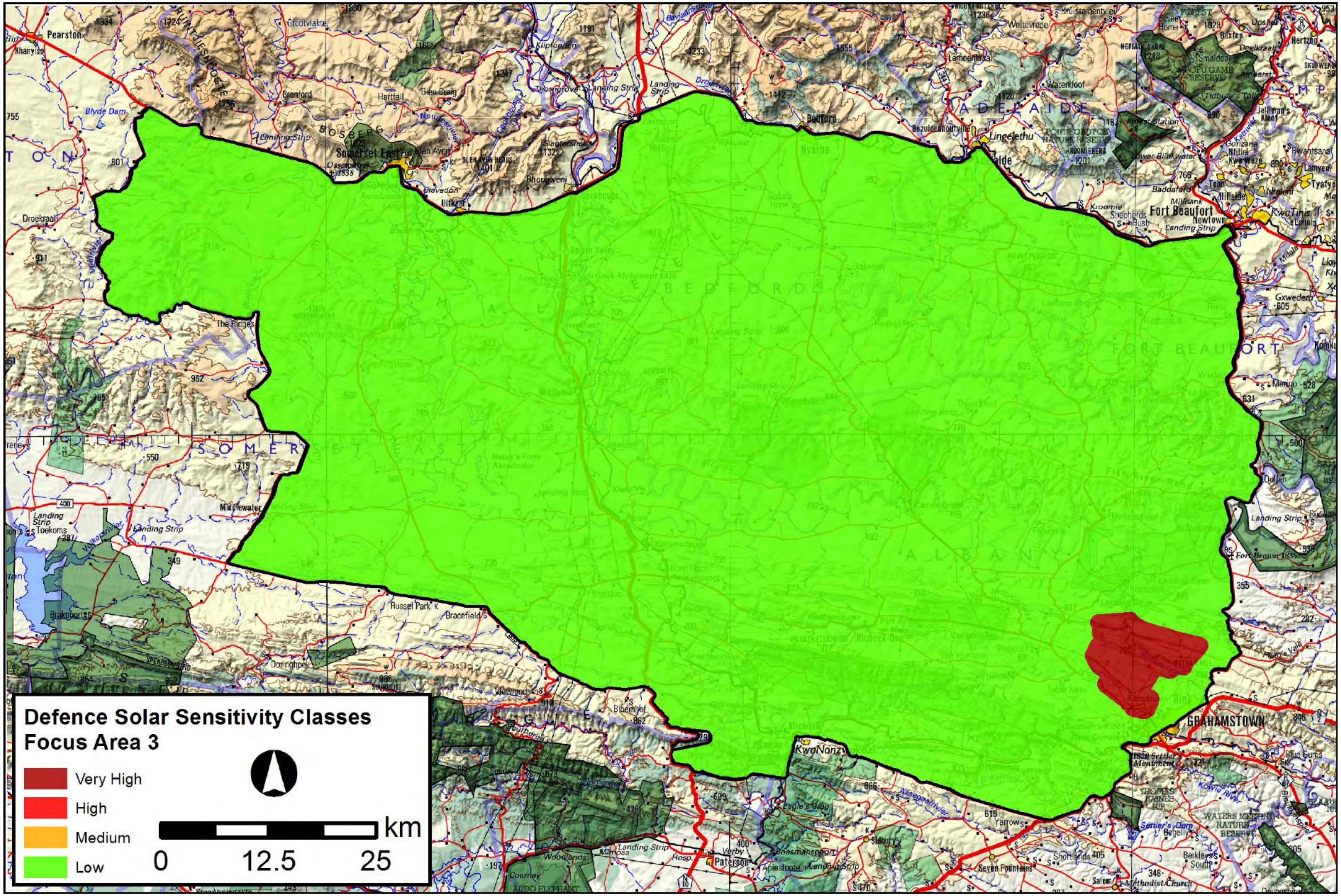
Map 5: Military sensitivity for wind energy development in the Komsberg focus area (FA 2)



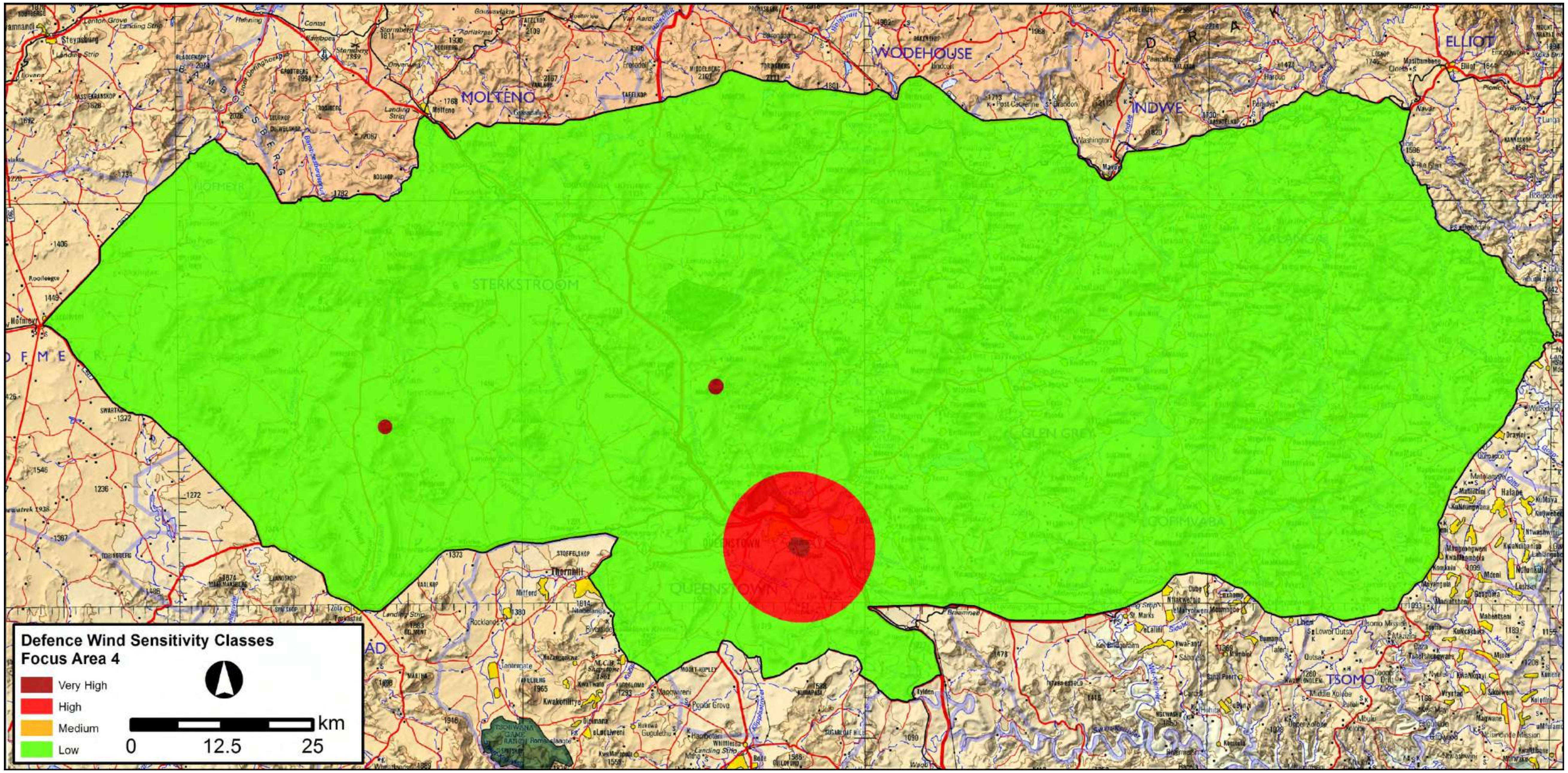
Map 6: Military sensitivity for solar PV energy development in the Komsberg focus area (FA 2)



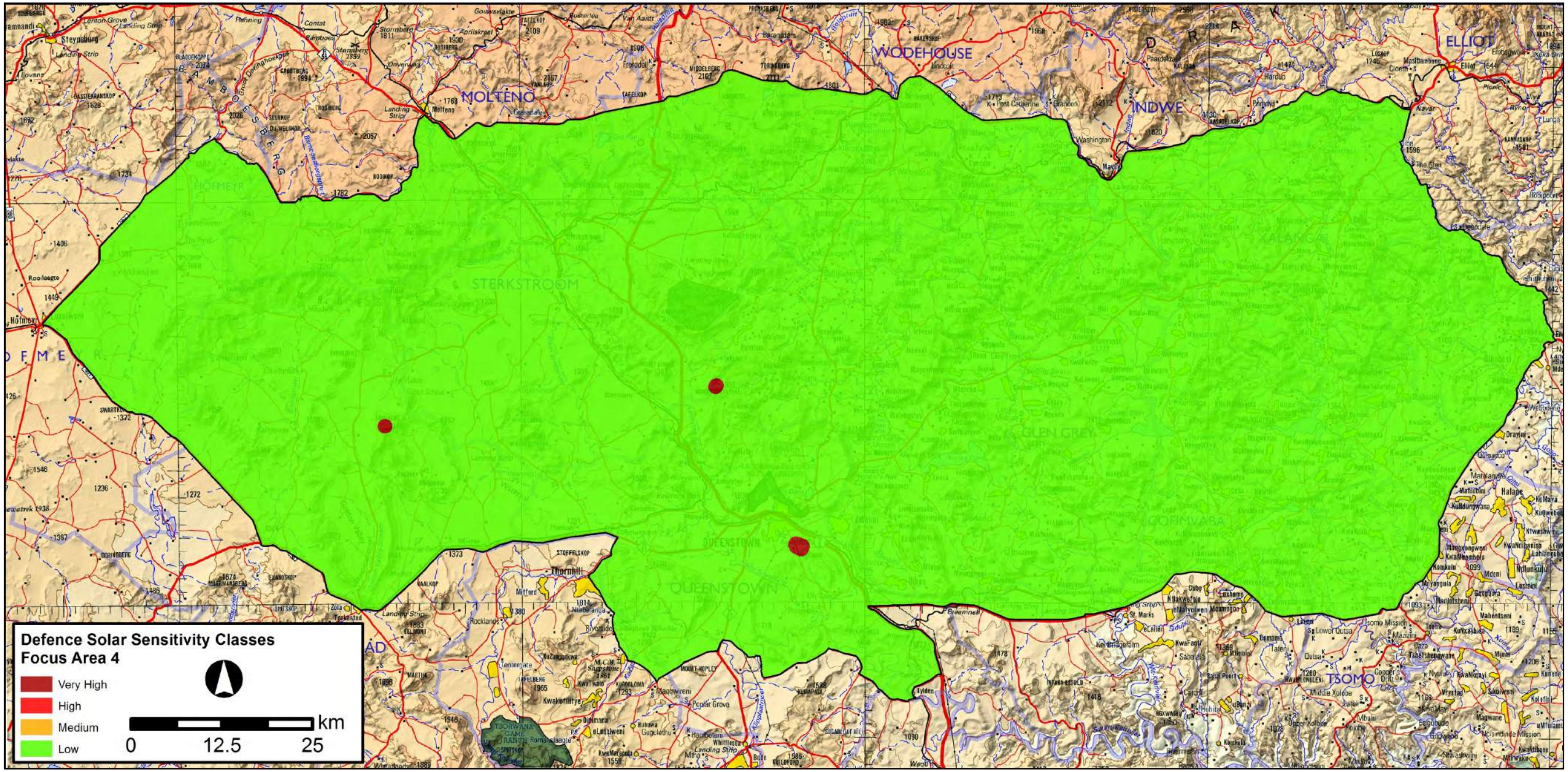
Map 7: Military sensitivity for wind energy development in the Cookhouse focus area (FA 3)



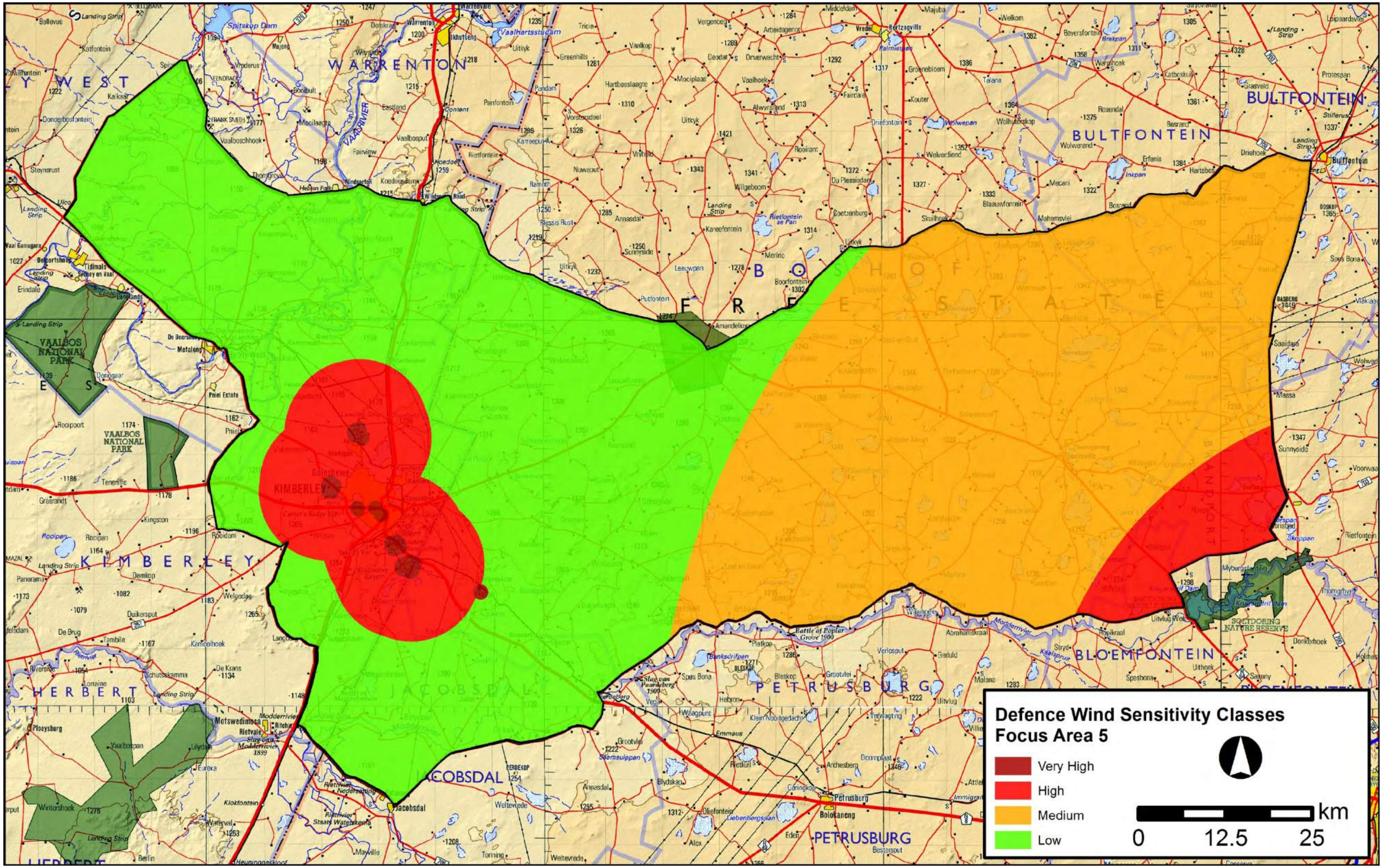
Map 8: Military sensitivity for solar PV energy development in the Cookhouse focus area (FA 3)



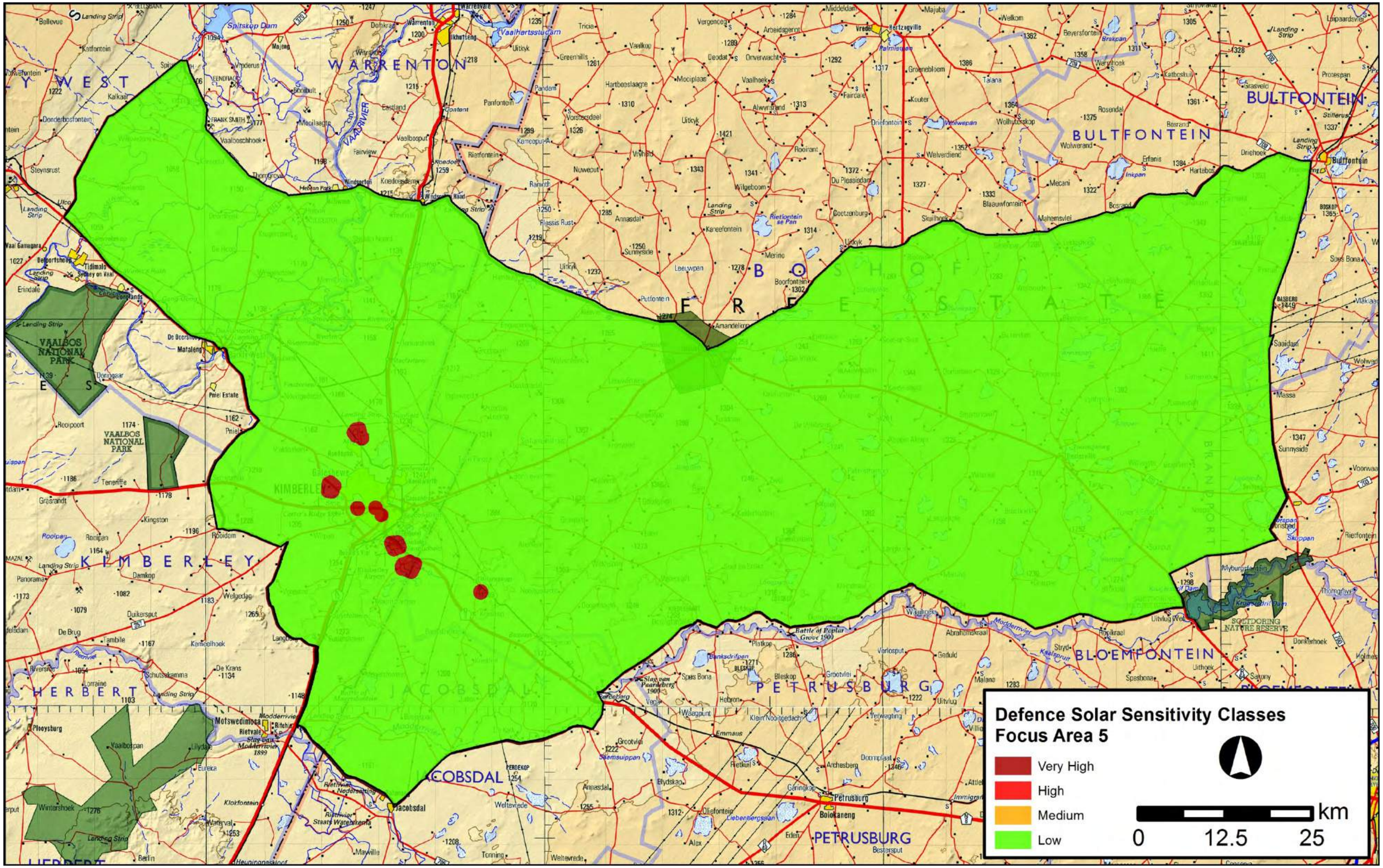
Map 9: Military sensitivity for wind energy development in the Stormberg focus area (FA 4)



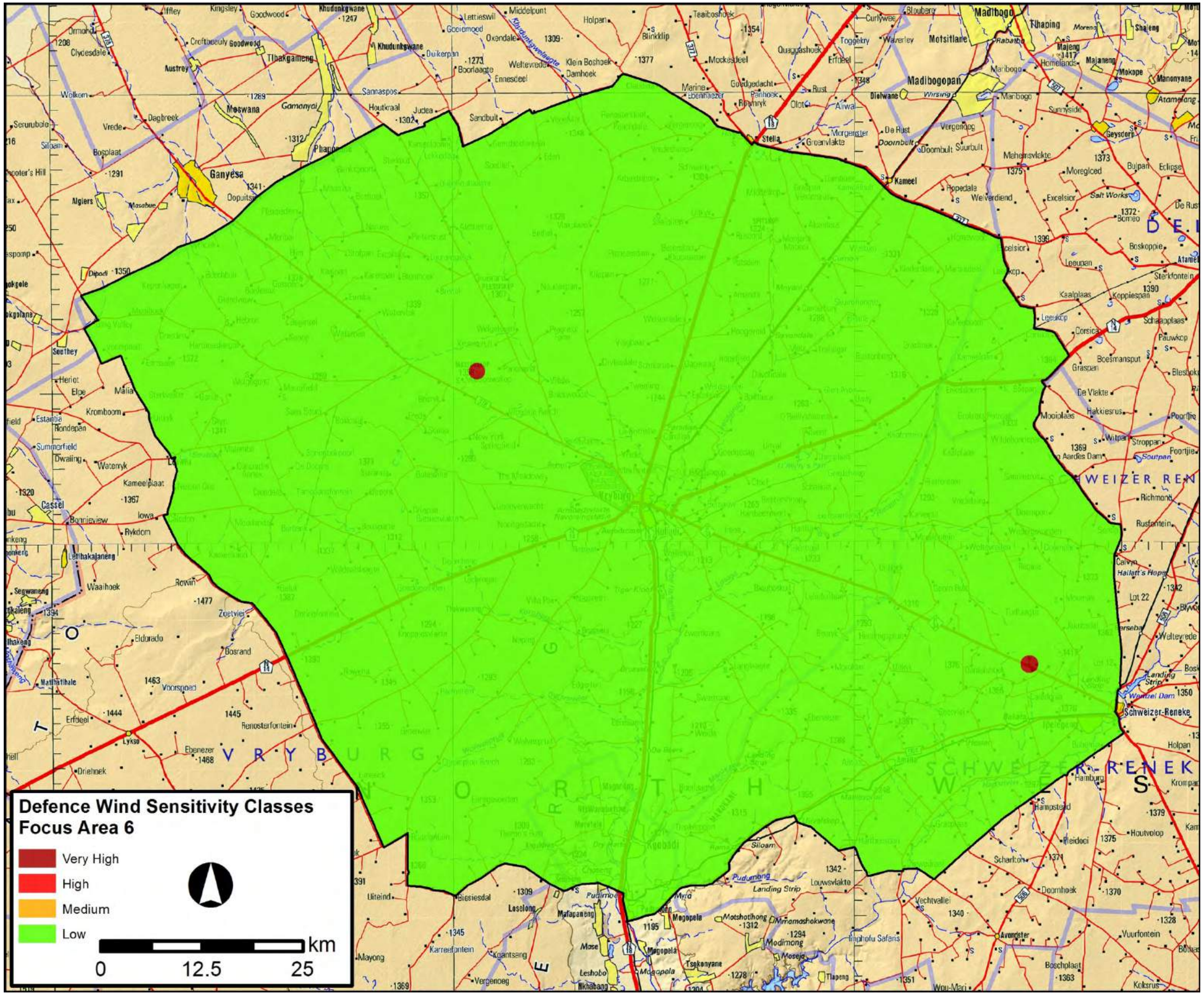
Map 10: Military sensitivity for solar PV energy development in the Stormberg focus area (FA 4)



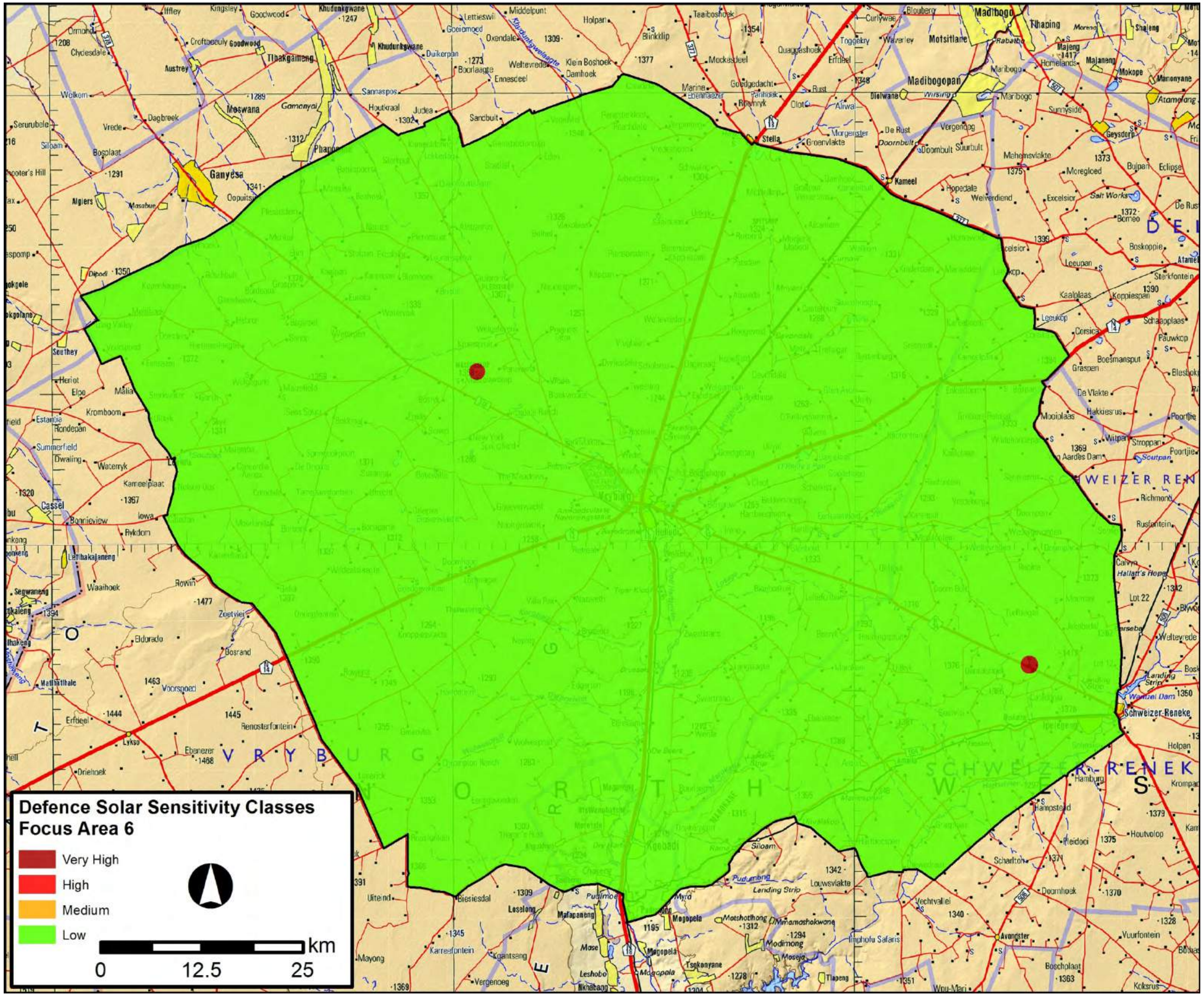
Map 11: Military sensitivity for wind energy development in the Kimberley focus area (FA 5)



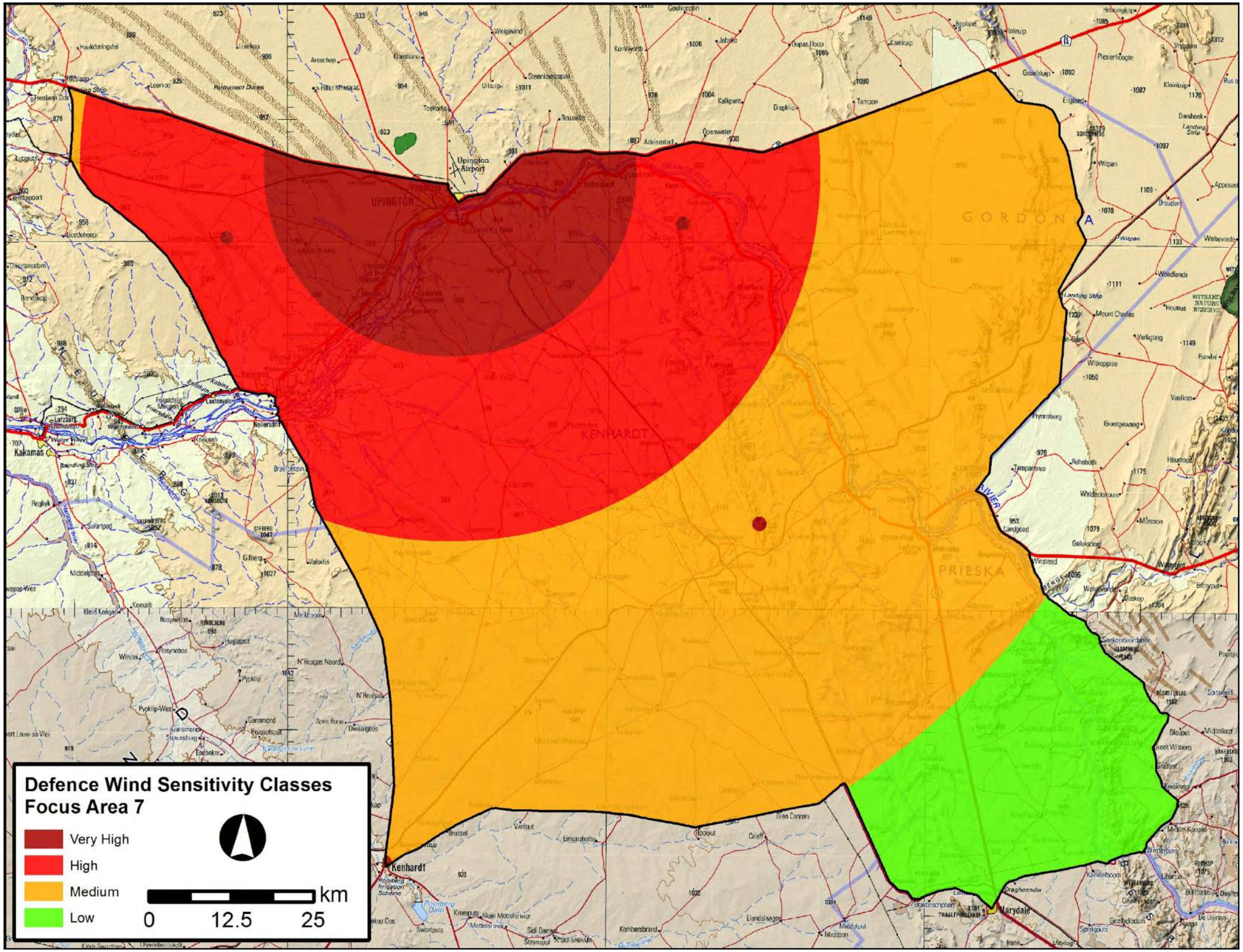
Map 12: Military sensitivity for solar PV energy development in the Kimberley focus area (FA 5)



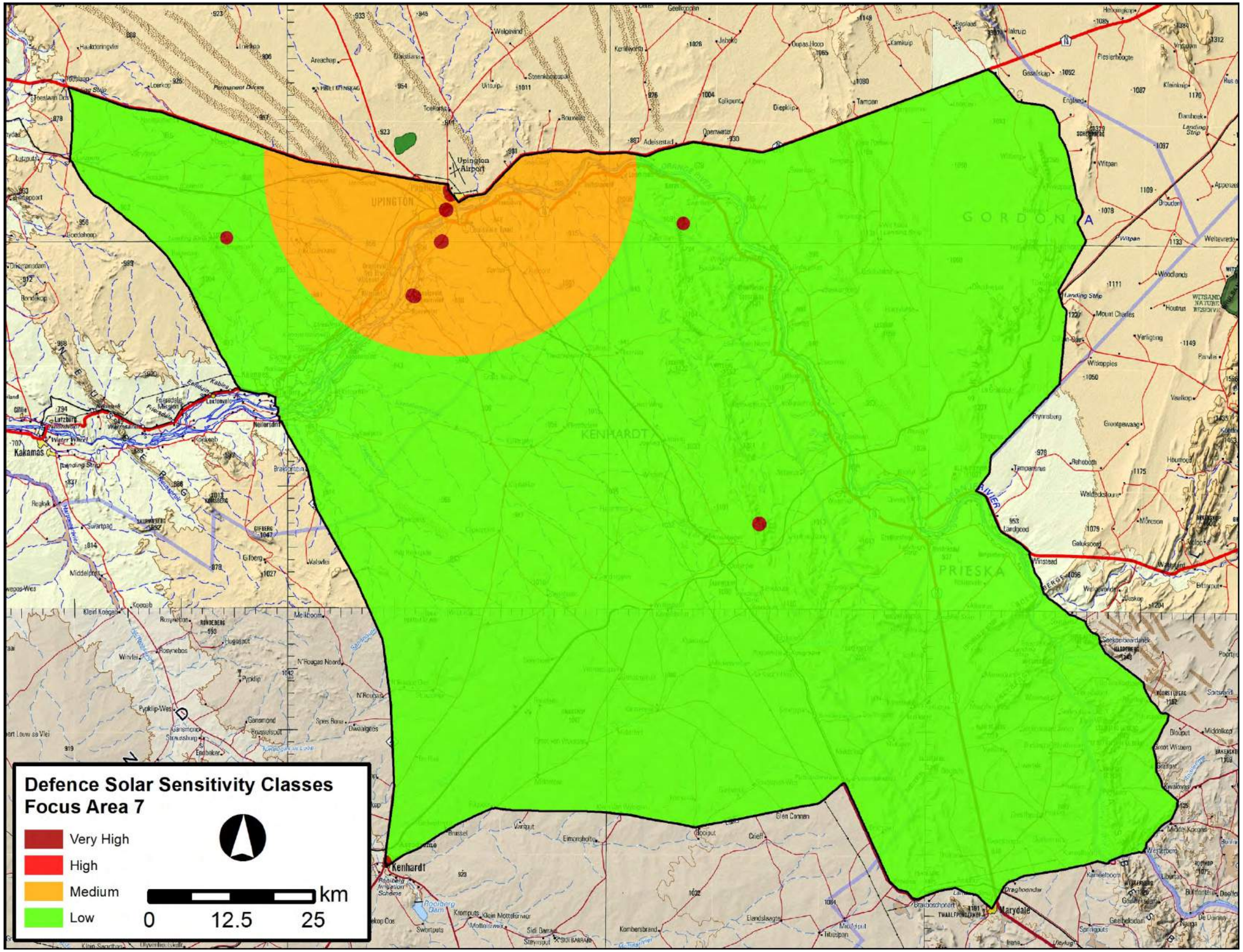
Map 13: Military sensitivity for wind energy development in the Vryburg focus area (FA 6)



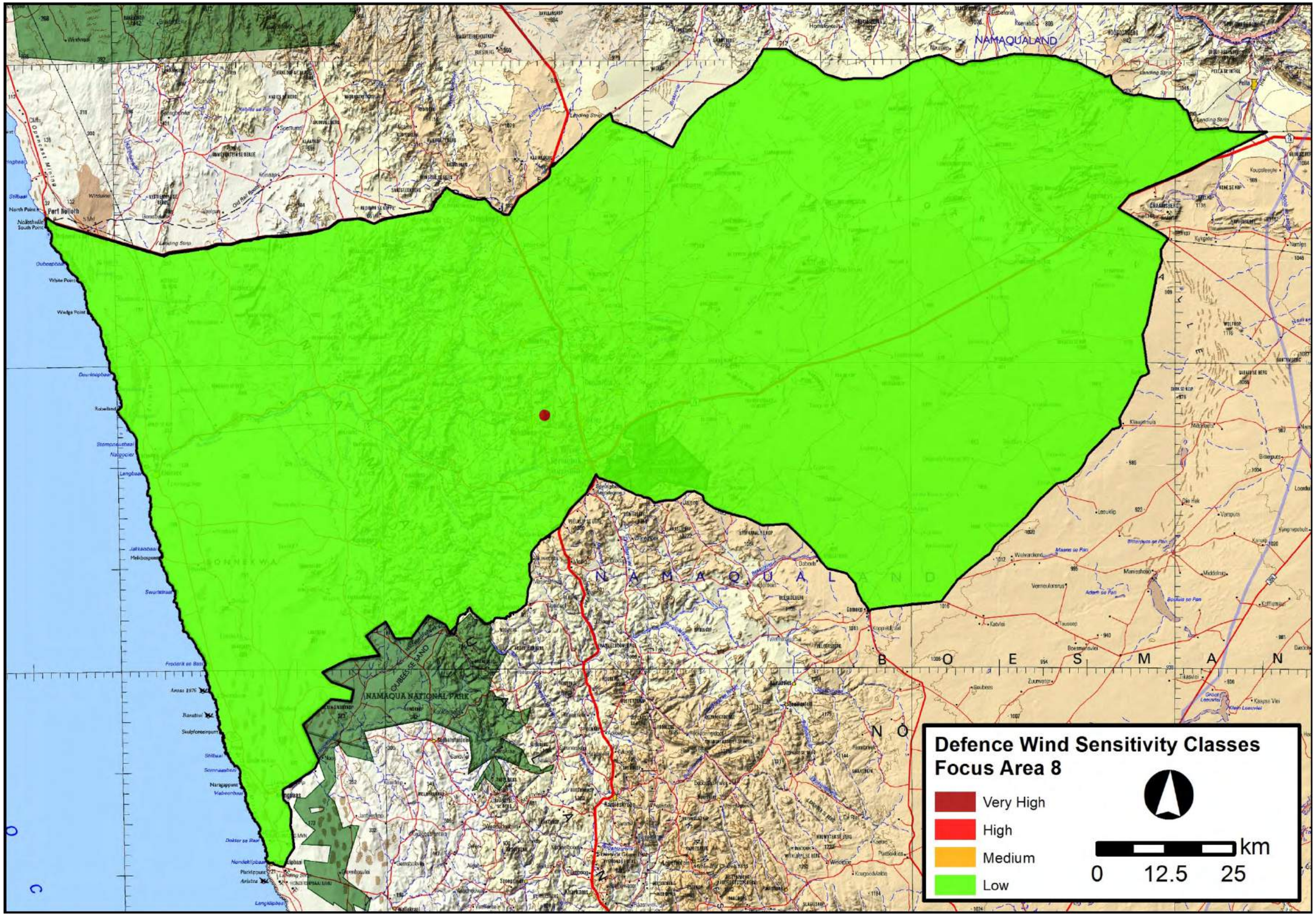
Map 14: Military sensitivity for solar PV energy development in the Vryburg focus area (FA 6)



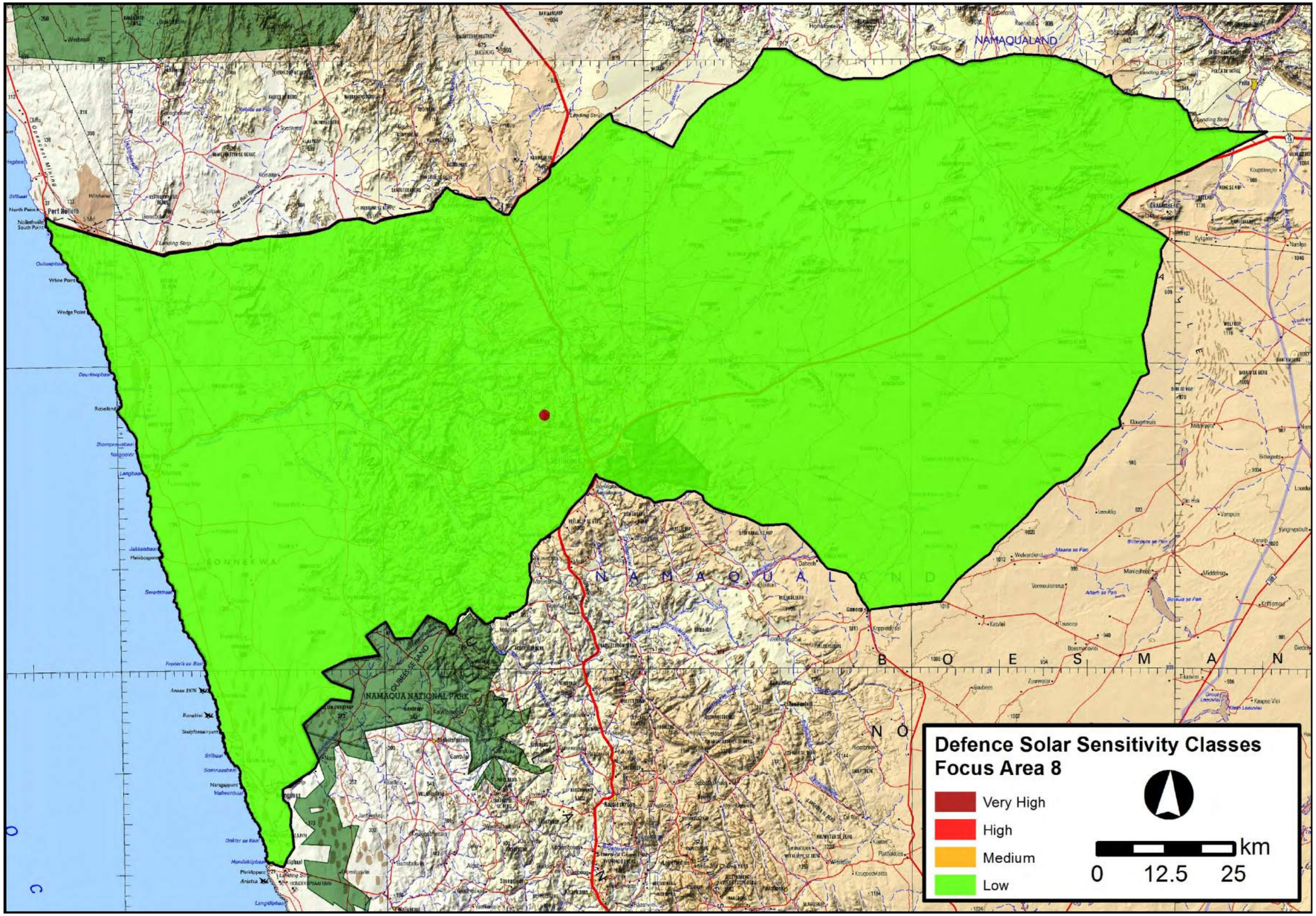
Map 15: Military sensitivity for wind energy development in the Upington focus area (FA 7)



Map 16: Military sensitivity for solar PV energy development in the Upington focus area (FA 7)



Map 17: Military sensitivity for wind energy development in the Springbok focus area (FA 8)



Map 18: Military sensitivity for solar PV energy development in the Springbok focus area (FA 8)

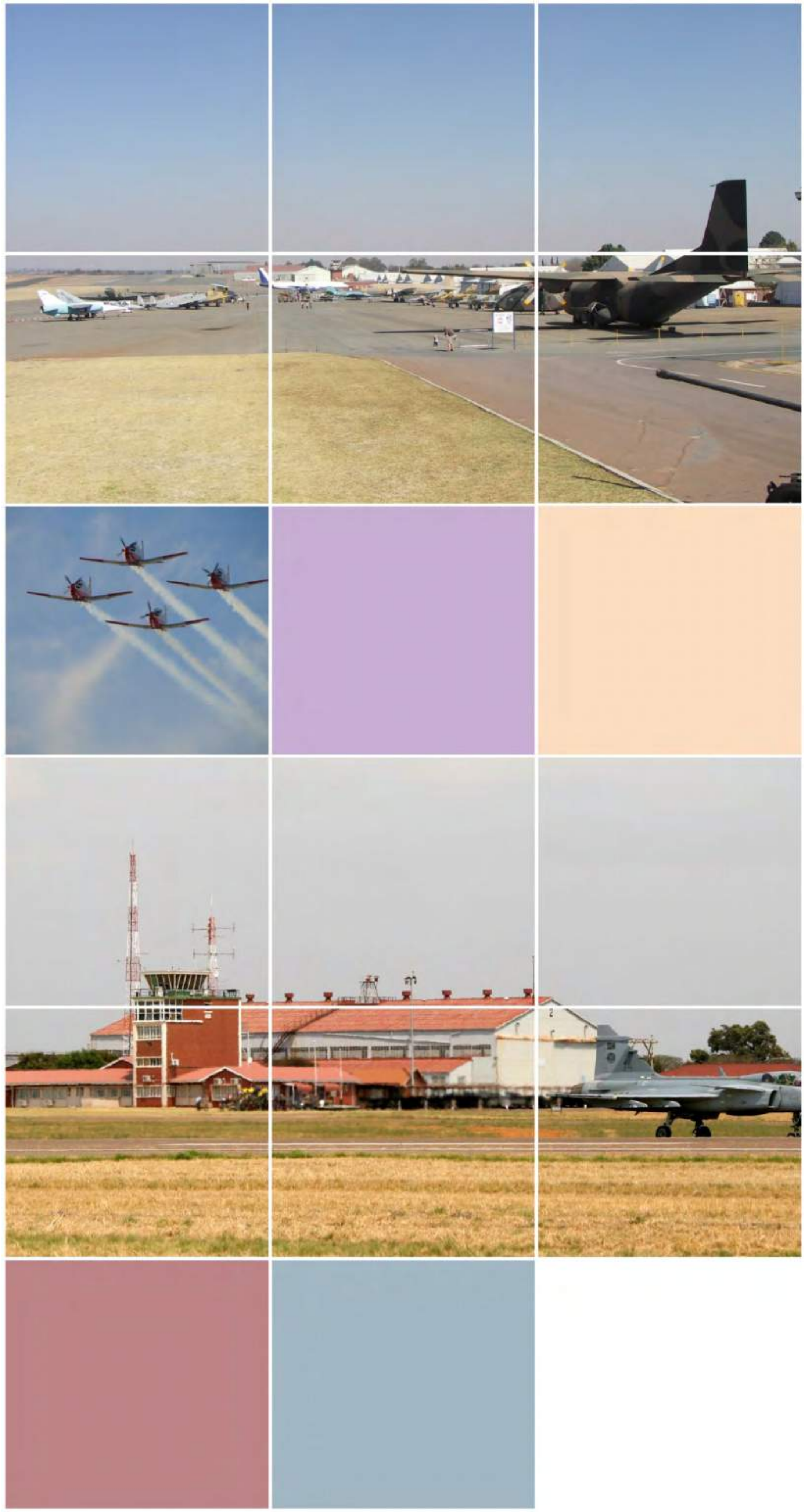
8.3 Development Protocols

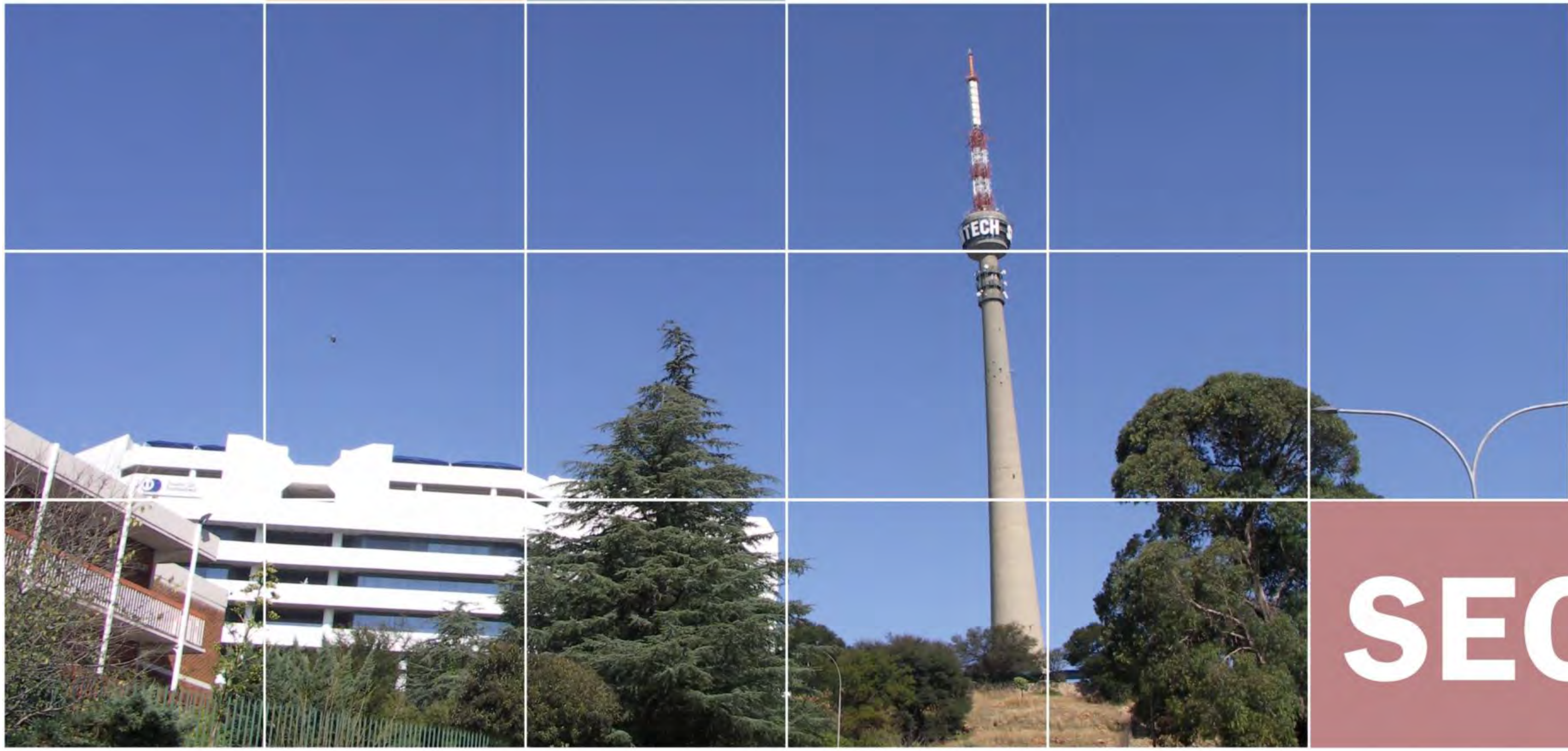
The OEC, under the chairmanship of the Senior Staff Officer Air Traffic Management of the Air Force, is responsible for streamlining and coordinating the approvals for the construction of potential aviation obstacles in the vicinity of military areas of interest. The OEC consists of members from both the Air Force and the South African Civil Aviation Authority (SACAA), and is mandated to make final recommendations to the Deputy Chief of the Air Force regarding the approval of obstacles that might impact on Air Force activities. Due to the complexity of impacts potentially posed by obstacles on aviation, surveillance, communication, and other military activities, all proposed wind and solar PV facilities must be evaluated by this committee. Even in instances where the distance from the nearest area of military interest may seem far enough for it not be able to have an impact, there is still potential for interference with communication, surveillance, or other military services.

Without being able to guarantee that any development will not be found to have an unacceptable impact on military areas of interest by the OEC, the main objective of this section is to clarify the different levels of potential sensitivities of wind and solar PV developments in this regard. In Table 2, sensitivity classes for wind and solar PV developments are interpreted and assessment requirements clarified. These requirements are specific to the sensitivity classes and are therefore related to the sensitivity maps in sub-Section 8.2. These requirements will be applicable to developments proposed both inside and outside the FAs, once these areas have been adopted as Renewable Energy Development Zones (REDZs).

Table 2: Interpretation of sensitivity maps and associated assessment requirements

Colour	Sensitivity	Interpretation of the sensitivity	Further wind and solar PV assessment requirements
Dark red	Very High	In very high sensitivity areas there is a high likelihood for significant negative impacts that cannot be mitigated. In-depth assessment of the potential impacts and mitigation measures is likely to be required before development can be considered in these areas.	Proponents intending to develop a wind or solar PV facility that triggers an environmental assessment process anywhere in South Africa must prove to the relevant competent authority that the proposed development will not have an unacceptable negative impact on defence activities. In order to do so, the proponent must request a comment from the OEC confirming no unacceptable impact on military areas of interest. Inputs from the OEC, if provided within stipulated timeframes, will be considered by the relevant competent authority for decision making.
Red	High	In high sensitivity areas there is potential for negative impacts that can potentially be mitigated. Further assessment may be required to investigate potential impacts and mitigation measures.	
Orange	Medium	In medium sensitivity areas there is a low potential for negative impacts, and if there are impacts there is a high likelihood of mitigation. Further assessment of the potential impacts may not be required.	
Green	Low	No significant impacts are expected in low sensitivity areas. It is unlikely for further assessment and mitigation measures to be required.	

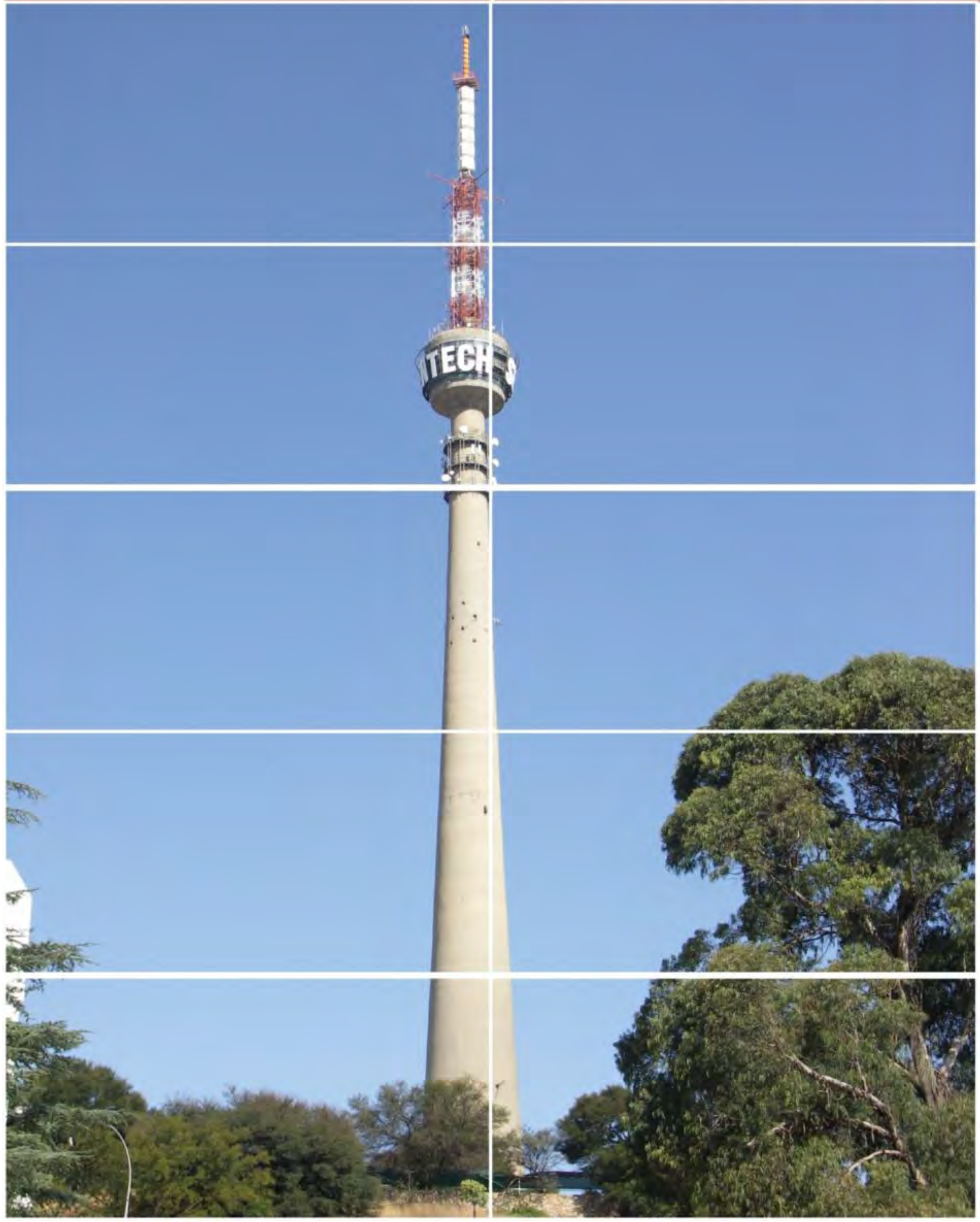




SECTION 9

TELECOMMUNICATIONS

contents



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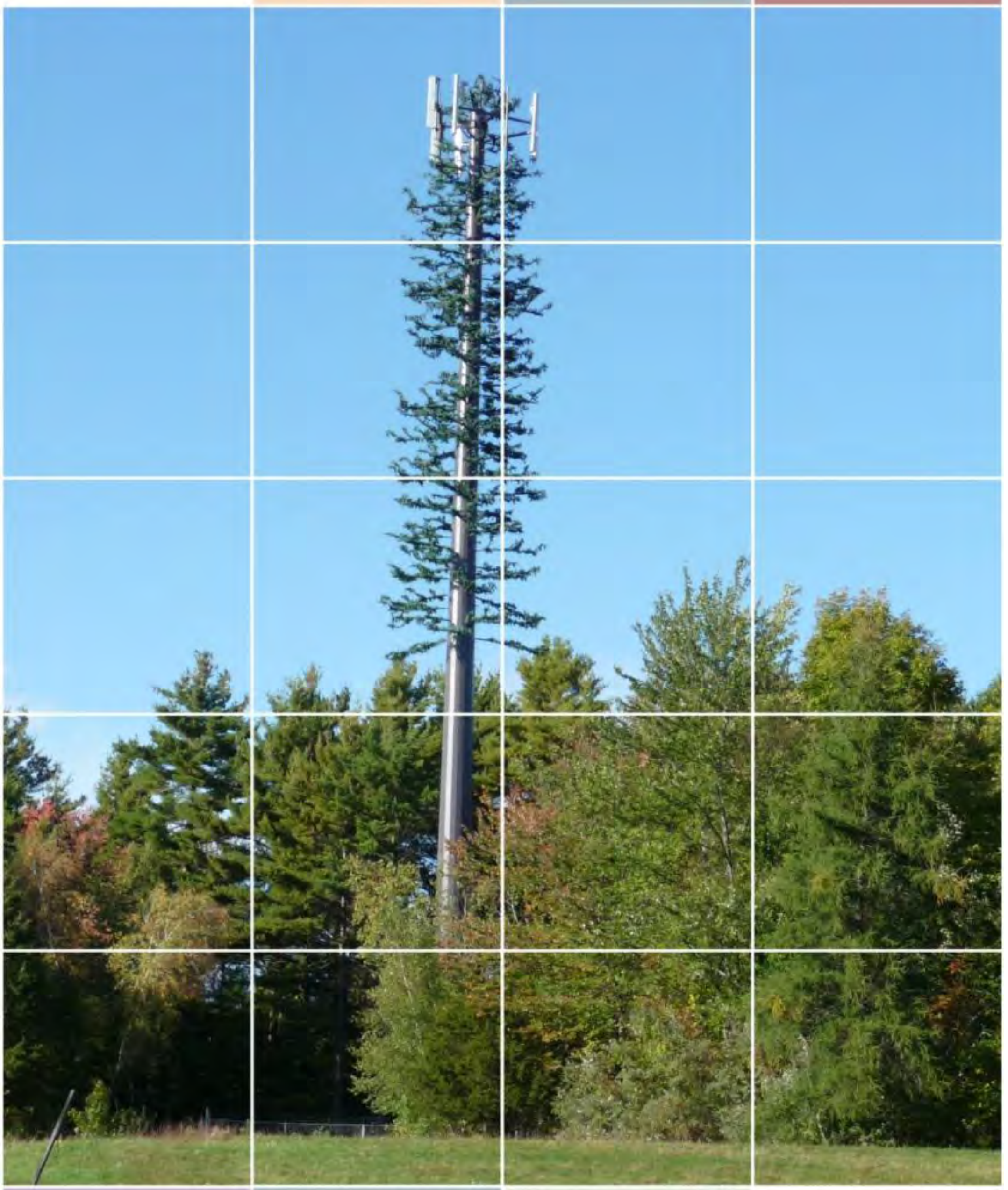


PART 3. SCOPING ASSESSMENTS AND DEVELOPMENT PROTOCOLS

SECTION 9: TELECOMMUNICATIONS

Telecommunication and terrestrial broadcasting facilities spread across South Africa allow for the national distribution of television, radio, phone and data signals. Sentech is a State Owned Enterprise (SOE) that provides signal distribution services for most of South Africa's broadcasters. Other terrestrial broadcasting companies include the South African Broadcasting Corporation (SABC), Multichoice, and others. Telecommunication companies include Telkom, Vodacom, MTN, Cell-C, Eskom Telecoms, Transtel Telecommunication, and others.

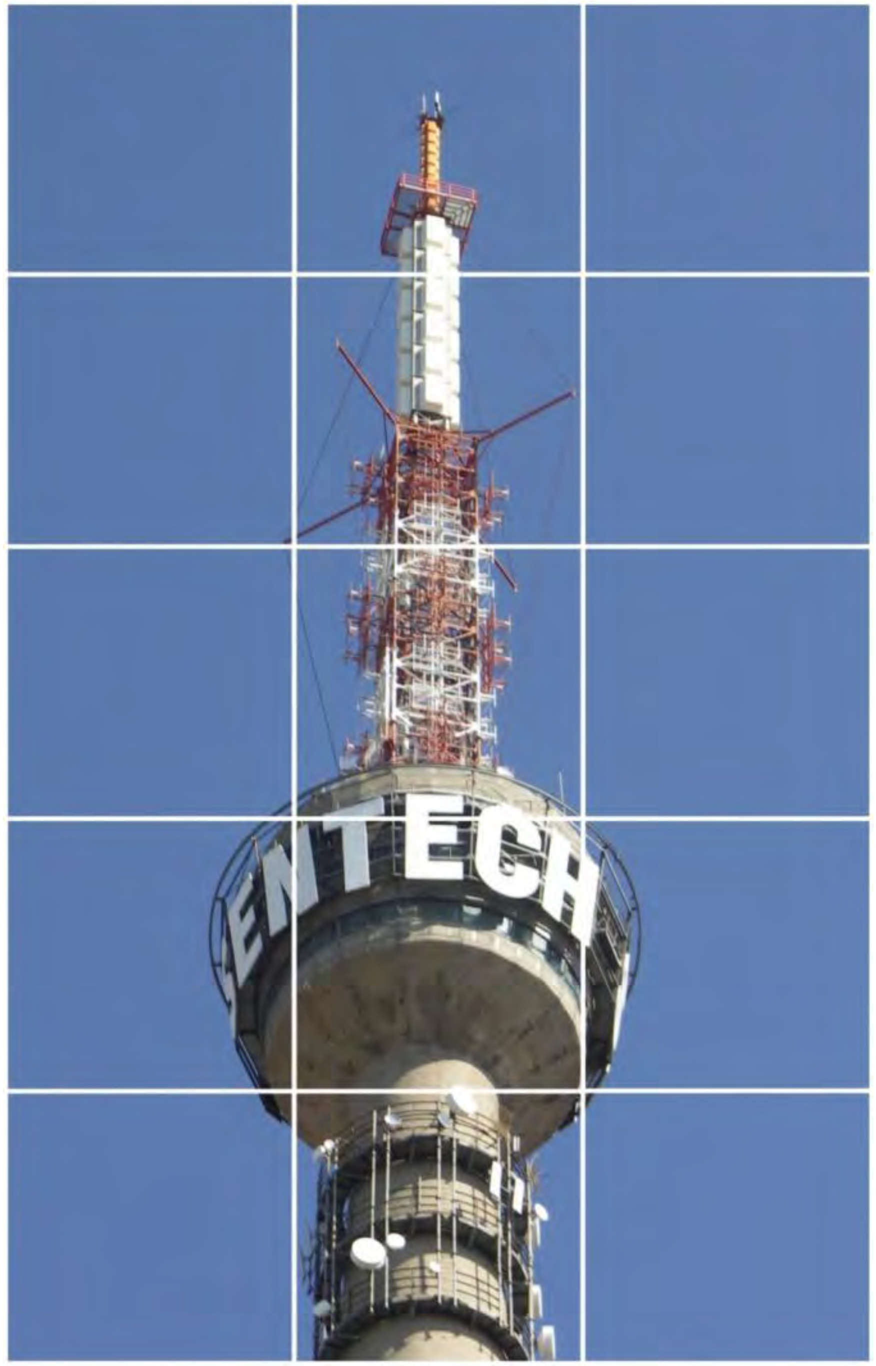
9.1 Renewable Energy and Telecommunication

The waves of transmitted telecommunication signals can be reflected or diffracted when they strike an object or an edge such as the blade of a wind turbine. Two types of echo can be induced by wind turbine interference, a static echo induced by the reflection from the steel tower of a wind power generator and a dynamic echo induced by the reflection from rotating blades. In terms of AM (amplitude modulation) and FM (frequency modulation) radio and television broadcasts, in particular, wind turbines may alter the signal amplitude when it passes through the spinning blades (chopped) or when it is reflected from the blades (multipath). The multipath interference creates a delayed signal (echo) that arrives at the receiving antenna after the primary signal and adds to the amplitude of the primary signal at the receiver. An additional distortion of the signal can be induced by the Doppler shift of the echo which occurs when the signal reflects off a moving object. Weak signals from distant transmitters are especially susceptible to multipath interference. Wind energy facilities usually have the greatest impact if located in close proximity to high power transmitter stations, but could also affect distant transmitters if located in the line of sight.

The key potential impacts of wind energy facilities on broadcasting and telecommunications services/facilities are:

- On analogue television (TV) it may result in "Ghost Pictures" appearing on the screen and in severe cases result in synchronisation loss resulting in the "rolling" of the picture;
- On Digital TV it may result in the freezing of the pictures and in severe cases loss of synchronisation lock which will prevent a decoder from continuing to operate;
- On telecommunication networks it may result in excessive errors resulting in dropping of cellular phone calls and slow data transmission.

Although unlikely, solar photovoltaic (PV) plants might have an impact where elevation of the PV plant is relatively high in relation to the transmitter station, and where the PV plant is located in close proximity to the south of a transmitter (with PV panels generally facing north towards the equator). Broadcasting signals could be reflected from the solar panels and result in "Ghost Pictures" on analogue TV and multipath interference on digital TV. Telecommunication signals crossing a solar PV facility might be affected with multipath reflection and result in the degradation of the quality of the link.

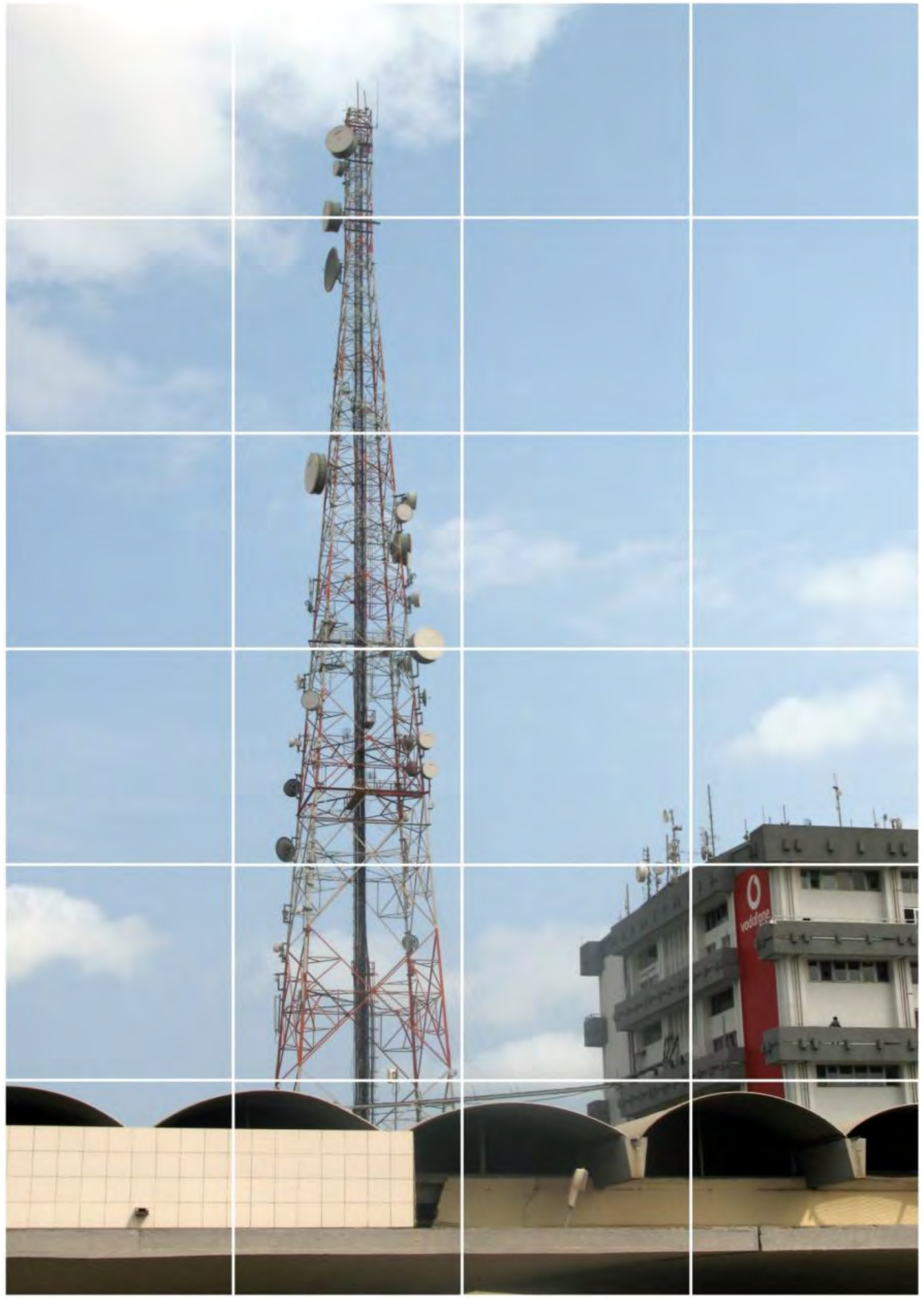


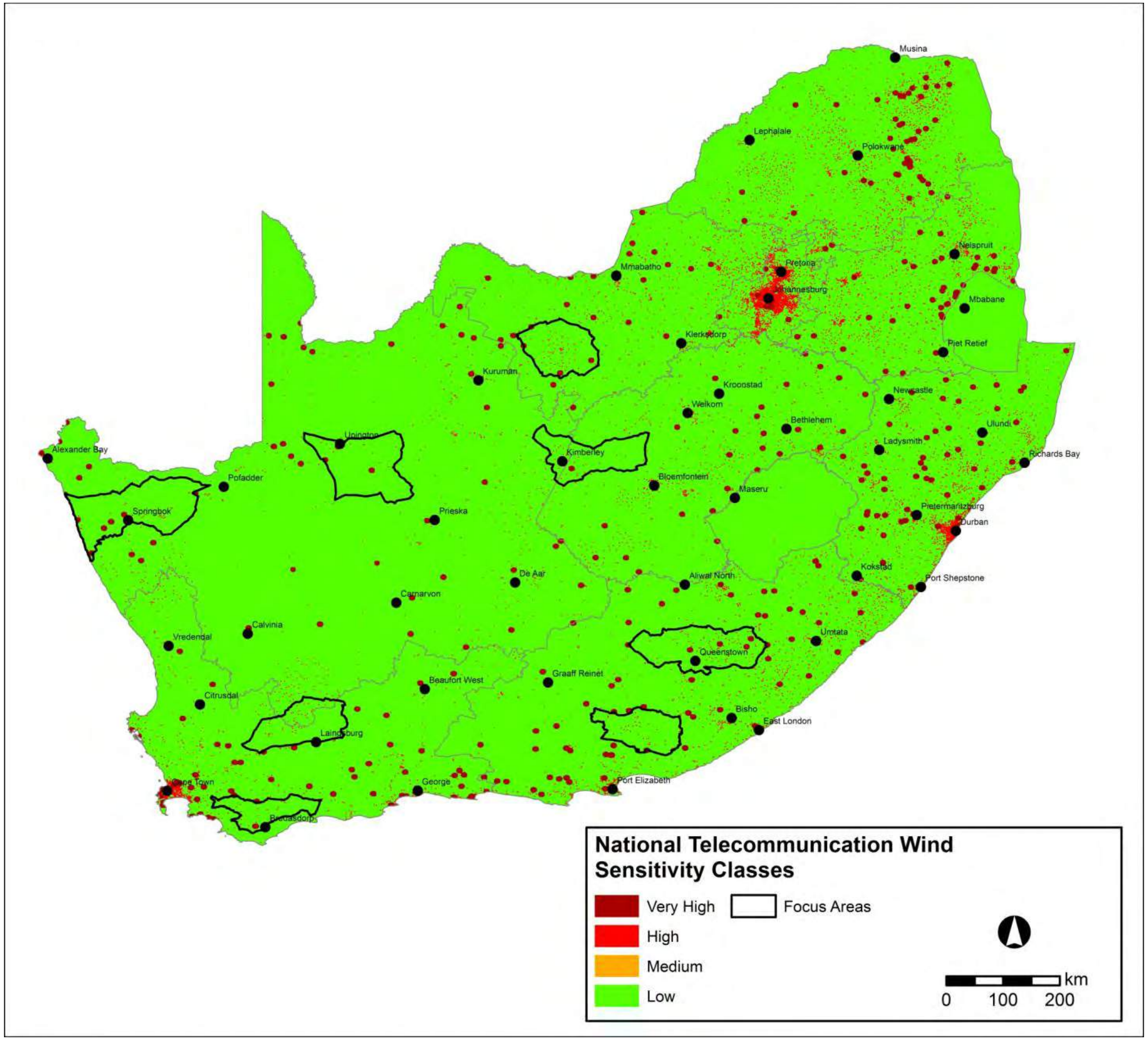
9.2 Sensitivity Mapping

In accordance with submissions by Sentech, and the data provided by the South African Civil Aviation Authority (SACAA), appropriate sensitivity buffers around high powered broadcasting facilities and other communication masts were mapped as per Table 1. The sensitivity data were available at a national scale and used to produce national wind and solar PV sensitivity maps (see Maps 1 and Map 2). Sensitivities were also mapped for each focus area (FA) (see Maps 3 to 18).

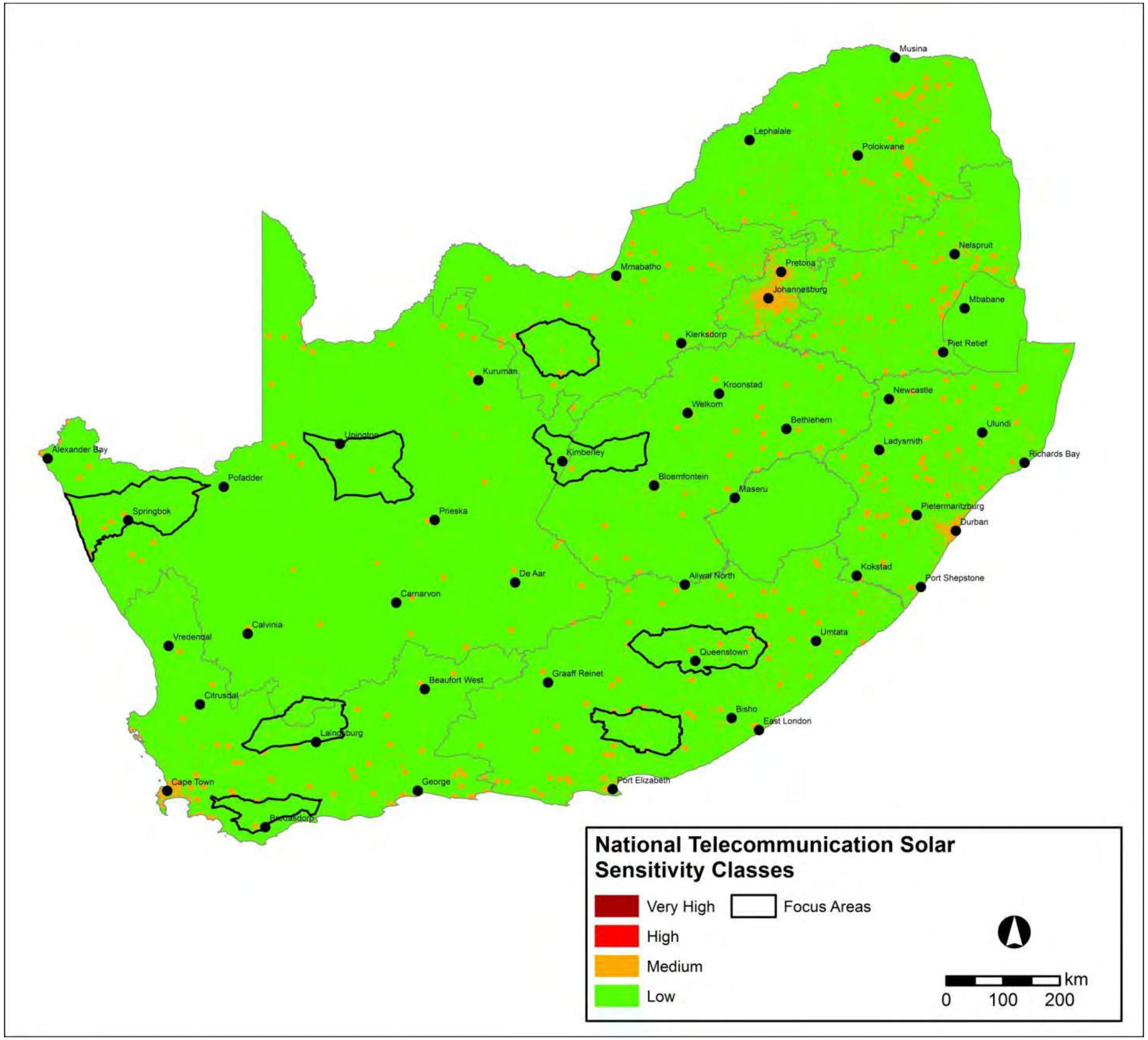
Table 1: Telecommunication sensitivity criteria

Sensitivity Feature	Data Source	Sensitivity Mapping Application	
		Wind	Solar PV
Sentech High Power Terrestrial Broadcasting Facilities	· Sentech	· **Very High sensitivity** 5 km	· **Medium sensitivity** 5 km
Other Communication Facilities	· SACAA Obstacle Database	· **High sensitivity** 1 km	· **Medium sensitivity** 1 km

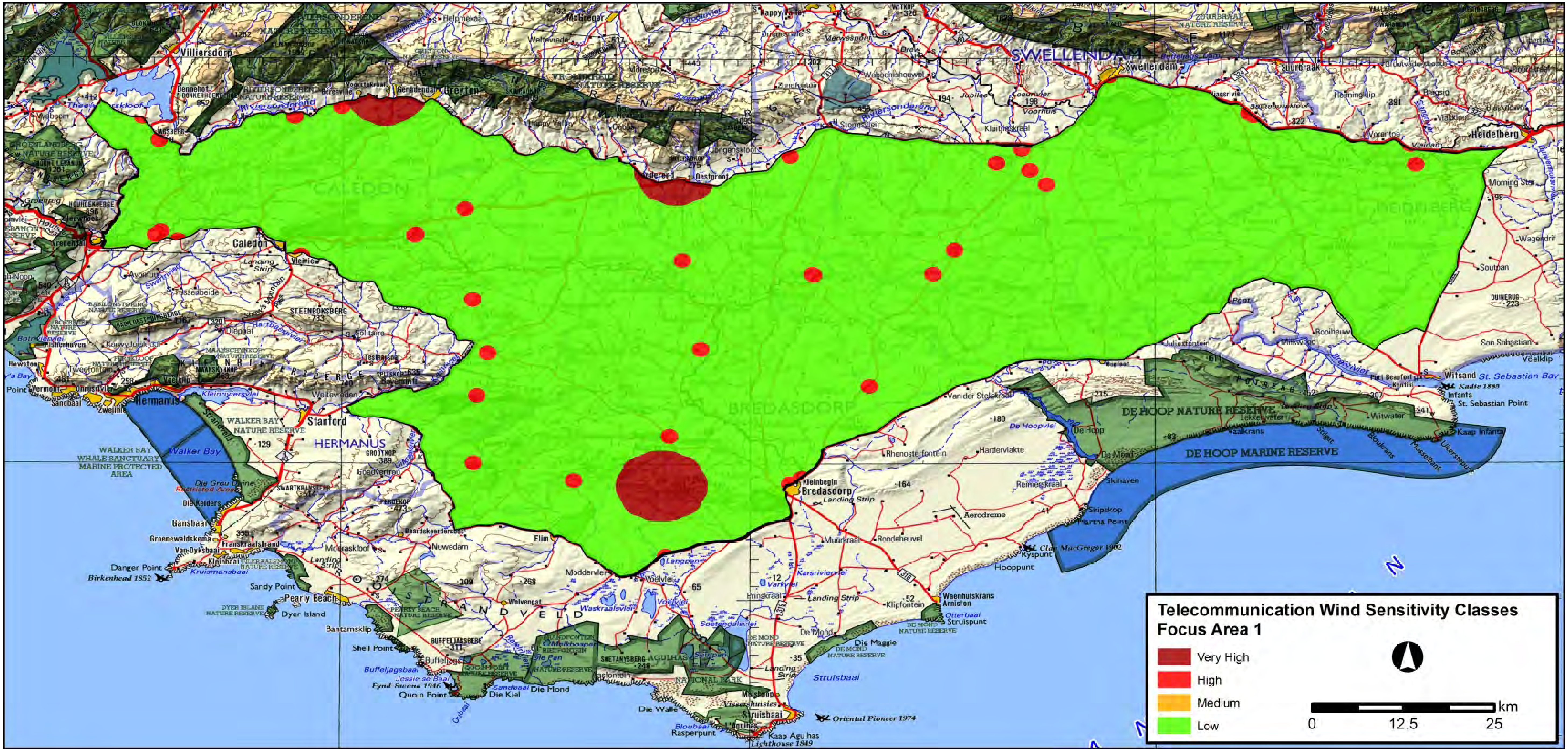




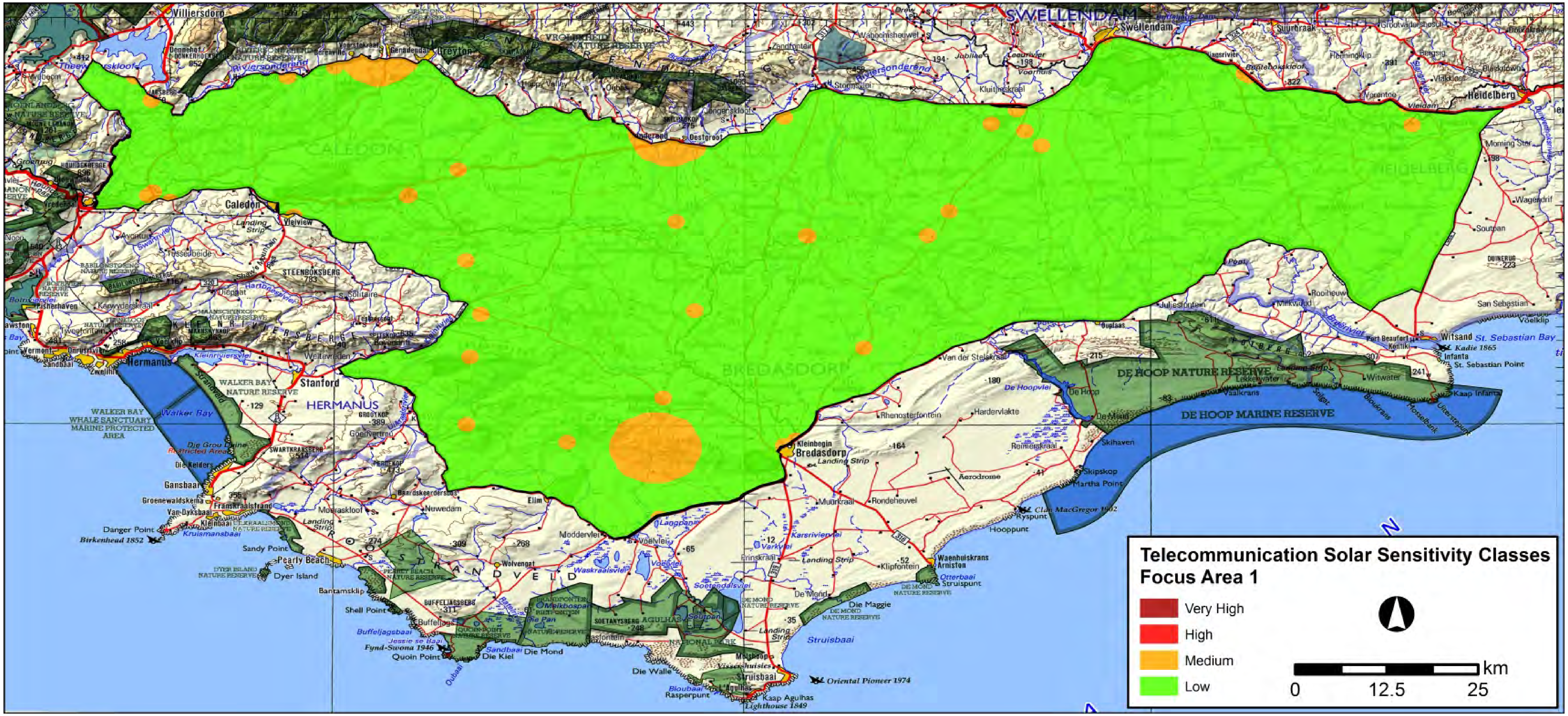
Map 1: National telecommunication sensitivity map for wind development



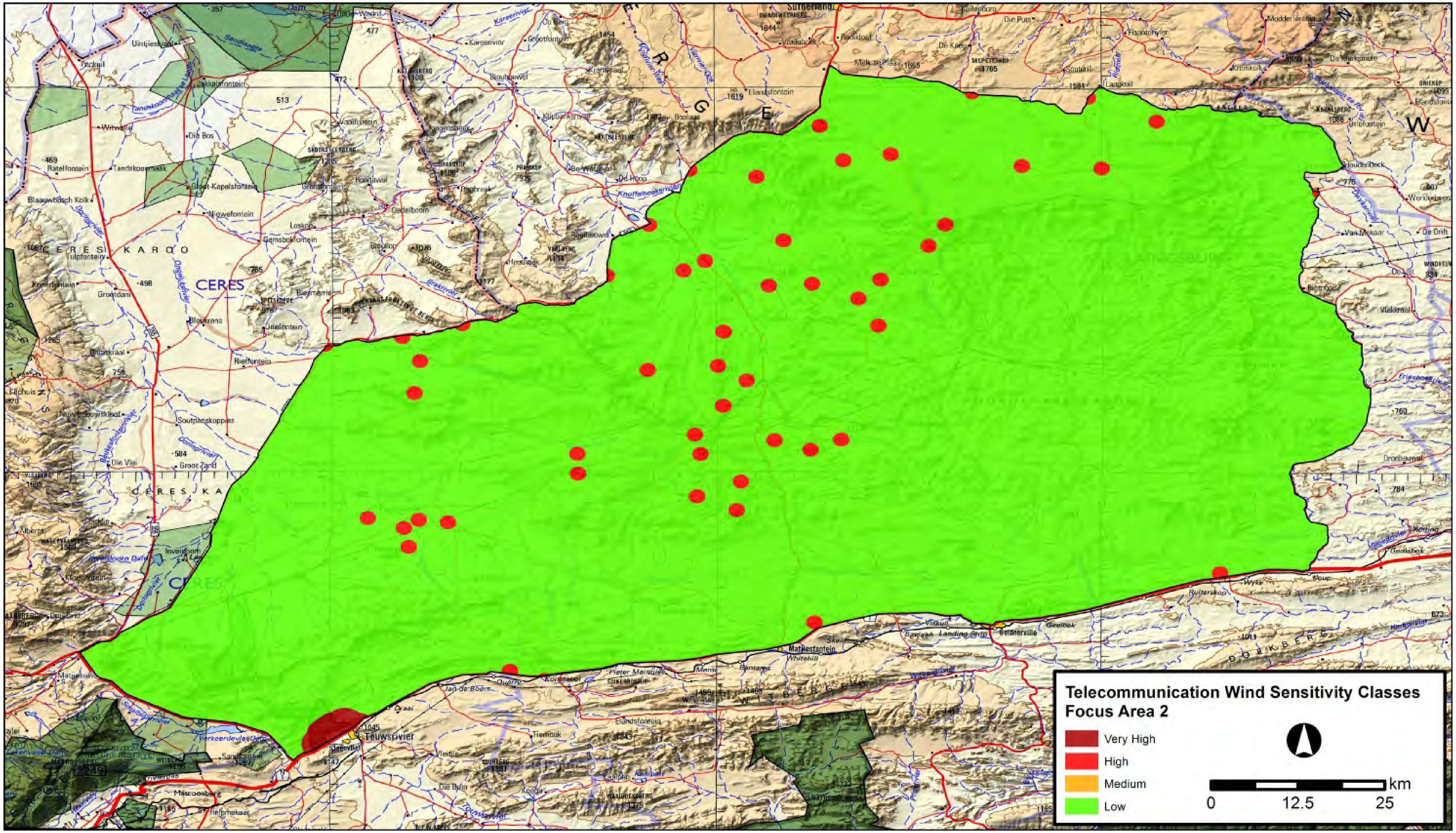
Map 2: National telecommunication sensitivity map for solar PV development



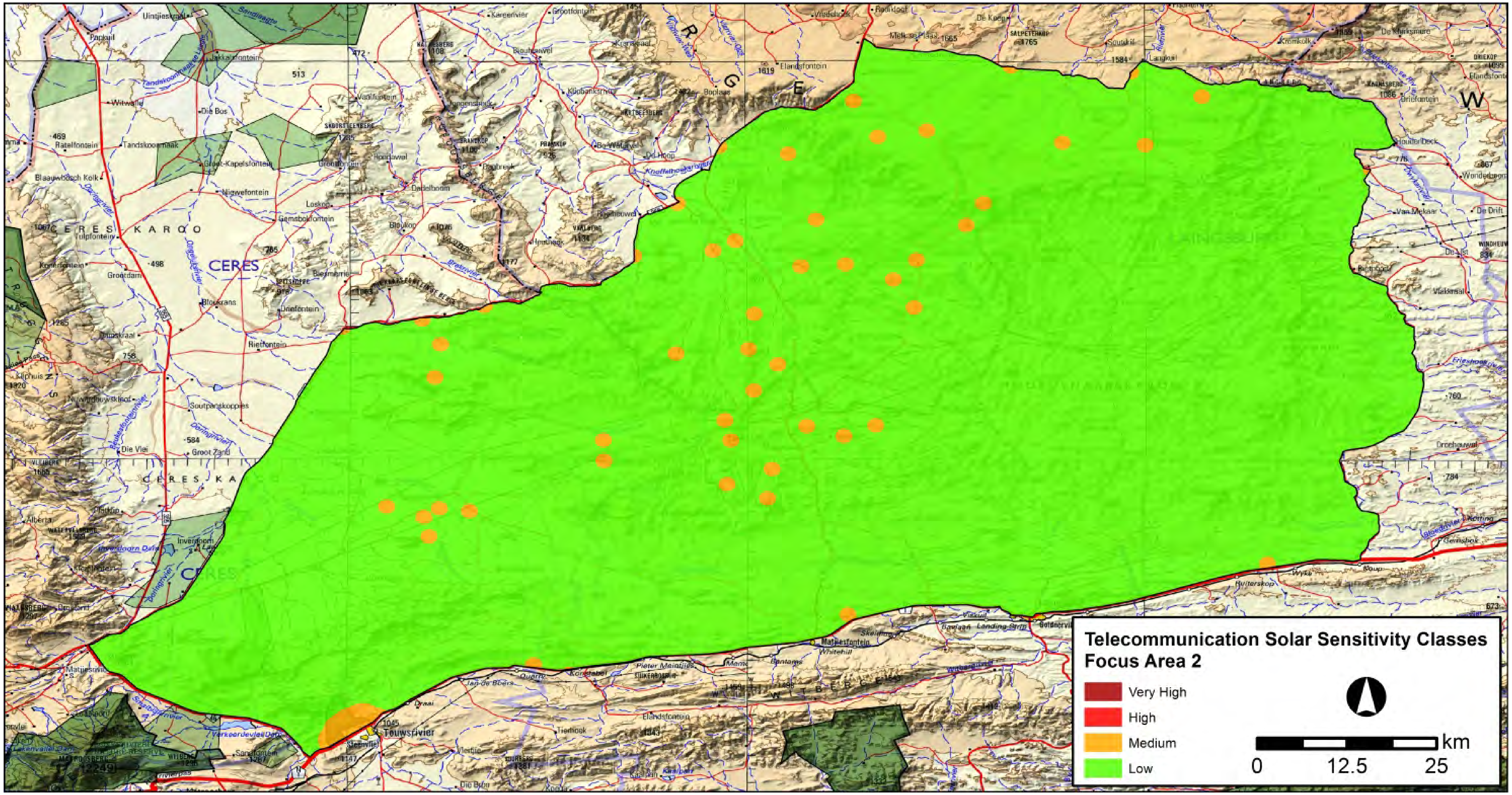
Map 3: Telecommunication sensitivity for wind energy development in the Overberg focus area (FA 1)



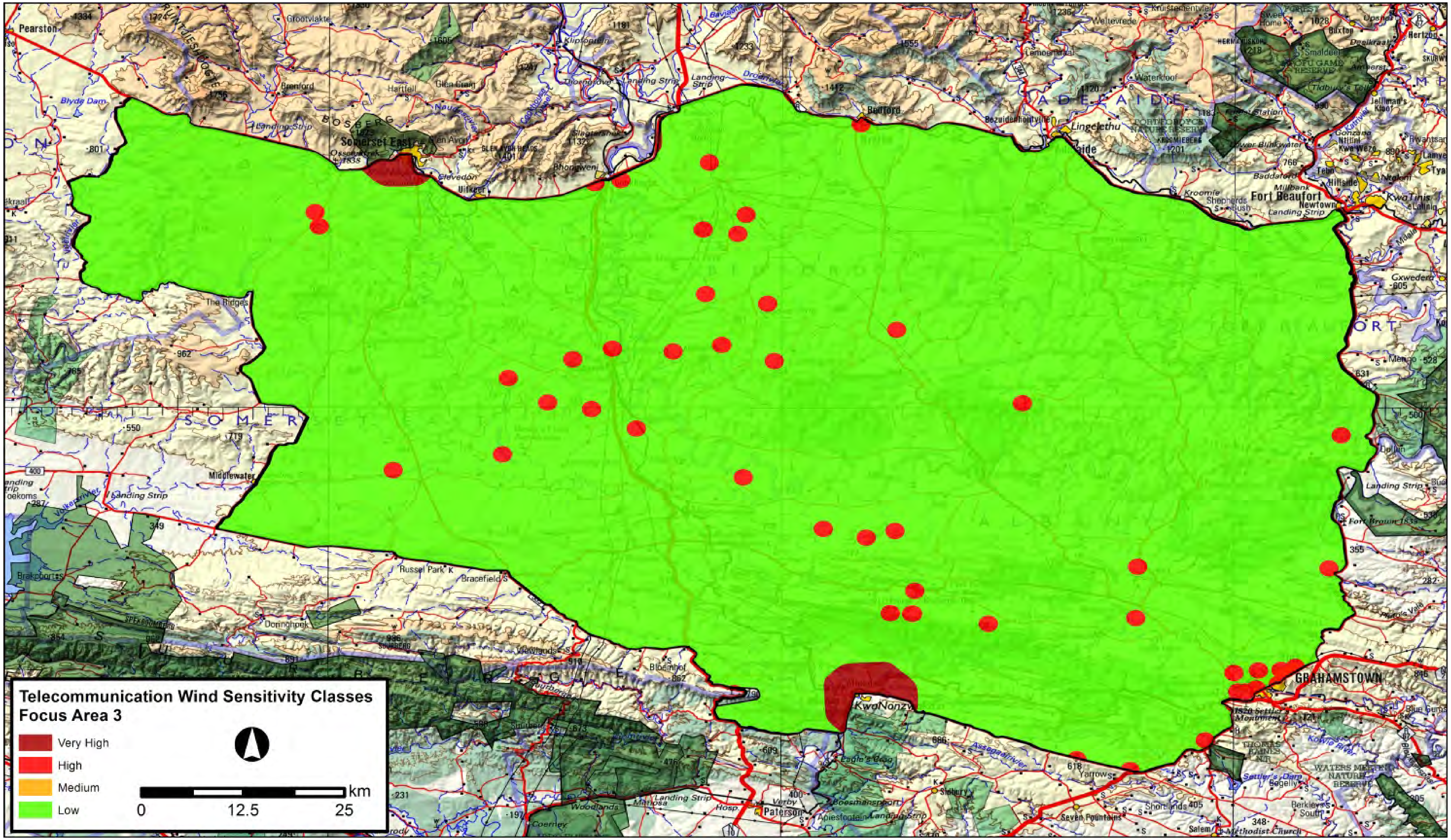
Map 4: Telecommunication sensitivity for solar PV energy development in the Overberg focus area (FA 1)



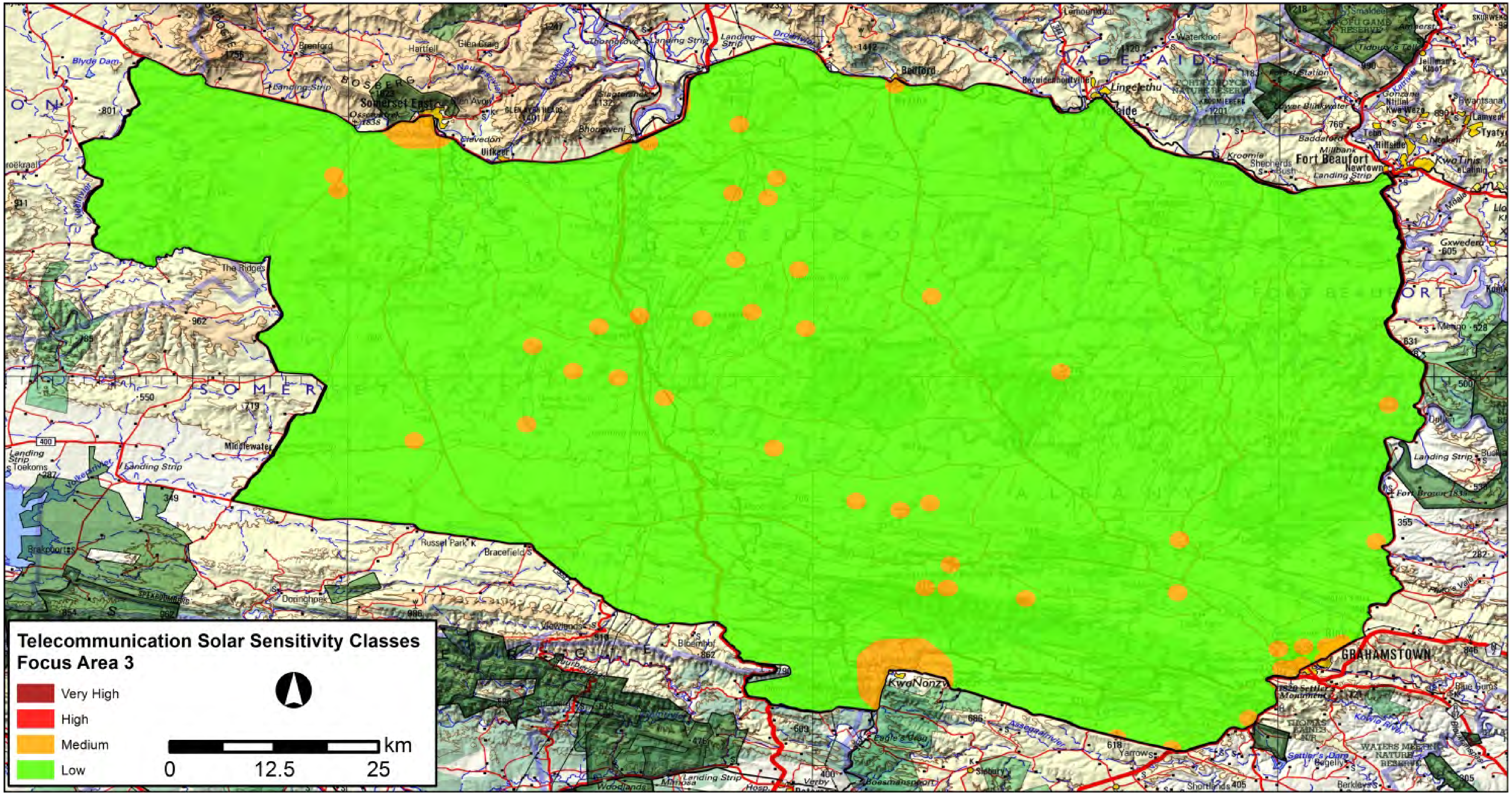
Map 5: Telecommunication sensitivity for wind energy development in the Komsberg focus area (FA 2)



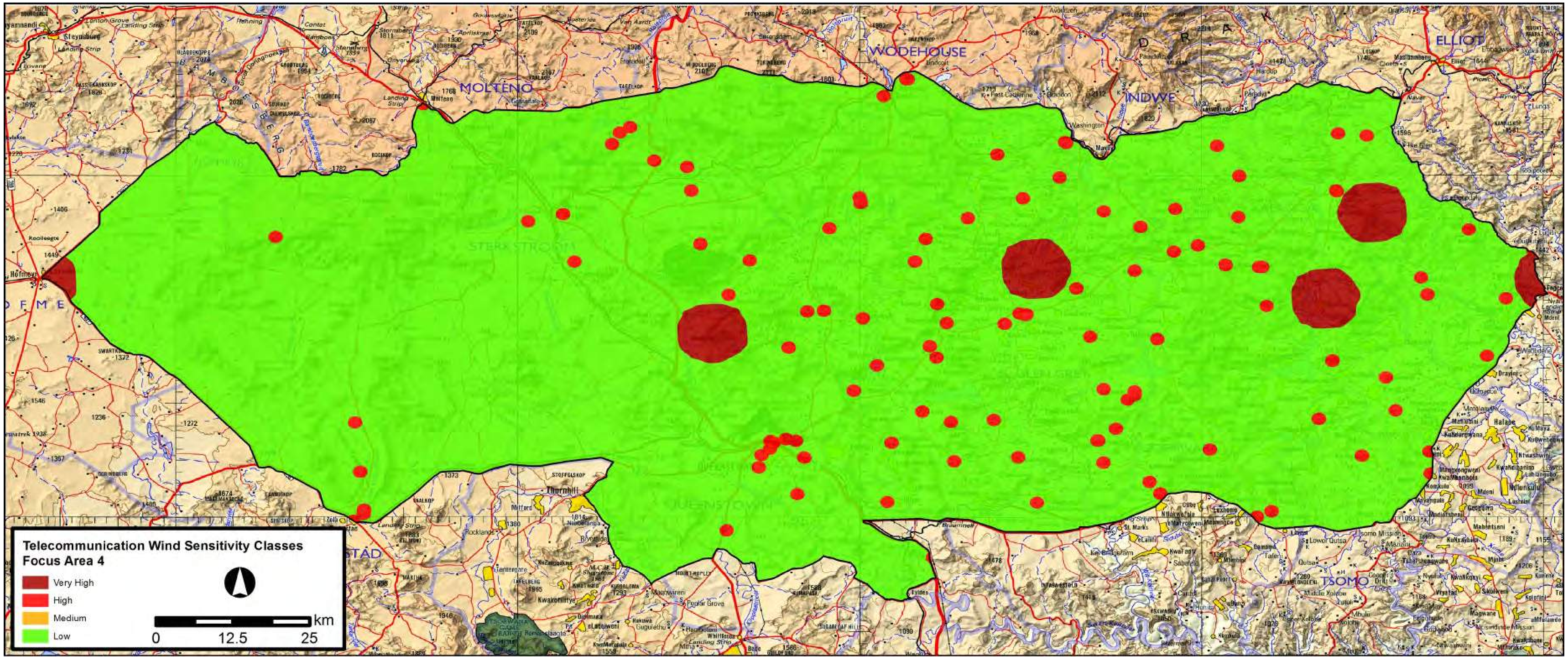
Map 6: Telecommunication sensitivity for solar PV energy development in the Komsberg focus area (FA 2)



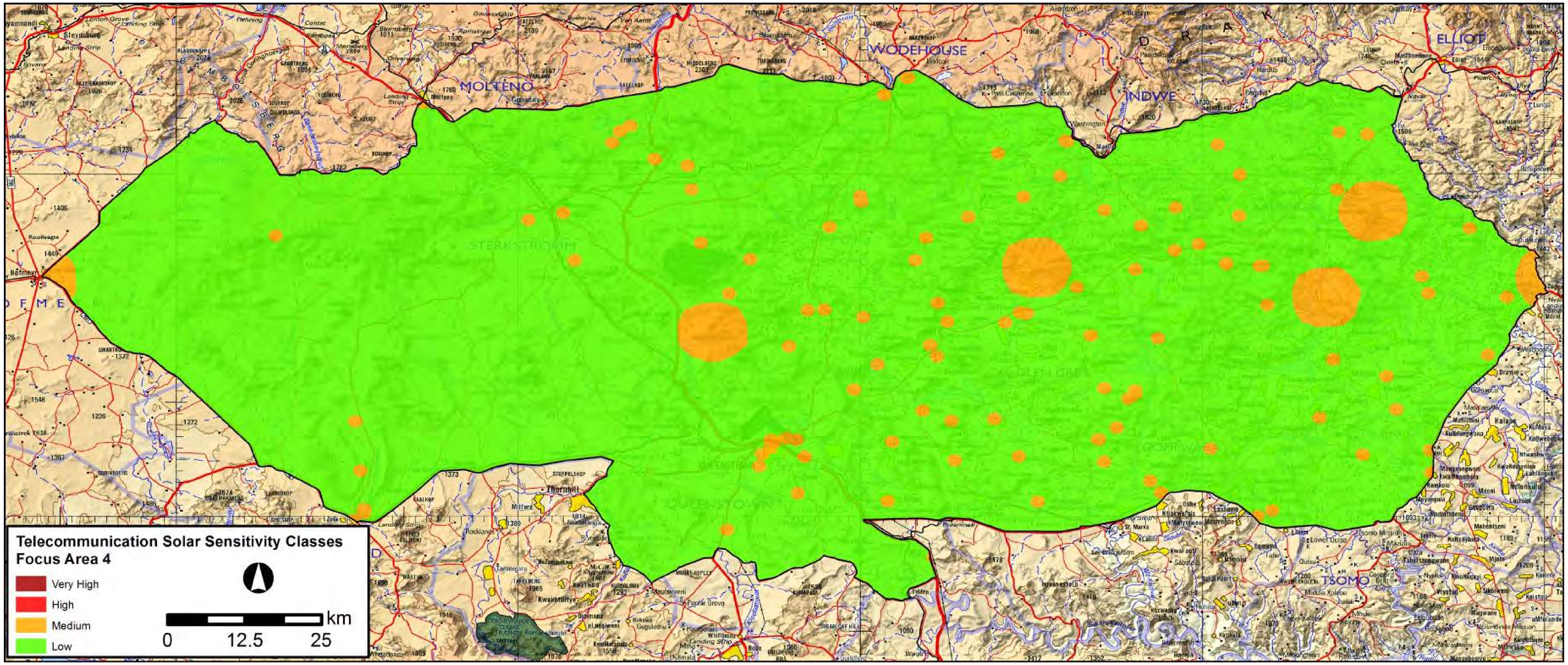
Map 7: Telecommunication sensitivity for wind energy development in the Cookhouse focus area (FA 3)



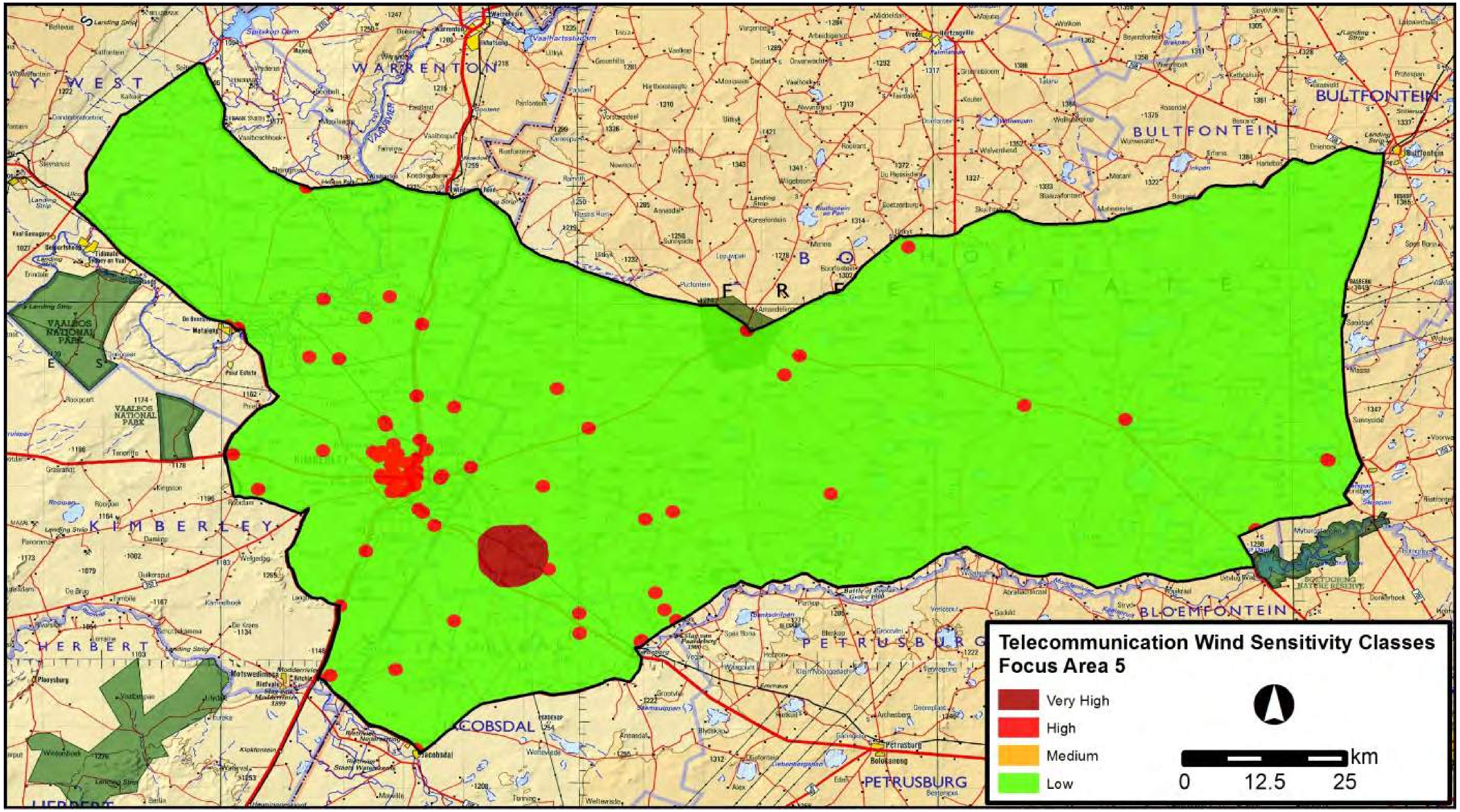
Map 8: Telecommunication sensitivity for solar PV energy development in the Cookhouse focus area (FA 3)



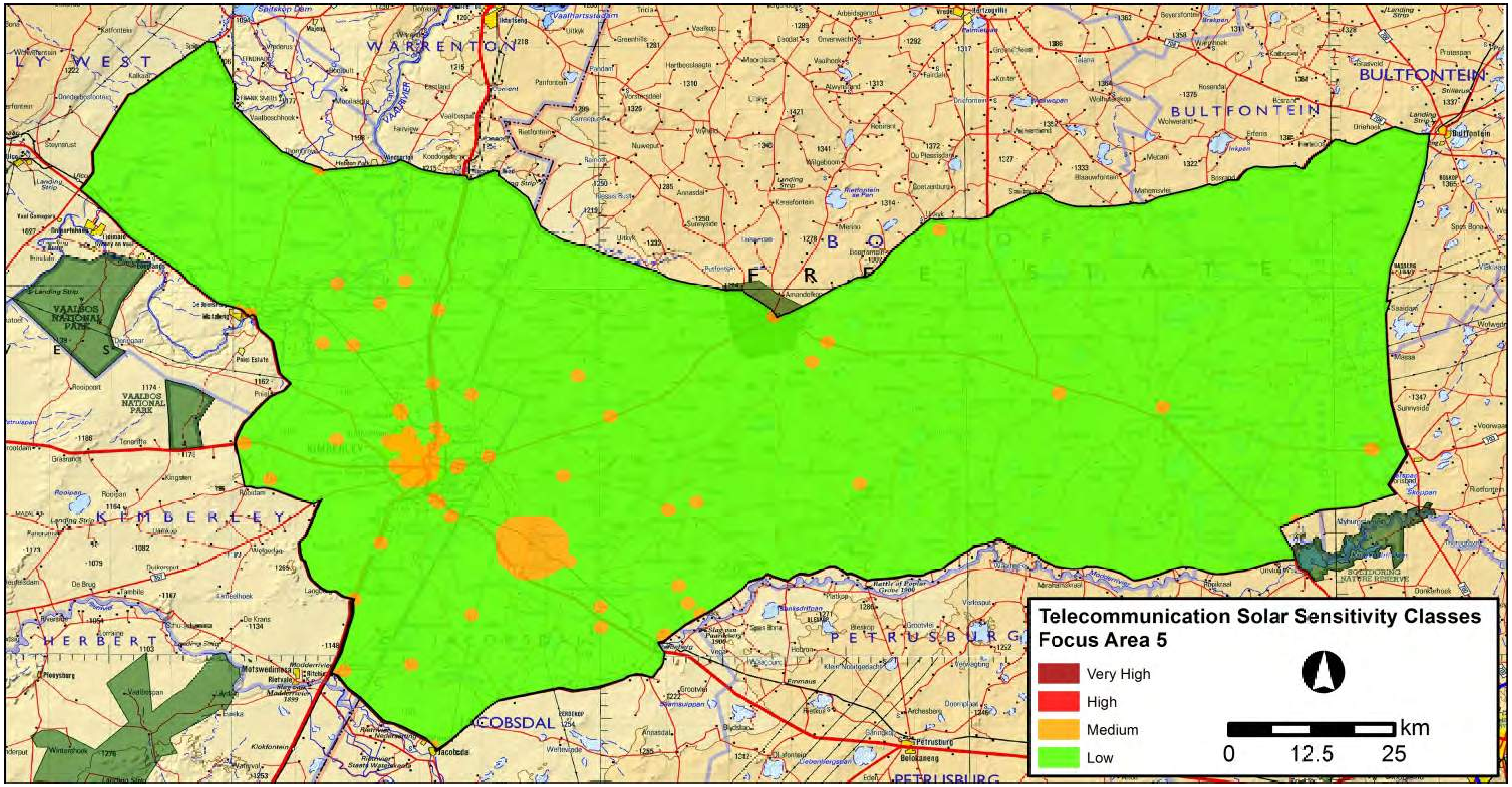
Map 9: Telecommunication sensitivity for wind energy development in the Stormberg focus area (FA 4)



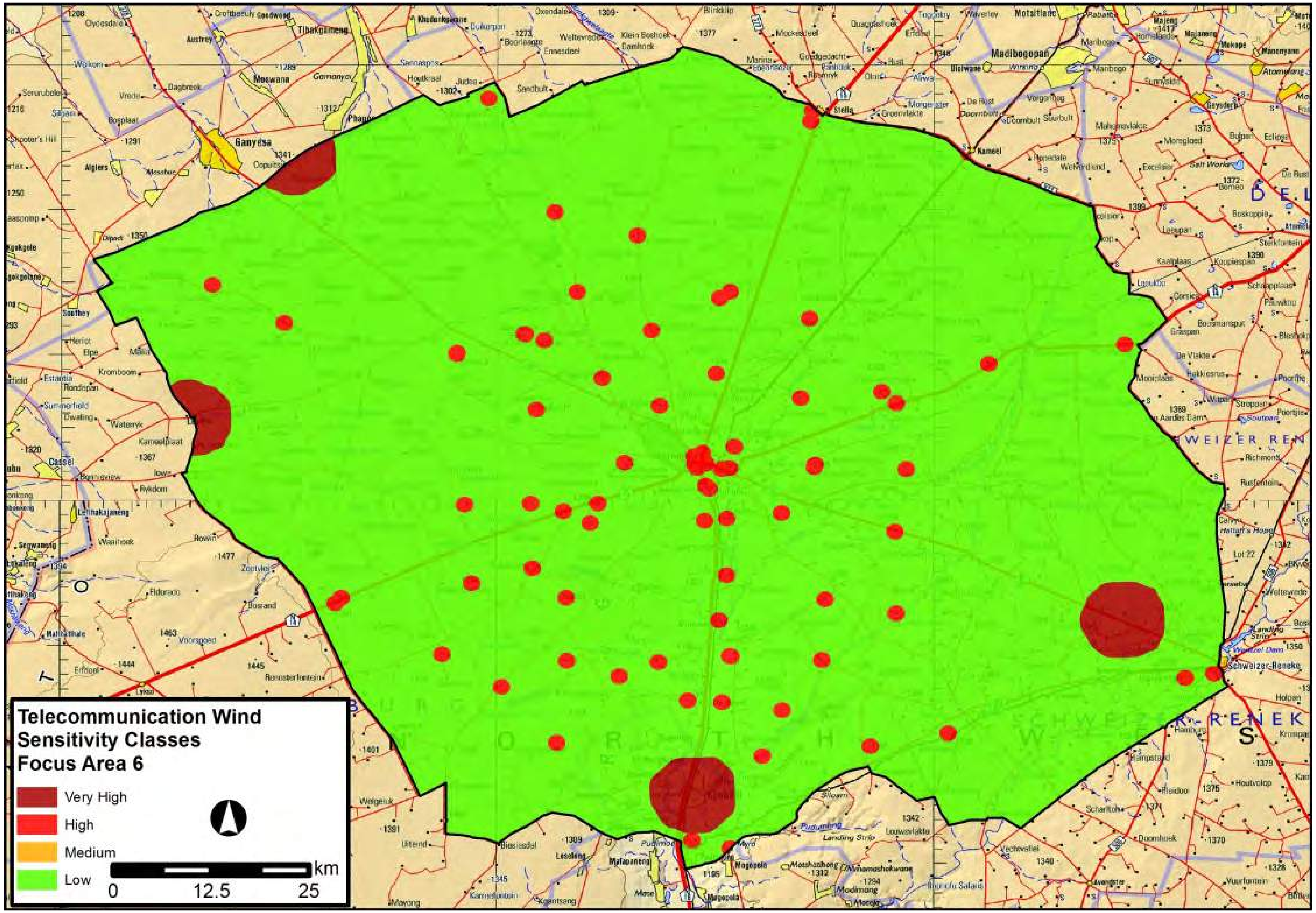
Map 10: Telecommunication sensitivity for solar PV energy development in the Stormberg focus area (FA 4)



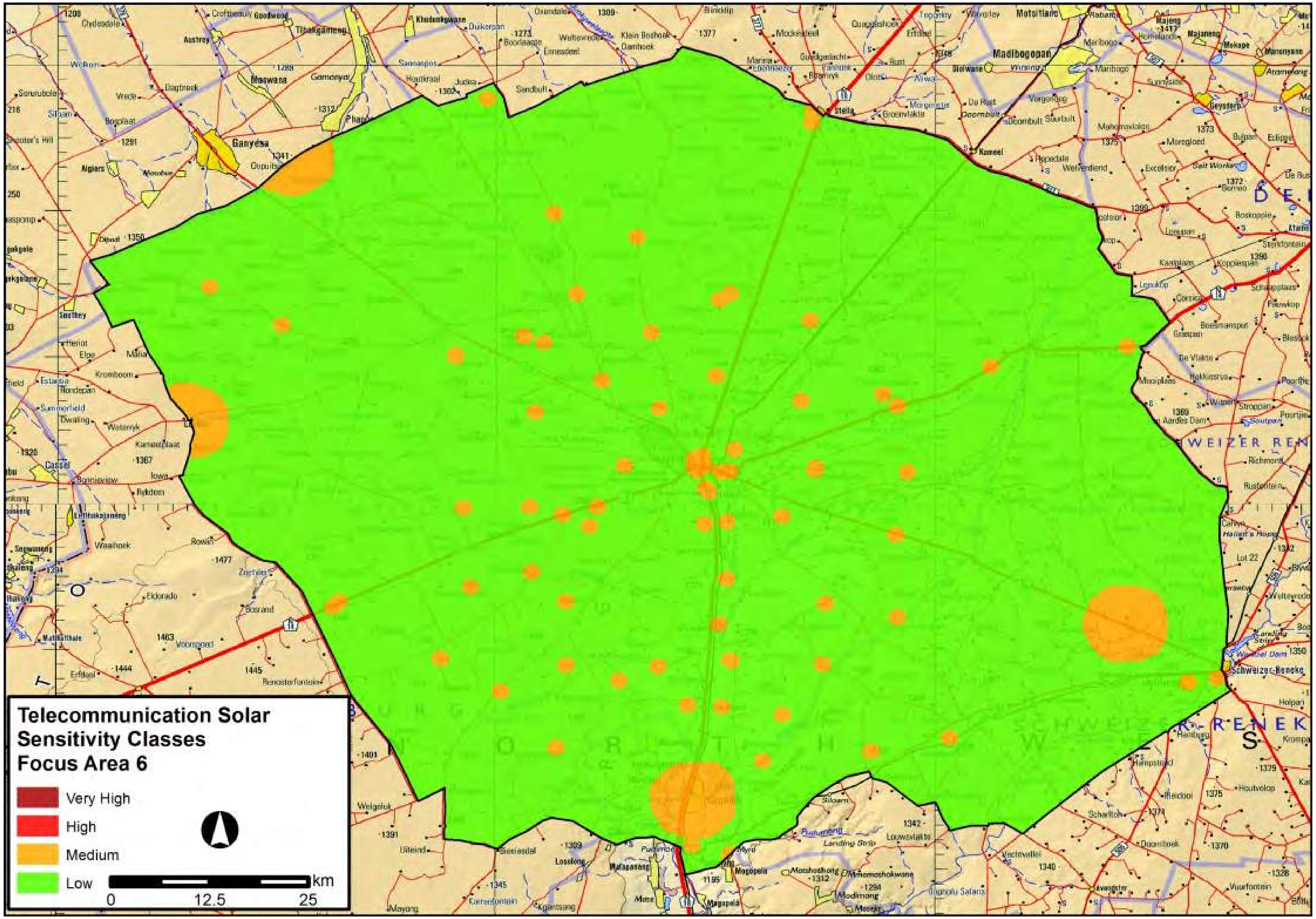
Map 11: Telecommunication sensitivity for wind energy development in the Kimberley focus area (FA 5)



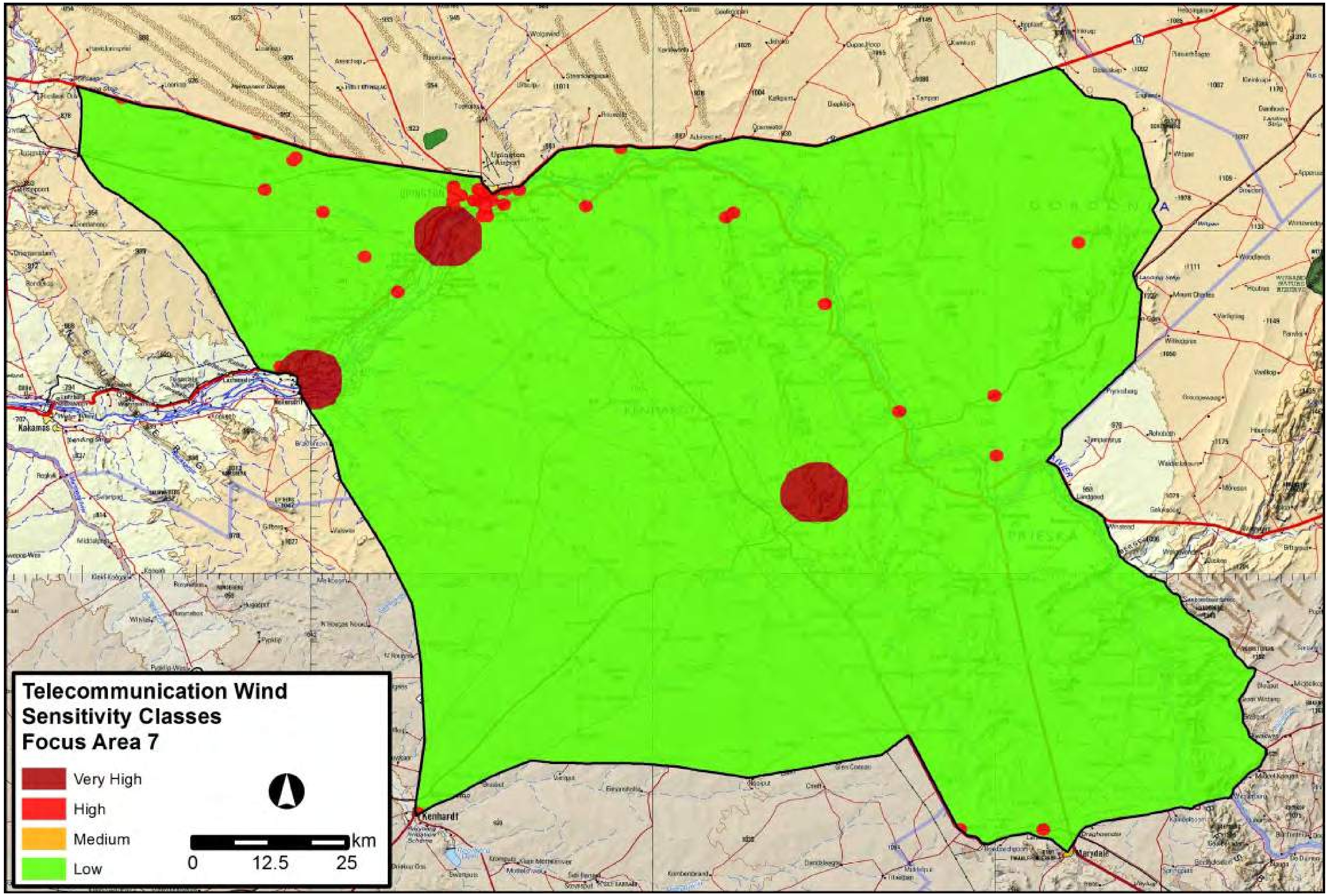
Map 12: Telecommunication sensitivity for solar PV energy development in the Kimberley focus area (FA 5)



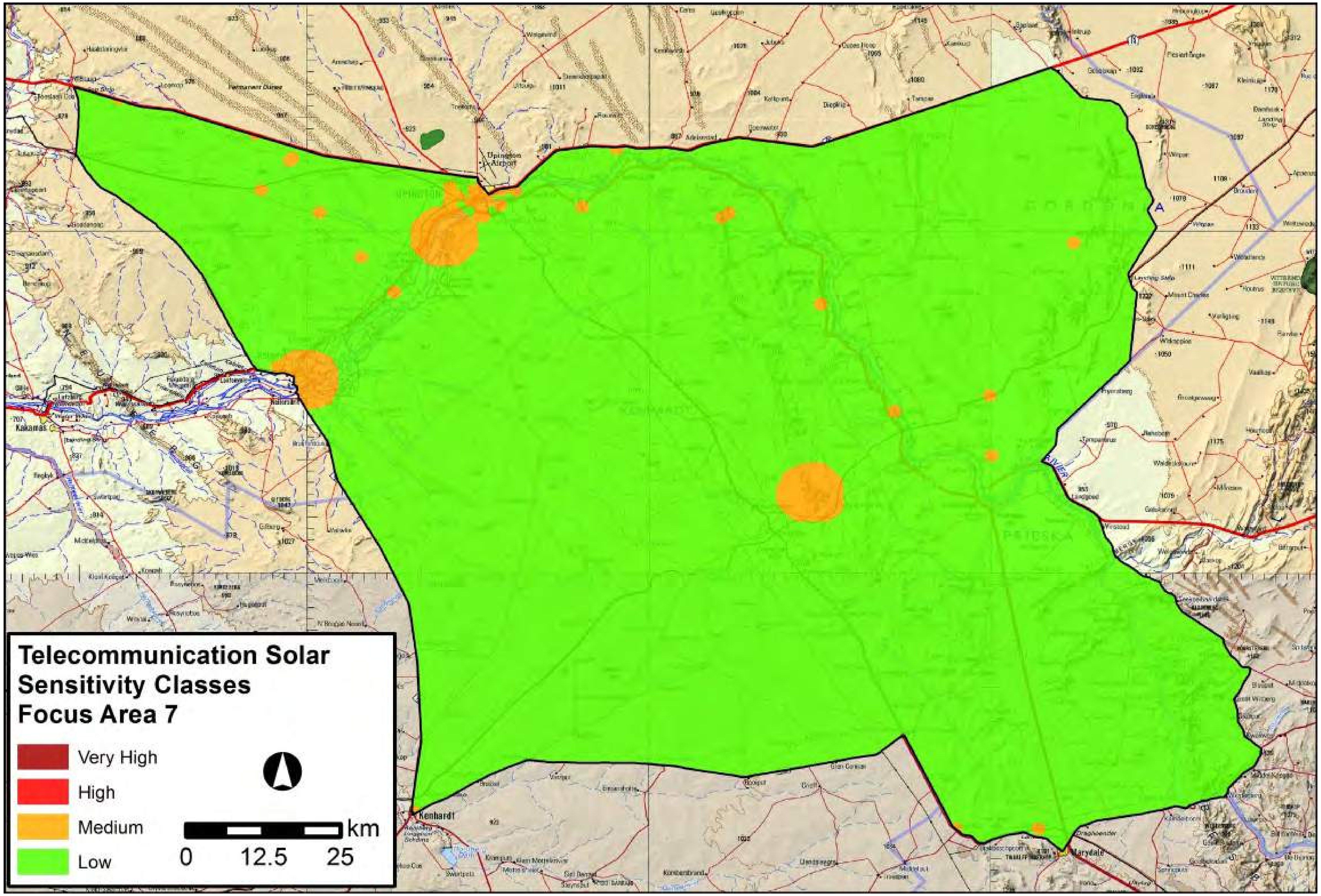
Map 13: Telecommunication sensitivity for wind energy development in the Vryburg focus area (FA 6)



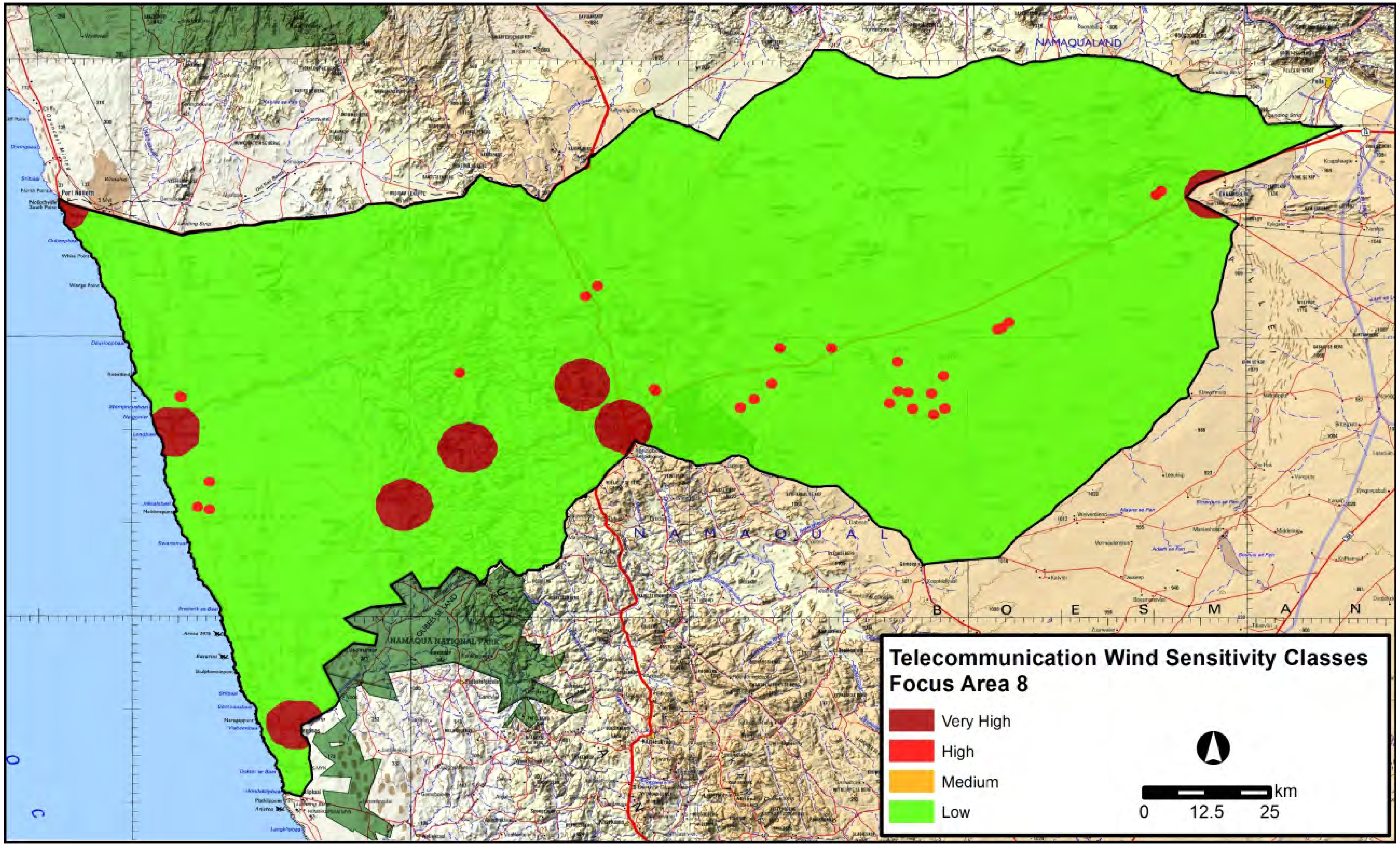
Map 14: Telecommunication sensitivity for solar PV energy development in the Vryburg focus area (FA 6)



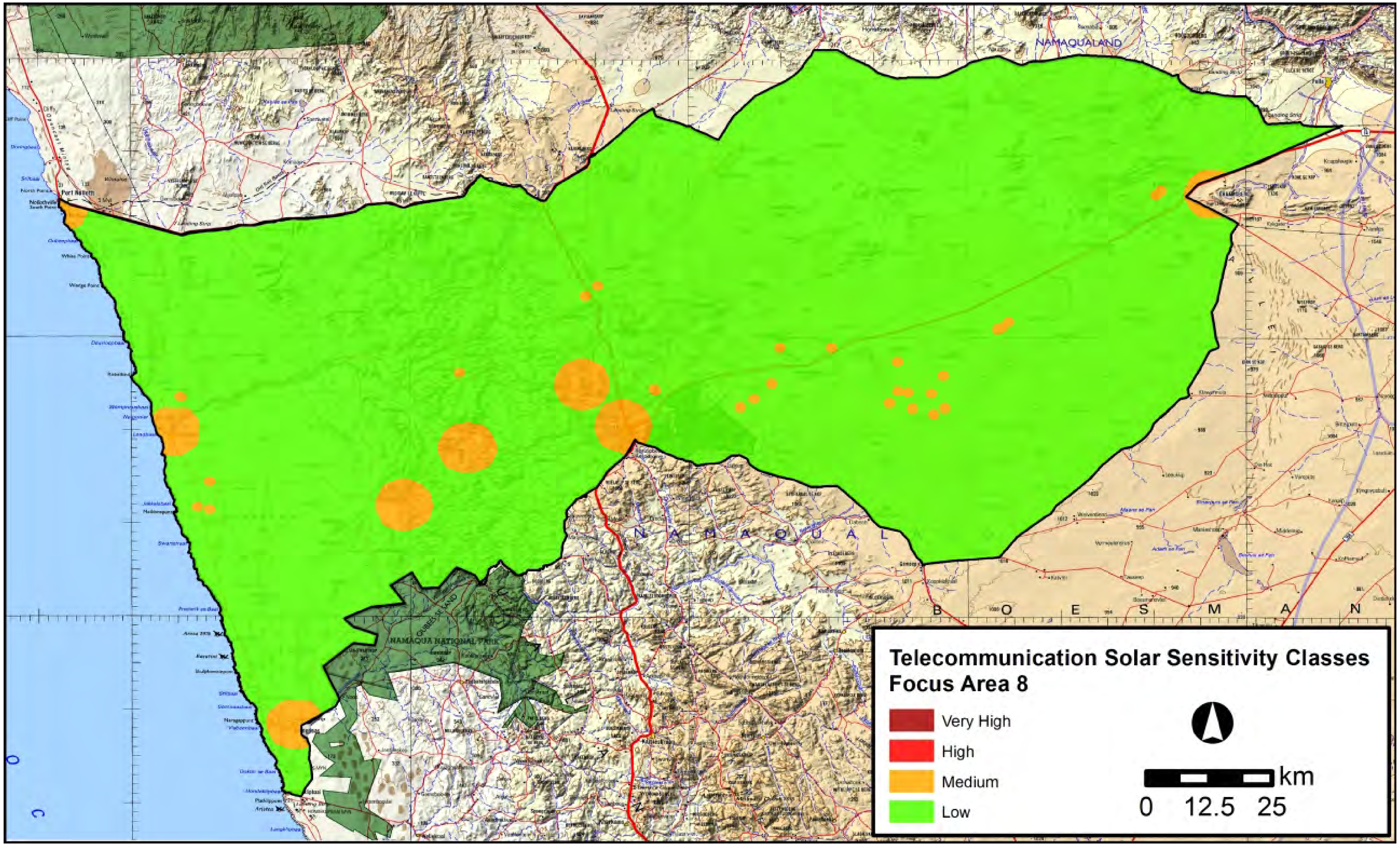
Map 15: Telecommunication sensitivity for wind energy development in the Upington focus area (FA 7)



Map 16: Telecommunication sensitivity for solar PV energy development in the Upington focus area (FA 7)



Map 17: Telecommunication sensitivity for wind energy development in the Springbok focus area (FA 8)



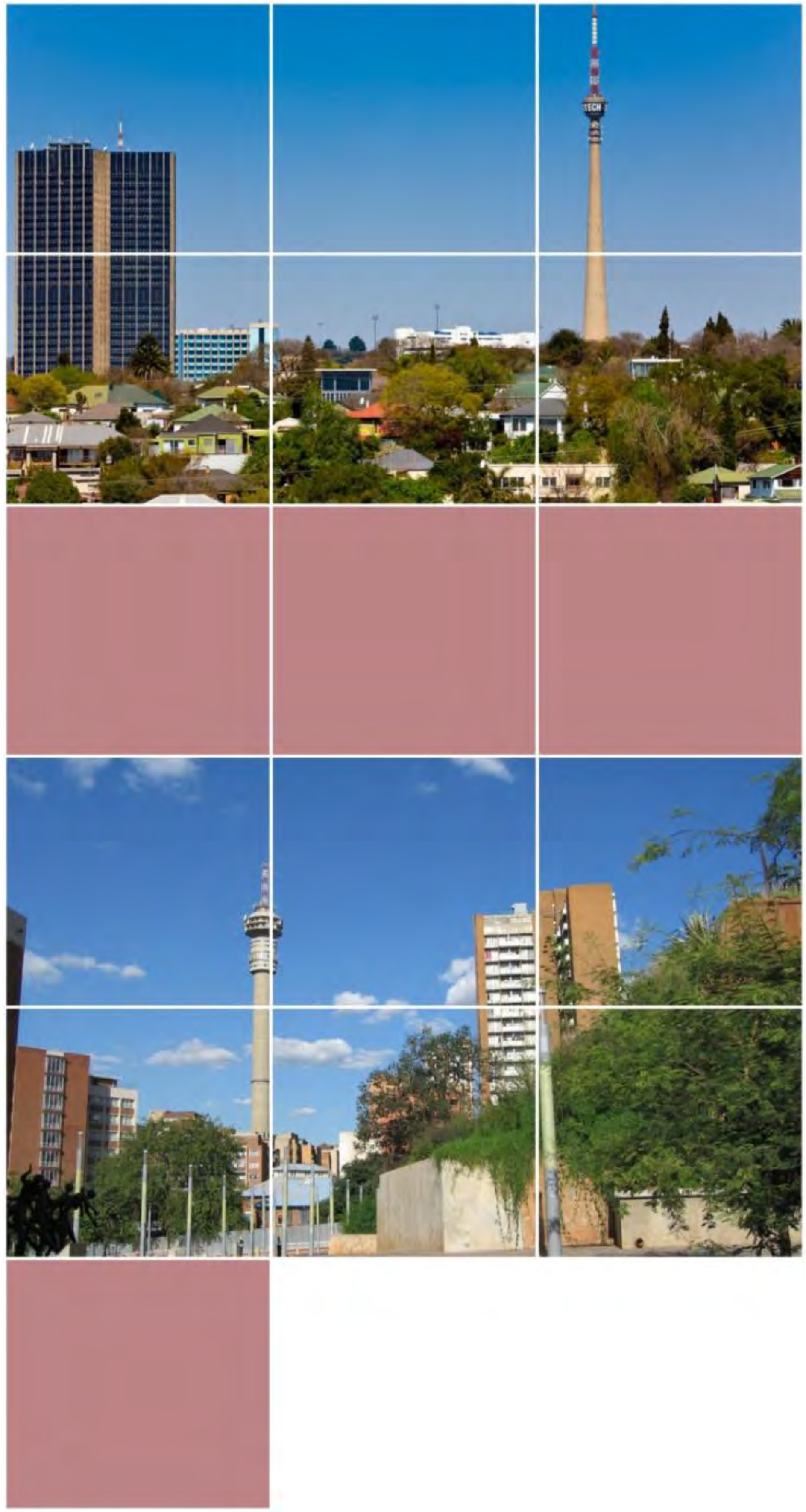
Map 18: Telecommunication sensitivity for solar PV energy development in the Springbok focus area (FA 8)

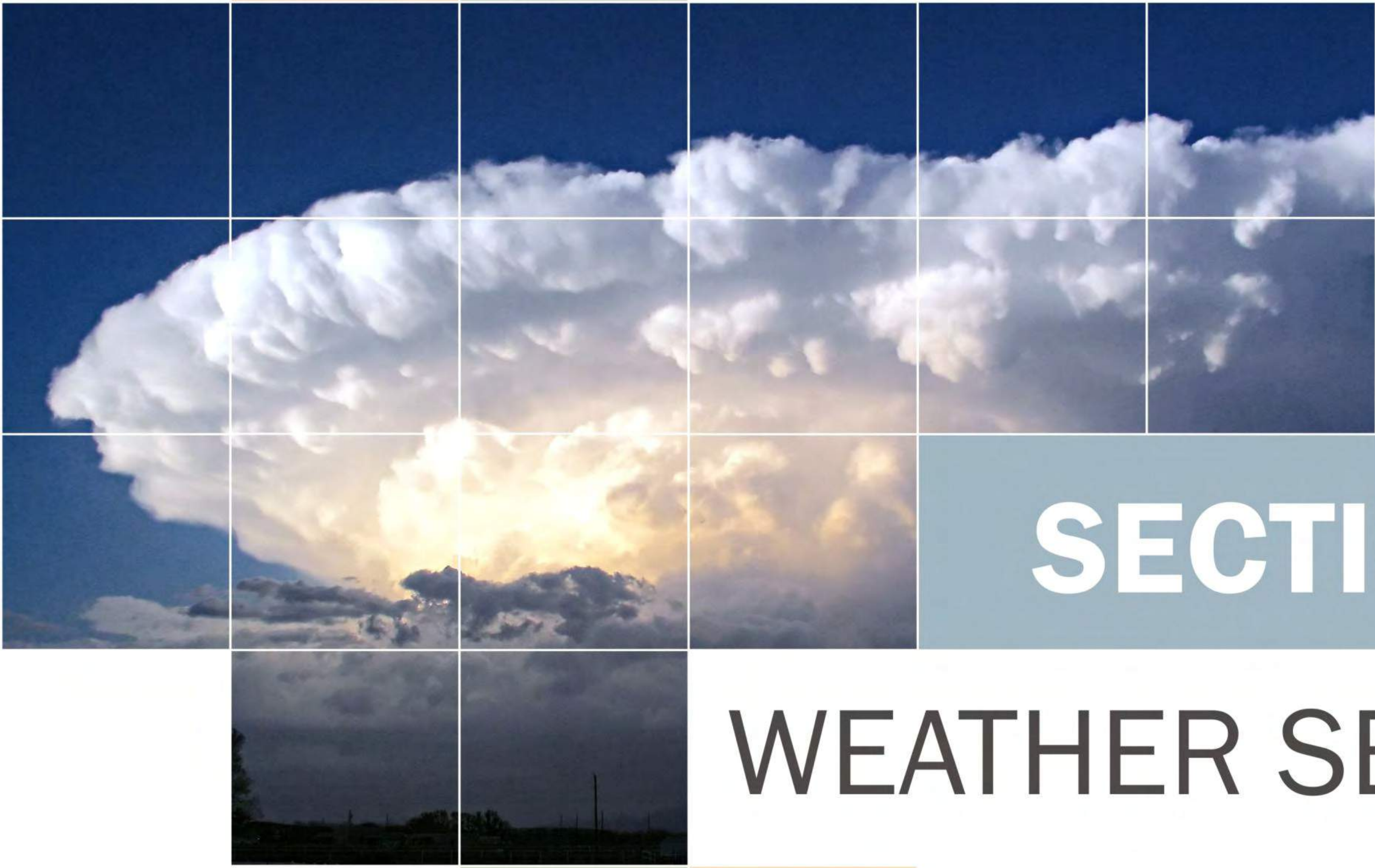
9.3 Development Protocols

Considering that spatial data for high powered terrestrial broadcasting facilities operated by only one company (i.e. Sentech) are available, and the fact that the other telecommunication facility data were derived from the SACAA obstacle database and may include obstacles other than telecommunication facilities, the main objective of this section is to provide indicative spatial sensitivities of wind and solar PV developments on broadcasting and telecommunication services. Sensitivity classes for wind and solar PV developments are interpreted and assessment requirements clarified in Table 2. These requirements are related to the sensitivity maps in sub-Section 9.2 and will be applicable to developments proposed both inside and outside the FAs, once these areas have been adopted as Renewable Energy Development Zones (REDZs).

Table 2: Interpretation of telecommunication sensitivity maps and associated assessment requirements

Colour	Sensitivity	Interpretation of the sensitivity	Further wind and solar PV assessment requirements
Dark red	Very High	In very high sensitivity areas there is a high likelihood for significant negative impacts that cannot be mitigated. In-depth assessment of the potential impacts and mitigation measures is likely to be required before development can be considered in these areas.	Proponents intending to develop a wind or solar PV facility that triggers an environmental assessment process anywhere in South Africa must prove to the relevant competent authority that the proposed development will not have an unacceptable negative impact on telecommunication services. In order to do so, the proponent must request comment from Sentech, and any other stakeholder operating telecommunication facilities in the vicinity of the proposed development. Such comment, if provided within stipulated timeframes, will be considered by the relevant competent authority for decision making.
Red	High	In high sensitivity areas there is potential for negative impacts that can potentially be mitigated. Further assessment may be required to investigate potential impacts and mitigation measures.	
Orange	Medium	In medium sensitivity areas there is a low potential for negative impacts, and if there are impacts there is a high likelihood of mitigation. Further assessment of the potential impacts may not be required.	
Green	Low	No significant impacts are expected in low sensitivity areas. It is unlikely for further assessment and mitigation measures to be required.	





SECTION 10

WEATHER SERVICES

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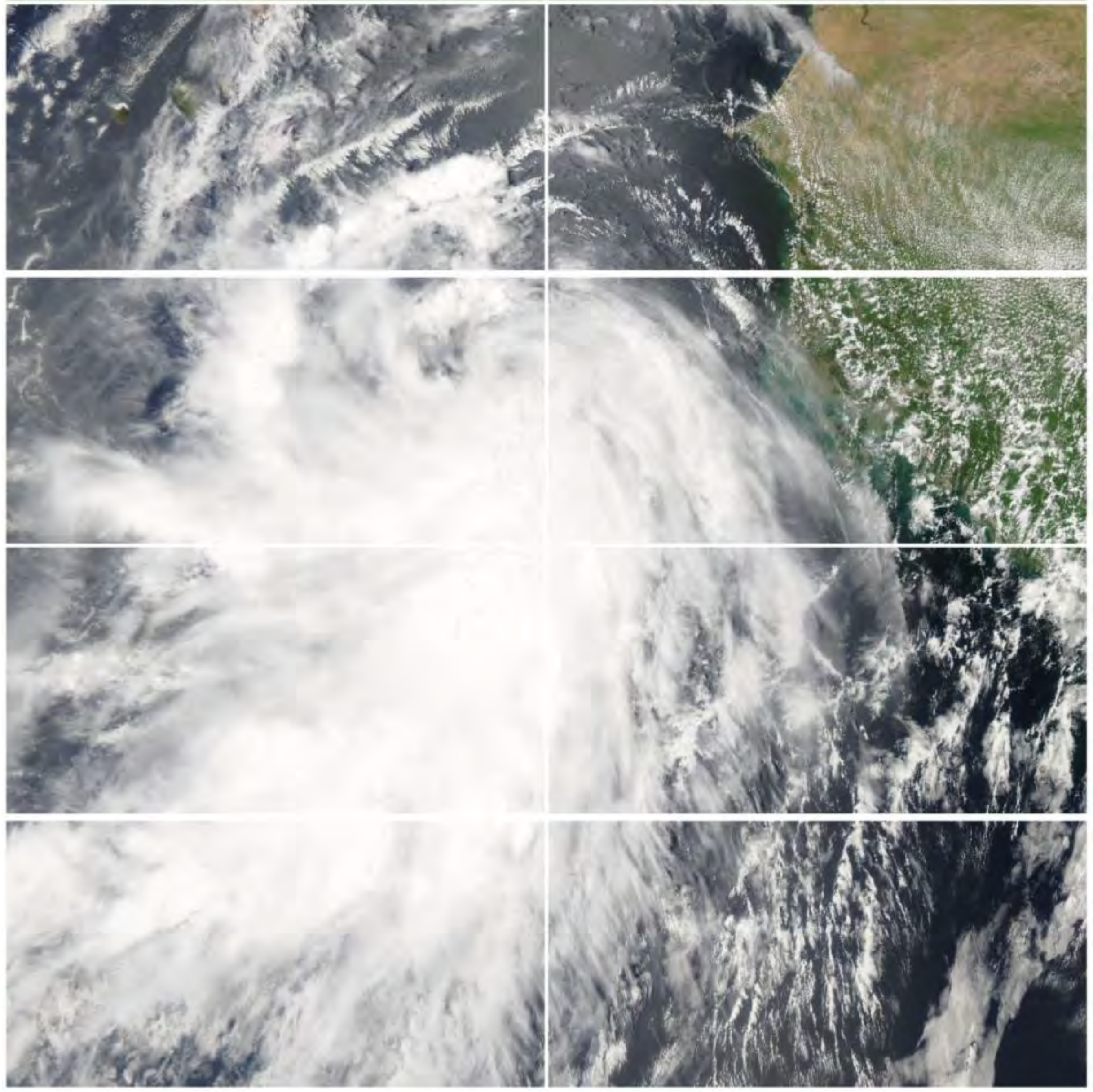


PART 3. SCOPING ASSESSMENTS AND DEVELOPMENT PROTOCOLS

SECTION 10: WEATHER SERVICES

The South African Weather Services (SAWS) makes use of a national network of 14 Doppler radars for weather forecasting and surveillance. In addition to being used for general weather forecasting, the data gathered from these radars are used for national and international early warning systems and informs disaster management planning. Such data are also used to supplement aviation weather forecasting services and inform air traffic control.

10.1 Renewable Energy and Weather Radar

While weather surveillance and air surveillance radars both operate on similar principles, their target of interest and signal processing is different. Air surveillance radar as used for aviation and defence purposes searches for large solid objects (e.g. planes) while weather surveillance radar searches for very small and widely dispersed targets (e.g. water droplets). The impact of moving objects such a rotating wind turbine blades on weather surveillance radar is especially difficult to mitigate since the rotating blades create a signal very similar to real weather data. This causes conventional radar clutter filtering algorithms, which filter energy returned from nearly stationary objects, to fail in isolating the actual weather signal. Since solar photovoltaic (PV) facilities have no moving parts, the energy returned from such facilities can be isolated and removed by filter algorithms, solar PV development is generally considered not to have an impact on weather surveillance radar.

The Radar Operations Centre in Norman, Oklahoma has assessed 844 wind farm projects and developed criteria for evaluating wind turbine impacts on weather radar[1]. This document indicates that the severity of impacts of wind turbines on weather radar is dependent on distance, intervening terrain, height of turbines relative to the radar beam, and the size of the wind farm. This document summarises the impacts of wind turbines on weather radar under the following three categories:

- When turbine blades protrude into the radar line of sight, unfiltered energy can be reflected back to the radar system and appear as clutter which cannot be removed by conventional clutter filtering algorithms. These corrupted data are then used to detect certain storm characteristics, and to produce a suite of erroneous weather information such as precipitation estimates, vertical wind profiles, and severe weather alerts. This impact is pronounced for turbines sited within 18 km of a weather radar site, where they start to impact multiple elevation scanning angles and create multipath scattering returns;
- If constructed within 3 km of a weather radar, wind turbines can physically block a significant percentage of the radar's narrow beam, attenuating the radar signal and impacting data throughout the entire range of the radar; and
- If turbines are sited in the radar's near field, which is generally within 1.5 km of the antenna, radar energy reflected from towers and turbine blades can damage the radar receiver and cause severe impacts.

10.2 Sensitivity Mapping

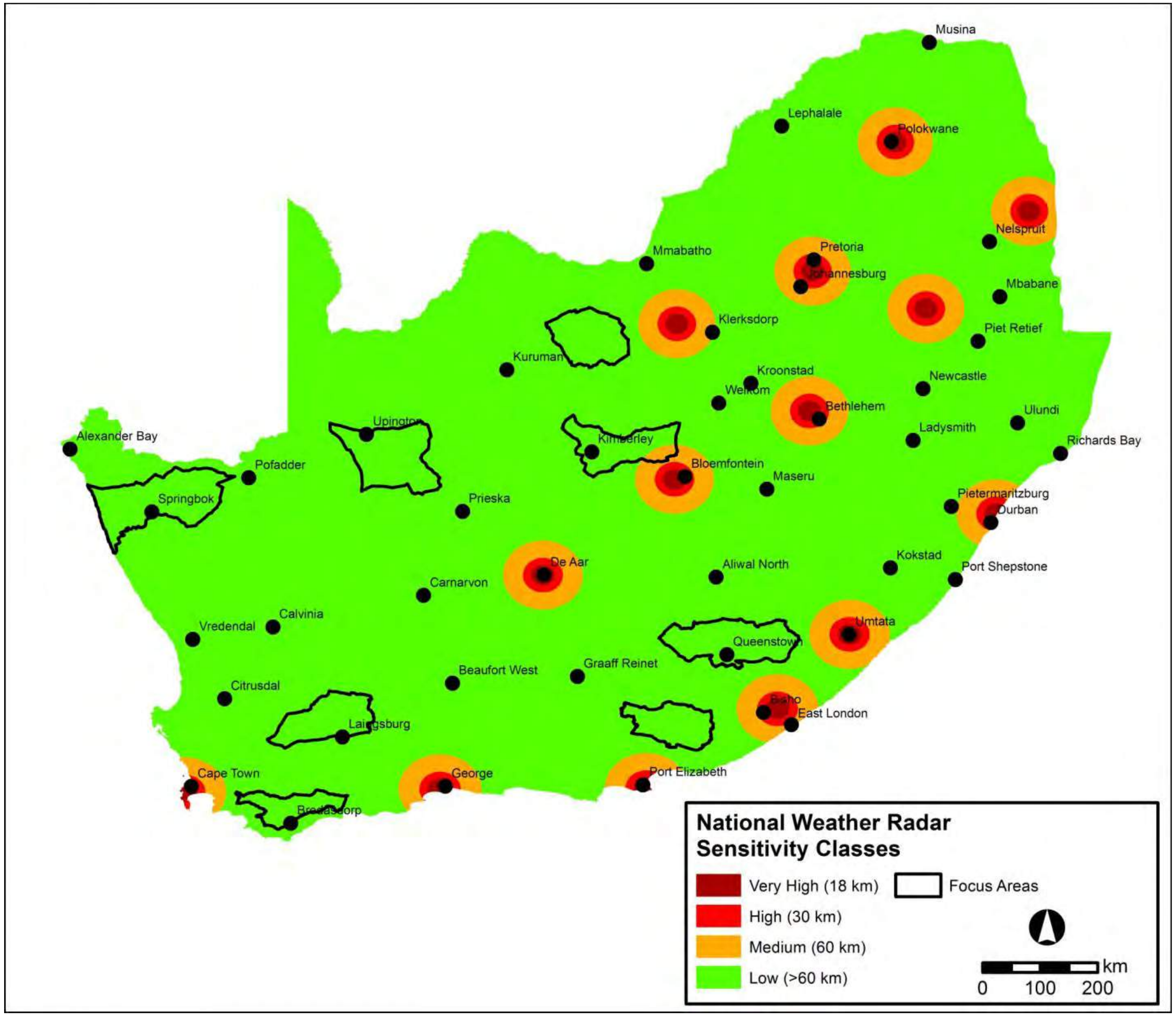
Some of South Africa's weather radars (e.g. the C-band radar at Port Elizabeth) have coverage ranges of up to 300 km, and considering the potential impacts it is important to ensure that wind energy development does not result in unacceptable negative impacts on these radars. The weather radar sensitivity criteria presented in Table 1 has been determined for wind development and applied to the 14 radars to produce a national sensitivity map (see Map 1). In terms of the FAs it is only the Kimberley one (FA 5) that overlaps with a weather radar sensitivity class other that low sensitivity (see Map 2).

Table 1: Weather radar sensitivity criteria for wind development

Colour	Sensitivity	Distance
Dark red	Very High	Less than 18 km
Red	High	Between 18 and 30 km and within the radar's line of sight*
Orange	Medium	Between 30 and 60 km and within the radar's line of sight
Green	Low	More than 60 km

*Where required (i.e. within 60 km of a radar site), viewsheds will need to be determined at a project level.

[1] Vogt, R.J., Crum, T.D., Greenwood, W., Ciardi E.J., Guenther, R.G. (2011) New Criteria for Evaluating Wind Turbine Impacts on NEXRAD Radars. Preprints, WINDPOWER 2011, American Wind Energy Association Conference and Exhibition, Anaheim, CA. Available online at: http://www.roc.noaa.gov/WSR88D/Publicdocs/WINDPOWER2011_Final.pdf



Map 1: National weather radar sensitivity map for wind development.

Note to map: It is only the Kimberley Focus Area (FA5) that overlaps with weather radar sensitivity.

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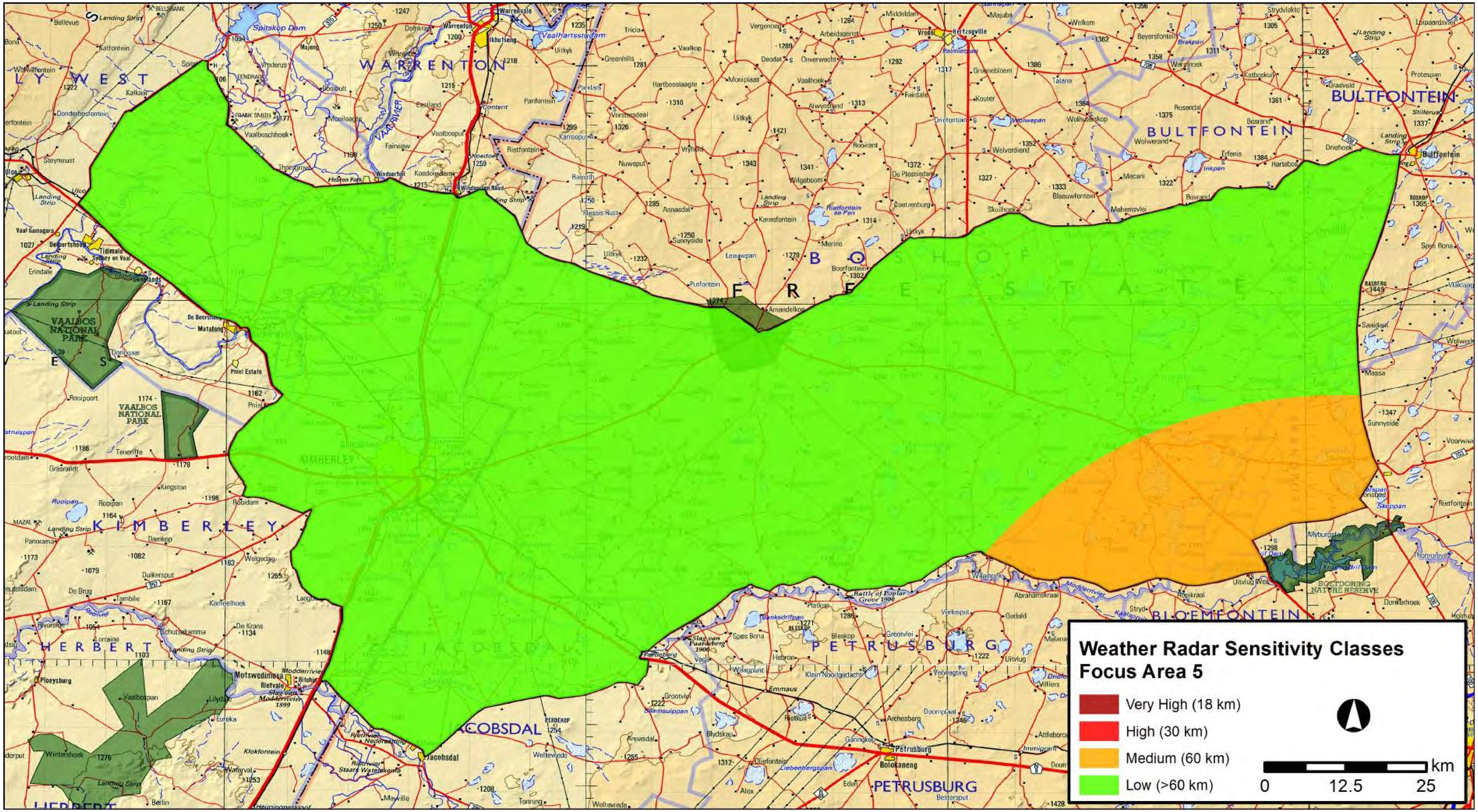


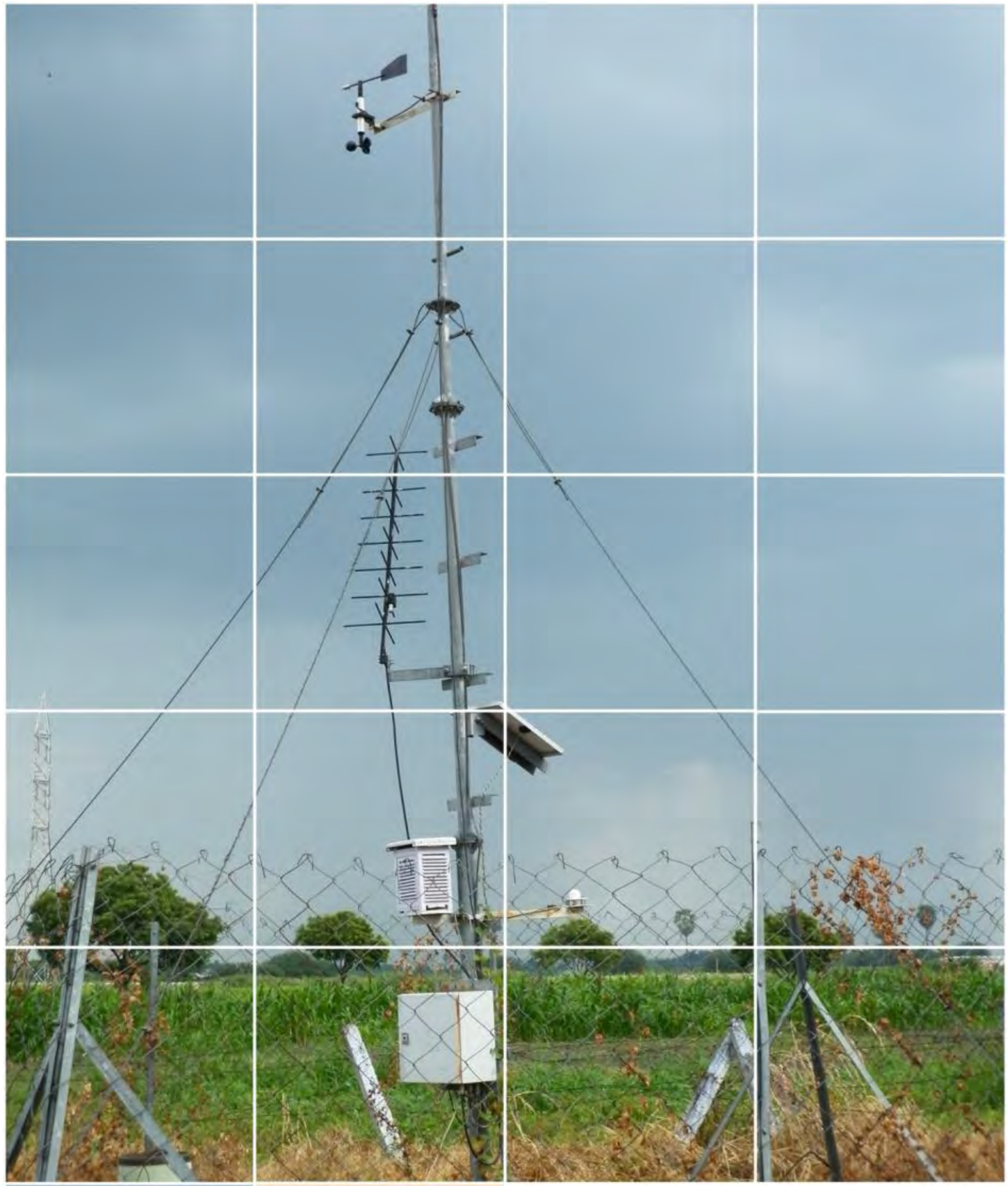
Map 2: Weather radar sensitivity map for wind energy development in the Kimberley FA.

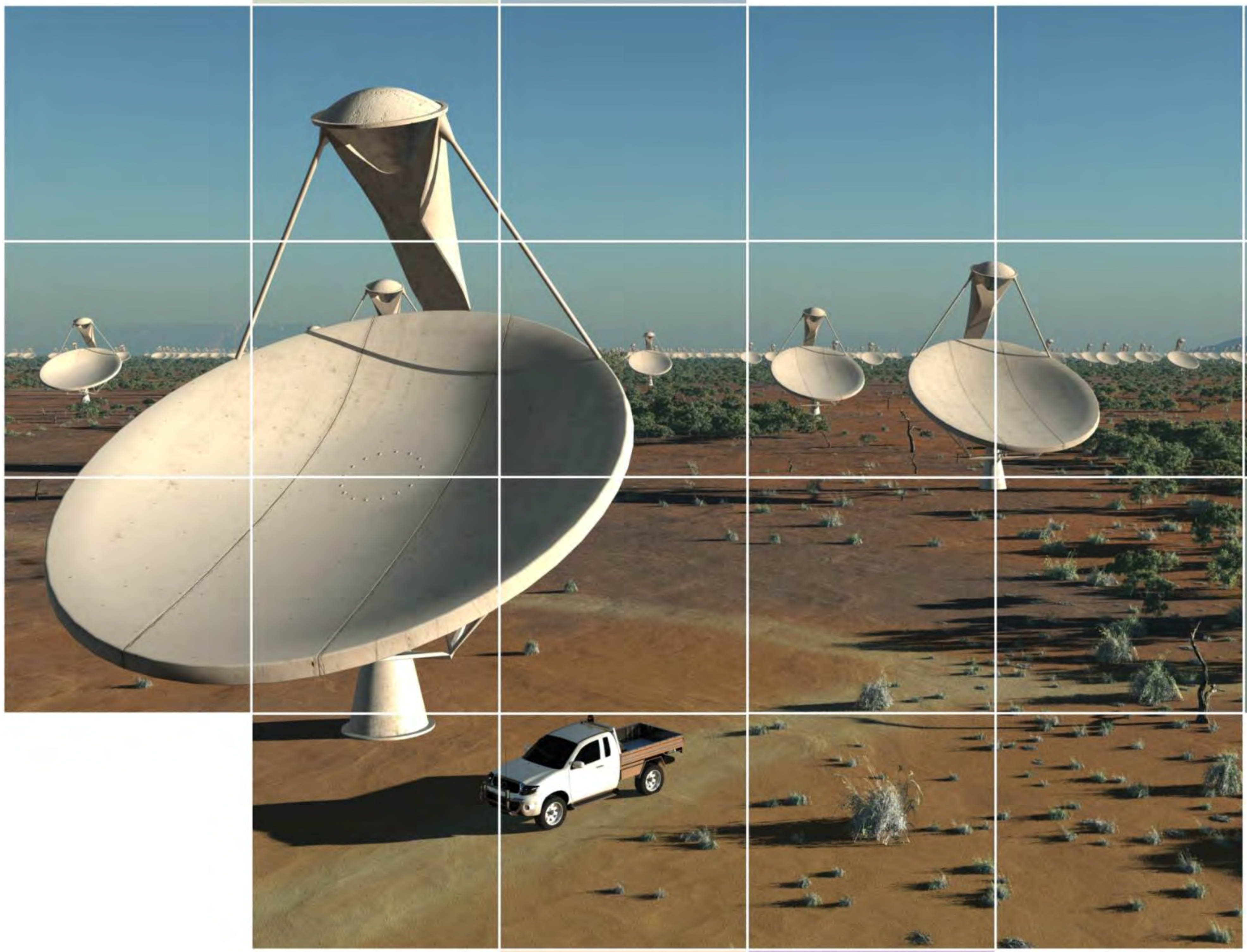
10.3 Development Protocols

The main objective of this section is to clarify the different levels of sensitivity with respect to potential impacts of wind and solar PV developments on weather surveillance radars, and to prescribe relevant assessment requirements. Since solar PV is not considered to have a significant impact on weather radar, such developments do not require any assessment or authorisation in this regard. In Table 2 sensitivity classes for wind developments are interpreted and assessment requirements prescribed. These requirements are specific to sensitivity classes and are therefore related to the sensitivity maps in sub-Section 10.2. These requirements will be applicable to developments proposed both inside and outside the FAs, once these areas have been adopted as Renewable Energy Development Zones (REDZs).

Table 2: Interpretation of sensitivity maps and associated assessment requirements

Colour	Sensitivity	Interpretation of the sensitivity	Further assessment requirements	
			Wind	Solar PV
Dark red	Very High	In very high sensitivity areas there is a high likelihood for significant negative impacts that cannot be mitigated. In-depth assessment of the potential impacts and mitigation measures is likely to be required before development can be considered in these areas.	Proponents intending to develop a wind facility that triggers an environmental impact assessment process in very high to medium sensitivity areas (i.e. within 60 km of a radar site) must prove to the relevant competent authority that the proposed development will not have an unacceptable negative impact on weather surveillance radars. In order to do so, the proponent must request a comment from the SAWS confirming no unacceptable impact on weather radars. Inputs from the SAWS, if provided within stipulated timeframes, will be considered by the relevant competent authority for decision making. When assessing proposed wind projects within 60 km of weather surveillance radars, SAWS will consider: • The distance of the development from the radar; • The maximum height of the turbine; • The number of turbines; • The elevation of the radar antenna; and • Whether the turbines will be in line of sight of the antenna.	No assessment or authorisation for solar PV development in terms of weather surveillance radar is required.
Red	High	In high sensitivity areas there is potential for negative impacts that can potentially be mitigated. Further assessment may be required to investigate potential impacts and mitigation measures.		
Orange	Medium	In medium sensitivity areas there is a low potential for negative impacts, and if there are impacts there is a high likelihood of mitigation. Further assessment of the potential impacts may not be required.		
Green	Low	No significant impacts are expected in low sensitivity areas. It is unlikely for further assessment and mitigation measures to be required.	No assessment or authorisation is required for wind development in terms of weather surveillance radar if the proposed development is further than 60 km from any radar site.	





SECTION 11

SQUARE KILOMETRE ARRAY PROJECT

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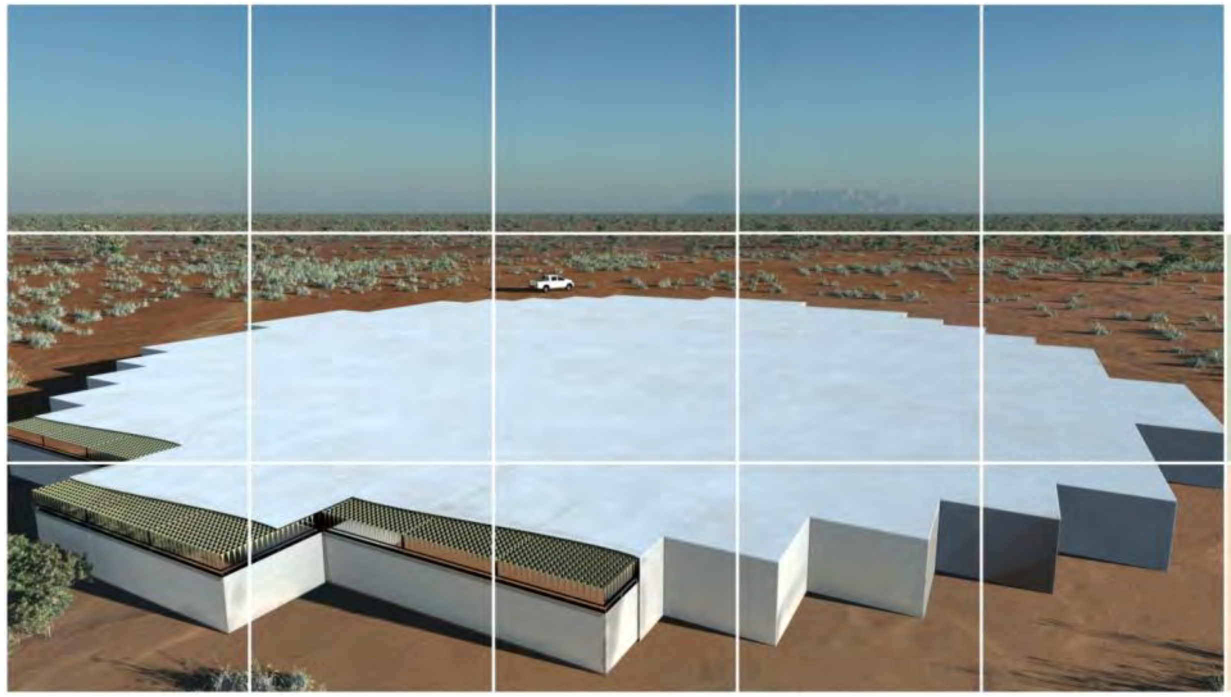


PART 3. SCOPING ASSESSMENTS AND DEVELOPMENT PROTOCOLS

SECTION 11: SQUARE KILOMETRE ARRAY PROJECT

11.1 Renewable Energy and SKA

The Square Kilometre Array (SKA) project is an international project to build the world's largest radio telescope, with a square kilometre of collecting area. The telescope will be used to study space in order to improve the understanding of the universe and the laws of physics. The SKA operates across a wide frequency range, and so requires multiple receptor technologies to conduct astronomical observations. The use of multiple receptor types enables the SKA facility to be split between Africa and Australia. The South African component of the SKA will consist of approximately 3 000 receptors comprising dish antennas, each with a diameter of 15 m, and radio receptors known as dense aperture-arrays. The majority of the receptors (approximately 50%) will be located in a dense core region in the Northern Cape Province, while the remaining receptors will be grouped in radio stations arranged in arms spiralling out from the central core area. The outer stations in the spiral arms will extend beyond the borders of South Africa and at least 3 000 km from the core area. About 80% of the receptors, including a dense core and up to 5 spiral arms, will be located in the Karoo Central Astronomy Advantage Area (KCAAA).

The KCAAA which is located between Brandvlei, Van Wyksvlei, Carnarvon and Williston in the Northern Cape Province was in early 2014 officially declared by the Minister of Science and Technology in terms of the Astronomy Geographic Advantage Act (Act No. 21 of 2007) for the purposes of protection from Radio Frequency Interference (RFI) and Electromagnetic Interference (EMI). The declaration of the KCAAA ensures the long term viability of the area to be used for astronomical installations. The KCAAA has since also been identified for the construction of other astronomy projects such as PAPER (Precision Array for Probing the Epoch of Re-ionisation), C-BASS (C-Band All Sky Survey) and MeerKAT, with the latter being a pathfinder for SKA.

The key characteristics of the area, making it particularly suitable for astronomical installations, can be summarised as:

- Having a very low population density, which results in a low presence of RFI and EMI which can interfere with celestial signals that the telescope aims to detect;
- Having a landscape with flat-topped escarpments and hills provide additional natural shielding from RFI and EMI;
- Having low economic activity which reduces the potential impact of future development on the SKA, and the impact of the SKA on the area by limiting the development opportunities in order to limit RFI and EMI, while still being near enough to bulk infrastructure such as roads and power lines
- Being near to small towns that can provide services;
- Having a dry climate and favourable construction terrain; and
- Having an elevation of 1 000 m or higher that reduces the atmospheric opacity (i.e. the amount of absorption and scattering of incoming signals by the atmosphere).

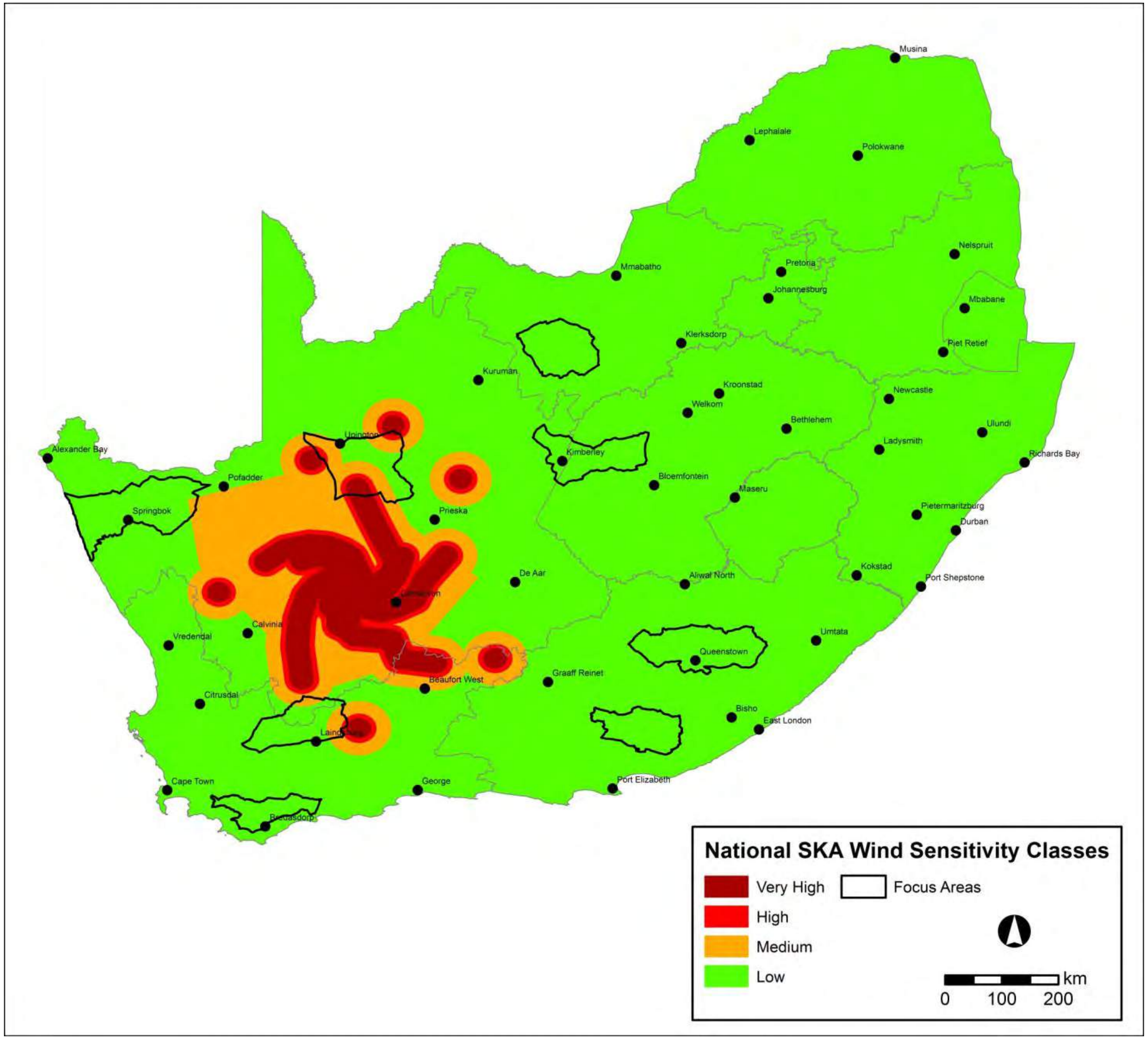
Any large scale development with its associated human activities, including renewable energy and supporting infrastructure, result in RFI and EMI, which have the potential to degrade the performance of the SKA if such development is sited in close proximity to the radio sites. In extreme cases, strong sources of RFI and EMI have the potential to render the SKA dysfunctional or even to permanently damage the SKA receivers.

11.2 Sensitivity Mapping

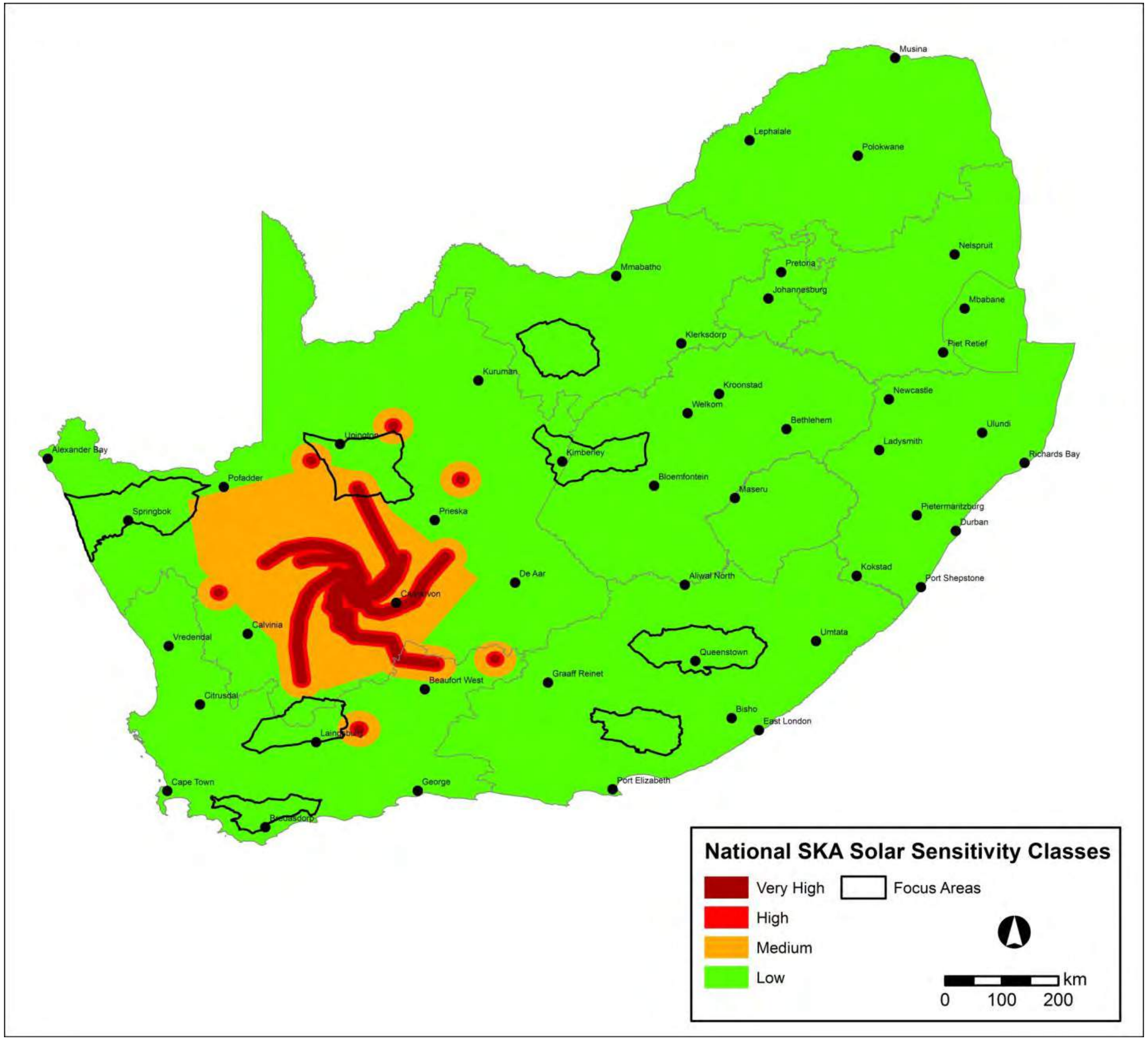
Based on the potential RFI and EMI impacts of wind and solar photovoltaic (PV) developments on SKA receptors, sensitivity buffers as presented in Table 1 were determined and applied to the preliminary SKA radio sites to produce national sensitivity maps (see Maps 1 and 2) as well as individual sensitivity maps of those Focus Areas (FAs) which overlap with identified sensitivities (see Maps 3 – 8).

Table 1: SKA sensitivity distance guidelines

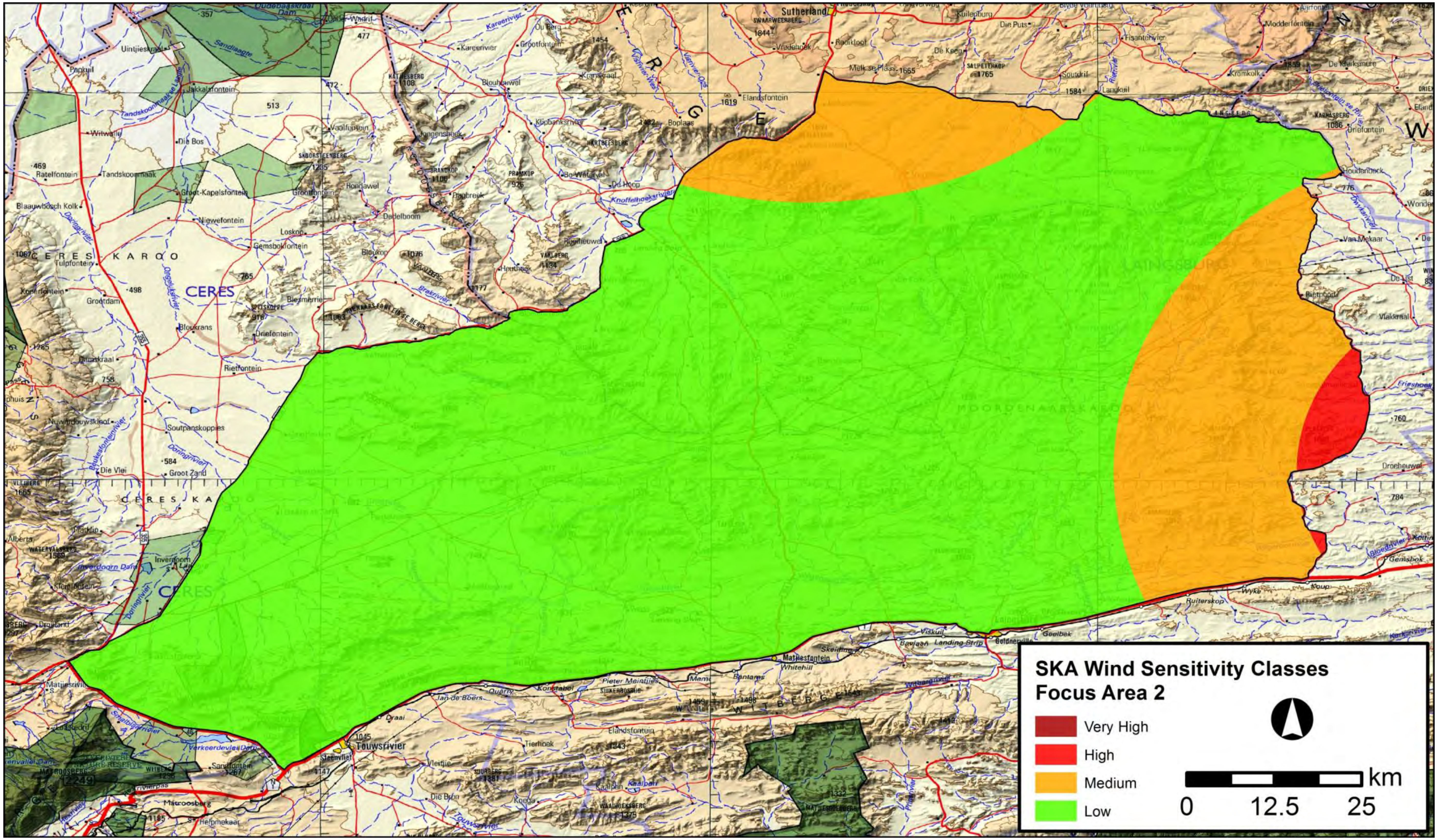
Colour	Sensitivity	Distance from SKA facility	
		Wind	Other Solar PV
Dark red	Very High	Less than 18 km	Less than 8 km
Red	High	Between 18 and 26 km	Between 8 and 14 km
Orange	Medium	Between 26 and 48 km	Between 14 and 32 km
Green	Low	Greater than 48 km	Greater than 32 km



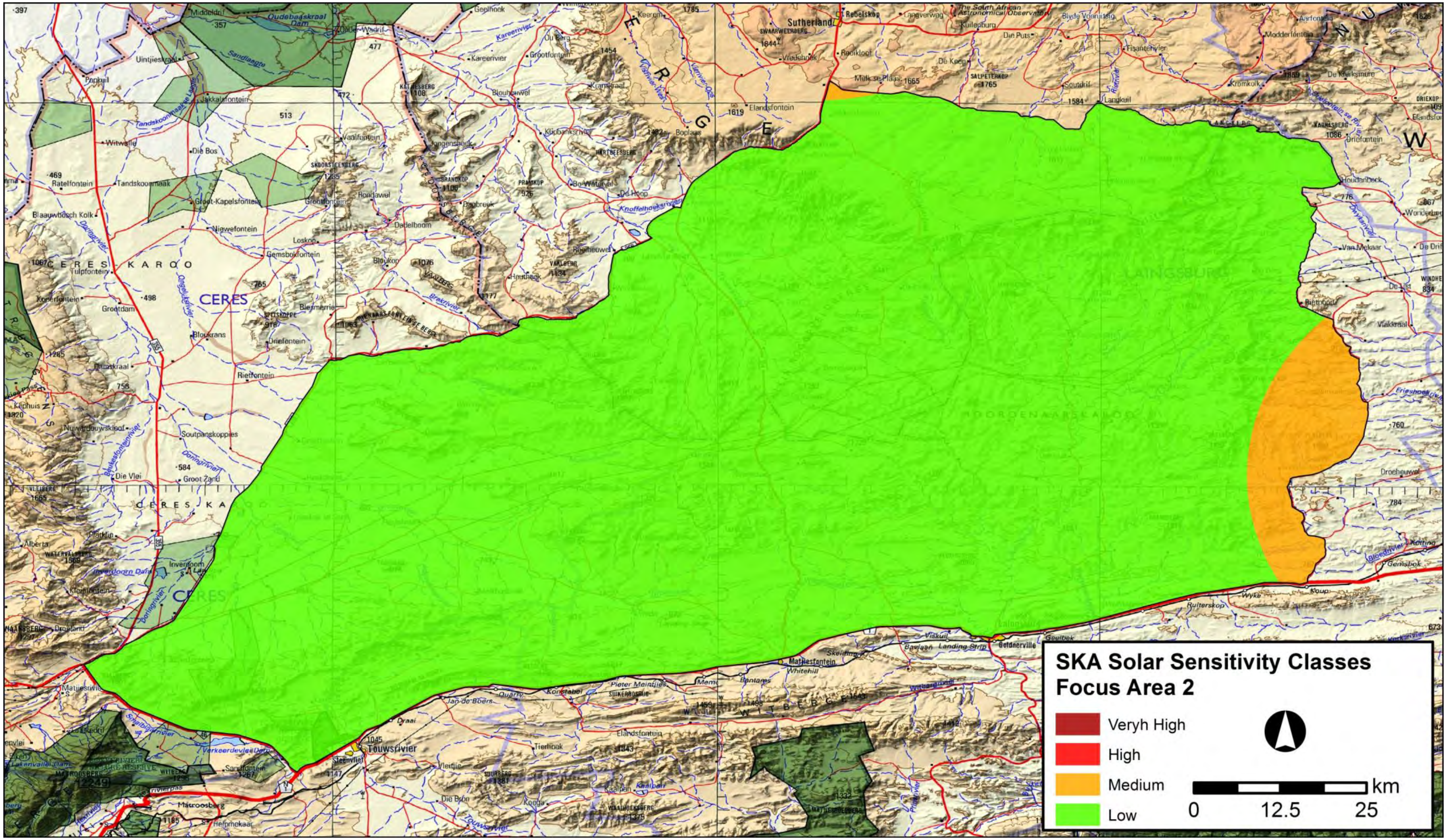
Map 1: National SKA sensitivity for wind energy development



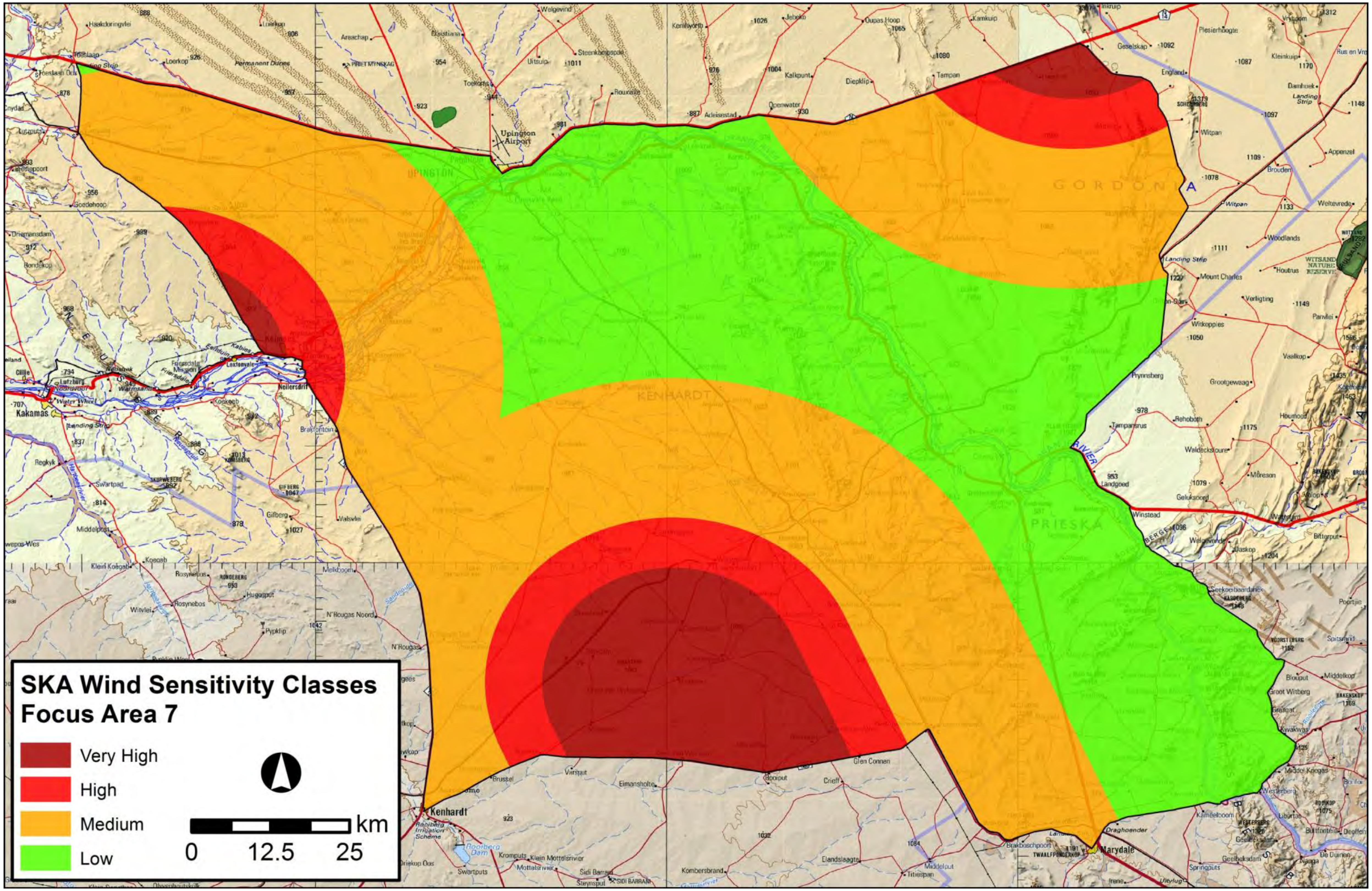
Map 2: National SKA sensitivity for solar PV energy the development



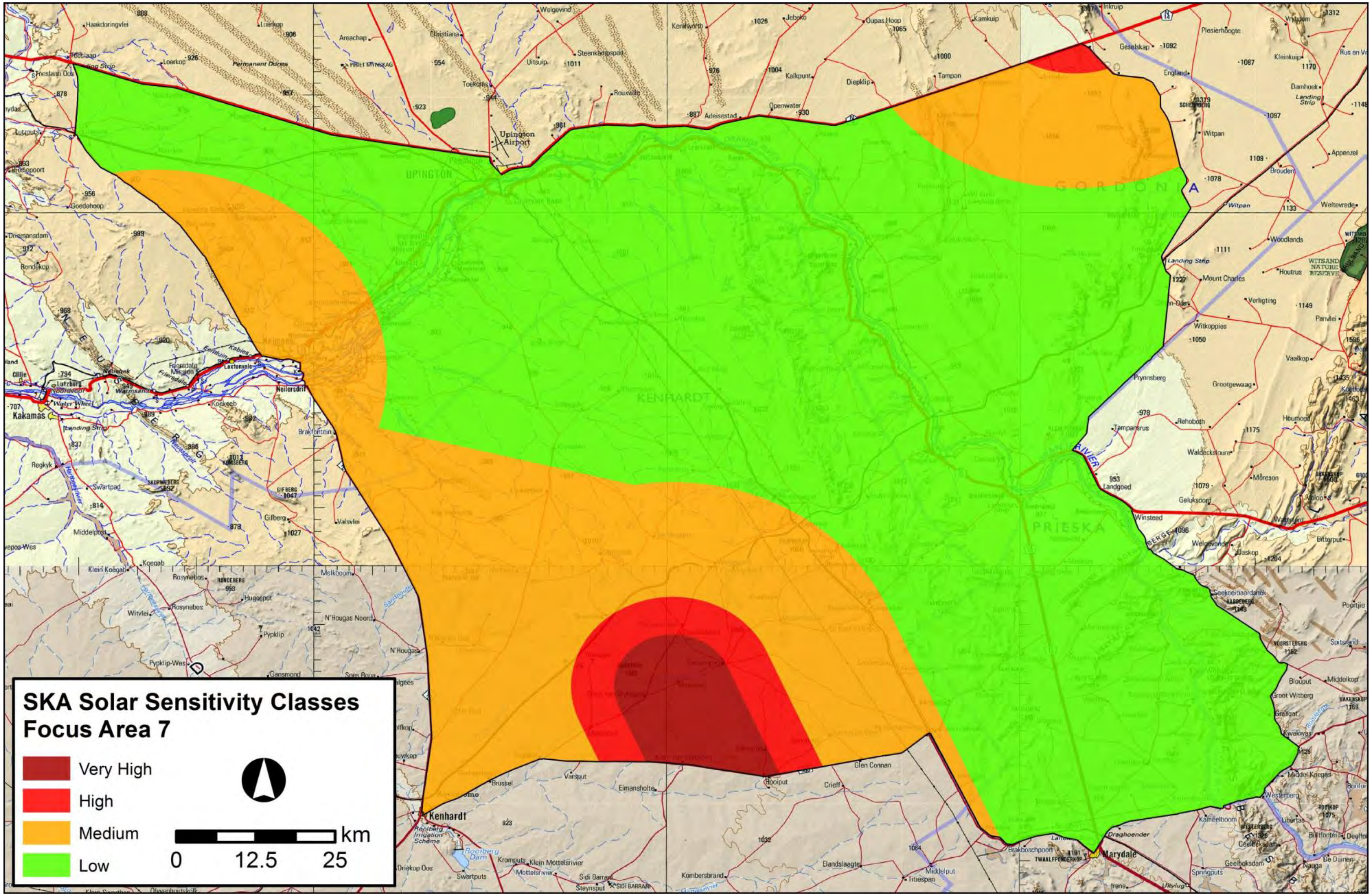
Map 3: SKA sensitivity for the development of wind energy in the Komsberg focus area (FA 2)



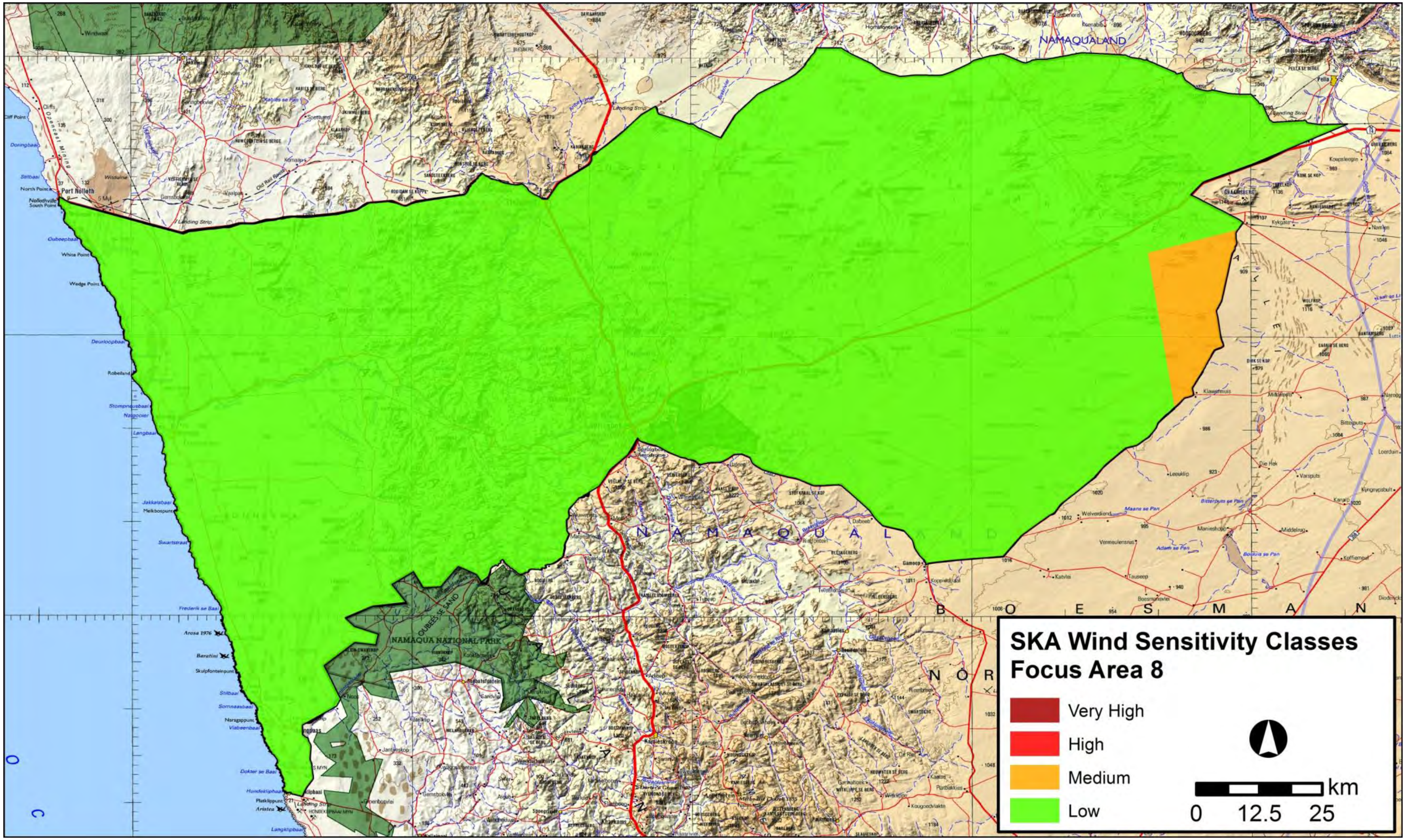
Map 4: SKA sensitivity for the development of solar PV energy in the Komsberg focus area (FA 2)



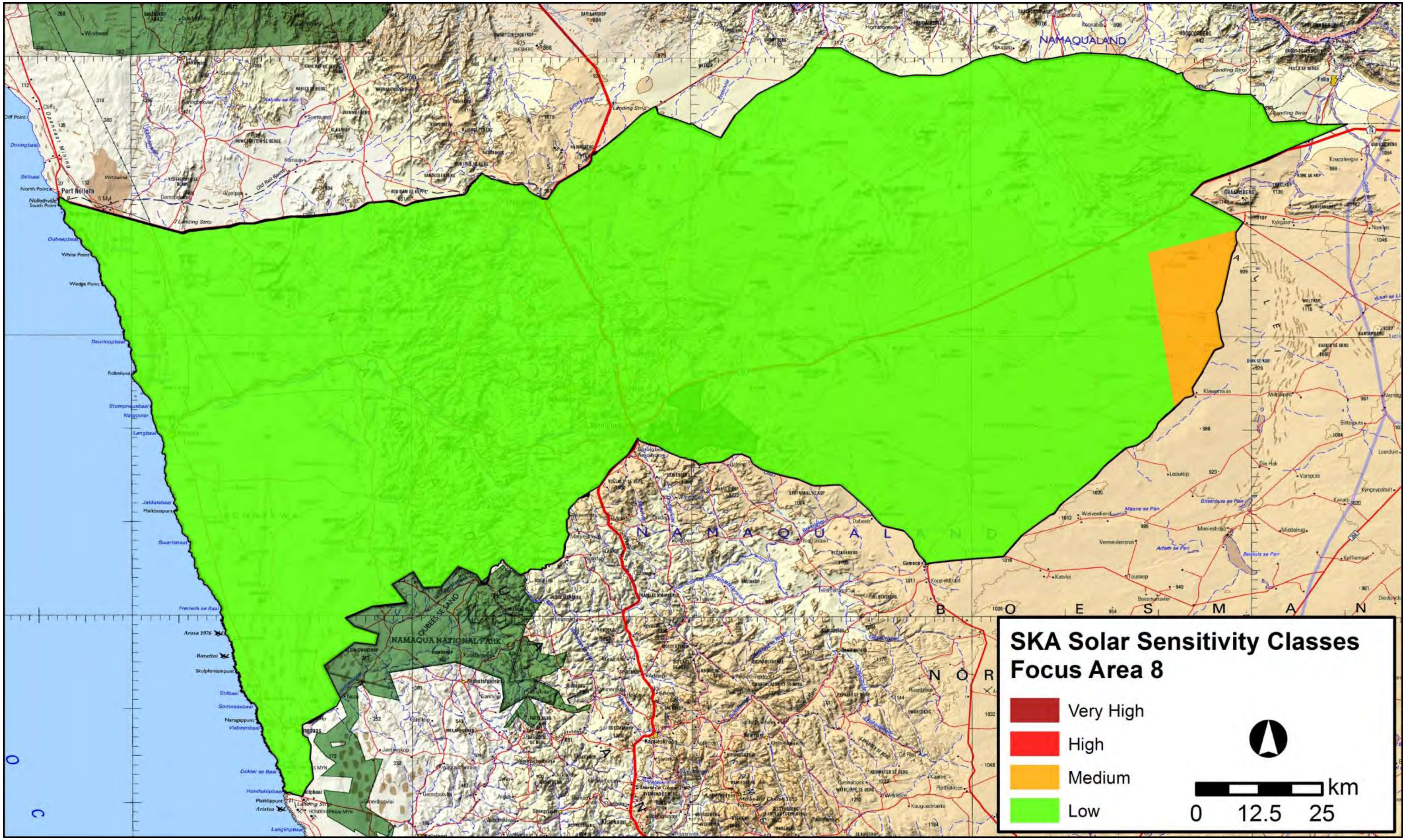
Map 5: SKA sensitivity for the development of wind energy in the Upington focus area (FA 7)



Map 6: SKA sensitivity for the development of solar PV in the Upington focus area (FA 7)



Map 7: SKA sensitivity for the development of wind energy in the Springbok focus area (FA 8)



Map 8: SKA sensitivity for the development of solar PV energy in the Springbok focus area (FA 8)

11.3 Development Protocols

The main objective of this section is to clarify the different levels of sensitivity with respect to the potential impact of wind and solar PV development on the SKA project, and prescribe relevant assessment requirements. In Table 2 sensitivity classes are interpreted and assessment requirements prescribed. These requirements are specific to the sensitivity classes and are therefore related to the sensitivity maps in sub-Section 11.2. These requirements will be applicable to developments proposed both inside and outside the FAs as soon as these areas have been adopted as Renewable Energy Development Zones (REDZs).

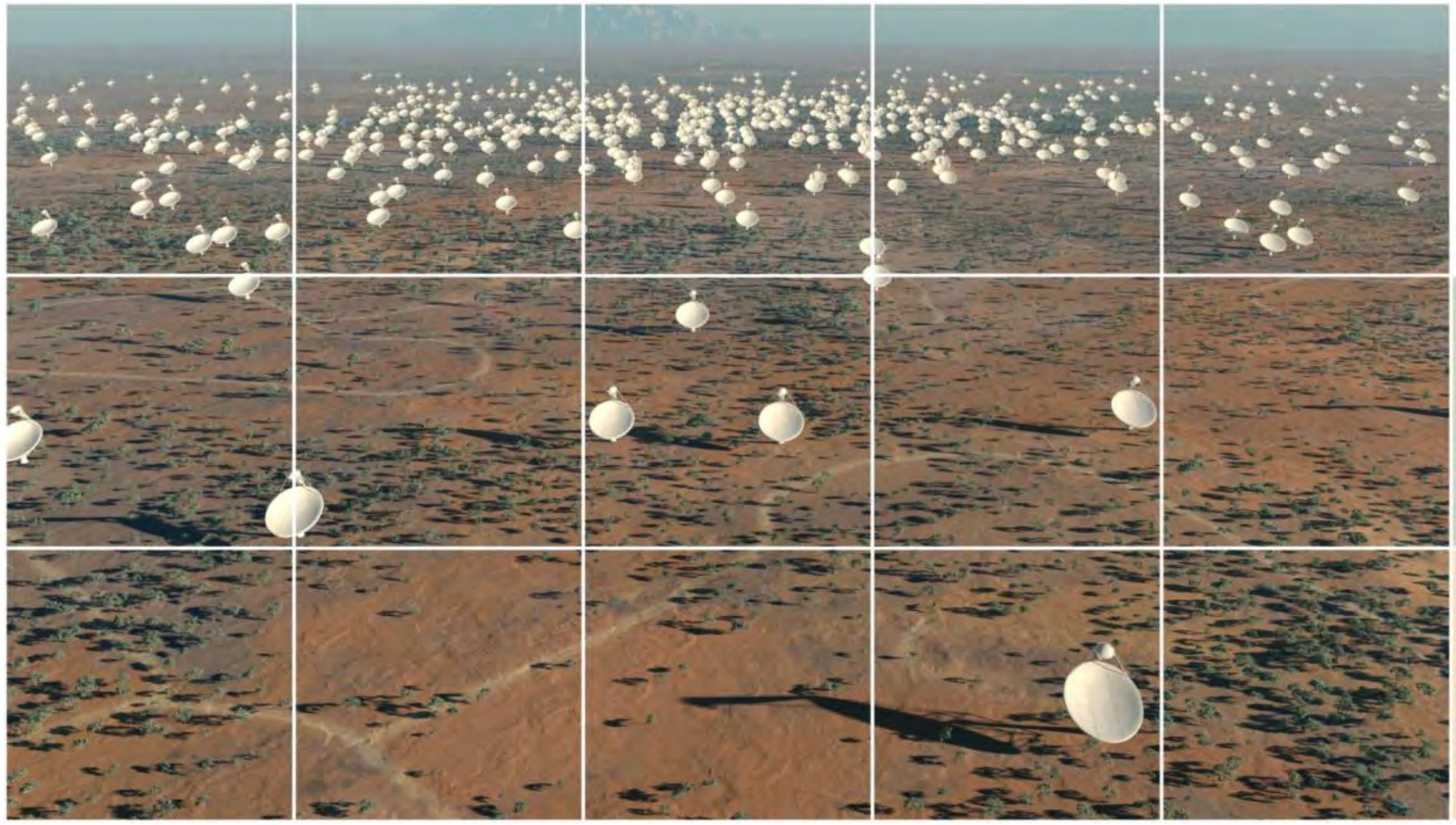


Table 2: Interpretation of SKA sensitivity maps and associated assessment requirements

Colour	Sensitivity	Interpretation of the sensitivity	Further wind and solar PV assessment requirements
Dark red	Very High	In very sensitive areas there is a high likelihood of significant negative impacts that cannot be mitigated. In-depth assessment of the potential impacts, and proof of efficacy of proposed mitigation measures, will be required before development can be considered in these areas. Proof of compliance with mitigation requirements will be required should the proposed development be considered favourably, following construction.	Proponents intending to develop a wind or solar PV facility that triggers an environmental assessment process in very high to medium sensitivity areas must prove to the relevant competent authority that the proposed development will not have an unacceptable negative impact on the SKA project. In order to do so, the proponent must request a comment from SKA South Africa confirming no unacceptable impact on radio sites. Inputs from SKA South Africa, if provided within stipulated timeframes, will be considered by the relevant competent authority for decision making. SKA South Africa will conduct a high level risk assessment on the proposed facility, and will consider the following: • The potential RFI and EMI emitted by the development; • The size of the development; • The distance of the development from the radio site; • The elevation of development relevant to the radio site; and • Whether the development will be in line of sight of the receptors, or whether topographical shielding exists. Should SKA South Africa determine that an in-depth assessment is required, the proponents of the wind or solar PV facility will be required to undertake, at own cost, the relevant assessments. These can be sub-contracted to relevant experts in the field, and will include: • Radio frequency measurements of operational facilities of equivalent electrical and structural design, to determine the RFI and EMI characteristic emissions profile; • Radio frequency propagation modelling between the proposed facility and the near SKA stations at risk; and • Any other studies that may be required and will be determined in consultation between the SKA project and the relevant proponent. Any mitigation requirements stipulated by SKA South Africa in its comment will be included as a condition on the Environmental Authorisation (EA). Any mitigation measures recommended will be tested by SKA South Africa to ensure compliance following implementation, and the Environmental Authority responsible for the EA will be notified of the results of these tests.
Red	High	In high sensitivity areas there is potential for negative impacts that can potentially be mitigated. In-depth assessment of the potential impacts and proven mitigation measures will be required before development can be considered in these areas. Proof of compliance with mitigation requirements will be required, should the proposed development be considered favourably, following construction.	
Orange	Medium	In medium sensitivity areas there is a low potential for negative impacts, and if there are impacts there is a high likelihood of mitigation. Further high level risk assessment of the potential impacts is required. An in-depth assessment may be required, if found necessary through the high level risk assessment.	
Green	Low	No expected impacts.	No assessment or authorisation for wind or solar PV development in terms of the SKA project is required if the proposed development is not within the sensitive distances from radio sites (i.e. further than 48 km for wind and further than 32 km for solar PV development). SKA South Africa must, however, be notified as an Interest and Affected Party if the development is located within the Northern Cape Province.

SECTION 12

MINING

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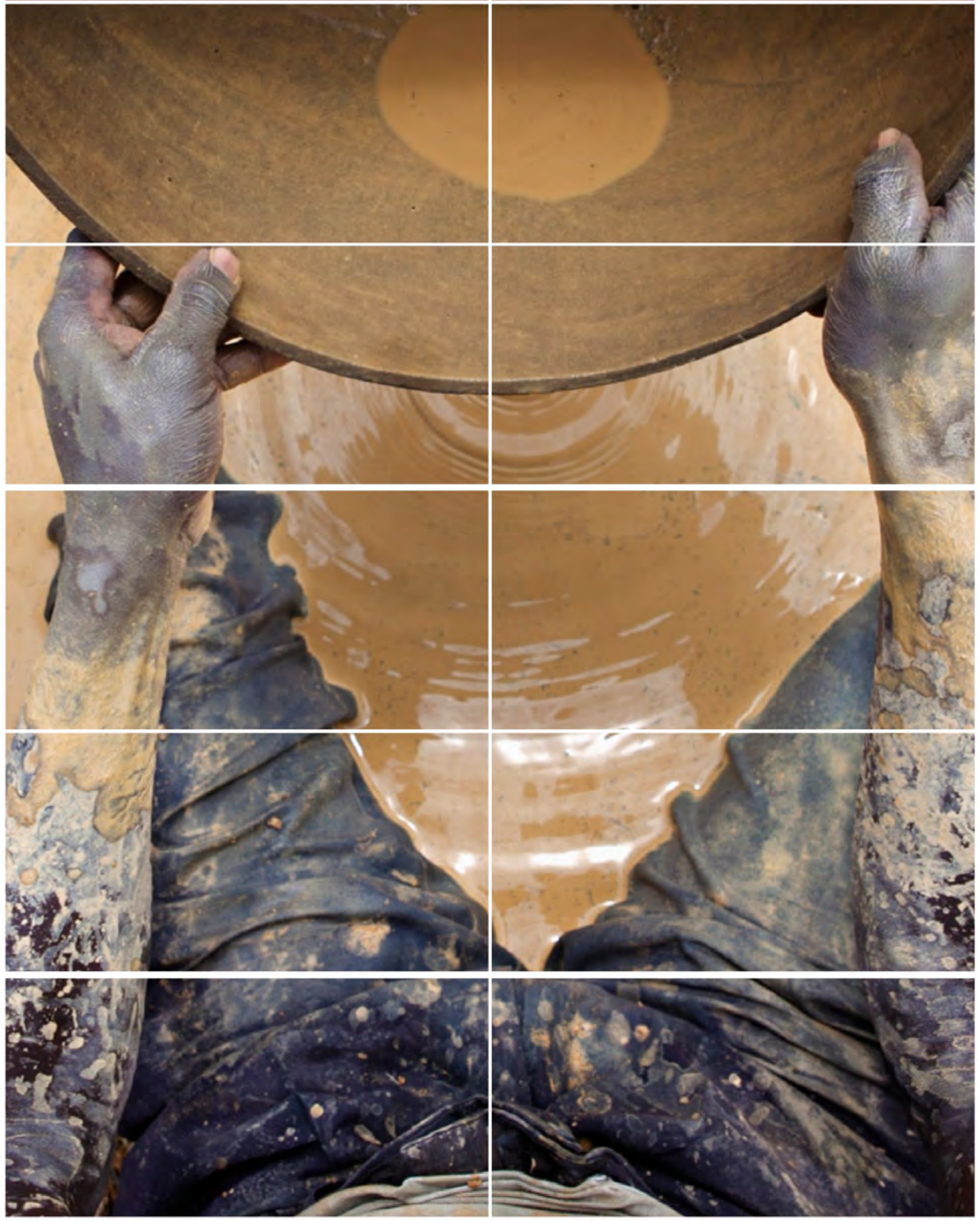


PART 3. SCOPING LEVEL STUDIES

SECTION 12: MINING

With access to some of the world's largest mineral reserves the mining industry in South Africa has been, and still is, a major contributor to national economic growth and job creation. Mining in South Africa is governed by the Mineral and Petroleum Resources Development Act (MPRDA) (Act 28 of 2002) with the national Department of Mineral Resources (DMR) as the competent authority. The DMR is assisted by the Council for Geoscience (CGS) which provides expert earth-science information in support of national mineral resource management. The following section dealing with the potential impacts and integration opportunities of renewable energies and mining has been prepared in consultation with DMR and CGS.

12.1 Renewable Energy and Mining

The MPRDA stipulates that mineral and petroleum resources are the common heritage of all the people of South Africa and that the State is the custodian thereof for the benefit of all South Africans. In terms of Section 53 of the MPRDA the approval of the DMR Minister is thus required for any land surface use than may be contrary to the objectives of the MPRDA. These objectives include the right of the State to exercise sovereignty over all mineral and petroleum resources within the Republic, promote equitable access to the nation's mineral and petroleum resources to all the people of South Africa, and promote economic growth from mineral and petroleum resources development in the Republic. Such an application is required for all land uses other than those proposed within an area with an already approved town planning scheme, farming related land uses, or other land uses identified by the Minister as not requiring approval.

With a project lifespan of approximately 25 years and the likelihood of extension, wind and solar PV developments are considered to have the potential for temporarily preventing access to below ground mineral resources, and hence require approval in terms of Section 53 of the MPRDA. Considering the potential for mining and renewable energy land use integration (e.g. to offset grid or diesel derived electricity usage by generating onsite renewable energy on rehabilitated or restricted mining land which is not suitable for any other land use), the consideration of Section 53 applications for renewable energy project are complex and case specific. Furthermore, the presence of below ground mineral resources at a specific site can only be confirmed through exploration, and without such certainty it is challenging to justify the prevention of wind and solar photovoltaic (PV) development on such a site by refusing a Section 53 application.

With the foregoing complexities requiring consideration when evaluating the potential impacts of proposed renewable energy developments on mining, the following principles are important:

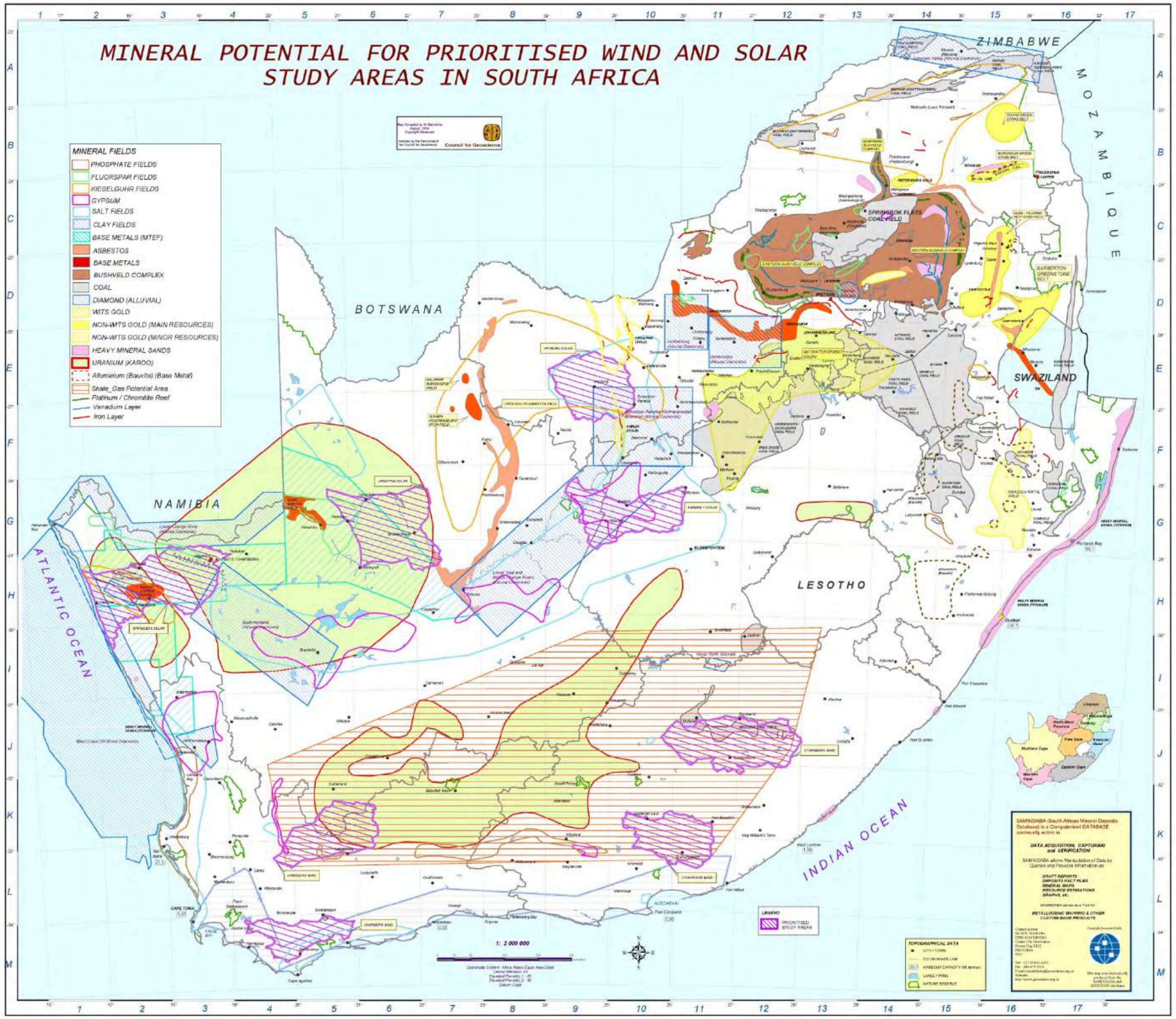
- There is significant potential for land use integration which could be mutually beneficial for mining and renewable energy development. The potential for such benefits may be dependent on the type of mining (e.g. surface or underground), the mining life cycle phase (e.g. exploration or rehabilitation), and several other case specific factors. Due to these case specific factors influencing potential benefits, every application will be dependent on the agreement that can be reached between the mining and renewable project operators and must be considered on its own merit;
- It is difficult to justify the sterilisation of land for renewable energy development based on mining sensitivities without some degree of certainty that there are indeed below ground mineral resources that can be affected. Furthermore, where an exploration or mining right has either lapsed or the relevant activities have not started within the stipulated timeframes, such unused rights do not justify the sterilisation of land for other land uses contributing to the national economy, such as renewable energy development;
- To the same extent that confirmed mineral resource areas and existing mining operations receive preference when considering proposed renewable energy development, where a mineral or petroleum resource is found subsequent to the construction of a renewable energy facility such a facility must receive preference for the duration of its lifespan when considering the exploitation of the found resource;
- Although renewable energy development can contribute to a great extent towards the rehabilitation and re-use of mining affected land, the rehabilitation commitments and responsibilities of mining operators cannot be passed on to renewable energy operators.

12.2 Sensitivity Mapping

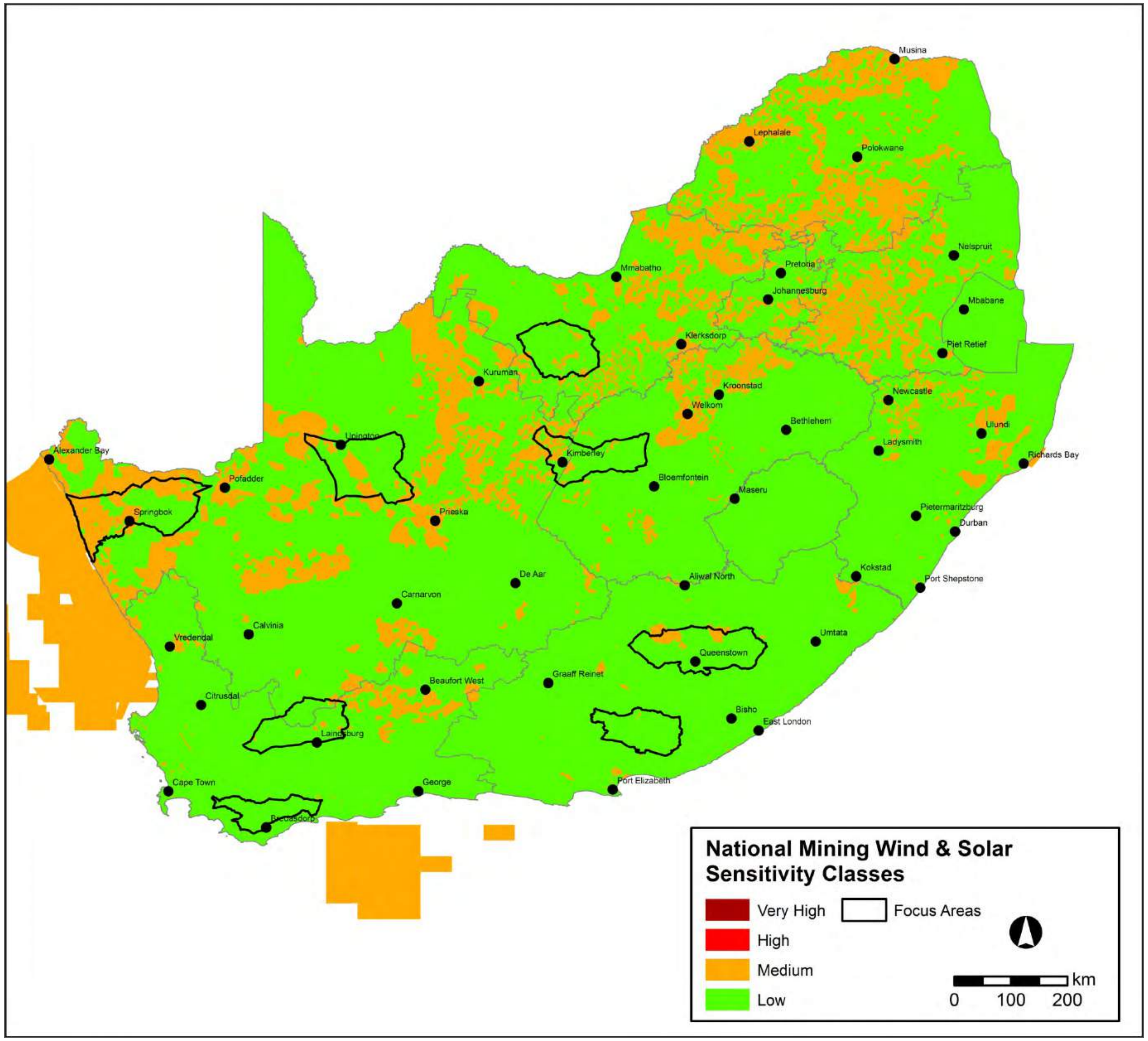
Based on the above principles and in consultation with CGS and DMR, mineral resource sensitivities were identified and mapped (see Table 1). Although data on mineral and petroleum resource potential areas are available (see Map 1) the resolution and accuracy of these data are not considered adequate for sensitivity mapping. Only known prospecting and mining rights were considered as being sensitive and mapped at a national scale (see Maps 2). The sensitivity was also mapped for each Focus Area (FA) (see Maps 3 - 11).

Table 1: Mineral Resources sensitivity criteria

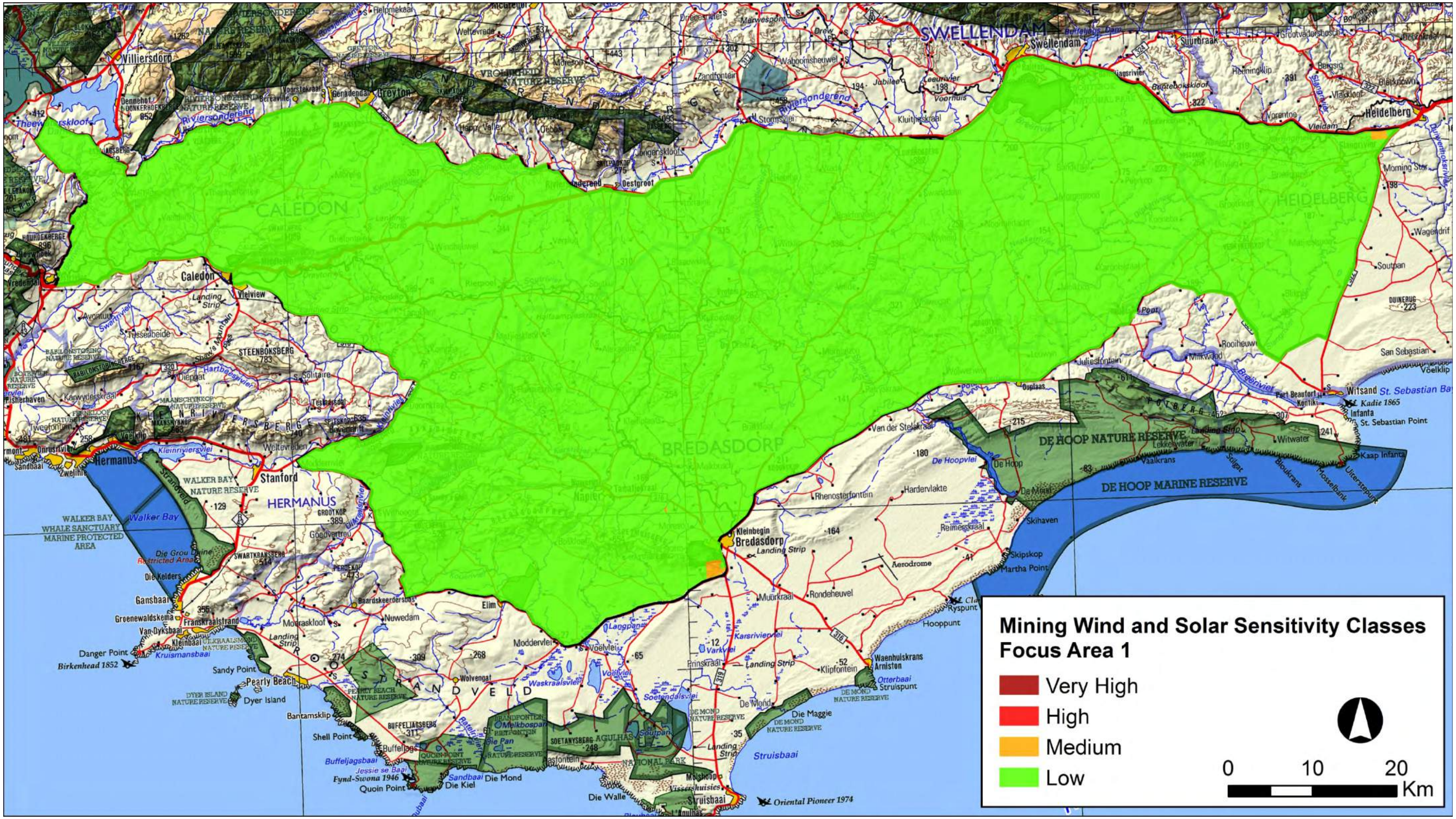
Sensitivity Feature	Data Source	Sensitivity Mapping Application for Wind and Solar PV
Known prospecting and mining rights	Council for Geosciences (CGS), 2014	**Medium sensitivity**



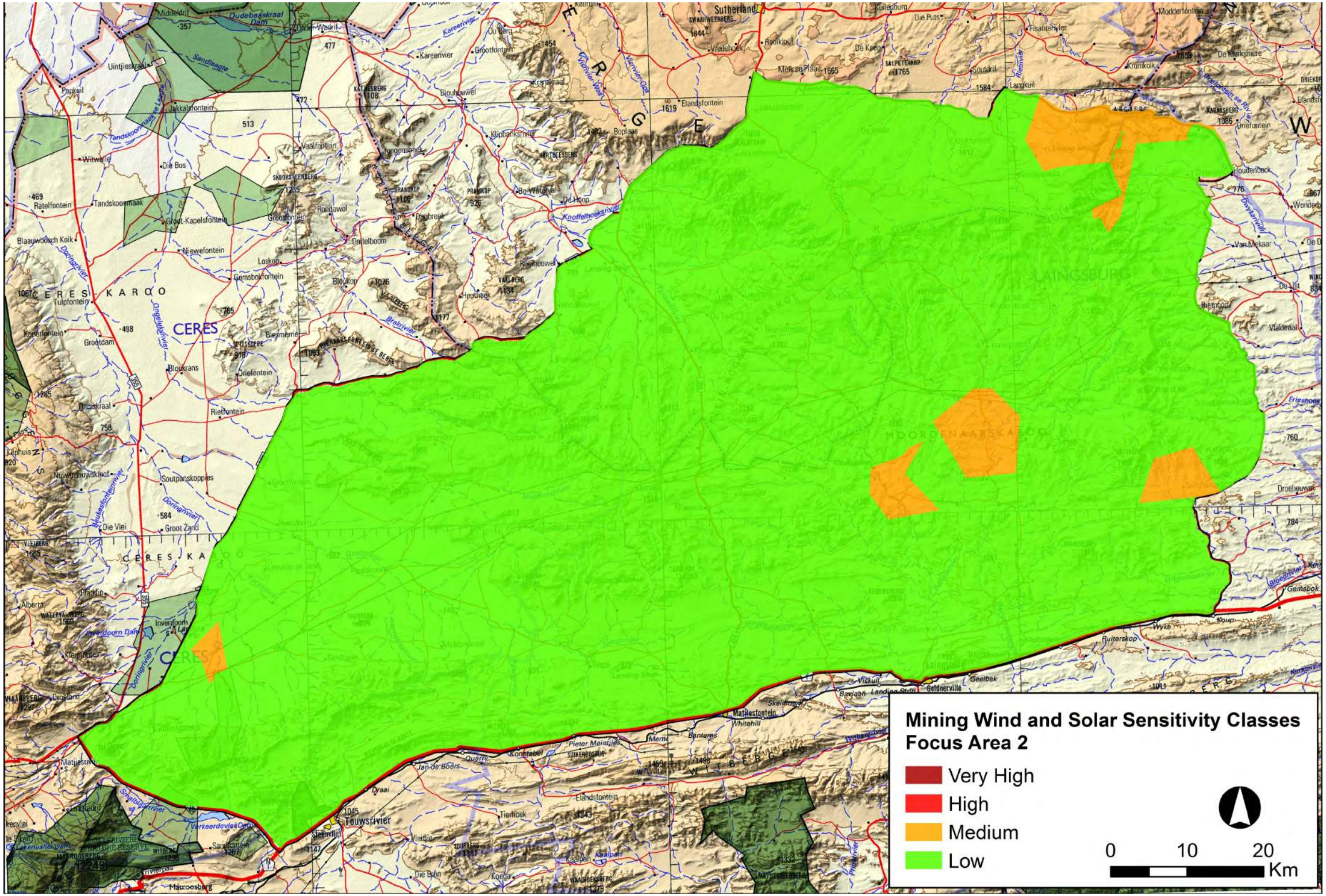
Map 1: Mineral and petroleum resource potential areas (2014)



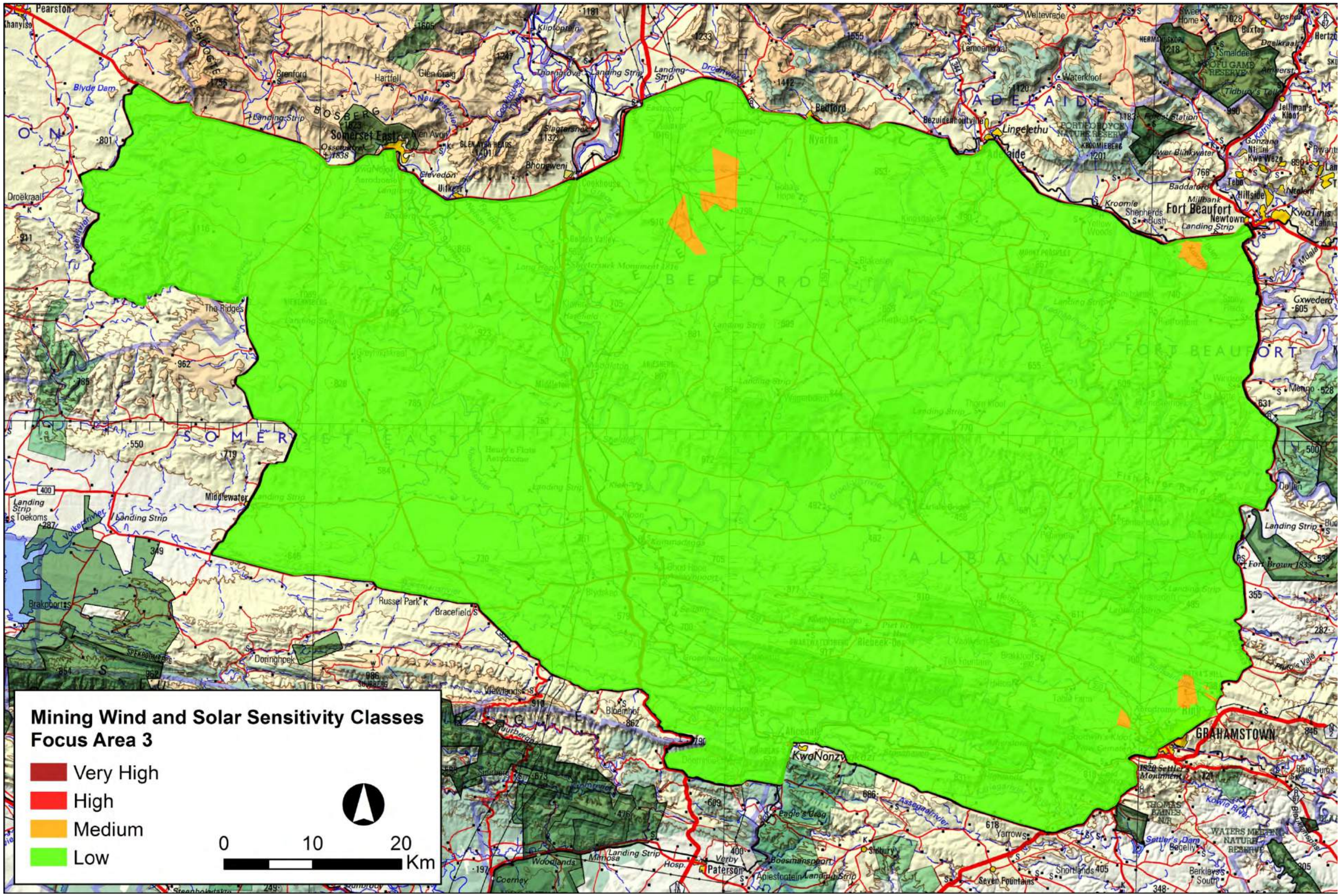
Map 2: Mining sensitivity map for wind and solar PV development



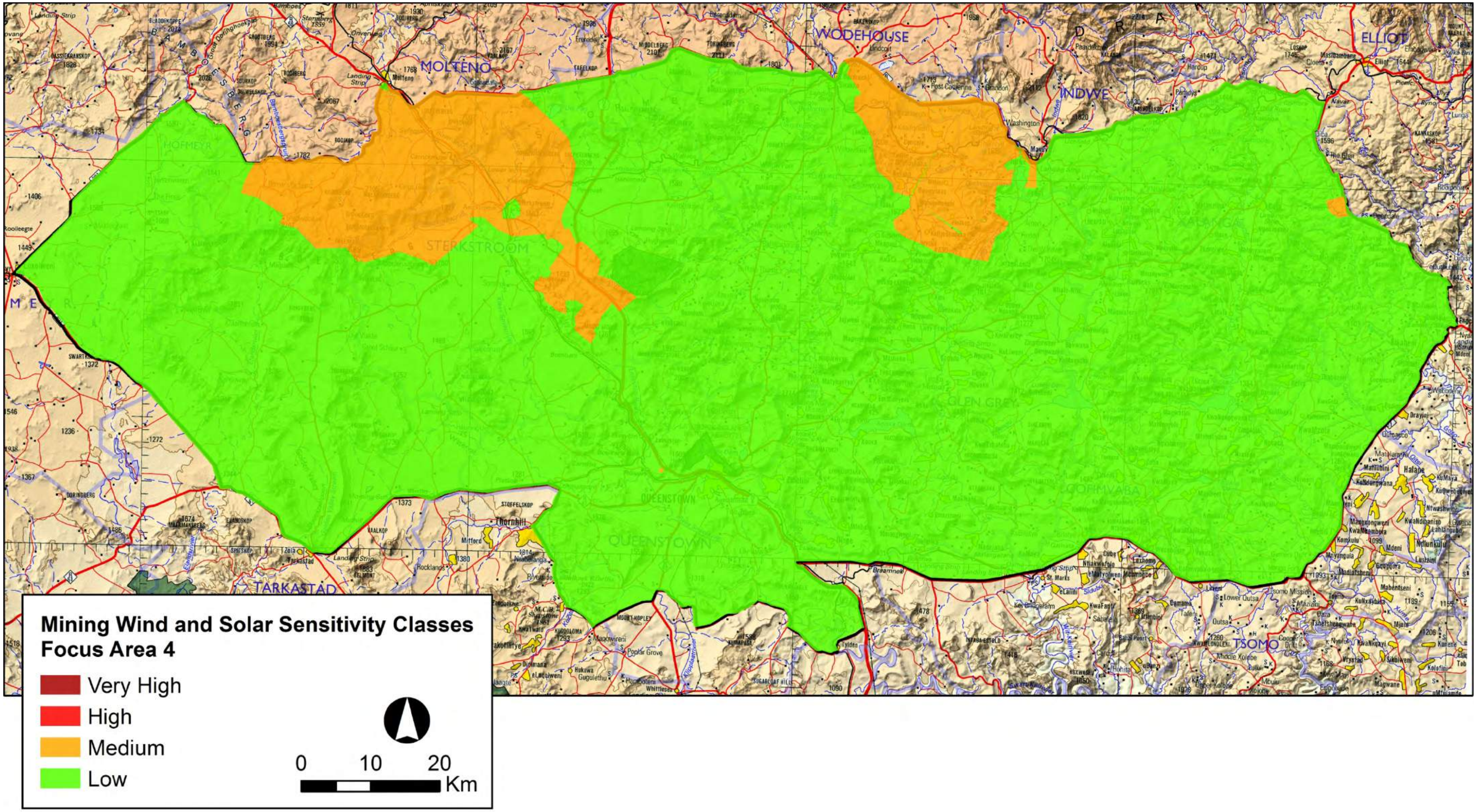
Map 3: Mining sensitivity map for wind and solar PV development in the Overberg Focus Areas (FA 1)



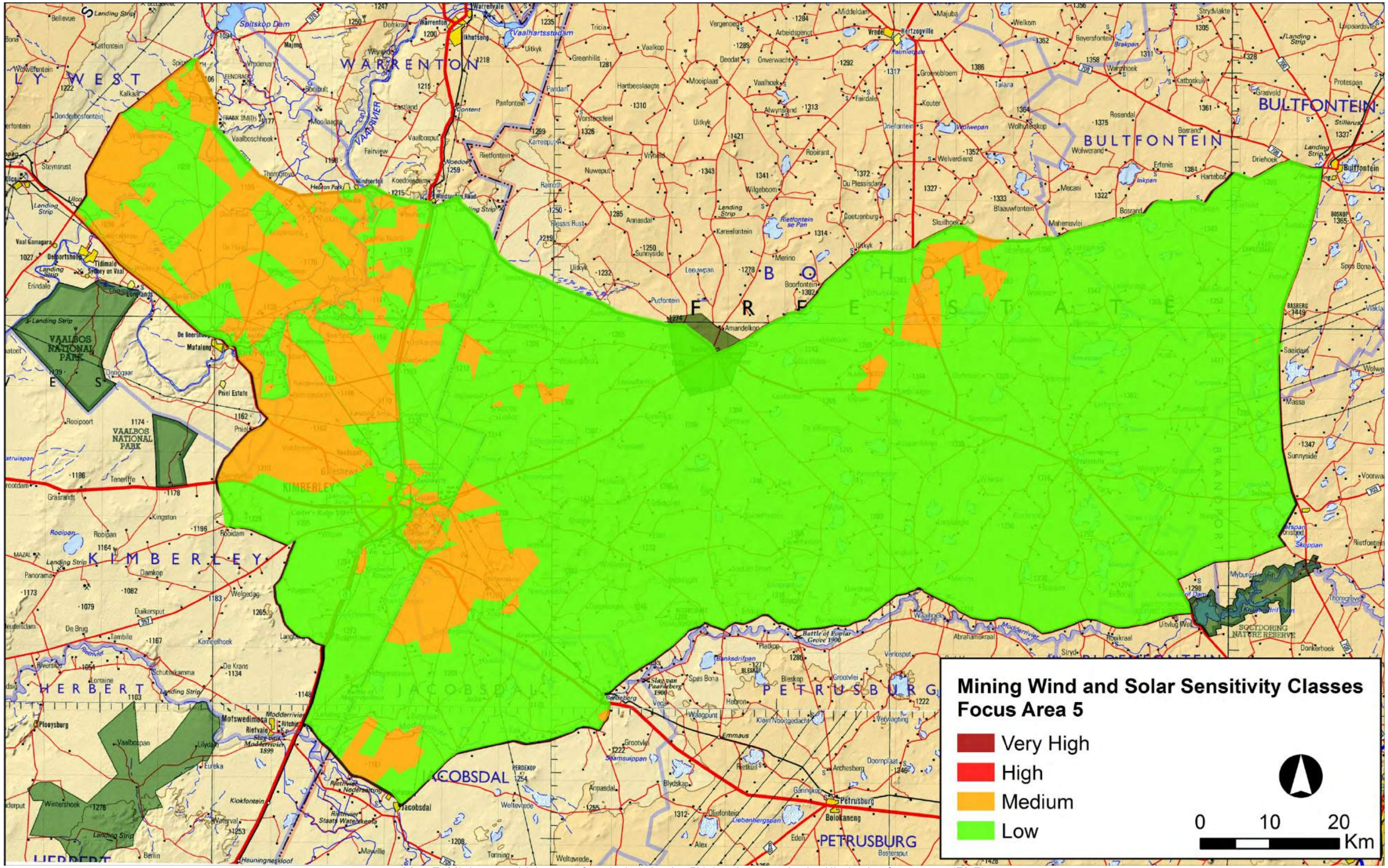
Map 4: Mining sensitivity map for wind and solar PV development in the Komsberg focus area (FA 2)



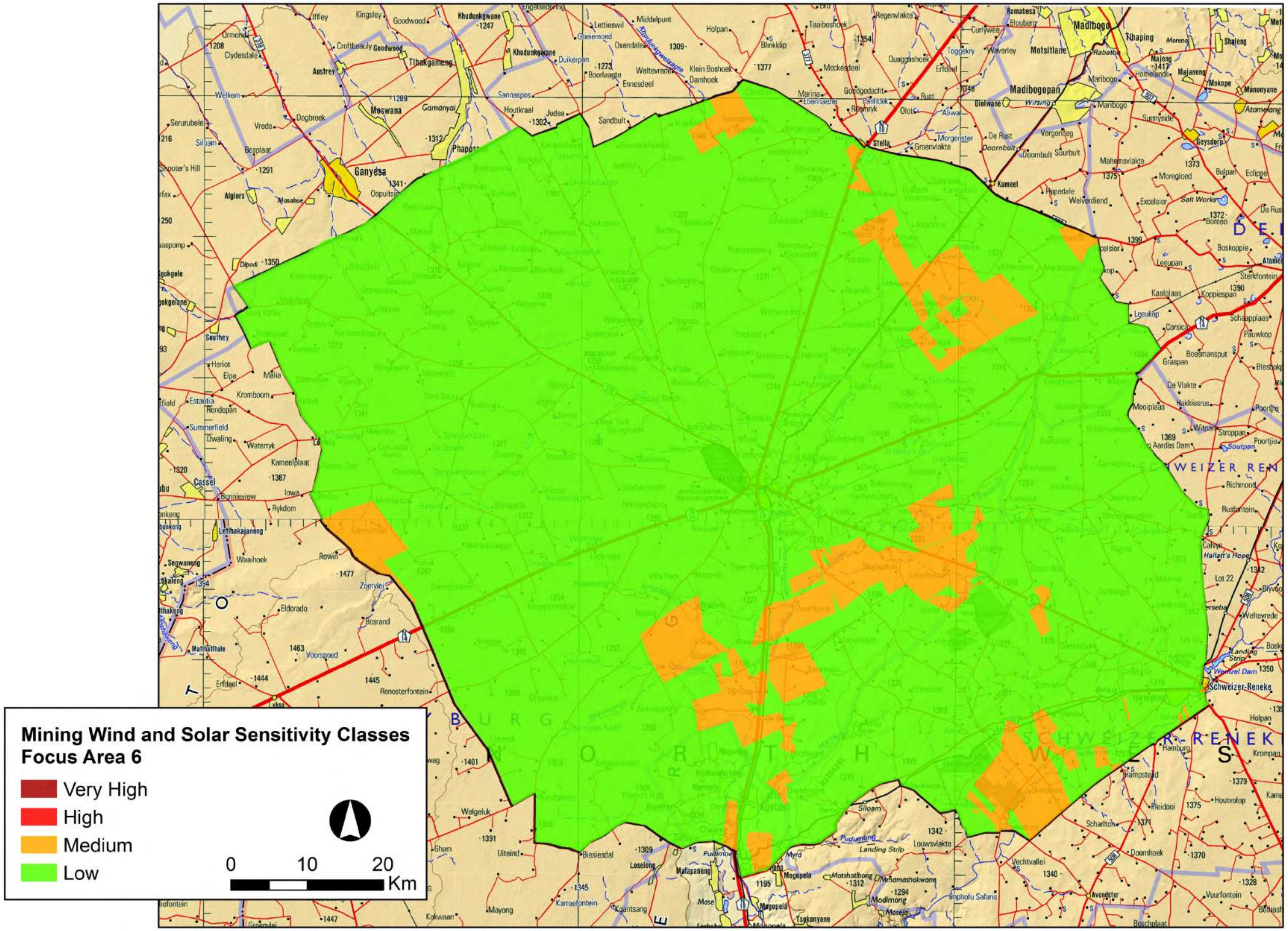
Map 5: Mining sensitivity map for wind and solar PV development in the Cookhouse focus area (FA 3)



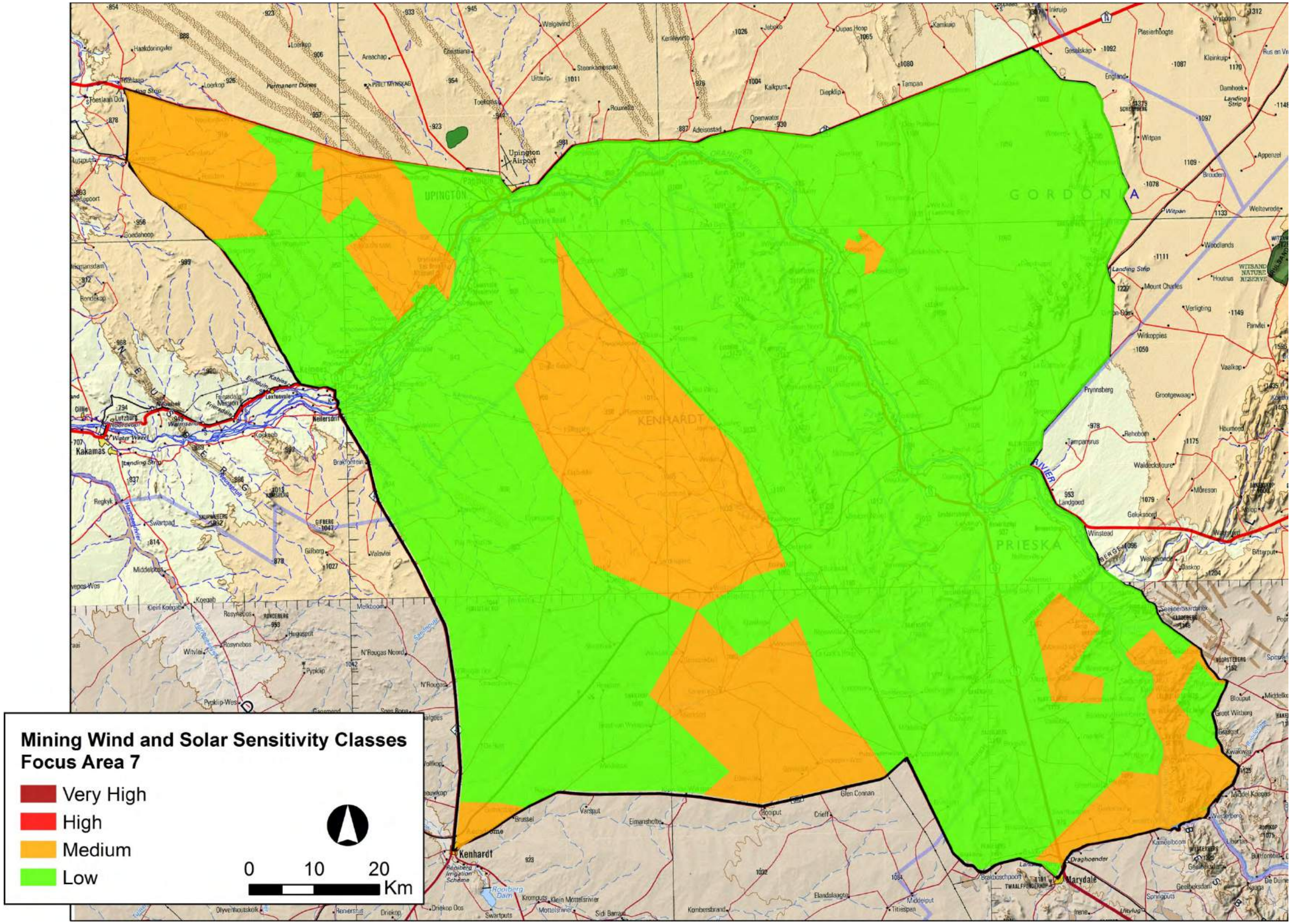
Map 6: Mining sensitivity map for wind and solar PV development in the Stormberg focus area (FA 4)



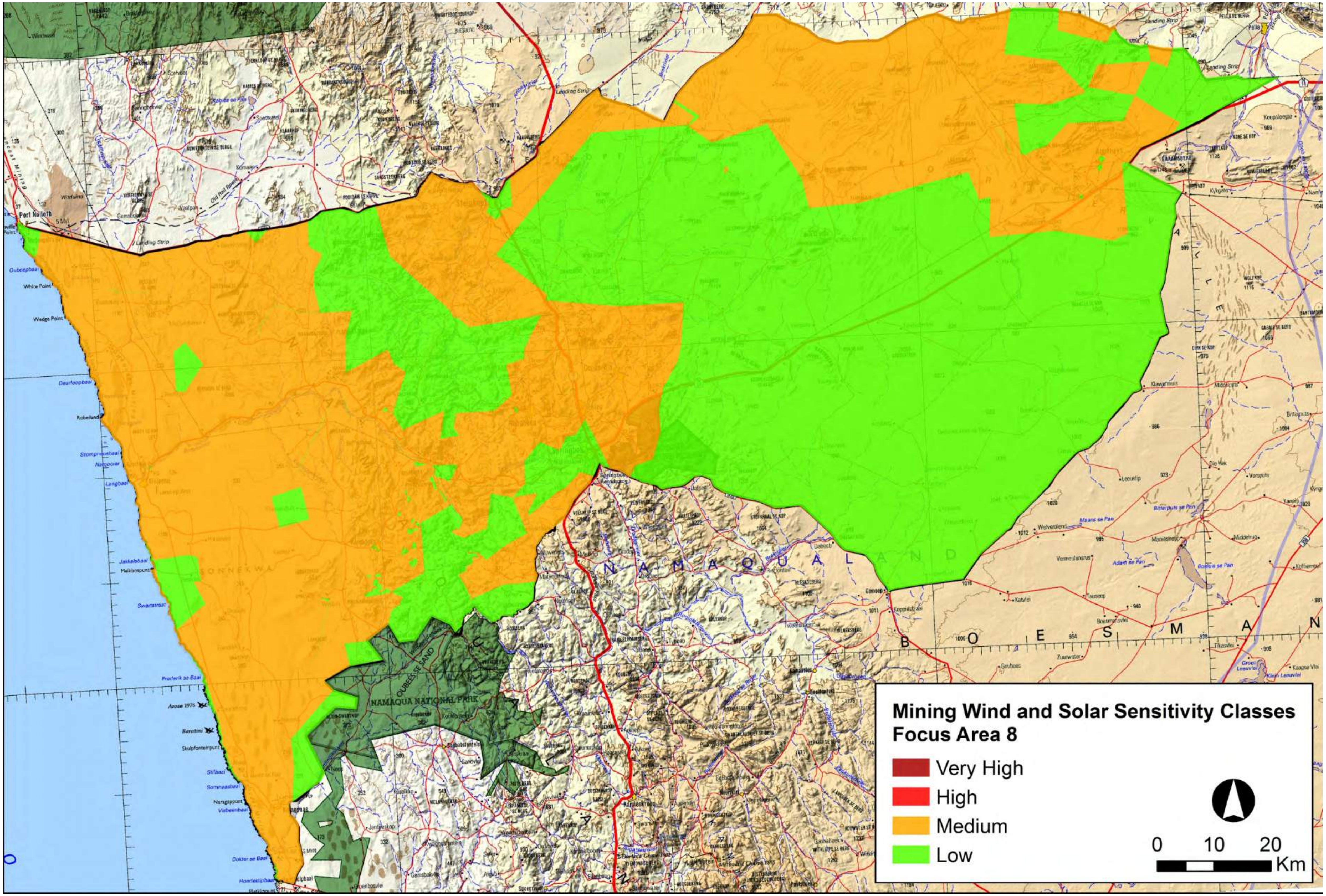
Map 7: Mining sensitivity map for wind and solar PV development in the Kimberley focus area (FA 5)



Map 8: Mining sensitivity map for wind and solar PV development in the Vryburg focus area (FA 6)



Map 9: Mining sensitivity map for wind and solar PV development in the Upington focus area (FA 7)



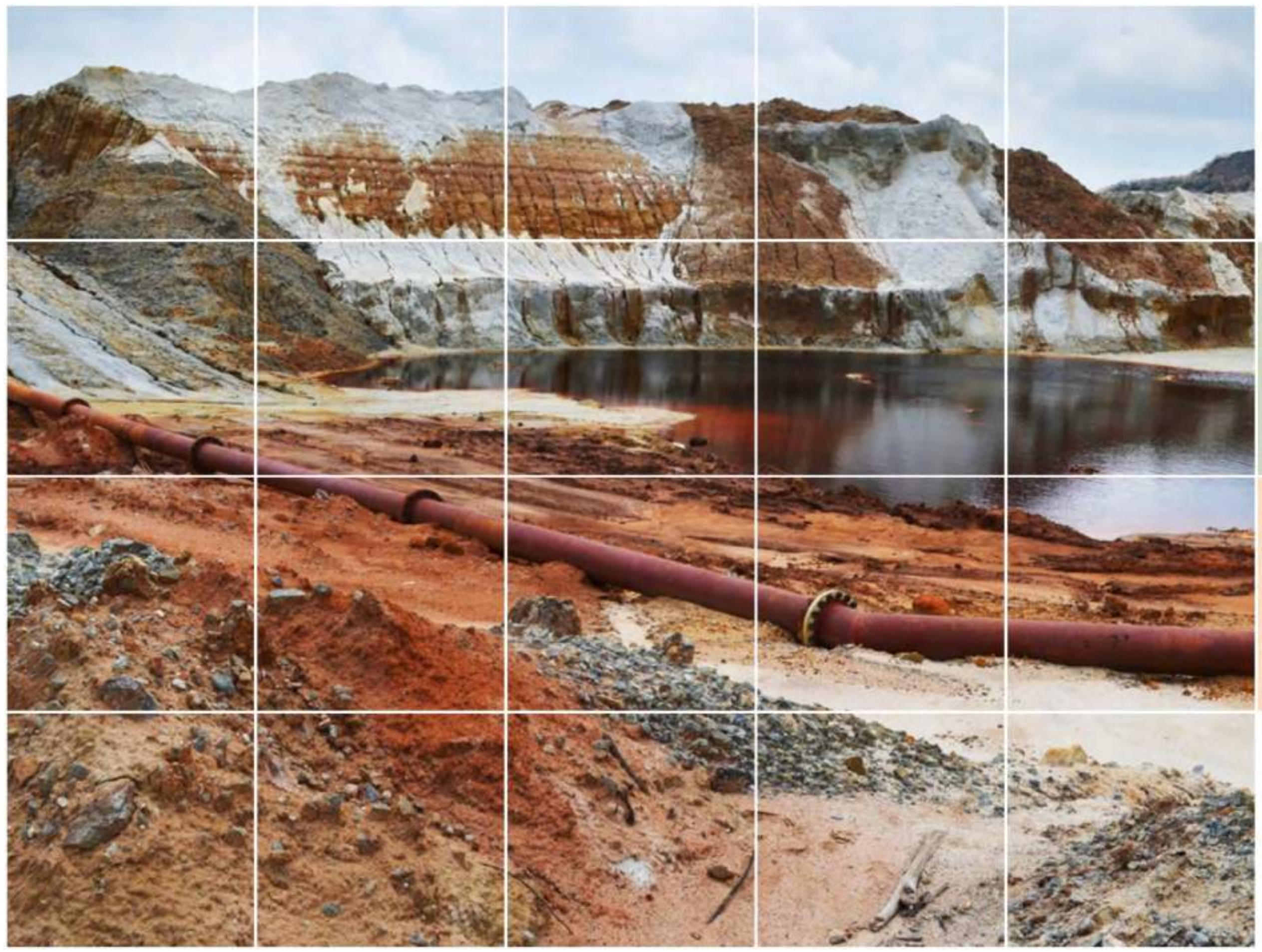
Map 10: Mining sensitivity map for wind and solar PV development in the Springbok focus area (FA 8)

12.3 Development Protocols

The main objective of this section is to clarify the levels of sensitivity with respect to the potential impact of wind and solar PV development on mineral resources and prescribe relevant assessment requirements. In the following table the sensitivity classes are interpreted and assessment requirements prescribed. These requirements are specific to sensitivity classes and therefore are related to the sensitivity maps in sub-Section 12.2. These requirements will be applicable to developments proposed both inside and outside the FAs as soon as these areas have been adopted as Renewable Energy Development Zones (REDZs).

Table 2: Interpretation of mineral resources sensitivity maps and associated assessment requirements

<table>
<tr><th>Colour</th><th>Sensitivity</th><th>Interpretation of the sensitivity</th><th>Further wind and solar PV assessment requirements</th></tr>
<tr><td>Dark red</td><td>Very High</td><td>There is a high likelihood for the sterilisation of strategic mineral resources. In-depth assessment of the potential impacts and mitigation measures is likely to be required before development can be considered in these areas.</td><td rowspan="4">Proponents intending to develop a wind or solar PV facility anywhere in South Africa that triggers the need for an environmental authorisation must prove to the relevant competent authority that the proposed development will not have an unacceptable negative impact on mineral resources. In order to do so, the proponent must request comment from the DMR in the form of an MPRDA Section 53 application. Such comment, if provided within the stipulated timeframe, will be considered by the competent authority for decision making. When evaluating a Section 53 application the following will be taken into consideration:
• Existing mining operations;
• Valid exploration and mining rights;
• Potential for below ground mineral and petroleum resources known with some degree of certainty to be present; and
• The potential for land use integration and mutual benefits as agreed to by the exploration/mining right holder and renewable energy proponent.</td></tr>
<tr><td>Red</td><td>High</td><td>There is potential for the sterilisation of strategic mineral resources. The potential benefits and offsets must be assessed to inform decision making.</td></tr>
<tr><td>Orange</td><td>Medium</td><td>Low potential for the sterilisation of strategic mineral resources, and if there are impacts there is a high likelihood of mitigation.</td></tr>
<tr><td>Green</td><td>Low</td><td>No expected sterilisation of strategic mineral resources. Unlikely for further assessment of potential impacts to be required.</td></tr>
</table>



SECTION 13

NOISE

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PART 3. SCOPING ASSESSMENTS AND DEVELOPMENT PROTOCOLS

SECTION 13: NOISE

13.1 Renewable Energy and Noise Emissions

While Solar photovoltaic (PV) facilities have no moving parts, except perhaps tracking mechanisms, and result in no significant noise emissions, wind turbines are generally noisy and can result in noise pollution. The two main sources of wind turbine noise are mechanical noise from components, such as gearboxes and generators, and aerodynamic noise from the blades. Figure 1 illustrates the decrease in noise generated by a wind turbine and audible to the human ear in relation to distance from the wind turbine. While this illustration presents general noise levels, the values will vary depending on the characteristics of the turbine, wind speed and the environment in which the sound is heard.

Although it is generally assumed that the significance of noise impacts resulting from wind turbines is dependent only on the presence of human receptors in the vicinity, it should be borne in mind that noise emissions far away from human receptors and at frequencies potentially inaudible to the human ear might still impact on other ecological receptors. The nature of the noise emitted from turbines is, however, generally perceived as more constant and natural than most other sources of industrial noise. As discussed in the Terrestrial and Aquatic biodiversity section of this report ecological receptors in the vicinity of wind turbines are thus likely to become habituated to such noise over time. At this time related standards, and thus this section, can only deal with potential anthropogenic sensitivities of noise emissions.

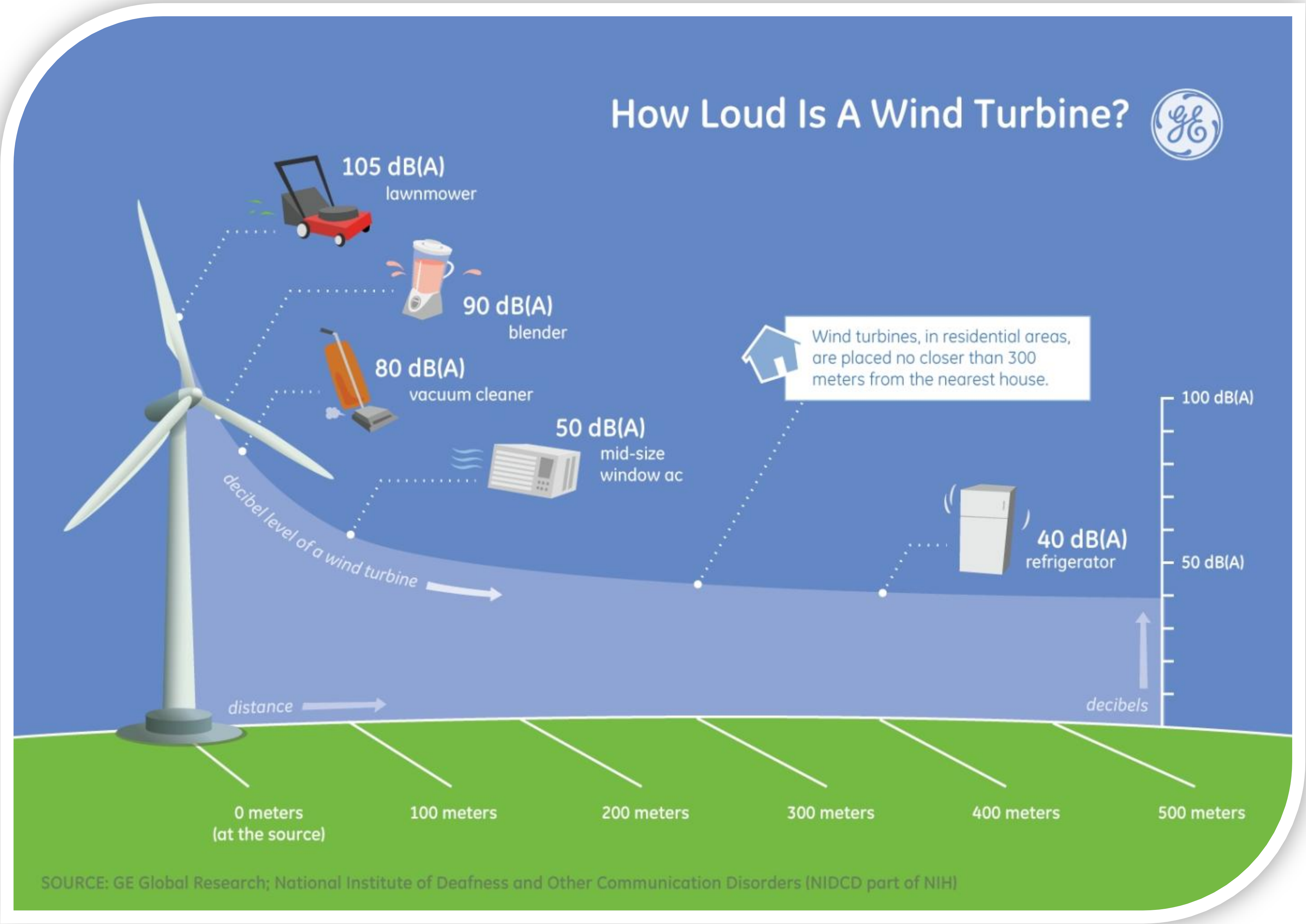


Figure 1: Decrease in audible noise generated from wind turbine with increasing distance from turbine.

Source: GE Global Research; National Institute of Deafness and Other Communication Disorders (NIDCD part of NIH)

13.2 Sensitivity Mapping

In the South African context national standards for typical ambient noise levels exists. Table 1 presents the maximum noise levels for residential and non-residential areas as prescribed by the South African National Standards (SANS) 10103:2008 - *The measurement and rating of environmental noise with respect to annoyance and to speech communication*. Most wind farm applications target rural residential areas where the ambient outdoor noise should not exceed 35 A-weighted decibels (dB(A)) at night and 45 dB(A) during the day, and industrial non-residential areas where the ambient noise should not exceed 60 dB(A) at night and 70 dB(A) during the day.

Table 1: Typical rating levels for noise in various types of districts.

Type of District	Equivalent Continuous Rating Level, LReq.T for Noise					
	Outdoors (dBA)			Indoors, with open windows (dBA)		
	Day-night	Daytime	Night-time	Day-night	Daytime	Night-time
Residential						
Rural Districts	45	45	35	35	35	25
Suburban districts with little road traffic	50	50	40	40	40	30
Urban districts	55	55	45	45	45	35
Non-Residential						
Urban districts with one or more of the following: Workshops, business premises. or main roads	60	60	50	50	50	40
Central business districts	65	65	55	55	55	45
Industrial districts	70	70	60	60	60	50

Source: Adapted from SANS 10103, The measurement and rating of environmental noise with respect to annoyance and to speech communication.

As stipulated in SANS 10328, the impact of noise generated by a wind farm on local receptors is assessed by determining whether the ambient noise level at a specific time (day time or night time) will exceed the typical rating levels of noise presented in Table 1. If the ambient noise level is expected to exceed the typical level at the receptor's location, it can be assumed that there will be an impact on that receptor. The intensity of a noise impact on a receptor is defined in SANS 10103 as per Table 2. Based on these impact ratings, and the expected noise levels illustrated in Figure 1, sensitivity buffers have been determined for implementation in the Renewable Energy Development Zones (REDZs) once adopted (see Table 3). Sensitivity maps were generated by applying these buffers to every roof (derived from the 2013 SPOT Building Count dataset) in each Focus Area (FA) (see Maps 1 to 8).

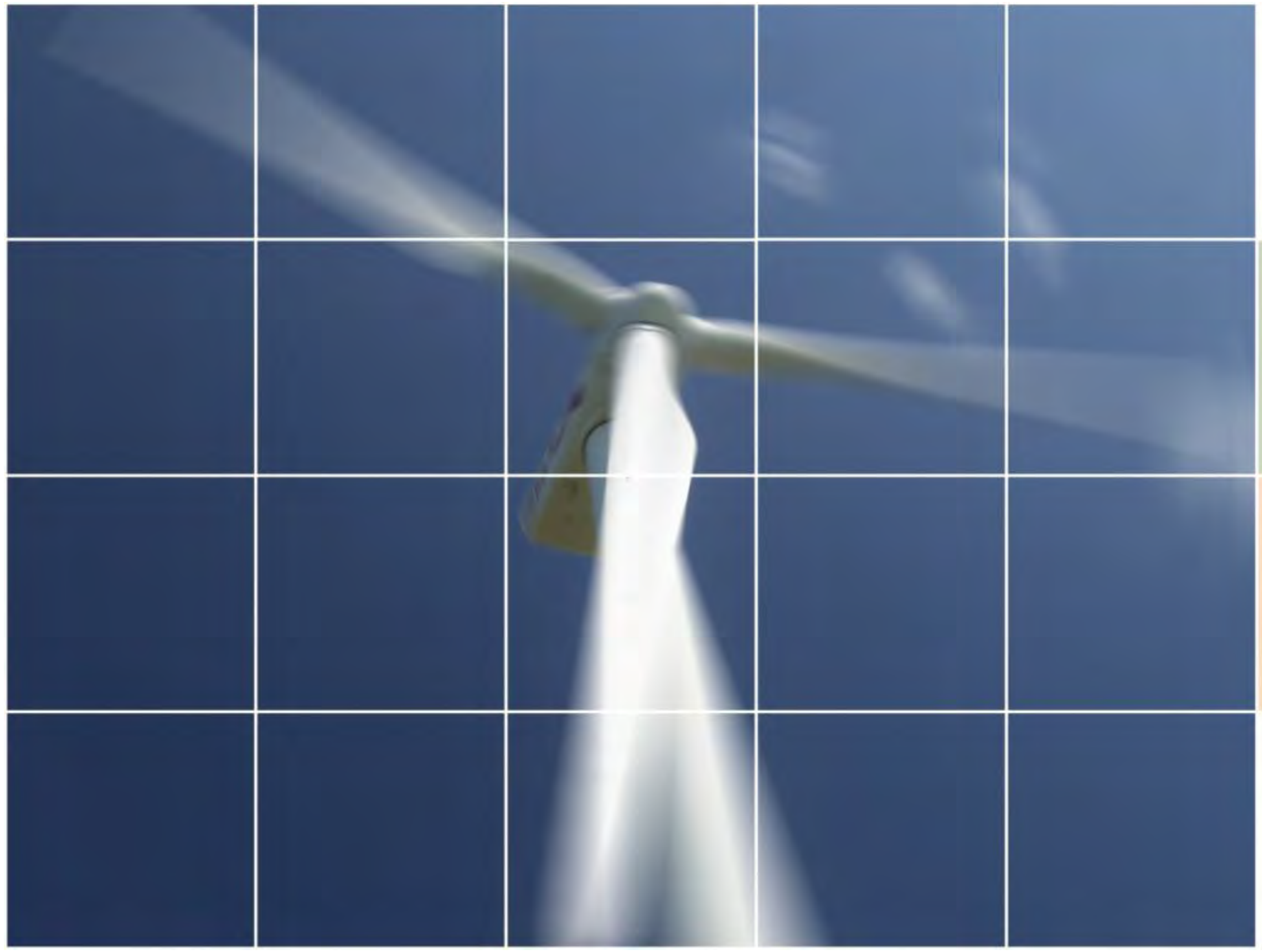


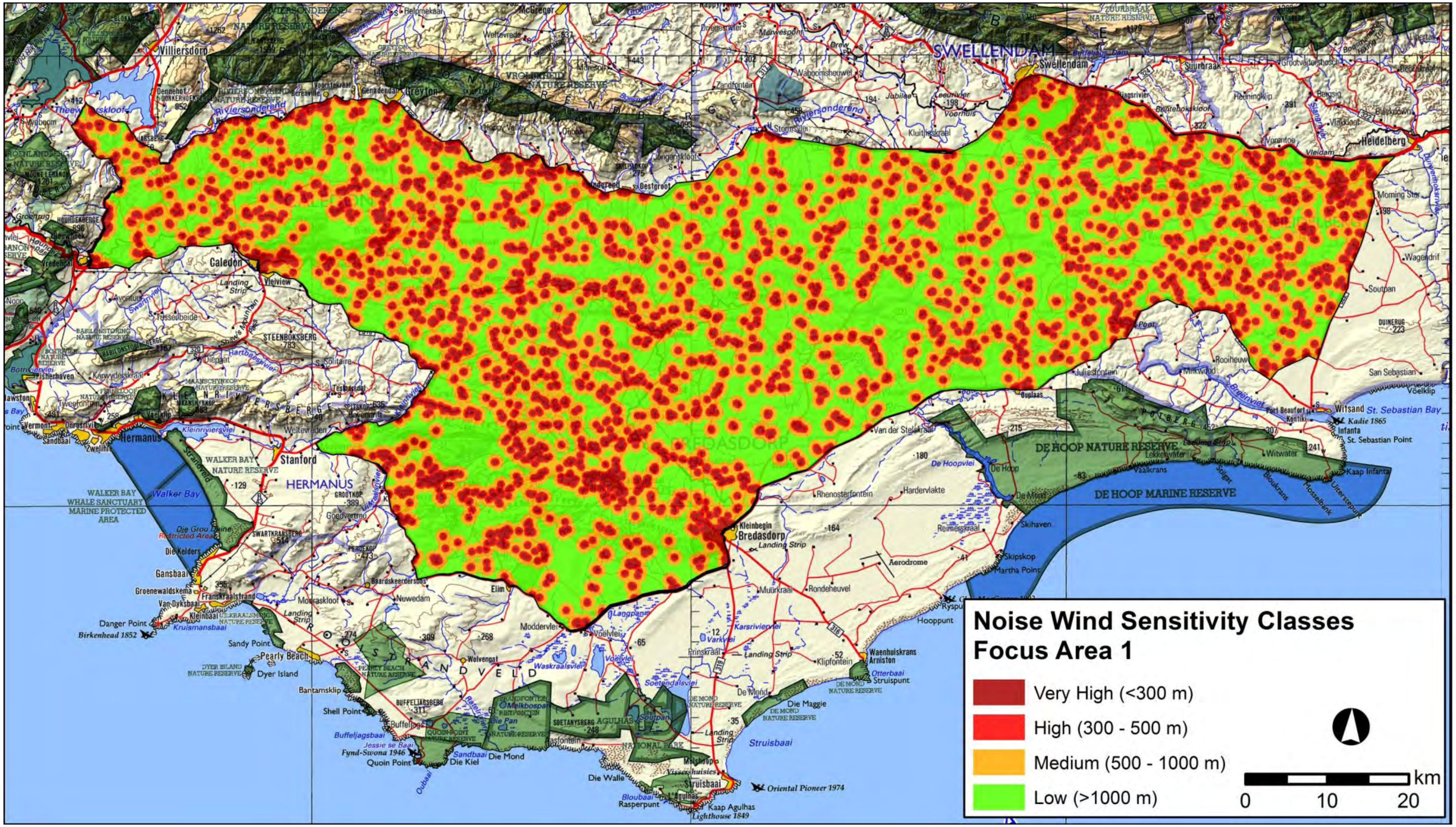
Table 2: Impact ratings for various increases in ambient noise levels.

Impact rating	Increase in ambient noise levels
None	Predicted noise does not exceed the typical rating level of noise
Low	Predicted noise exceeds the typical rating level of noise by 0 to 5 dBA
Medium	Predicted noise exceeds the typical rating level of noise by 5 to 10 dBA
High	Predicted noise exceeds the typical rating level of noise by more than 10 dBA

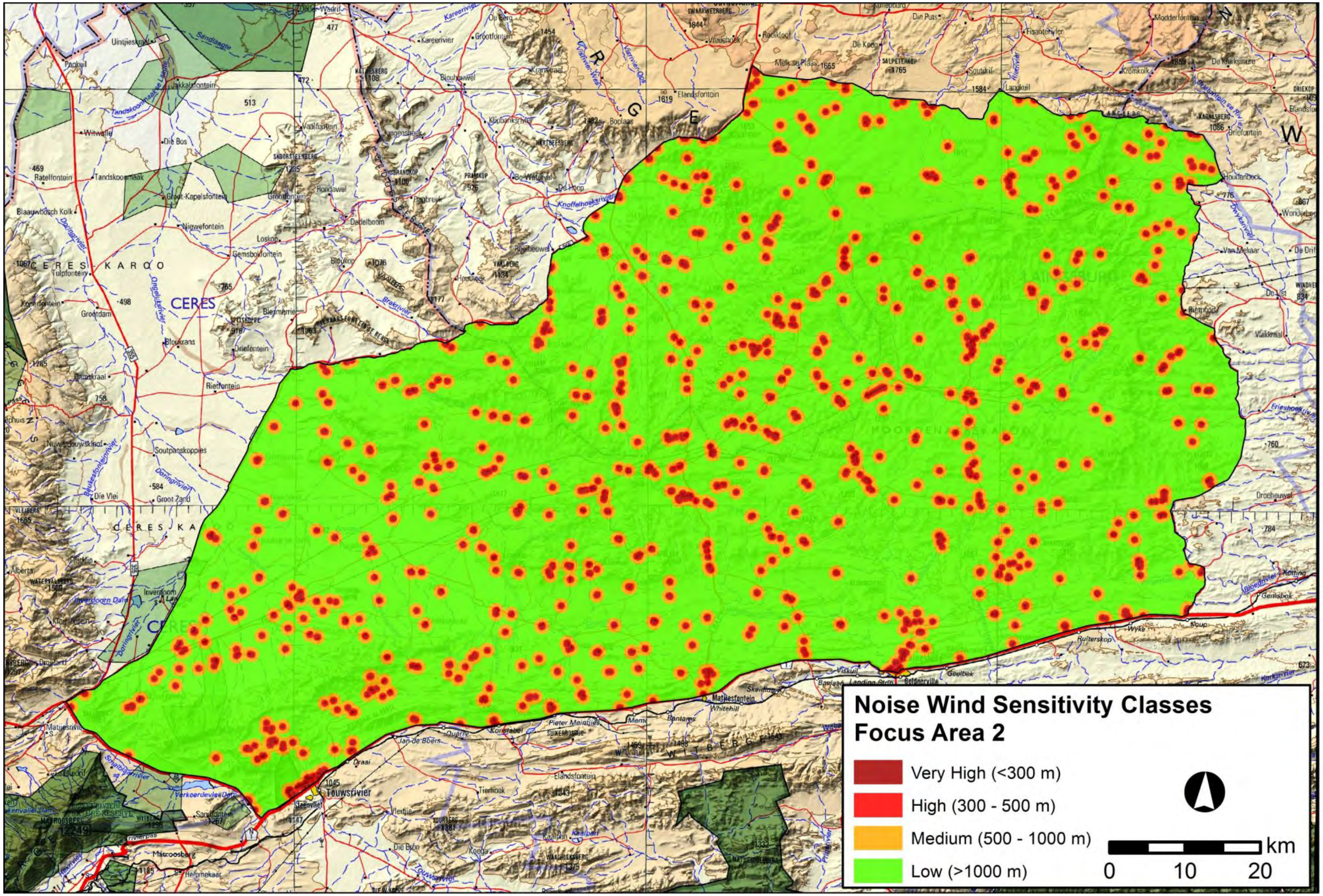
Source: Adapted from SANS 10103, The measurement and rating of environmental noise with respect to annoyance and to speech communication.

Table 3: Noise sensitivity criteria

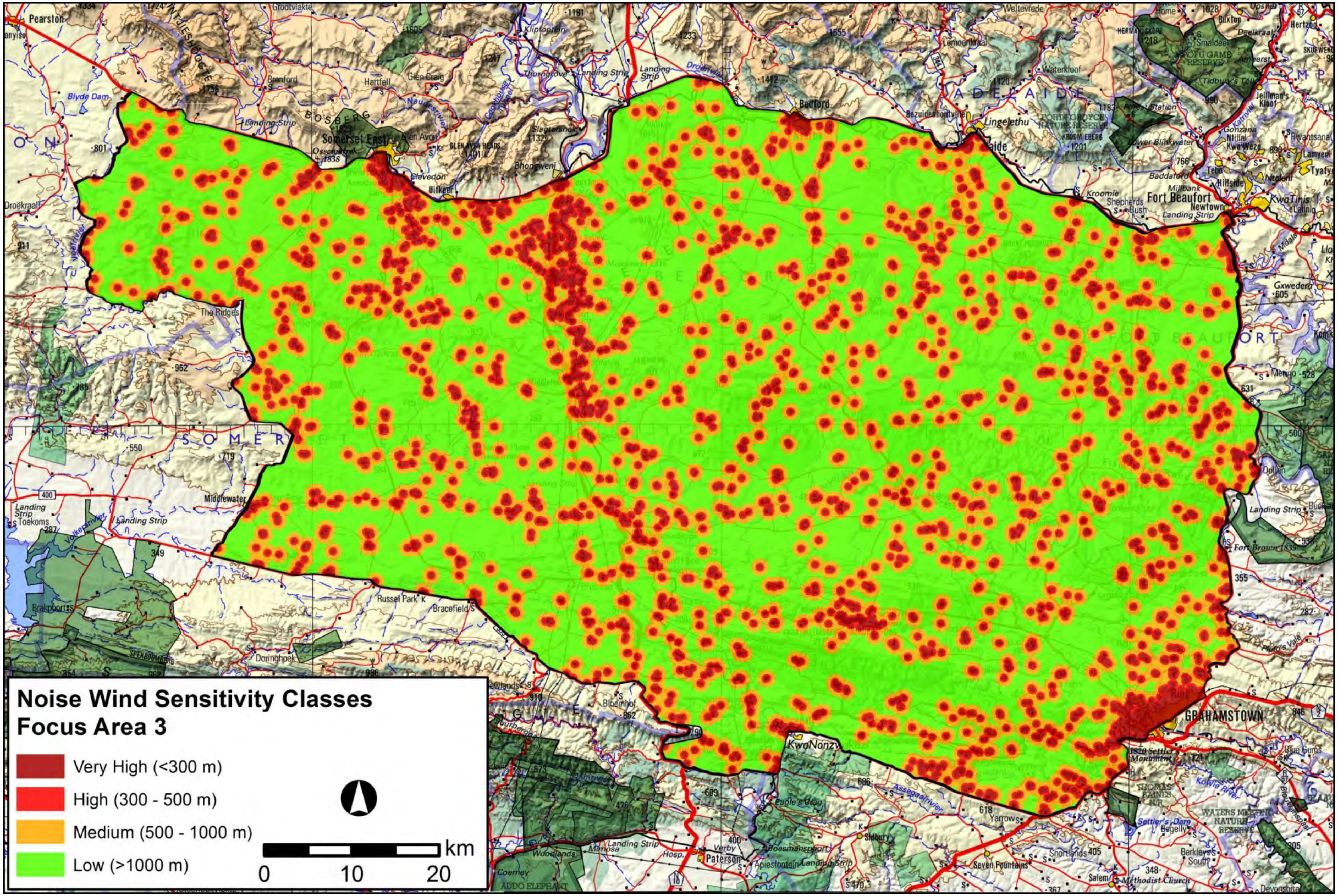
Sensitivity Feature	Data Source	Sensitivity Mapping Application for Wind
Potential temporarily or permanently inhabited residence	2013 SPOT Building Count	- **Very High Sensitivity** within 300 m of temporarily or permanently inhabited residence Considering the fact that most wind developments are likely to be situated in rural districts with some residences, and a typical outdoor ambient night time noise level of 35 dBA, and an expected noise level of 45 dBA or more resulting from a wind turbine within 300 m from the turbine, more than 10 dBA increase in ambient noise level within 300 m is defined by SANS 10103 as a high impact. - **High Sensitivity** between 300 and 500 m from temporarily or permanently inhabited residence Considering the fact that most wind developments are likely to be situated in rural districtswith some residences, and a typical outdoor ambient night time noise level of 35 dBA, and an expected noise level of between 45 and 40 dBA resulting from a wind turbine between 300 and 500 m from the turbine, the 5 to 10 dBA increase in ambient noise level is defined by SANS 10103 as a medium impact. - **Medium Sensitivity** between 500 and 1000 m from temporarily or permanently inhabited residence Considering the fact that most wind developments are likely to be situated in rural districts with some residences, and a typical outdoor ambient night time noise level of 35 dBA, and an expected noise level of between 35 and 40 dBA resulting from a wind turbine at between 500 and 1 000 m from the turbine, the 0 to 5 dBA increase in ambient noise level is defined by SANS 10103 as a low impact. - **Low Sensitivity** greater than 1000 m from temporarily or permanently inhabited residence Considering the fact that most wind developments are likely to be situated in rural districts with some residences, and a typical outdoor ambient night time noise level of 35 dBA, and an expected noise level of less than 35 dBA resulting from a wind turbine at more than 1 000 m from the turbine, there are likely to be no noise impacts.



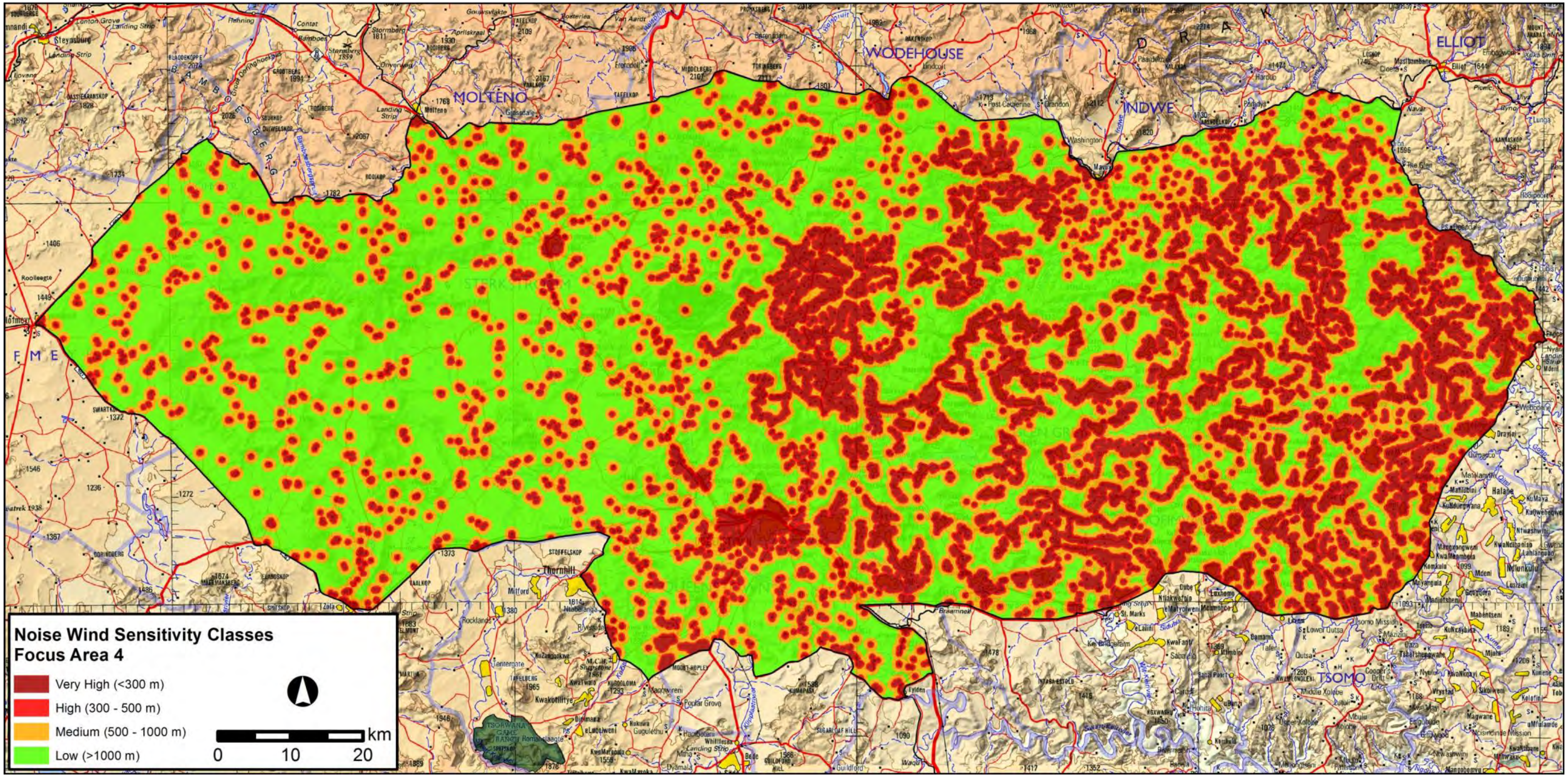
Map 1: Noise sensitivity for wind energy development in the Overberg focus area (FA 1)



Map 2: Noise sensitivity for wind energy development in the Komsberg focus area (FA 2)



Map 3: Noise sensitivity for wind energy development in the Cookhouse focus area (FA 3)



Map 4: Noise sensitivity for wind energy development in the Stormberg focus area (FA 4)

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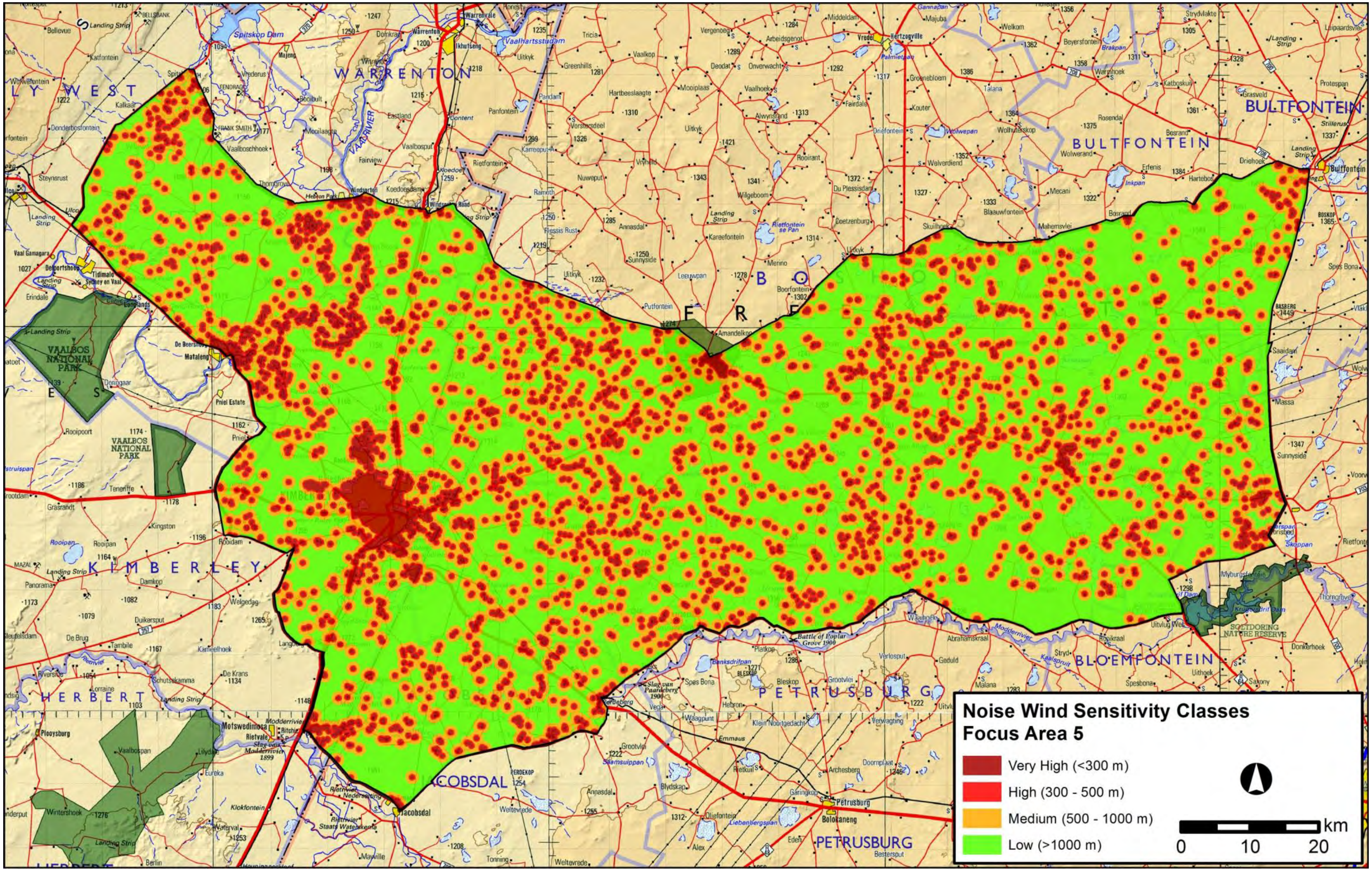
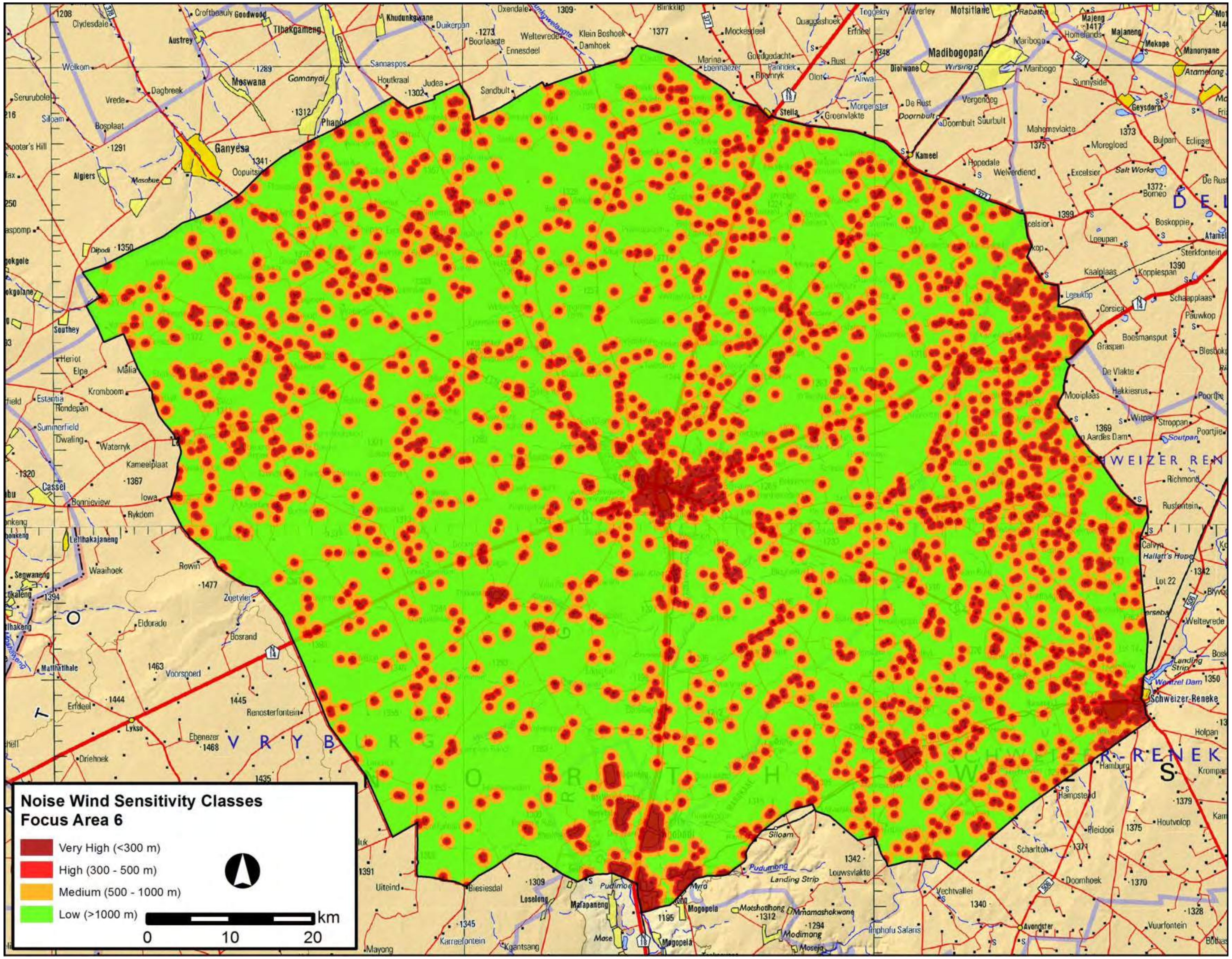
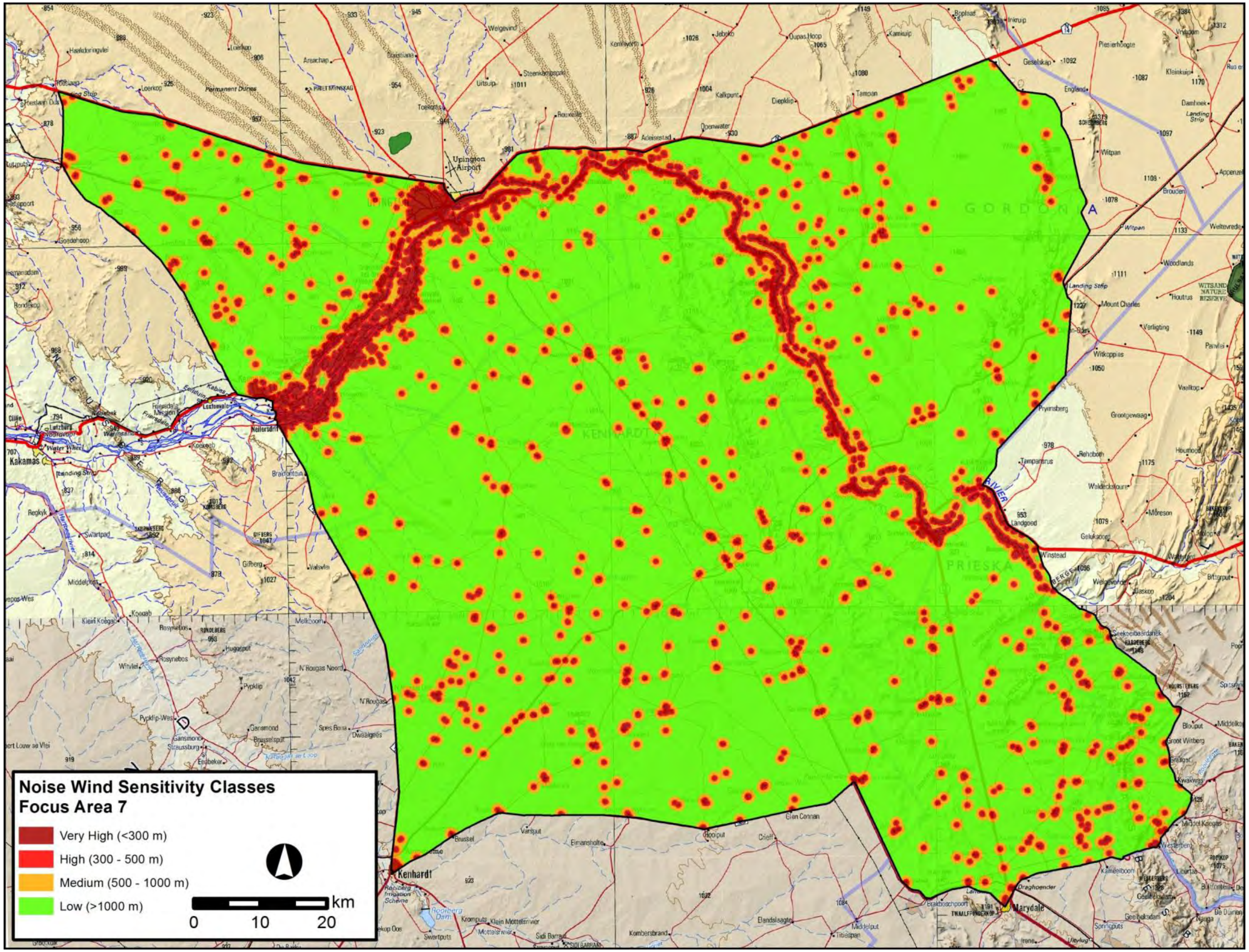


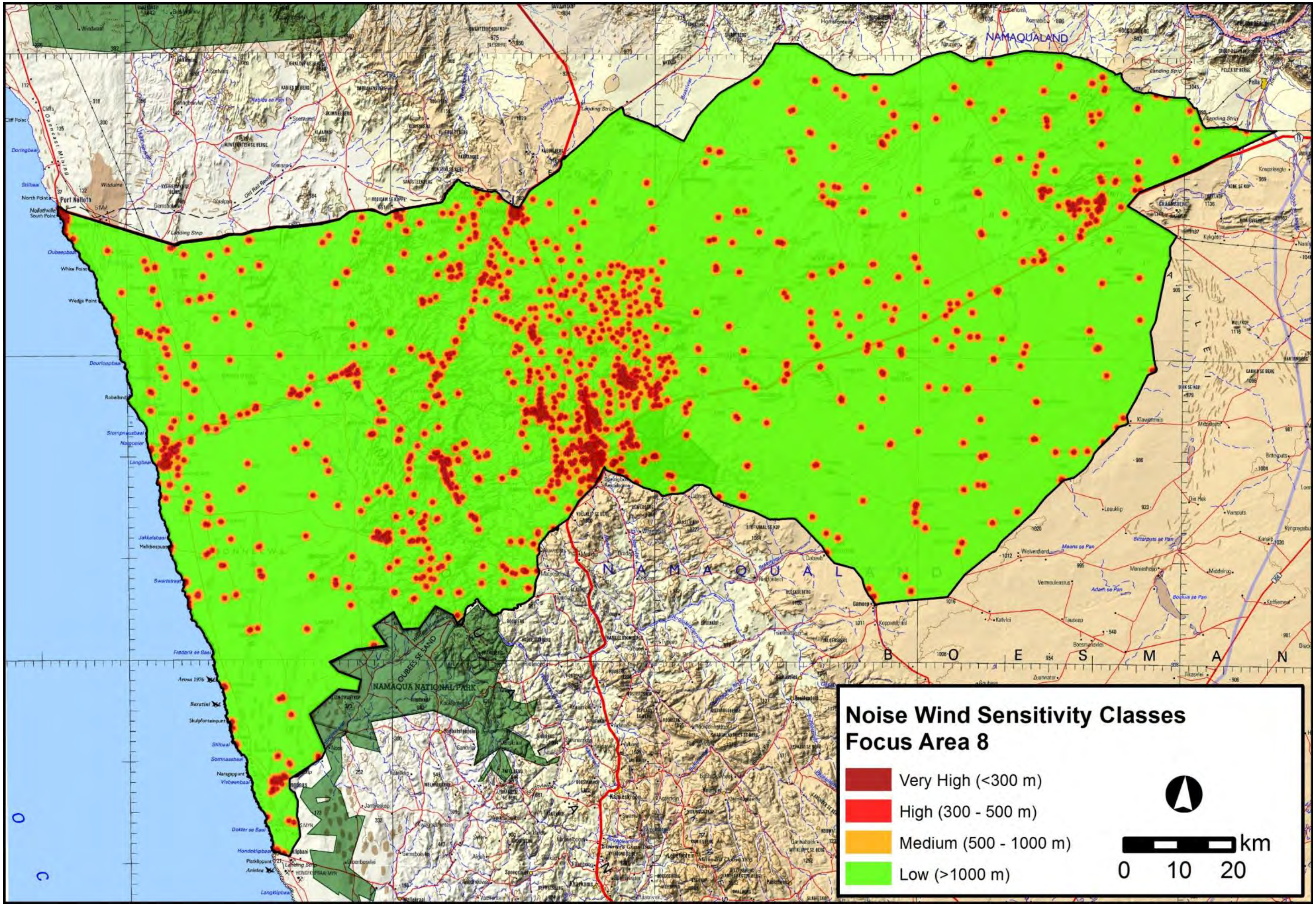
Map 5: Noise sensitivity for wind energy development in the Kimberley focus area (FA 5)



Map 6: Noise sensitivity for wind energy development in the Vryburg focus area (FA 6)



Map 7: Noise sensitivity for wind energy development in the Upington focus area (FA 7)



Map 8: Noise sensitivity for wind energy development in the Springbok focus area (FA 8)

13.3 Development Protocols

The main objective of this section is to clarify the different levels of sensitivity with respect to noise impacts potentially resulting from wind and solar PV developments and to prescribe relevant assessment requirements. Since solar PV is not considered to result in significant noise impacts, such developments do not require any assessment or authorisation in this regard. In Table 4, sensitivity classes for wind developments are interpreted and assessment requirements prescribed. These requirements are specific to sensitivity classes and are therefore related to the sensitivity maps in sub-Section 13.2. These requirements will be applicable to developments proposed both inside and outside the FAs once these areas have been adopted as REDZs.

Table 4: Interpretation of noise sensitivity maps and associated assessment requirements

Colour	Sensitivity	Interpretation of the sensitivity	Further assessment requirements	
			Wind	Solar PV
Dark red	Very High	High likelihood for significant negative impacts that cannot be mitigated.	Proponents intending to develop a wind facility that triggers an environmental assessment process in very high to medium sensitivity areas (i.e. within 1 km of a permanent or temporarily inhabited residence as a receptor) must prove to the relevant competent authority that the proposed development will not have an unacceptable negative impact on a receptor. In order to do so, a comprehensive Noise Impact Assessment undertaken by a competent noise specialist, and in accordance with the National Environmental Management Act (NEMA) regulations pertaining to specialist reports and impact assessment, is required. In addition to the NEMA requirements the report must include: • project footprint (including supporting infrastructure) with a 50 m buffered development envelope, overlaid on a sensitivity map prepared in accordance with the sensitivity criteria set out in this study; • clear and justified opinion statement by the specialist recommending whether the project should from a noise perspective receive approval. If this statement is subject to any conditions these must also be clearly stated; and • where required, proposed mitigation measures for inclusion in the Environmental Management Programme (EMPr).	No assessment or authorisation for solar PV development in terms of noise is required.
Red	High	High potential for negative impacts that can potentially be mitigated.		
Orange	Medium	Potential for negative impacts, and if there are impacts there is a high likelihood of mitigation.		
Green	Low	No expected impacts.	No assessment or authorisation for wind development in terms of noise impacts is required if the proposed development is further than 1 km from any temporarily or permanently inhabited residence.	

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FLICKER

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SECTION 14: FLICKER EFFECTS

14.1 Renewable Energy and Flicker Effects

Shadow flicker is a unique impact associated only with wind turbines, and not applicable to solar photovoltaic (PV) facilities. It is the flickering of light resulting from the passage of the rotating blades of a wind turbine between the sun and the observer. Flicker effects have been more of a problem in northern Europe with its high latitudes and low angle of the sun exacerbating the effect. The significance of this impact also depends on the frequency[1] at which it is experienced by a specific observer, and the duration of the effect which is dependent on the location of the observer relative to the turbine and the time of day and year. German best practice guidelines[2] recommend a maximum limit to flicker duration of less than 30 minutes per day for local permanent receptors, and a limit to total flicker time of less than 30 hours per year, assuming permanent clear sky. Other guidelines such as the Wisconsin Wind Siting Rules specify that mitigation is required when the flicker duration for a specific observer is anticipated to be more than 20 hours per year[3].

There is also potential for flicker effects to impact on ecological receptors. At this time international standards, and thus this section, can only deal with potential anthropogenic sensitivities to flicker effects.

[1] The frequency of shadow flicker is proportional to the rotational speed of the rotor times the number of blades (generally between 0.5 and 1.1 Hz for typical larger turbines).
[2] Hinweise zur Ermittlung und Beurteilung der optischen Immissionen von Windenergieanlagen, Länderausschuss für Immissionsschutz, (2002)
[3] Wisconsin Administrative Code Chapter PSC 128: Final wind siting rules (2010). Available online at: http://docs.legis.wisconsin.gov/code/admin_code/psc/128.pdf

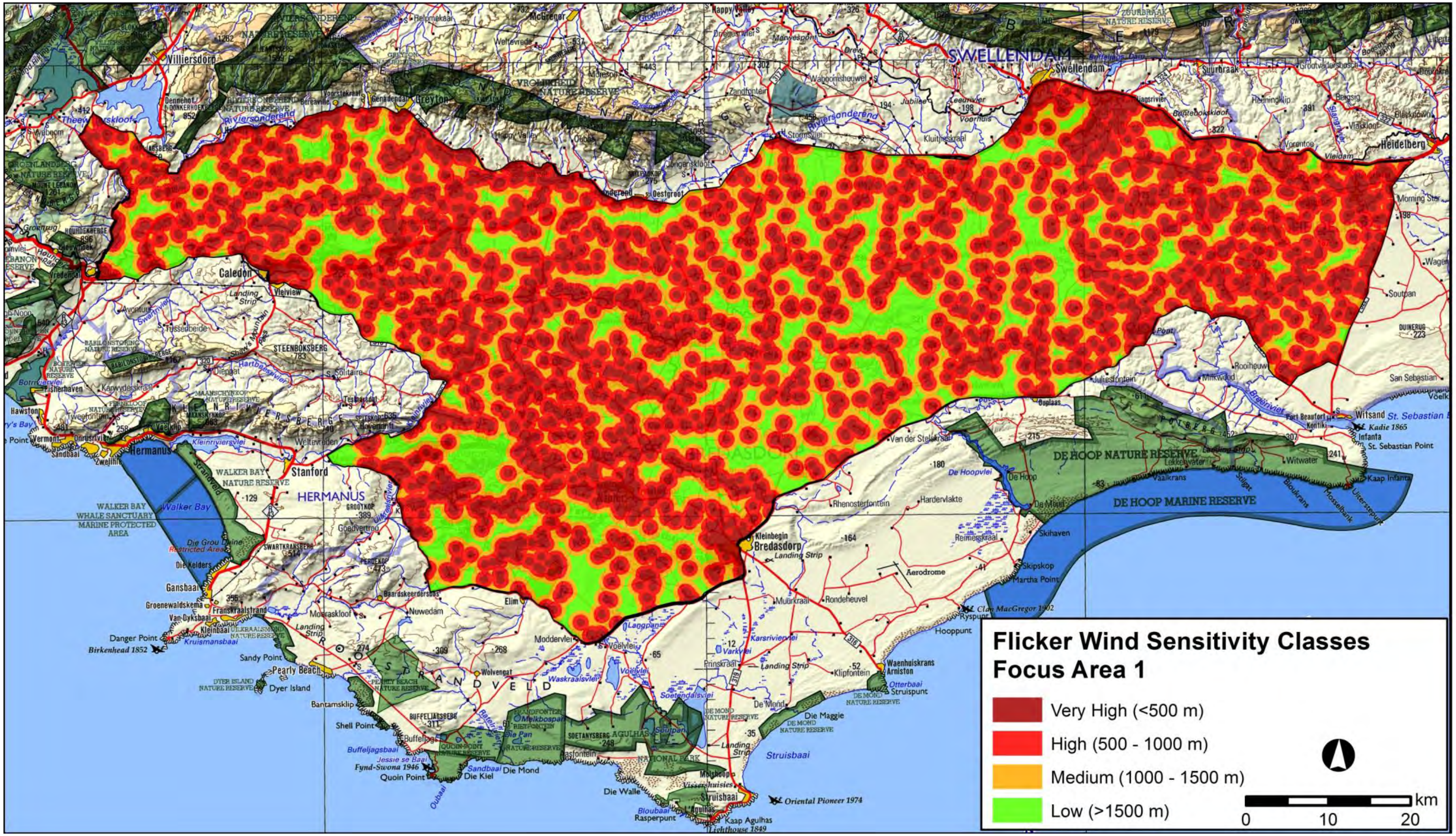
14.2 Sensitivity Mapping

According to a study undertaken by an independent expert panel in the United States of America (USA)[4], and based on a review of existing wind farms reporting shadow flicker observations, shadow flicker generally only occurs at distances less than 1400 m. In Europe it is widely accepted that flicker effects are unlikely to occur beyond 10 rotor blade diameters[5, 6 & 7] (i.e. approximately 1 km) from the turbine. It must be noted that this is a general distance and would be dependent on local topography and the specific dimensions of the turbine. Based on this information, sensitivity buffers have been determined for implementation in the Renewable Energy Development Zones (REDZs) once adopted (see Table 1). Sensitivity maps were generated by applying these buffers to every roof (derived from the 2013 SPOT Building Count dataset) in each FA (see Maps 1 to 8).

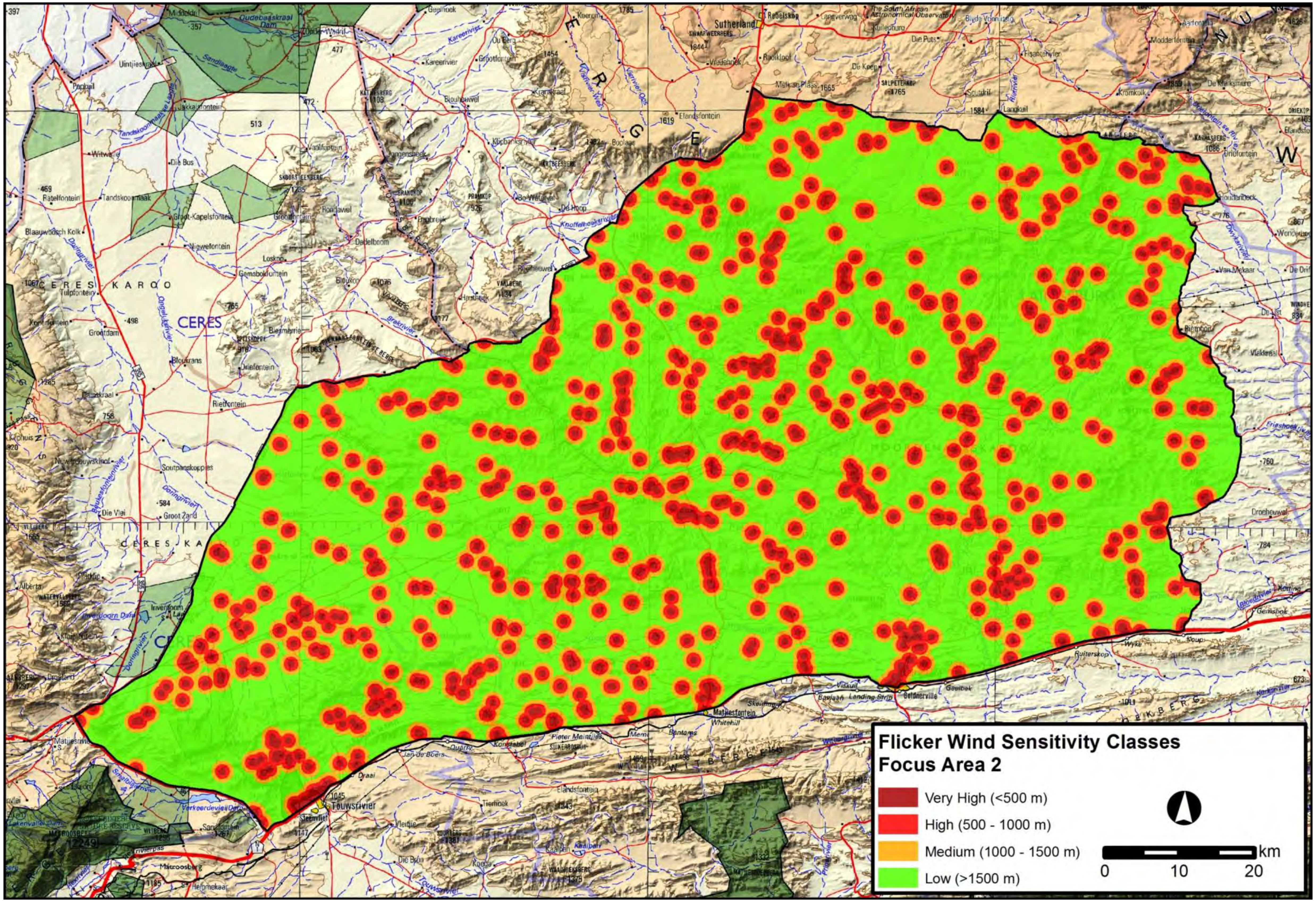
Table 1: Flicker effect sensitivity criteria

Sensitivity Feature	Data Source	Sensitivity Mapping Application for Wind
Potential temporarily or permanently inhabited residence	2013 SPOT Building Count	**- Very High Sensitivity** within 500 m of temporarily or permanently inhabited residence **- High Sensitivity** between 500 and 1000 m from temporarily or permanently inhabited residence **- Medium Sensitivity** between 1000 and 1500 m from temporarily or permanently inhabited residence **- Low Sensitivity** greater than 1500 m from temporarily or permanently inhabited residence

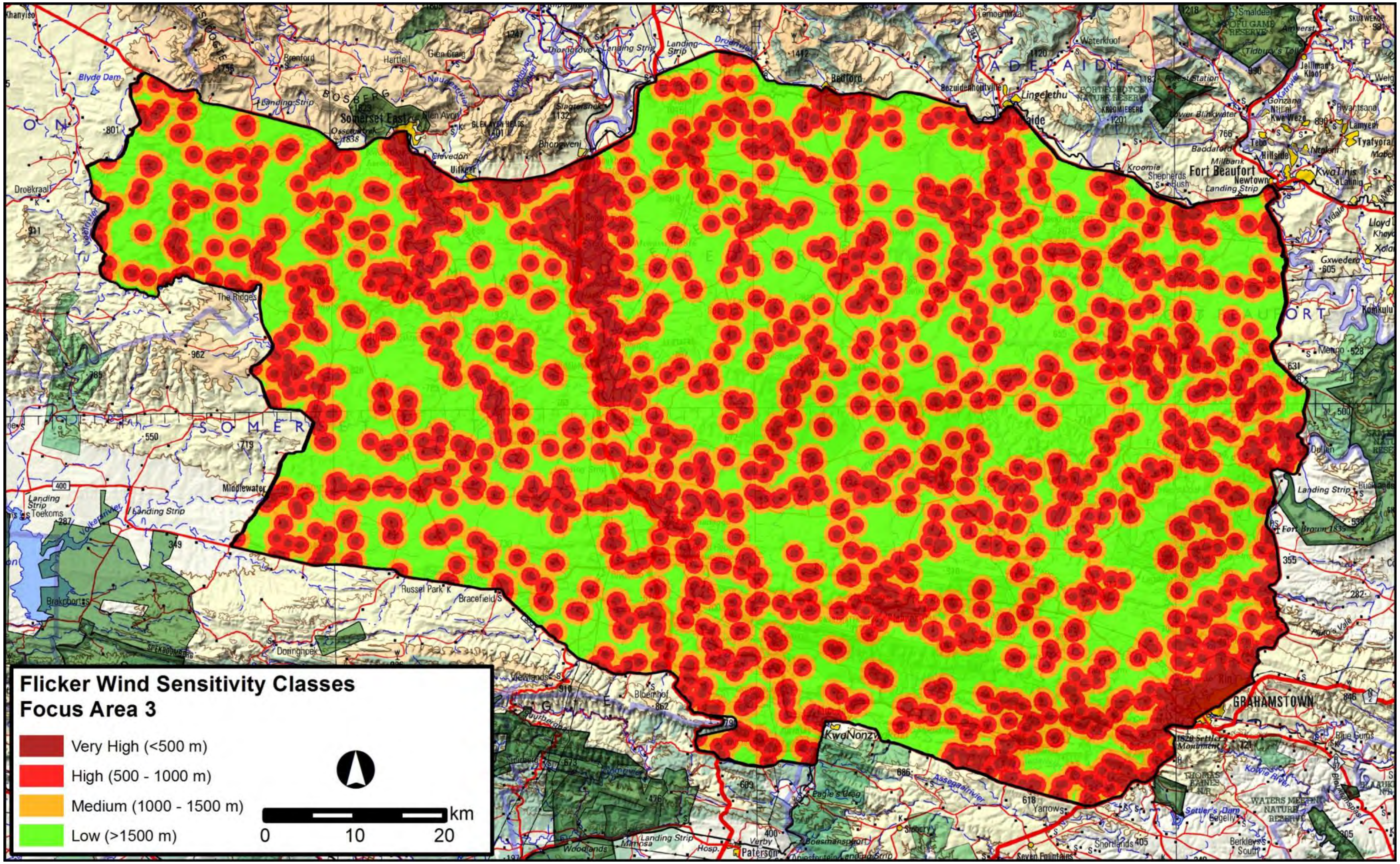
[4] Ellenbogen, J.M., Grace, S., Heiger-Bernays, W.J., Manwell, J.F., Mills, D.A., Sullivan, K.A. and Weisskopf, M.G. (2012). Wind Turbine Health Impact Study: Report of Independent Expert Panel. Prepared for Massachusetts Department of Environmental Protection and Massachusetts Department of Public Health. Available online at: http://www.mass.gov/eea/docs/dep/energy/wind/turbine-impact-study.pdf
[5] Update of UK Shadow Flicker Evidence Base. Prepared by Parsons Brinkerhoff for the Department of Energy and Climate Change. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/48052/1416-update-uk-shadow-flicker-evidence-base.pdf
[6] Burton, T., Sharpe, D., Jenkins, N. and Bossanyi, E. (2001). Wind Energy Handbook. West Sussex, England: John Wiley & Sons
[7] Scottish Planning Policy: Onshore Wind Turbines (2013).



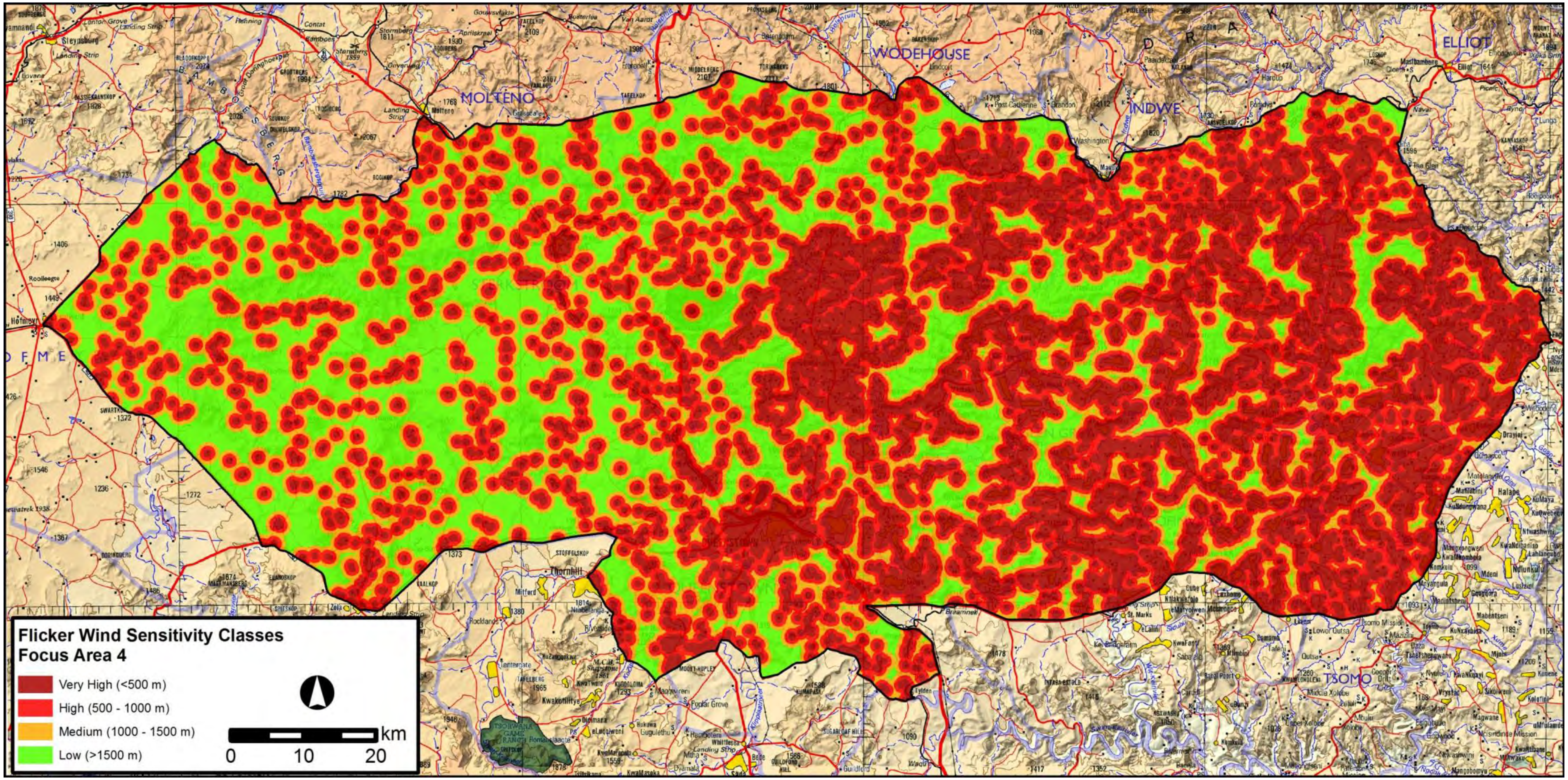
Map 1: Flicker sensitivity for wind energy development in the Overberg focus area (FA 1)



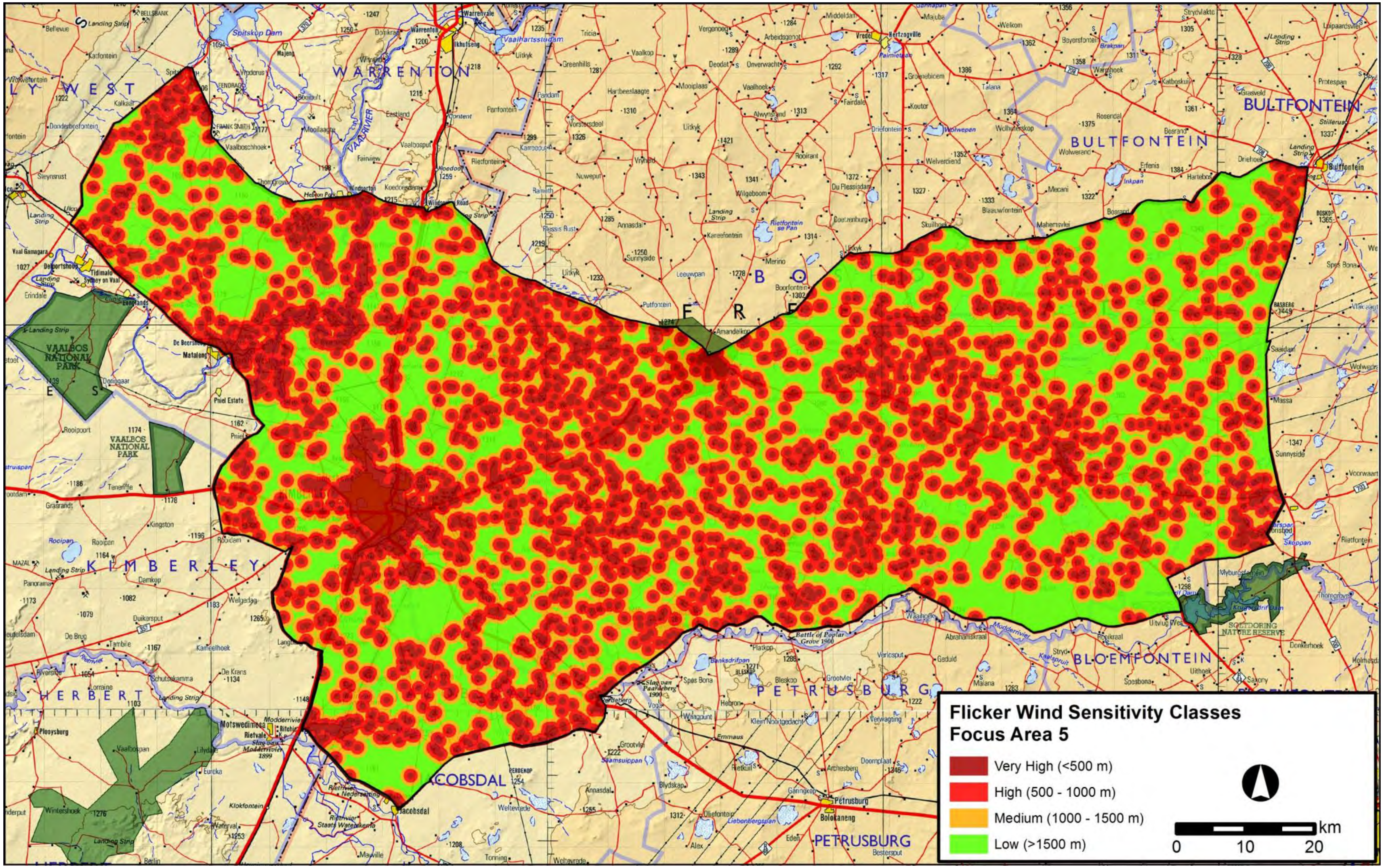
Map 2: Flicker sensitivity for wind energy development in the Komsberg focus area (FA 2)



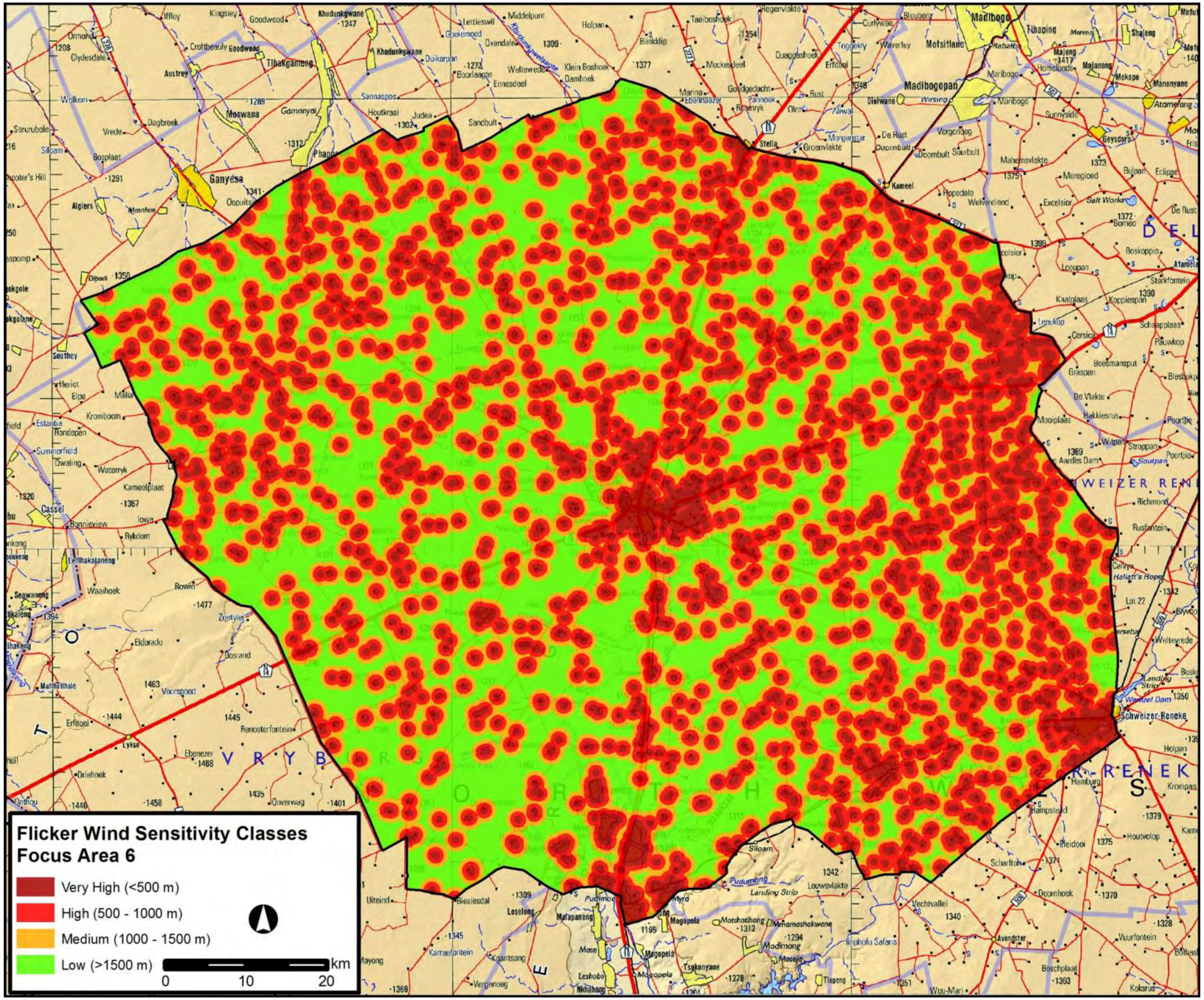
Map 3: Flicker sensitivity for wind energy development in the Cookhouse focus area (FA 3)



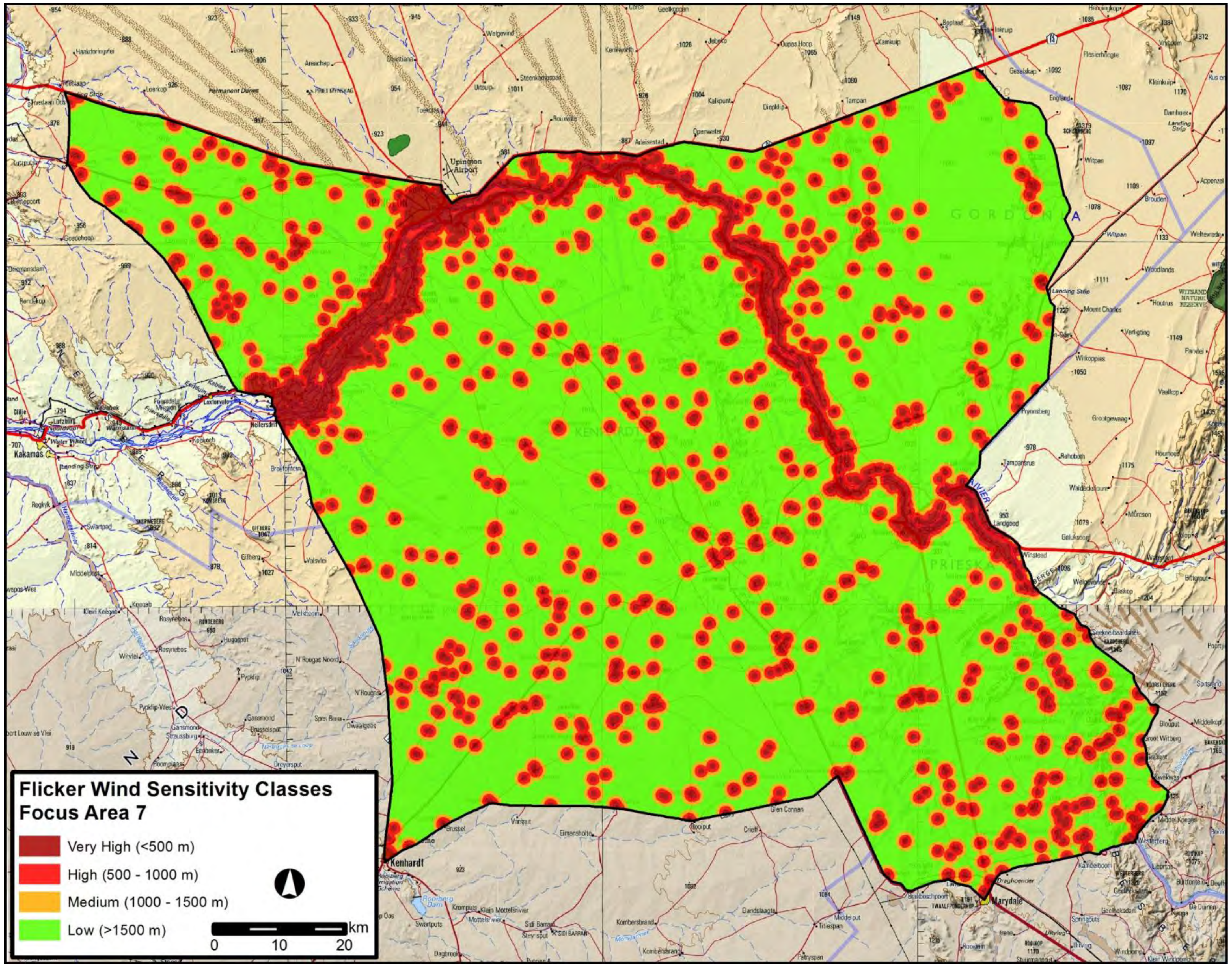
Map 4: Flicker sensitivity for wind energy development in the Stormberg focus area (FA 4)



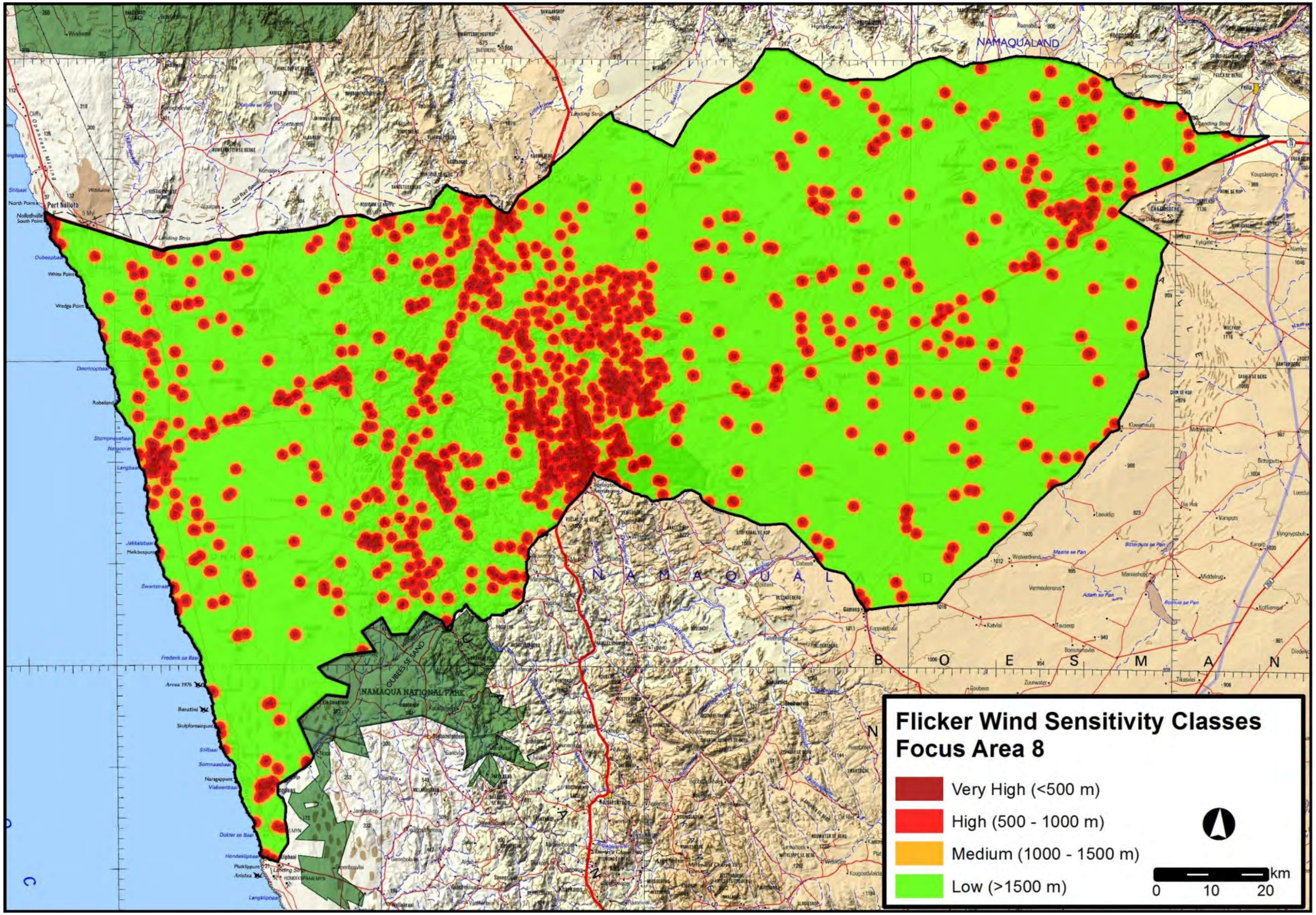
Map 5: Flicker sensitivity for wind energy development in the Kimberley focus area (FA 5)



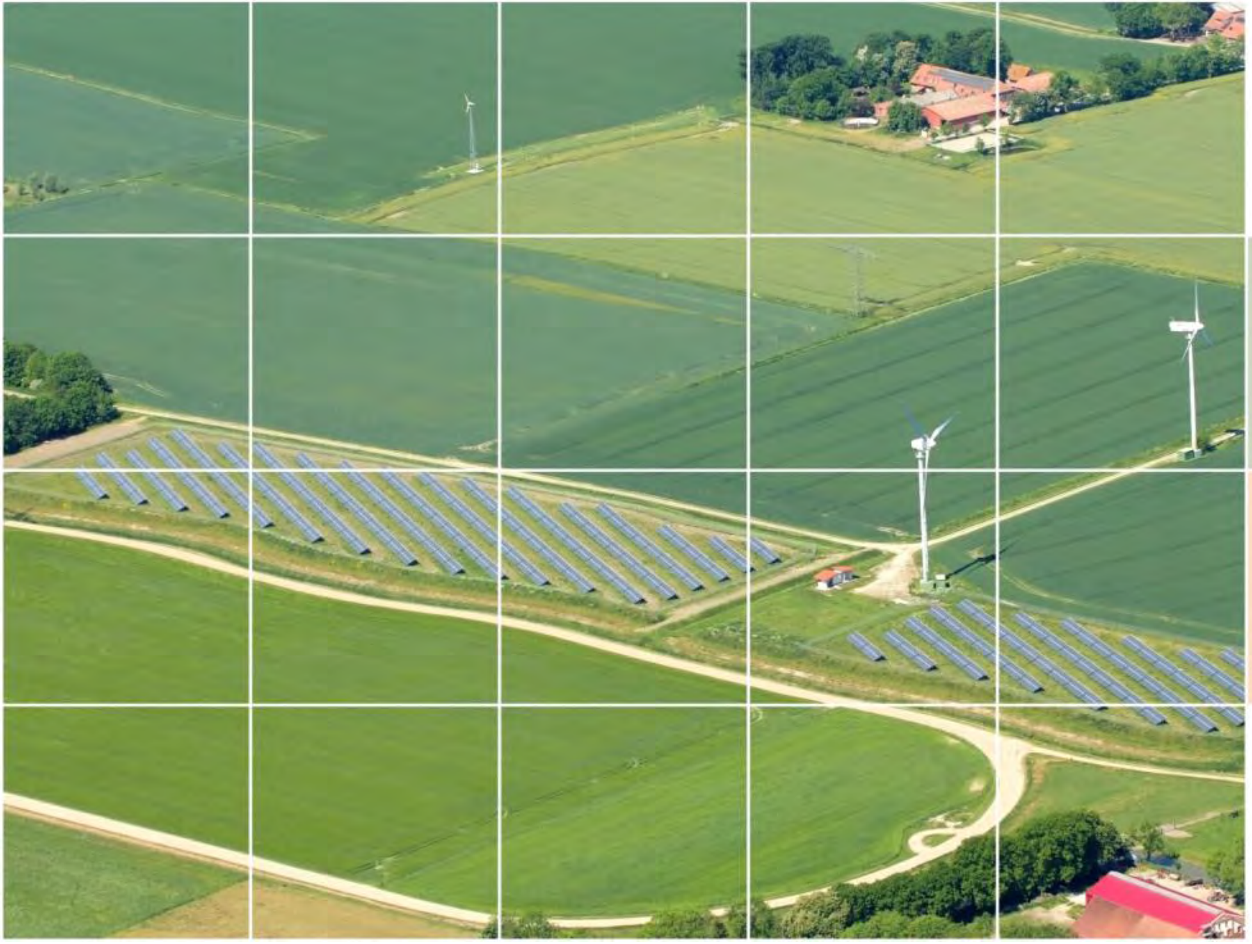
Map 6: Flicker sensitivity for wind energy development in the Vryburg focus area (FA 6)



Map 7: Flicker sensitivity for wind energy development in the Upington focus area (FA 7)



Map 8: Flicker sensitivity for wind energy development in the Springbok focus area (FA 8)



14.3 Development Protocols

The main objective of this section is to clarify the different levels of sensitivity with respect to flicker impacts potentially resulting from wind and solar PV developments, and prescribe relevant assessment requirements. Since solar PV does not result in any flicker impacts, such developments do not require any assessment or authorisation in this regard. In Table 2 sensitivity classes for wind developments are interpreted and assessment requirements prescribed. These requirements are specific to sensitivity classes and are therefore related to the sensitivity maps in sub-Section 14.2. These requirements will be applicable to developments proposed both inside and outside the FAs once these areas have been adopted as REDZs.

Table 2: Interpretation of flicker sensitivity maps and associated assessment requirements

Colour	Sensitivity	Interpretation of the sensitivity	Further assessment requirements	
			Wind	Solar PV
Dark red	Very High	High likelihood for significant negative impacts that cannot be mitigated.	Proponents intending to develop a wind facility that triggers an environmental assessment process in very high to medium sensitivity areas (i.e. within 1.5 km of a permanent or temporarily inhabited residence as a receptor) must prove to the relevant competent authority that the proposed development will not have an unacceptable negative impact on a receptor. In order to do so, a comprehensive Flicker Impact Assessment undertaken by a competent flicker specialist and in accordance with the NEMA regulations pertaining to specialist reports and impact assessment is required. Proposed developments anticipated to result in more than 20 hours of flicker duration per year on any permanent or temporarily inhabited residence will require mitigation. In addition to the NEMA requirements the report must include: • project footprint (including supporting infrastructure) with a 50 m buffered development envelope, overlaid on a sensitivity map prepared in accordance with the sensitivity criteria set out in this study; • clear and justified opinion statement by the specialist recommending whether the project should from a flicker perspective receive approval. If this statement is subject to any conditions these must also be clearly stated; and • where required, proposed mitigation measures for inclusion in the Environmental Management Programme (EMPr).	No assessment or authorisation for solar PV development in terms of flicker is required.
Red	High	High potential for negative impacts that potentially can be mitigated.		
Orange	Medium	Potential for negative impacts, and if there are impacts there is a high likelihood of mitigation.		
Green	Low	No expected impacts.	No assessment or authorisation for wind development in terms of flicker impacts is required if the proposed development is further than 1.5 km from any temporarily or permanently inhabited residence.	

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SECTION 15

SOCIO-ECONOMICS

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PART 3. SCOPING ASSESSMENTS AND DEVELOPMENT PROTOCOLS

SECTION 15: SOCIO-ECONOMIC BASELINE

The following section is informed by the scoping level socio-economic specialist pre-assessment of the eight Focus Areas (FAs) for which the complete report is provided as Appendix A7. Due to the integrated and strategic nature of this strategic environmental assessment (SEA), and based on consultation with relevant government departments and wider stakeholders, the final views presented in this section differ from those contained in the specialist report.

15.1 Renewable Energy and Socio-Economics

The establishment of renewable energy projects influences the well-being of local communities as well as the structure and dynamics of the related economies. The spatial extent, duration and magnitude of the key positive and negative socio-economic impacts resulting from the development of wind and solar photovoltaic (PV) facilities presented in Table 1 below depend on the project phase (i.e. construction, operation, decommissioning), socio-economic environment, and to a lesser degree, technology type. Due to the nature of the technologies the temporary positive and negative impacts observed during construction are more significant than the longer term impacts observed during the operational phase. The positive impacts that ensue during the operational phase are more sustainable but of a lower magnitude than those observed during the construction phase (see Table 1).

Table 1: Key potential positive and negative socio-economic impacts resulting from the development of wind and solar PV facilities

	Impact	Description
Positive Impacts	Improved energy security	The country in general and all users of electricity can benefit from improved energy security and the increased efficiency of the national electrical grid resulting from renewable energy development.
	Economic growth	Local and national economies can benefit from investment into renewable energy development and operational expenditure. This benefit is pronounced during the construction phase of projects.
	Job creation	Temporary and permanent employment opportunities can be created directly or indirectly in various local and national economic sectors as a result of renewable energy development. Although the creation of direct temporary jobs is particularly pronounced during the construction phase, a number of direct and indirect permanent jobs are likely to be created during the operational phase. Temporary construction jobs potentially can be sustained through continuous and phased development of renewable energy projects in a specific geographical area.
	Skills development	Skills development in the local economy may result from employing and training an unskilled local labour force. At a national level the introduction of new technologies and facilitation of international knowledge transfer can also contribute to higher level skills development. Skills development at a local level is particularly pronounced during the construction phase of renewable energy projects.
	Improved living standards	At a local and, to a lesser degree, national economic level the standard of living can be improved for those households that are either directly or indirectly benefiting from reduced environmental impacts resulting from electricity generation, energy security, job creation, skills development, and economic growth associated with the development of renewable energy.
	Increased government revenue	Local, provincial and national governments can directly and/or indirectly benefit from several streams of revenue (including taxes) resulting from renewable energy projects.
	Local community investment	Local communities can derive direct benefits from the Socio-Economic Development (SED) and Enterprise Development (ED) initiatives to which renewable energy projects commit to fund social development, social infrastructure, creation of new businesses, and growing the local economy. Income derived by local shareholders and land owners will further contribute to local community investment and growth.
	Improved economic value derived from land as a production factor	The economic value of renewable energy development as a land-use is generally significantly greater than non-commercial land uses, especially in un-productive and marginal land such as non-arable or degraded agricultural land.
	Increased property values	The increased revenue from renewable energy development can increase the value of the land it is sited on, while the property value in the surroundings might also increase due to regional economic growth and the increased demand for land.
Negative Impacts	**Impact**	**Description**
	Deterioration of living and working conditions	Living and working conditions of the local community can deteriorate due to environmental impacts associated with renewable energy development, such as an altered sense of place which can negatively impact residents as well as visitors to the area.
	Economic losses	The loss of land and negative environmental impacts such as a change in the sense of place that are associated with renewable energy development can negatively impact on economic returns from agricultural and tourism activities.
	Job losses	The negative impact on economic returns of activities such as agriculture and tourism can result in job losses.
	Demographical changes	An influx of migrant workers and job seekers can change the demographics of the area and trigger an increase in social pathologies such as health issues, crime, prostitution, xenophobia and others.
	Added pressure on basic services and infrastructure	Renewable energy development can result in added pressures on local infrastructure and basic services. Road infrastructure takes particular strain during the construction phase, while policing, healthcare and educational services can also come under additional pressure.
	Decreased property values	Renewable energy development can result in the decrease in value of surrounding properties used for activities that can be negatively impacted by the development due to, for instance, an altered sense of place (e.g. tourism and game farming).

15.2 Socio-economic characteristics of the Focus Areas

The following section provides the key socio-economic characteristics of the eight FAs to be considered when wind and solar PV developments are proposed in these areas. The most sensitive receptors or beneficiaries in the FAs that could be affected by renewable energy development include:

- The local economy, and specifically the current economic base with its ability to provide employment opportunities for the local labour force;
- The existing labour force and its ability to satisfy the potential demand for skills and labour;
- Existing land uses and associated commercial activities that potentially could be affected either due to the sterilisation of land or environmental impacts; and
- Local communities that may experience a change in the demographics and an increase in social pathologies due to an influx of migrant workers and job seekers, as well as deterioration of living and working conditions.

In all the FAs it is important that the need for a well-planned strategy for a possible increase in the local population (specifically in and around existing settlements and towns) be emphasized to the local authorities. Such a strategy must include provisions for accommodation, social services and basic services to ensure that current standards are retained as a minimum.

In addition to the above, particular attention must be given to areas of high touristic value that directly or indirectly generate revenue from the local tourism industry (in particular game farming and commercial hunting) and precautionary measures should be implemented during the project design to avoid any unacceptable negative impacts affecting the income from these activities.

15.2.1 Overberg Focus Area 1

The Overberg FA is located in the southern region of the Western Cape Province and is characterised by relatively low population densities with the Overstrand and Theewaterskoof Local Municipalities (LMs) having the highest population densities. In 2011 there were approximately 20 309 households and 70 806 people living in this FA. In terms of employment, the labour force of the Overberg FA consisted of 28 558 people in 2011, of whom about 16.3 % were unemployed. All LMs included in the FA currently rely on agriculture as the main economic sector, despite the number of job losses in this sector totalling 12 059, or 49.5 %, between 2005 and 2011. The diversification of economic development in the area has recently become a priority for several LMs with a focus on the tertiary sector which has created 1 968 new employment opportunities between 2005 and 2011. The biggest contributor to the local economy in 2011 was the "finance and business services" sector which created much of the growth in employment opportunities, particularly in the Theewaterskloof and the Overstrand LMs.

The District Municipalities (DMs) and LMs included in FA 1, with their seats, are listed in Table 2 and illustrated in Map 1.

Table 2: Local and district municipalities with their seats in the Overberg Focus Area (FA 1)

Local Municipalities (and number on map)	Local Municipalities' Seat	District Municipalities	District Municipalities' Seat
1: Theewaterskloof	Caledon	Overberg	Bredasdorp
2: Swellendam	Swellendam	Overberg	Bredasdorp
3: Hessequa	Riversdale	Eden	George
4: Cape Agulhas	Bredasdorp	Overberg	Bredasdorp
5: Overstrand	Hermanus	Overberg	Bredasdorp

The priorities of the local municipalities in the Overberg FA are aligned with those of provincial and national policies. These priorities include the adoption of a low carbon economy and the encouragement of alternative and resource-efficient forms of energy generation. They aim to accomplish this by stimulating and subsidising innovation in clean and renewable technologies. It should, however, be noted that these LMs are encountering bottlenecks with respect to transport, infrastructure and basic services, including:

- Insufficient infrastructure development;
- Inadequate basic service delivery (including provision of water, public transport, etc.);
- Housing needs and spatial imbalances;
- Need for higher order roads and access routes; and
- Potential issues with electricity availability and connectivity.

Existing local spatial plans identify tourism corridors between Napier, Bredasdorp and Elim which overlap with the FA. The area surrounding the Breede River crossing in the eastern part of the FA (Malgas) has also been identified for conservation and tourism purposes. The local governments in the FA support eco-tourism development which will protect the natural environment and landscape while also developing infrastructure in support of tourism. This is particularly applicable to the Overstrand LM which covers a small part of the FA to the south-west and has the fastest growing economy in the region.

The Cape Agulhas LM, which covers the largest part of the FA, has adopted renewable energy as one of the most prominent sectors to be developed, while similar initiatives have been launched in the Hessequa and Theewaterskloof municipalities. Even though renewable energy development is generally supported by the local municipalities in this FA, the limited availability of infrastructure and services poses a potential obstacle that requires addressing. With only the main towns being connected by regional roads, some areas within the FA are particularly hard to reach. It was proposed in the Overberg SDF that a road/rail corridor be established from Bredasdorp to Cape Town, via Caledon, which would cut across the FA from south-east to north-west.

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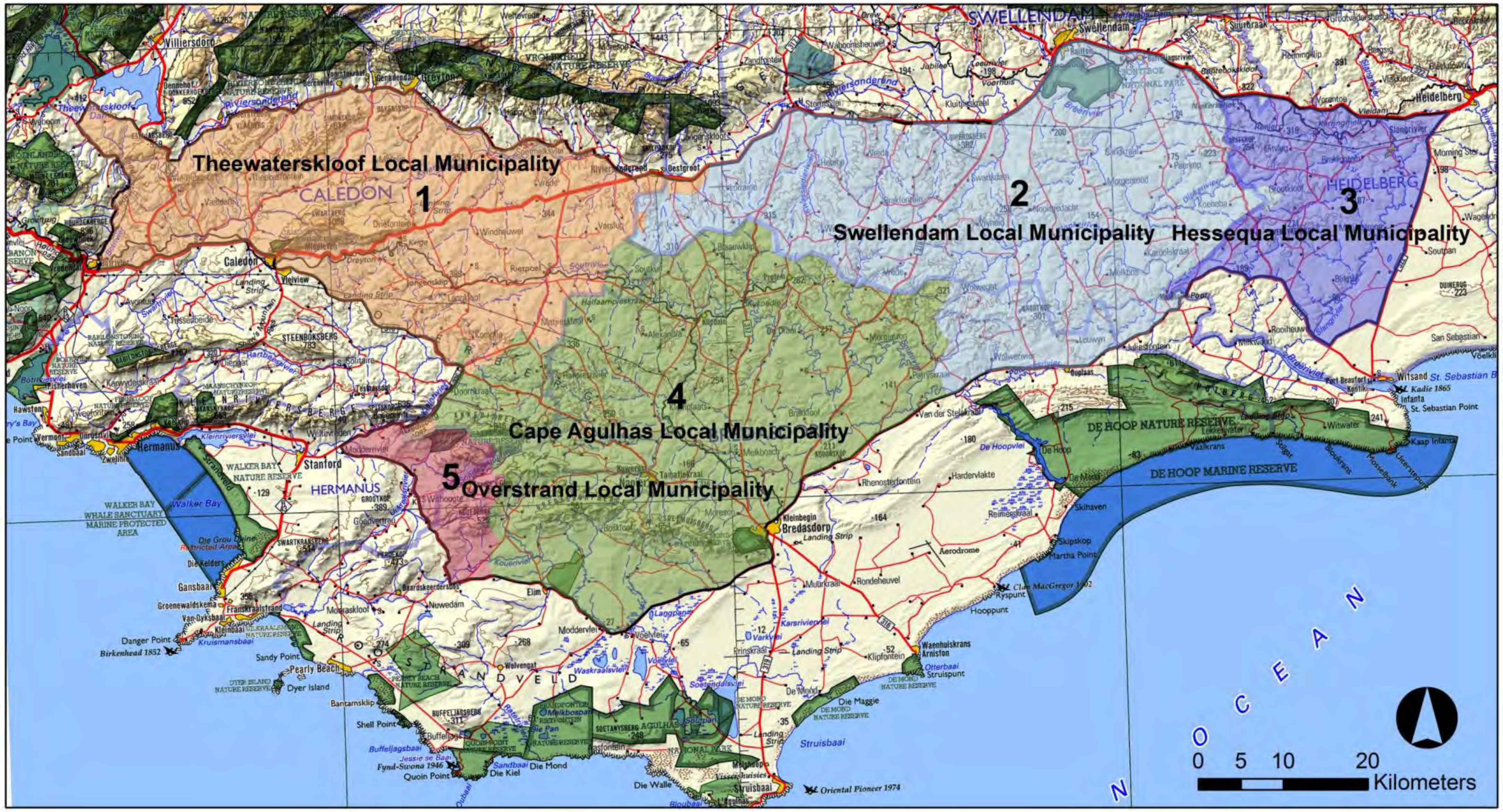


Map 1: Local municipalities in the Overberg Focus Area (FA 1)

The key socio-economic development priorities of, and potential challenges for the local municipalities in the Overberg FA are presented in Table 3 and referenced to Map 1.

The following list of spatial plans and policies relevant to the FA have been reviewed as part of this assessment, and should also be considered during assessment at the project level.

- Provincial plans and policies :
  - The Western Cape Provincial Strategic Plan (2010-2015)
  - Western Cape Provincial Spatial Development Framework (Draft , 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 (2007)
  - Climate Change Strategy and Action Plan for the Western Cape (2008)
  - Growth and Development strategy. White Paper (2008)
  - Strategic Initiative to Introduce Commercial Land Based Wind Energy Development to the Western Cape (2006)

- Regional spatial development priorities and policies:
  - Overberg District Regional Development Profile (working paper, 2013)
  - Overberg Integrated Development Plan (2nd Review of 2012-16 IDP) (Draft, 2014-2015)

  - Overberg Integrated Development Plan (2012-2016)
  - Cape Agulhas revised Integrated Development Plan (Draft, 2013-2014)
  - Cape Agulhas Local Economic Development Strategy (Revised draft, 2013)
  - Langeberg Integrated Development Plan (Draft, 2013)
  - Swellendam Municipality 3rd Generation Integrated Development Plan 2012-2017 (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 Local Economic Development Strategy, (2009)
  - Theewaterskloof Vision 2030 (2011)
  - Overberg District Municipal Spatial Development Framework (Draft, 2013)
  - Langeberg Municipal Spatial Development Framework (2013)
  - Hessequa Integrated Development Framework (1st Review, 2013-2017)
  - Eden District Municipality Spatial Development Framework (Review, 2009)
  - Swellendam Spatial Development Framework Volume II: Development Strategy (2008)
  - Cape Agulhas Spatial Development Framework (2012)

Table 3: Key socio-economic priorities and challenges identified in the Overberg Focus Area (FA 1)

Local Municipality	Key Priorities	Key Challenges
Theewaterskloof	• Create a healthy social fabric and improve service delivery • Develop the tourism sector • Facilitate economic development, infrastructure and housing development	• Poverty and unemployment
Swellendam	• Promote a healthy environment and skills development • Protect natural environment • Correct spatial imbalances and create sustainable settlements • Improve basic services delivery	• Job losses • Education deficiency
Hessequa	• Improve the delivery of basic services and develop integrated settlements • Grow the local economy through tourism and preserve the natural environment	• Economic poverty and unemployment • Lack of formal dwellings
Cape Agulhas	• Develop bulk infrastructure and provide basic services • Promote diversification and economic development and safety and livelihoods of vulnerable groups • Develop tourism sector and create job opportunities	• Lack of transport infrastructure • Dependency on agriculture
Overstrand	• Promote health and safety and tourism • Facilitate economic and social development, and facilitate municipal service delivery	• Housing needs

15.2.2 Komsberg Focus Area 2

The Komsberg FA, covering the northern region of the Western Cape Province and the most southern part of the Northern Cape Province, is a rural area with very low population densities. Due to an undiversified economic base and a strong reliance on the agricultural sector, the FA presents limited opportunities for employment and has experienced 14 145 (or 40.4 %) job losses in the agricultural sector) between 2005 and 2011. The Breede Valley LM, in particular, lost 7 118 agricultural jobs over the same period. Other sectors have also experienced a decline in job opportunities, with the manufacturing industry showing the largest decrease in employment numbers. Because a large portion of the population in the FA lives in small, dispersed settlements which are dependent on the primary sectors of mining and agriculture, and have limited transport opportunities to travel to larger centres, the decline in primary sector jobs is a major concern in this FA.

The DMs and LMs included in FA 2, with their seats, are listed in Table 4 and illustrated in Map 2.

Table 4: Local and district municipalities with their seats in the Komsberg Focus Area (FA 2)

Local Municipalities (and number on map)	Local Municipalities' Seat	District Municipalities	District Municipalities' Seat
1: Witzenberg	Ceres	Cape Winelands	Worcester
2: Karoo Hoogland	Williston	Namakwa	Springbok
3: Laingsburg	Laingsburg	Central Karoo	Beaufort West
4: Breede Valley	Worcester	Cape Winelands	Worcester

Existing local spatial plans identify some areas in the FA that might be sensitive and include the northern part of the FA in the Karoo Hoogland LM which focuses on the development of astro-tourism linked to the astronomical observatories in the Sutherland area. The Witzenberg LM covering the western part of the FA is, however, showing a growing interest in an inclusive tourism industry which integrates sustainable development such as renewable energies with tourism.

The key socio-economic development priorities of, and potential challenges for the local municipalities in the Komsberg FA are presented in Table 5 and referenced to Map 2.

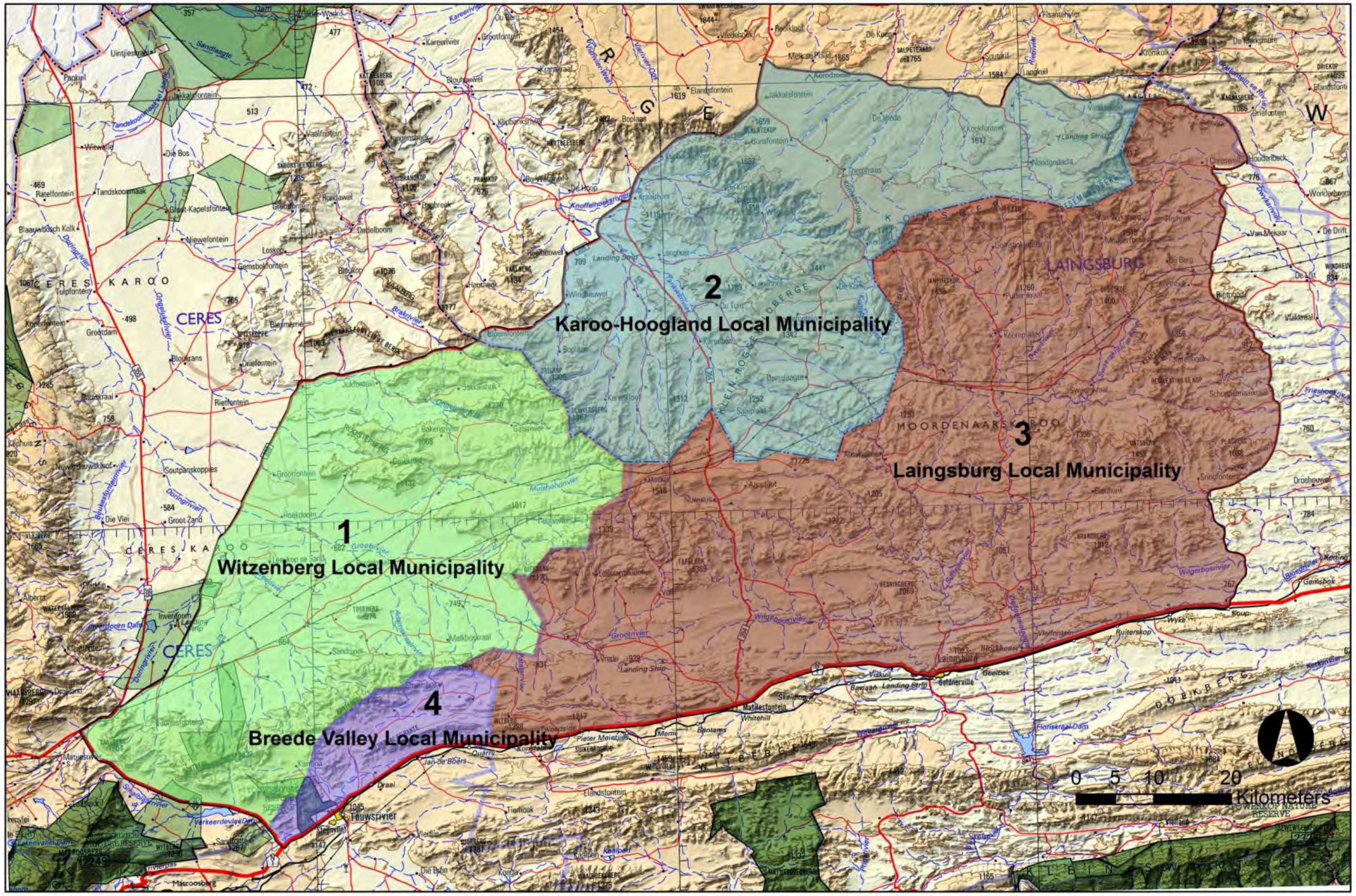
The following list of spatial plans and policies relevant to the FA have been reviewed as part of this assessment, and should also be considered during assessment at the project level.

- **Provincial plans and policies :**
  - The Western Cape Provincial Strategic Plan (2010 - 2015)
  - Western Cape Provincial Spatial Development Framework (Draft , 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 (2007)
  - Climate Change Strategy and Action Plan for the Western Cape (2008)
  - Growth and Development strategy. White Paper (2008)
  - Strategic Initiative to Introduce Commercial Land Based Wind Energy Development to the Western Cape (2006)
  - The Northern Cape Municipal Local Economic Development Framework (2011)
  - Northern Cape Provincial Spatial Development Framework (2012)
  - The Northern Cape Province Local Economic Development Framework (2011)
  - The Northern Cape Province Local Economic Development Strategy (2011)
  - The Northern Cape Provincial Growth and Development Strategy (2004 – 2014)
  - The Northern Cape Municipal Local Economic Development Framework (2011)

- **Regional spatial development priorities and policies:**
  - Cape Winelands District Municipality Integrated Development Plan (2012/13 - 2016/17)
  - Cape Winelands District Municipality Local Economic Development Strategy (2011)
  - Witzenberg Integrated Development Plan (2012/17)
  - Witzenberg Municipality Integrated Development Plan (Review, 2013/2014)
  - Breede Valley Municipality Integrated Development Plan (3rd Generation, 2012-2017)
  - Breede Valley Municipality Integrated Development Plan (Review, 2013 - 2017)
  - Breede Valley Municipality Spatial Development Framework (Draft, 2012)
  - Central Karoo District Municipality Integrated Developmen Plan (3rd Generation, 2012-2017)
  - Laingsburg Municipality Integrated Development Plan (Draft, 2012/ 2017)
  - Laingsburg Municipality Integrated Development Plan (First Annual Review, 2012/13)
  - Namakwa District Municipality Integrated Development Plan IDP (2012-2016)
  - Namakwa District Municipality Spatial Development Framework (Draft, 2012)
  - Karoo Hoogland Municipality Integrated Development Plan (2009-2011)
  - Karoo Hoogland Municipality Local Economic Development Strategy (2011)

Table 5: Key socio-economic priorities and challenges identified in the Komsberg Focus Area (FA 2)

Local Municipality	Key Priorities	Key Challenges
Witzenberg	• Develop integrated and sustainable settlements • Attract investment • Undertake bulk upgrades to water and sanitation • Promote tourism as the means for local economic development	• Housing needs • Unaccounted water and electricity losses • Growing number and size of informal settlements
Karoo Hoogland	• Reduce the number of households living in absolute poverty and halve the unemployment rate • Provide adequate infrastructure for economic growth and development	• Unemployment • Lack of basic life skills
Laingsburg	• Promote tourism-orientated developments and improve infrastructure and explore green energy opportunities • Promote small-scale farming and intensive agriculture • Provide access to basic social services, education and skills programmes, and promote	• Poverty • Housing backlogs
Breede Valley	• Stimulate the local economy through the development of the tourism sector • Increase infrastructure development and provide care for vulnerable groups • Facilitate job creation and accomplish financial sustainability	• Uncontrollable growth in informal settlements • Housing backlogs and limited tax base • High debt exposure by the municipality



Map 2: Local municipalities in the Komsberg Focus Area (FA 2)

15.2.3 Cookhouse Focus Area 3

The Cookhouse FA is located in the southern part of the Eastern Cape. In 2011 the FA had a population of approximately 84 314 people. In terms of employment, the FA's total labour force in 2014 comprised about 27 148 people, of which approximately 34.2 % are unemployed. This unemployment figure is notably higher than the national average of 25.4 % and is a considerable hindrance to social-economic cohesion in the FA. The agricultural sector has been struggling for the past few years and employment numbers in this sector have declined sharply with 18 770, or 58 %, job losses between 2005 and 2011. The economies that are encompassed by the FA are primarily reliant on the tertiary sector, which made up 83 % of the total local economy in 2011. The largest contributor to the tertiary sector is the General Governmental Services (GGS) sector which made up 29 % of the total local economy in 2011 and provided 24 % of employment opportunities. Increasing by 11.2 % between 2005 and 2011, the GGS represented 24 % (13 048 jobs) of total employment level by 2011. Another important contributor to the local economy is the Trade, Catering and Accommodation sector which includes eco-tourism, game farming and commercial hunting and made up 14 % of the total local economy in 2011 and provided 13 % of the total employment in the area by 2011. The high, and growing, reliance of this focus area on government funding and employment is an indication of the need for business and industrial development. The DMs and LMs included in FA 3, with their seats, are listed in Table 6 and illustrated in Map 3.

Table 6: Local and district municipalities with their seats in the Cookhouse Focus Area (FA 3)

Local Municipalities (and number on map)	Local Municipalities' Seat	District Municipalities	District Municipalities' Seat
1: Blue Crane Route	Somerset East	Cacadu	Port Elizabeth
2: Nxuba	Adelaide	Amathole	East London
3: Nkonkobe	Fort Beaufort	Amathole	East London
4: Makana	Grahamstown	Cacadu	Port Elizabeth
5: Sundays River valley	Kirkwood	Cacadu	Port Elizabeth

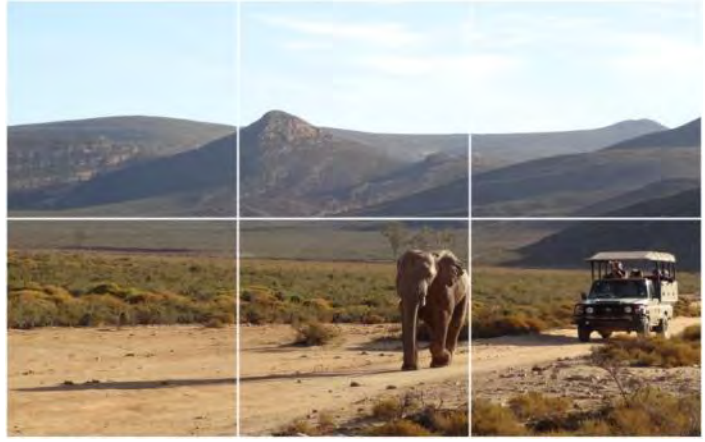
The major bottlenecks encountered in the local municipalities in this FA are linked to service delivery and include:

- Access to sanitation and water;
- The underdeveloped state of social infrastructure (e.g. health and education); and
- The road network and poor condition of existing roads.

The poor condition of roads and the road network is worth noting, especially when considering the logistics associated with delivery of materials/workers to renewable energy developments and the potential impacts thereof on traffic congestion on routes frequently used by tourists.

Existing local spatial plans prioritise game reserves and other tourism and recreational related activities. The south eastern half of the FA, which falls in the Makana LM, and includes several protected and endangered areas, is particularly important in terms of natural environmental protection. In the west of the FA, the Blue Crane Route LM prioritises agriculture and tourism with emphasis on maintaining the natural environment. The owners of private game reserves in the area are generally not supportive of any developments that will result in a visual impact and, therefore, consultation with local farmers and land owners in this area is essential prior to selecting development sites.

The key socio-economic development priorities of, and potential challenges for the local municipalities in the Cookhouse FA are presented in Table 7 and referenced to Map 3.

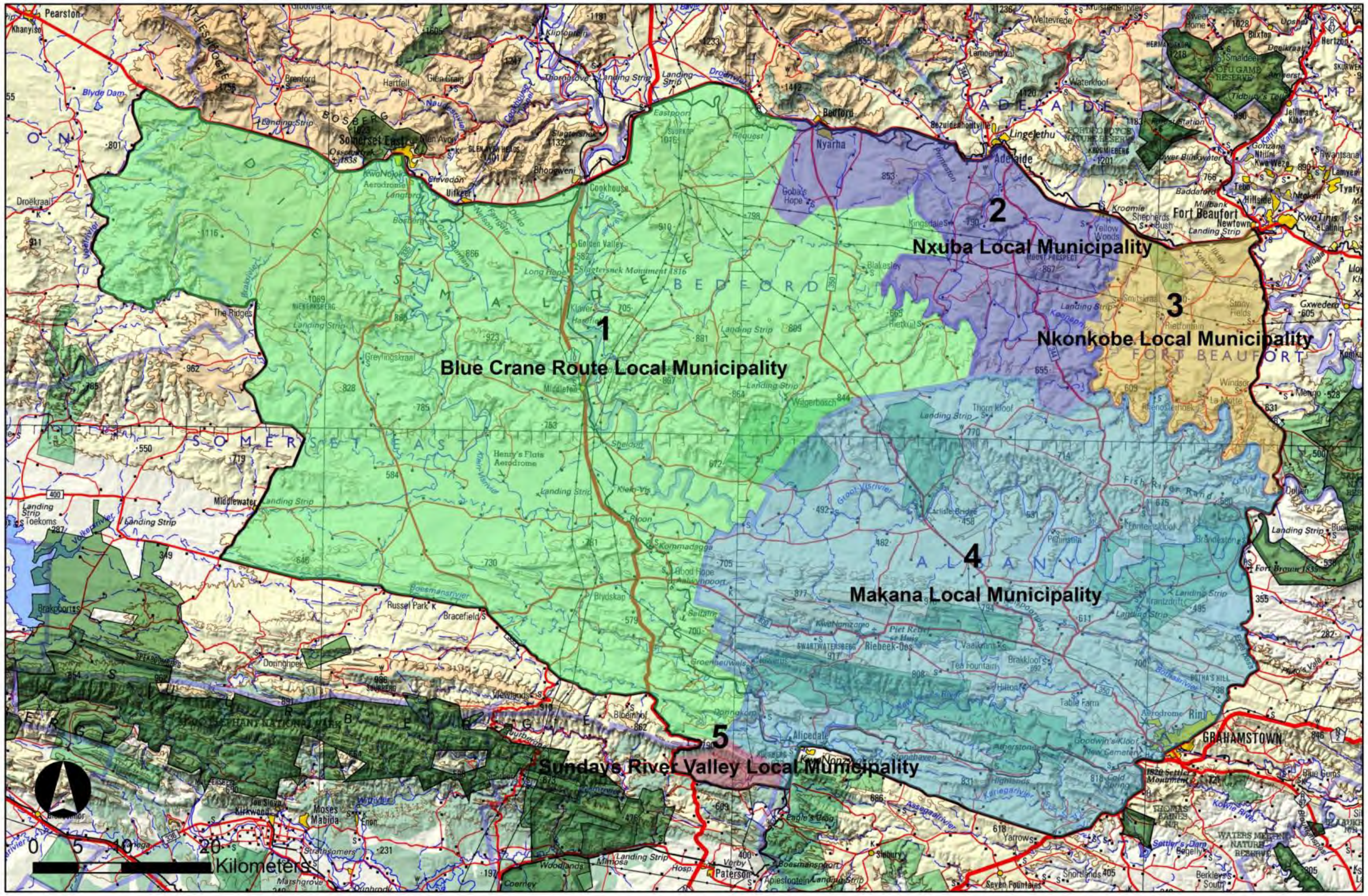


The following list of spatial plans and policies relevant to the FA have been reviewed as part of this assessment, and should also be considered during assessment at the project level.

- **Provincial plans policies:**
  - Eastern Cape Provincial Growth and Development Plan (2004-2014)
  - Eastern Cape Industrial Development Strategy (2011)
  - Eastern Cape Sustainable Energy Strategy (2012)
  - Eastern Cape Spatial Development Framework (2010)
- **Regional spatial development priorities and policies**
  - Amathole Integrated Development Plan (2012-2017)
  - Amathole Spatial Development Framework (2008)
  - Cacadu Integrated Development Plan (2012-2017)
  - Cacadu District Municipality Spatial Development Framework (2013)
  - Nkonkobe Local Economic Development Framework (2012)
  - Nkonkobe Integrated Development Plan (2012-2017)
  - Nkonkobe Spatial Development Framework (2013)
  - Nxuba Integrated Development Plan (2012-2017).
  - Nxuba Spatial Development Framework (2008)
  - Makana Integrated Development Plan 2013-2014
  - Makana Spatial Development Framework (2007)
  - Blue Crane Route Integrated Development Plan (2013-2014)
  - Blue Crane Route Spatial Development Framework (2010)

Table 7: Key socio-economic priorities and challenges identified in the Cookhouse Focus Area (FA 3)

Local Municipality	Key Priorities	Key Challenges
Blue Crane Route	• Grow the renewable energy sector • Promote the agricultural, industry and tourism sectors • Ensure high levels of infrastructure provision • Make use of good geography and geology for agriculture	• Budget constraints • High unemployment and poverty • Basic infrastructure shortages
Nxuba	• Promote tourism, agriculture and Small, Medium and Micro Enterprises (SMMEs) • Improve electricity provision • Improve solid waste removal • Improve road and storm-water infrastructure • Improve water and sanitation • Facilitate land reform	• Low levels of basic infrastructure • Low levels of education • Budget constraints
Nkonkobe	• Promote agriculture and food processing • Improve electricity provision • Improve road maintenance • Improve sporting and community facilities • Increase housing • Facilitate land reform	• Low levels of basic infrastructure • Low education levels • Budget constraints
Makana	• Promote renewable resource utilisation, tourism and SMMEs • Improve waste management • Improve water infrastructure • Improve road infrastructure	• High unemployment • Basic infrastructure shortages • Low education levels • Budget constraints



Map 3: Local municipalities in the Cookhouse Focus Area (FA 3)

15.2.4 Stormberg Focus Area 4

The Stormberg FA is located in the north-eastern part of the Eastern Cape and includes part of the former Transkei homeland which has a severe lack of infrastructure and very limited economic development. In terms of employment, the area is plagued by high unemployment rates (34.9 %) with the agricultural sector losing the highest number of jobs (10 743 layoffs or 46.9 % losses) between 2005 and 2011. In 2011, 76 % of formally employed individuals were employed in the tertiary sector with 30 % of all employment in the area being in the General Government sector. The north eastern corner of the FA is heavily reliant on agriculture with much of the land being used for cattle and sheep farming or for cultivation (40 % of the Engcobo LM). This same area is densely populated with rural settlements with poor access to basic services. The high unemployment rates illustrate the limited employment opportunities of the LMs and challenges faced by the local economies with respect to leveraging local competitive advantages. Although most of the municipalities included in the FA target agriculture, mining, industry and tourism (and to a smaller degree, forestry and manufacturing) as ways to develop the local economies and create new employment opportunities, the local economy is predominantly focused on the tertiary services sector associated with servicing the needs of local communities. In this focus area the high, and growing, reliance on government funding and employment is an indication of the need for business and industrial development.

The DMs and LMs included in FA 4, with their seats, are listed in Table 8 and illustrated in Map 4.

Table 8: Local and district municipalities with their seats in the Stormberg Focus Area (FA 4)

Local Municipalities (and number on map)	Local Municipalities' Seat	District Municipalities	District Municipalities' Seat
1:Tsolwana	Tarkastad	Chris Hani	Queenstown
2:Inkwanca	Molteno	Chris Hani	Queenstown
3:Maletswai	Aliwal North	Joe Gqabi	Barkly East
4:Emalahleni	Lady Frere	Chris Hani	Queenstown
5:Sakhisizwe	Cala	Chris Hani	Queenstown
6:Engcobo	Ngcobo	Chris Hani	Queenstown
7:Intsika Yethu	Cofimvaba	Chris Hani	Queenstown
8:Lukanji	Queenstown	Chris Hani	Queenstown

Existing local spatial plans prioritise conservation, game farming and communal livestock farming in much of the FA. Game farming and eco-tourism activities are, however, sparsely distributed in the area.

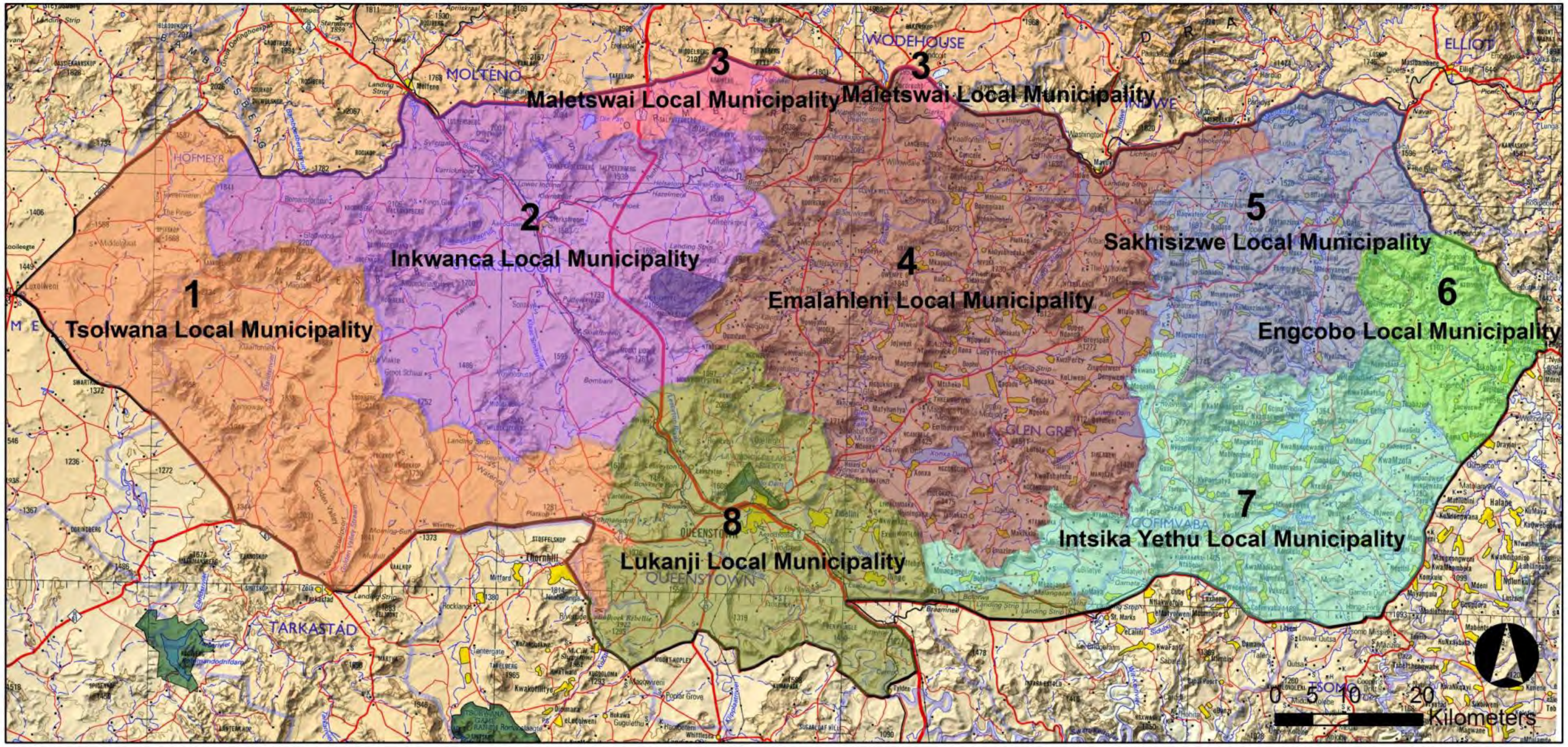
The key socio-economic development priorities of, and potential challenges for the local municipalities in the Stormberg FA are presented in Table 8 and referenced to Map 4.

The following list of spatial plans and policies that have relevance to the FA have been reviewed as part of this assessment, and should also be considered during assessment at the project level.

- **Provincial plans and policies:**
  - 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 Spatial Development Framework (2010)
- **Regional spatial development priorities and policies**
  - Chris Hani Integrated Development Plan (2012-2017)
  - Chris Hani Spatial Development Framework (2009)
  - Tsolwana Local Economic Development Framework (2011)
  - Tsolwana Spatial Development Framework (2010)
  - Inkwanca Integrated Development Plan (2012-2017)
  - Inkwanca Spatial Development Framework (2007)
  - Intsika Yethu Local Economic Development Framework (2007)
  - Intsika Yethu Spatial Development Framework (2013)
  - Engcobo Local Economic Development Framework (2010)
  - Engcobo Spatial Development Framework (2010)
  - Emalahleni Integrated Development Plan (2012-2017)
  - Emalahleni Spatial Development Framework (2010)
  - Lukhanji Integrated Development Plan (2012-2017)
  - Sakhisizwe Local Economic Development Framework 2007
  - Sakhisizwe Spatial Development Framework (2011)

Table 9: Key socio-economic priorities and challenges identified in the Stormberg Focus Area (FA 4)

Local Municipality	Key Priorities	Key Challenges
Tswolana	• Promote agriculture, mining, and tourism, and support SMMEs • Facilitate manufacturing and minerals beneficiation	• Budget constraints • High unemployment and poverty
Inkwanca	• Promote agriculture, tourism, mining and retail, and support SMMEs • Improve community services	• Budget constraints and basic infrastructure shortages • High unemployment and poverty
Emalahleni	• Improve community services • Promote retail, agriculture, mining, and tourism, and support SMMEs	• Budget constraints • High unemployment and poverty
Sakhisizwe	• Promote manufacturing and tourism, and support SMMEs	• Budget constraints and basic infrastructure shortages • High unemployment and poverty
Engcobo	• Promote tourism and support SMMEs	• Budget constraints and basic infrastructure shortages • High unemployment and poverty
Intsika Yethu	• Promote tourism, agriculture, forestry, and timber processing • Support SMMEs	• Budget constraints • High unemployment and poverty
Lukanji	• Promote agriculture and tourism and support SMMEs • Facilitate rural development	• Budget constraints and basic infrastructure shortages • High unemployment and poverty



Map 4: Local municipalities in the Stormberg Focus Area (FA 4)

15.2.5 Kimberley Focus Area 5

The Kimberley FA stretches over sections of the Free State and the Northern Cape provinces with almost two thirds of the FA being in the Free State. The majority of households as well as economic activities characterising the FA are concentrated in Kimberley (capital of the Northern Cape), which falls under the Sol Plaatjie LM. In terms of employment, the agricultural, manufacturing and trade sectors have shown significant decline in their job absorption capacities with more than 16 000 jobs being lost in these three sectors between 2005 and 2011. Across the FA, the tertiary sector makes the largest employment contribution with the General Government Services sector being the major employer. Job creation to curb rising unemployment remains one of the top priorities for most municipalities. Skills shortages are a major challenge within the FA with only about 63% of the active population having completed some secondary education and approximately 15 % having received some form of tertiary education. The DMs and LMs included in FA 5, with their seats, are listed in Table 10 and illustrated in Map 5.

Table 10: Local and district municipalities with their seats in the Kimberley Focus Area (FA 5)

Local Municipalities (and number on map)	Local Municipalities' Seat	District Municipalities	District Municipalities' Seat
1: Dikgatlong	Barkly West	Frances Baard	Kimberley
2: Magareng	Warrenton	Frances Baard	Kimberley
3: Sol Plaatjie	Kimberley	Frances Baard	Kimberley
4: Letsemeng	Koffiefontein	Lejweleputswa	Welkom
5: Tokologo	Boshof	Lejweleputswa	Welkom
6: Tswelopele	Bultfontein	Lejweleputswa	Welkom
7: Masilonyana	Theunissen	Lejweleputswa	Welkom
8: Mangaung Metropolitan	Bloemfontein	Mangaung Metropolitan	Bloemfontein

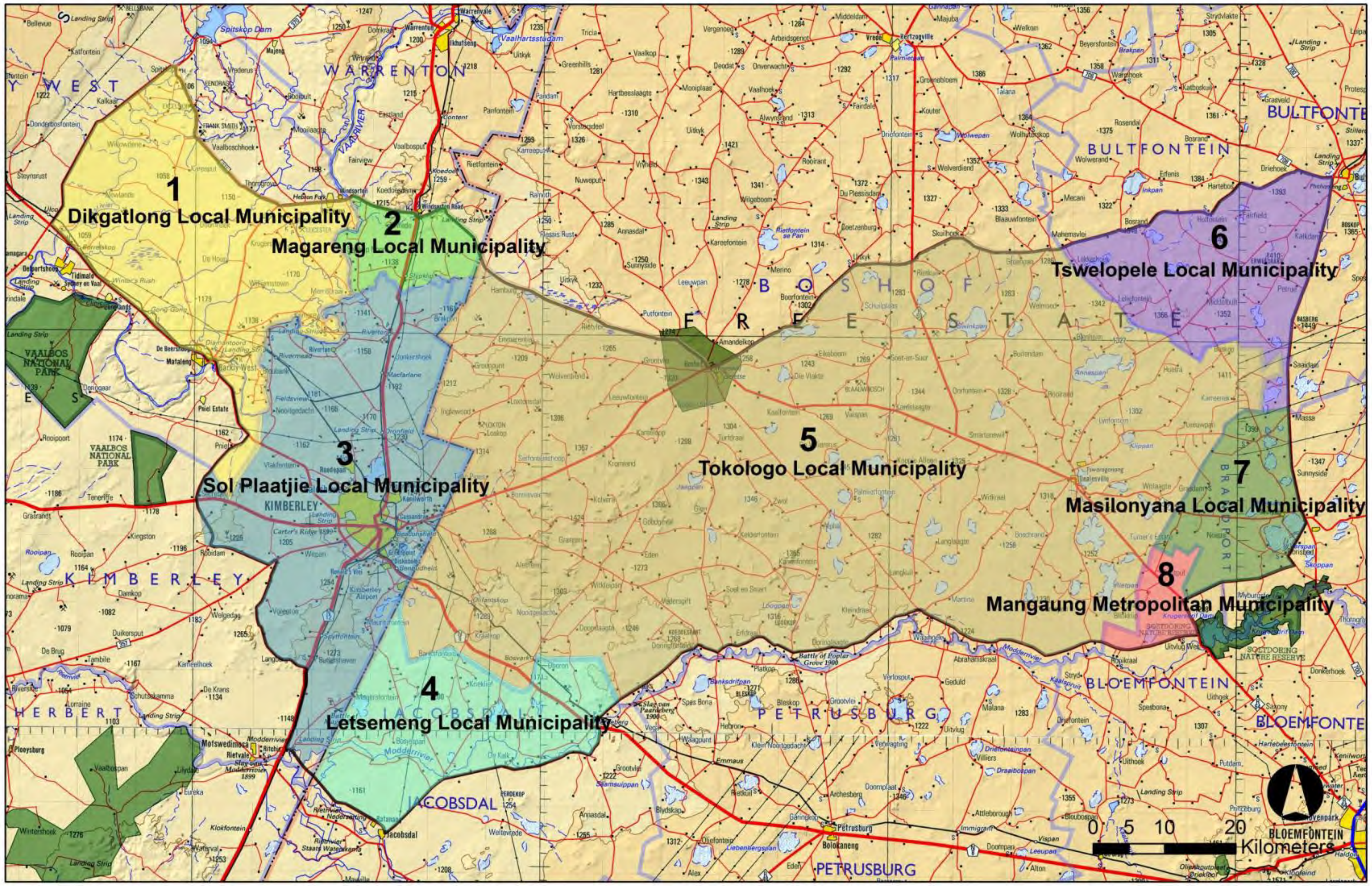
Existing local spatial plans identify agriculture and tourism as development priorities for most municipalities in the FA. The Mangaung Metropolitan Municipality, in particular, has explicitly expressed its interest in the construction of solar farms. The FA also contains areas with mineral deposits which may relate to issues of sterilisation of mineral resources when considering other developments. The key socio-economic development priorities of, and potential challenges for the local municipalities in the Kimberley FA are presented in Table 10 and referenced to Map 5.

The following list of spatial plans and policies that have relevance to the FA have been reviewed as part of this assessment, and should also be considered during assessment at the project level.

- **Provincial plans and policies:**
  - Free State Province Provincial Growth and Development Strategy (2005-2014)
  - Free State Province Provincial Spatial Development Framework (Phase 1, Revised 2013)
  - Free State Province Provincial Spatial Development Framework(Phase 2, 2013)
  - The Northern Cape Municipal Local Economic Development Framework (2011)
  - Northern Cape Provincial Spatial Development Framework (2012)
  - The Northern Cape Province Local Economic Development Framework (2011)
  - The Northern Cape Province Local Economic Development Strategy (2011)
  - The Northern Cape Provincial Growth and Development Strategy (2004-2014)
- **Regional spatial development priorities and policies**
  - Lejweleputswa District Municipality Integrated Development Plan (2011/2012)
  - Masilonyana Local Municipality Integrated Development Plan (2012-2017)
  - Tokologo Local Municipality Draft Integrated Development Plan (2013-2014)
  - Tokologo Local Municipality Spatial Development Framework (2012)
  - Tswelopele Local Municipality Integrated Development Plan(2010-2011)
  - Tswelopele Local Municipality Spatial Development Framework (2008)
  - Mangaung Metropolitan Integrated Development Plan Review (2013-2014)
  - Mangaung Metropolitan Spatial Development Framework (2010-2011)
  - Xhariep District Municipality Integrated Development Plan (2010/2011)
  - Xhariep District Municipality Spatial Development Framework 2012
  - Letsemeng Local Municipality Integrated Development Plan(2012/2013)
  - Frances Baard District Municipality Integrated Development Plan (2012/12-2016/17)
  - Ditgatlong Local Municipality Integrated Development Plan (2013/14)
  - Frances Baard Local Economic Development Strategy (2009)
  - Frances Baard District Municipality Spatial Development Framework (2013)
  - Magareng Local Municipality Integrated Development Plan(2013-2014)
  - Sol-Plaatje Local Municipality Integrated Development Plan(2012/13-2016/17)
  - Sol-Plaatje Local Municipality Spatial Development Framework (2008)
  - Pixley ka Seme District Municipality Integrated Development Plan (2011-2016)
  - Pixley ka Seme Spatial Development Framework (2013-2018)
  - Siyancuma Local Municipality Integrated Development Plan(2012-2013)
  - Bophirima District Municipality Integrated Development Plan (2007-2011)

Table 11: Key socio-economic priorities and challenges identified in the Kimberley Focus Area (FA 5)

Local Municipality	Key Priorities	Key Challenges
Dikgatlong	• Increase housing and land availability • Improve storm water services, roads, sanitation services and water availability • Promote local economic development and job creation • Improve early childhood development • Protect and improve parks and recreational areas	• Poverty and low income levels
Magareng	• Improve basic service provision	• Low education levels, poverty and unemployment • Backlogs in water and electricity supply
Sol Plaatjie	• Promote an infrastructure-led growth path to ensure sustainable development	• Household services backlog • Limited access to electricity
Letsemeng	• Support SMME and cooperatives development • Promote tourism • Improve basic service delivery and facilitate rural development •	• Unemployment and growing informal settlements • Lack of water provision in some parts
Tokologo	• Improve basic service provision	• Infrastructure backlogs
Tswelopele	• Improve basic service provision	• Shortage of skills and housing shortages
Masilonyana	• Improve basic service provision • Facilitate local and rural economic development to create employment opportunities	• HIV/AIDS infection • Unemployment • High illiteracy levels and high crime rate
Mangaung Metropolitan	• Improve human settlements • Improve public transport • Promote environmental management and climate change • Improve social and community services	• Housing backlog • Mushrooming of informal settlements • Youth unemployment



Map 5: Local municipalities in the Kimberley Focus Area (FA 5)

15.2.6 Vryburg Focus Area 6

The Vryburg FA is located in the south-western part of the North West province. The population density in this FA is very low and ranges from 7 to 26.7 people per km^2, which is significantly lower than that for the entire province (33.5 people per km^2) and the country (42.4 people per km^2). The average monthly household income for the FA is estimated to be only R 7 800. There is a service backlog in terms of access to acceptable levels of sanitation for some households in the area. The FA is characterised as a service economy with the trade, government services, and community and personal services sectors being the largest contributors. High levels of unemployment and poverty are the greatest developmental challenges throughout the FA. Levels of employment have declined in the past few years, resulting in an unemployment rate of about 32 % in 2014, which is significantly higher than the national unemployment rate of 25.4 %. The number of jobs declined by 12 800 (or 20.2 %) across the primary, secondary and tertiary sectors between 2005 and 2011 in the area. Agriculture and tourism are the major economic contributors to the FA. The agricultural sector has, however, declined by 2.74 % between 2005 and 2007, leading to a decrease in contribution to the local economic base and employment opportunities. Commercial farming is concentrated in the northern and eastern peripheral zones of the FA. The central part of the FA is currently not used for any high productivity commercial activity or tourism.

The DMs and LMs included in FA 6, with their seats, are listed in Table 12 and illustrated in Map 6.

Table 12: Local and district municipalities with their seats in the Vryburg Focus Area (FA 6)

Local Municipalities (and number on map)	Local Municipalities' Seat	District Municipalities	District Municipalities' Seat
1: Greater Taung	Taung	Dr Ruth Segomotsi Mompati	Vryburg
2: Naledi	Vryburg	Dr Ruth Segomotsi Mompati	Vryburg
3: Tswaing	Delareyville	Ngaka Modiri Molema	Mahikeng
4: Mamusa	Schweizer-Reneke	Dr Ruth Segomotsi Mompati	Vryburg
5: Kagisano-Molopo	Ganyesa	Dr Ruth Segomotsi Mompati	Vryburg

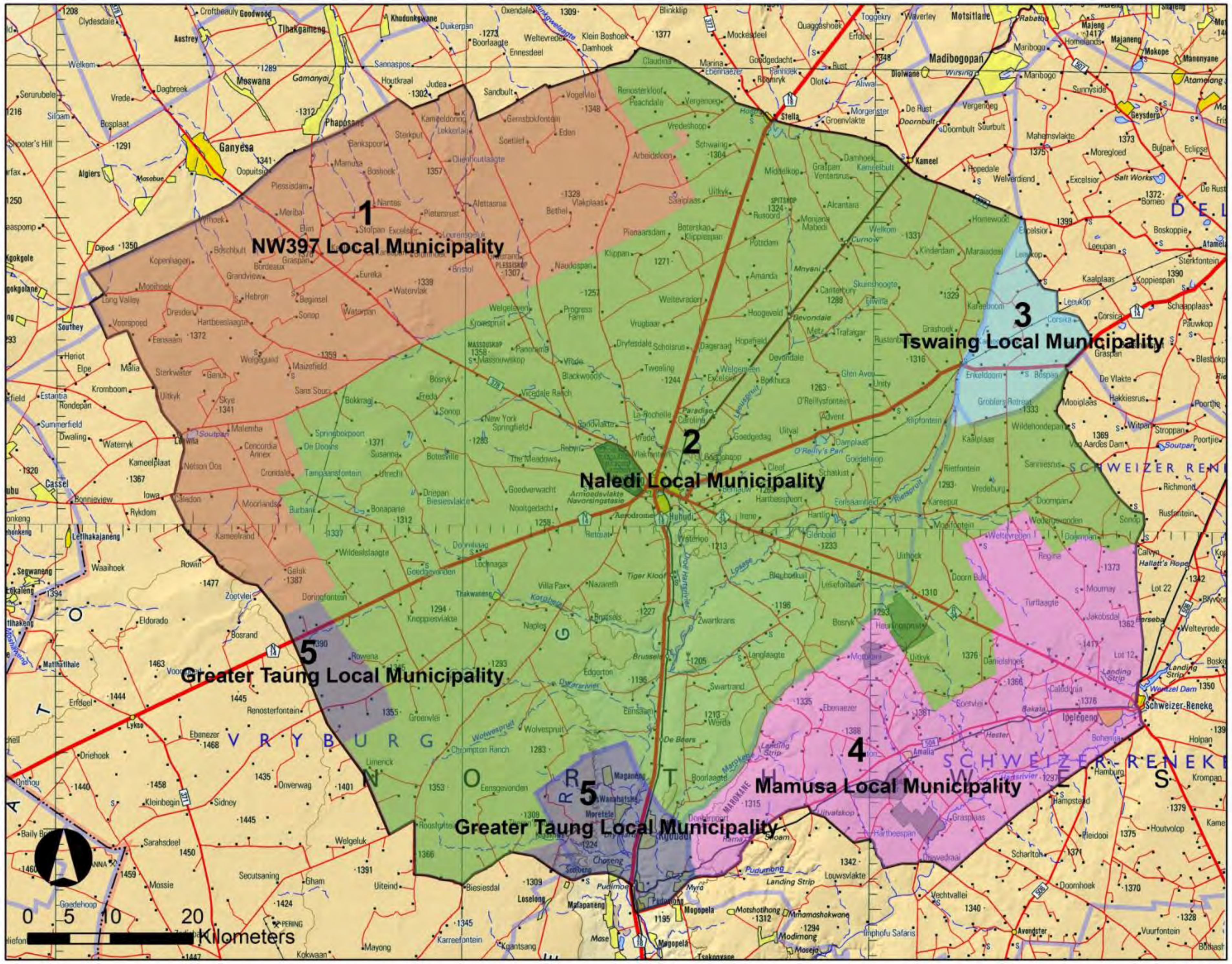
The key socio-economic development priorities of, and potential challenges for the local municipalities in the Vryburg FA are presented in Table 13 and referenced to Map 6.

The following list of spatial plans and policies relevant to the FA have been reviewed as part of this assessment, and should also be considered during assessment at the project level.

- **Provincial plans and policies:**
  - North West Provincial Growth and Development Strategy (2004 – 2014)
  - North West Province Spatial Development Framework and Environment Management Plan (2010)
  - Renewable Energy Strategy for the North West Province (2012)
- **Regional Level spatial development priorities and policies**
  - Dr Ruth S Mompati District Municipality Integrated Development Plan, Third Generation, (2012-2017)
  - Ngaka Modiri Molema District Municipality Integrated Development Plan (2012-2016)
  - Ngaka Modiri Molema District Municipality Strategic Plan (2011-2016)
  - Greater Taung Local Municipality 3rd Generation Integrated Development Plan (2011-2016),
  - Naledi Local Municipality Integrated Development Plan (2010/11)
  - Naledi Spatial Development Plan 2007
  - Bophirima District Municipality Integrated Development Plan 2007-2011, (First Review, May 2008)

Table 13: Key socio-economic priorities and challenges identified in the Vryburg Focus Area (FA 6)

Local Municipality	Key Priorities	Key Challenges
Greater Taung	• Improve roads, bridges and water supply •	• Basic service delivery shortages
Naledi	• Facilitate local economic development to create jobs • Promote sports and improve facility management	• Serious water shortages • High unemployment and increase in squatters • Poor waste management
Tswaing	• Facilitate local economic development to create jobs • Promote Environmental health management	• Water scarcity and housing backlogs • High unemployment and poverty • Lacking social and economic infrastructure
Mamusa	• Improve water and sanitation services • Facilitate local economic development to create jobs	• High unemployment • Bad roads
Kagisano-Molopo	• Improve infrastructure development, including the completion of public amenities and internal road construction • Facilitate local economic development and tourism and strengthen community participation	• High unemployment • Bad roads



Map 6: Local municipalities in the Vryburg Focus Area (FA 6)

15.2.7 Upington Focus Area 7

Almost the entire population (92 %) in this FA lives along the Orange River with only two towns (i.e. Kenhardt and Marydale) located away from the river. The major town in the FA is Upington, located in the centre on the northern boundary of the FA. Upington is also regarded as an important development centre and the link between South Africa and Namibia. In 2011 the total population of the area was estimated at approximately 93 468. The FA is characterised by good road connectivity among the settlements and with other main development nodes of the Northern Cape and North West provinces. 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 activities. The economic development of the FA is almost entirely dependent on the agricultural sector despite more than 7 100 (or 31 %) jobs being lost from this sector between 2005 and 2011. 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 other uses, including conservation. The DMs and LMs included in FA 7, with their seats, are listed in Table 14 and illustrated in Map 6.

Table 14: Local and district municipalities with their seats in the Upington Focus Area (FA 7)

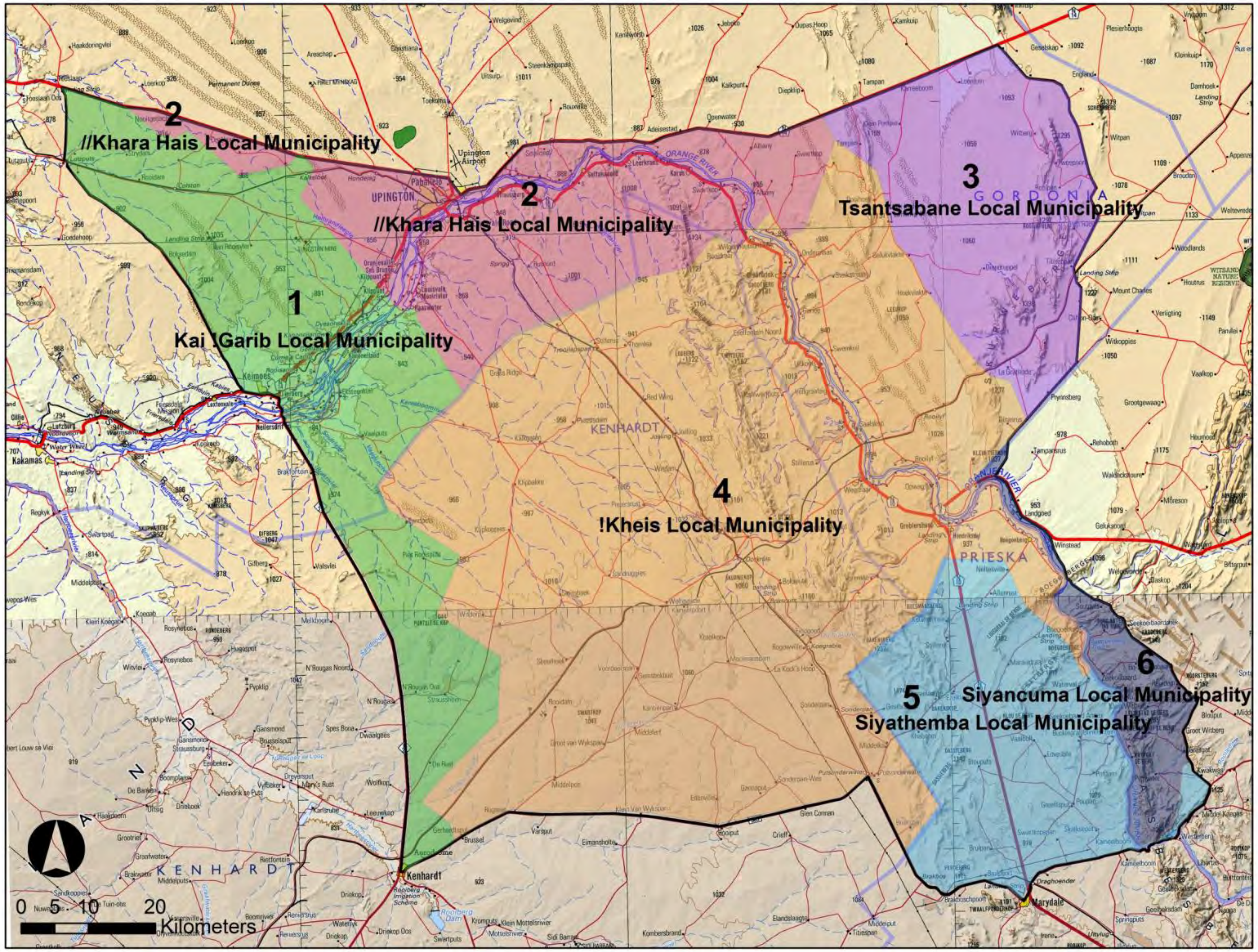
Local Municipalities (and number on map)	Local Municipalities' Seat	District Municipalities	District Municipalities' Seat
1: Kai! Garib	Kakamas	ZF Mgcawu DMs	Upington
2: Khara Hais	Upington	ZF Mgcawu DMs	Upington
3: Tsantsabane	Postmasburg	ZF Mgcawu DMs	Upington
4: !Kheis	Groblershoop	ZF Mgcawu DMs	Upington
5: Siyathemba	Prieska	Pixley Ka Seme	De Aar
6: Siyancuma	Douglas	Pixley Ka Seme	De Aar

Existing local spatial plans generally promote renewable energy developments in the area. Municipalities such as !Kheis, Siyacuma, and Siyathemba LMs encourage solar PV development in their areas of jurisdiction, with the !Kheis LM particularly emphasising the need to provide support to enhance the trade, catering and accommodation industry during the stages of construction and operation of such projects. Several solar projects already have been completed or are under construction in the Upington area. These developments have led to an influx of migrant workers which is resulting in social unrest in the area. At the same time the solar developments around Upington already have made a noticeable positive contribution to the local economy.

The key socio-economic development priorities of, and potential challenges to the local municipalities in the Upington FA, are presented in Table 15 and referenced to Map 7.

The following list of spatial plans and policies that have relevance to the FA have been reviewed as part of this assessment, and should also be considered during assessment at the project level.

- **Provincial plans and policies:**
  - The Northern Cape Municipal Local Economic Development Framework (2011)
  - Northern Cape Provincial Spatial Development Framework (2012)
  - The Northern Cape Province Local Economic Development Framework (2011)
  - The Northern Cape Province Local Economic Development Strategy (2011)
  - The Northern Cape Provincial Growth and Development Strategy (2004-2014)
  -
- **Regional Level spatial development priorities and policies:**
  - Pixley Ka Seme District Municipality Integrated Development Plan (2011-2016)
  - Pixley Ka Seme Local Municipality Integrated Local Economic Development Plan (2011-2016)
  - Pixley Ka Seme District Spatial Development Framework (2013-2018)
  - Siyancuma Integrated Development Plan (2012/13)
  - Siyanda District Spatial Development Framework (2012)
  - Siyathemba Municipality Integrated Development Plan (2012/13)
  - Siyathemba District Spatial Development Framework
  - Kai !Garib Municipality Integrated Development Pplan (2013/14)
  - Kai !Garib Municipality Local Economic Development Framework (2012)
  - //Khara Hais Municipality Integrated Development Plan (2012-2017)
  - Khara HaisMunicipality Local Economic Development Framework And Incentive Plan (2010)
  - Tsantsabane Municipality Integrated Development Plan (2011)
  - !Kheis Municipality Integrated Development Plan (2013/14)
  - !Kheis Municipality Spacial Development Framework (2014)



Map 7: Local municipalities in the Upington Focus Area (FA 7)

Table 15: Key socio-economic priorities and challenges identified in the Upington Focus Area (FA 7).

Local Municipality	Key Priorities	Key Challenges
Kai !Garib	• Increase and diversify farming activities • Improving tourism profile • Provide clean water to all in the area and eliminate sanitation problems • Reduce the number of households living in absolute poverty	• Lack of basic services, particularly water • Unemployment
Khara Hais	• Facilitate agro-processing and value-adding programmes • Revitalise the environs of the Orange River and develop outdoor nature-based attractions	• Poverty and unemployment • Lack of sewerage and sanitation services • Lack of access to clean drinking water in informal settlements
Tsantsabane	• Promote mining developments and mining tourism	• Insufficient supply of bulk water, sanitation, and electricity • Insufficient provision of roads and transport infrastructure
!Kheis	• Create jobs, and focus on agriculture development and processing • Refurbish tourism sites and exploit the solar project opportunities	• Lack of water provision and housing • Lack of road infrastructure and storm water systems • High levels of poverty and unemployment
Siyathemba	• Address sanitation and storm water drainage backlogs and develop low-income housing • Promote a solar energy incentive programme	• Poor provision of basic services • High levels of unemployment and poverty and illiteracy and lack of skills • Long distances between towns and lack of diversification of the region
Siyancuma	• Expand the tourism industry and agro-processing • Address housing, water and sanitation backlogs, and alleviate unemployment and poverty	• Poor levels of education and diminishing sources of income • Limited bulk water supply and lack of basic life skills

15.2.8 Springbok Focus Area 8

The Springbok FA is bordered on its western side by the South Atlantic Ocean and extends approximately 180 km inland to the Pofadder area. The main characteristic of the economy in this area is that it depends almost entirely on mining-related activities. There is very little development in the secondary and tertiary sectors and very few opportunities in the agriculture sector. The dry climate and poor agricultural potential, together with the decline in mining activities on which the economy of the region relies, are the main reasons for the limited economic growth experienced between 2005 and 2011. Industries such as agriculture, trade, construction and manufacturing experienced a decline in employment, with agriculture shedding the most jobs (1 122 or 34 %) between 2005 and 2011.

With many municipalities not having the financial resources to address backlogs, one of the main concerns of the local governments in the FA is the need to provide basic services and bulk infrastructure for their communities. There is an urgent need to generate income in order to improve the standard of living in the area. The majority of local governments prioritise the growth of tourism through taking advantage of the position of the N7, the national road connecting Cape Town with Namibia, as well as the local natural resources. The local governments in this FA are also exploring non-traditional opportunities such as mariculture to grow the economy.

The DMs and LMs included in FA 8, with their seats, are listed in Table 16 and illustrated in Map 8.

Table 16: Local and district municipalities with their seats in the Springbok Focus Area (FA 7)

Local Municipalities (and number on map)	Local Municipalities' Seat	District Municipalities	District Municipalities' Seat
1: Richtersveld	Port Nolloth	Namakwa	Springbok
2: Nama Khoi	Springbok		
3: Khai-Ma	Pofadder		
4: Kamiesberg	Garies		

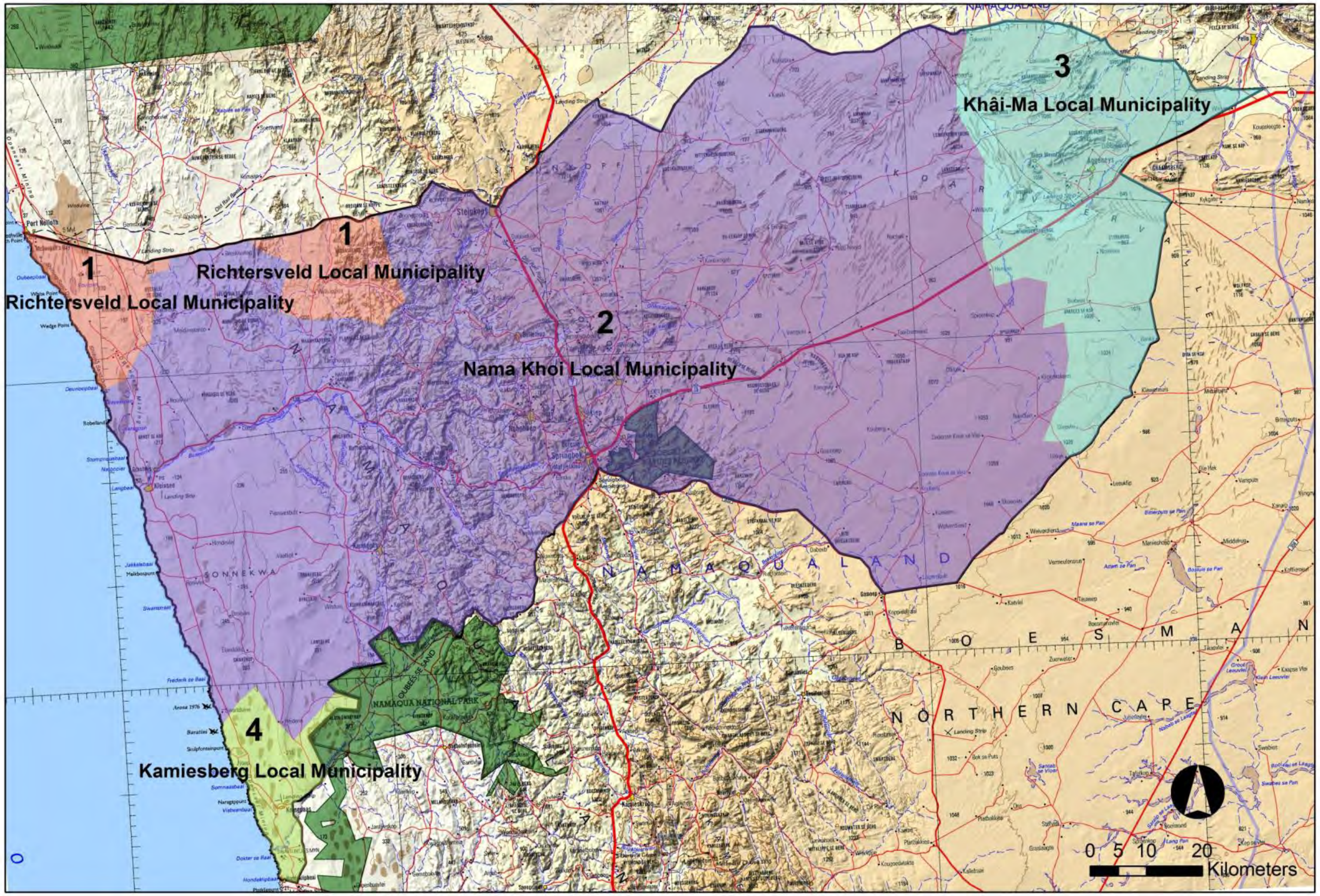
Existing local spatial plans contain areas designated by local governments for renewable energy developments. The Nama Khoi and the Richtersveld LMs are actively promoting alternative energy to be considered close to industrial zones such as Port Nolloth and Alexander Bay.

The key socio-economic development priorities of, and potential challenges for the local municipalities in the Springbok FA are presented in Table 16 and referenced to Map 8.

The following list of spatial plans and policies relevant to the FA have been reviewed as part of this assessment, and should also be considered during assessment at the project level.

- **Provincial Level policies and plans:**
  - 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

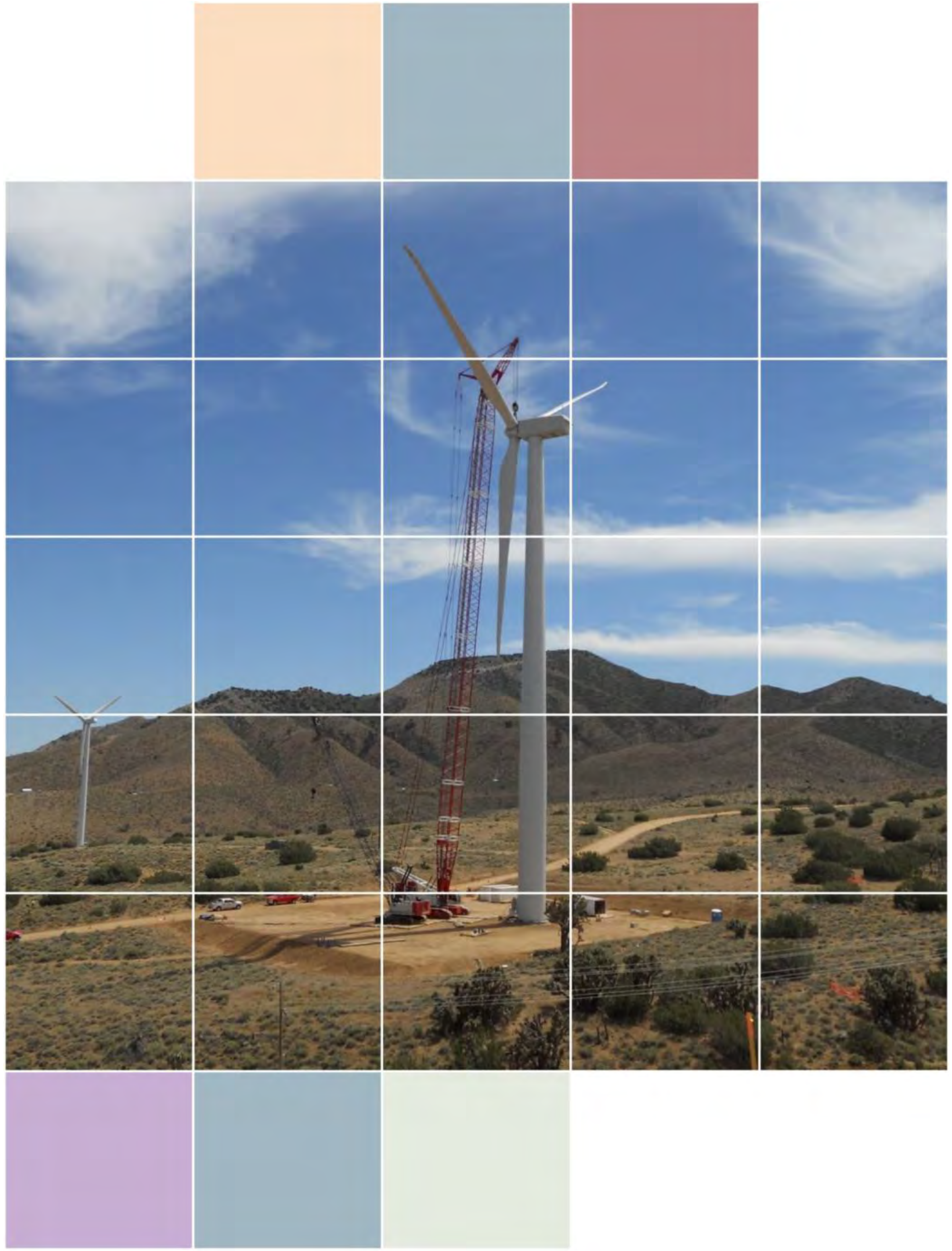
- **Regional Level spatial development priorities and policies**
  - Nama Khoi Municipality IDP (2012-2017)
  - Nama Khoi Municipality IDP 2012/2017 First Revision (2013/2014)
  - Nama Khoi Municipality LED 2011
  - Nama Khoi Municipality IDP 2012/2017 (Draft -Second Revision, 2014/2015)
  - Kamiesberg 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)
  - Richtersveld Local Municipality Rural Spatial Development Framework/Land Development Plan 2010
  - Khai Ma Municipality Rural Spatial Development Framework/Land Development Plan 2010
  - Namakwa District Municipality IDP (2012-2016)
  - Namakwa District Municipality SDF (Draft, May 2012)



Map 8: Local municipalities in the Springbok Focus Area (FA 8)

Table 17: Key socio-economic priorities and challenges identified in the Springbok Focus Area (FA 8).

Local Municipality	Key Priorities	Key Challenges
Richtersveld	• 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 • Explore potential for alternative/renewable energy resources • Exploit the opportunities for mariculture and tourism development	• Limited availability of bulk water and electricity • Low levels of income • Economic dependence on mining • High poverty levels
Nama Khoi	• Ensure provision of bulk infrastructure • Unlock unexploited mineral opportunities • Support agro-processing and mariculture • Develop solar power plants, especially towards Vioolsdrif • Facilitate wind farm developments	• Climate change will adversely affect water resources and agricultural activities • Limited water supply and low 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
Khâi Ma	• Promote local tourism • Protect environmental conservation corridors • Ensure economic development	• Limited farming opportunities • Insufficient engineering and social infrastructure development • High levels of poverty
Kamiesberg	• Facilitate job creation • Increase livestock grazing, mining and tourism economic growth • Provide housing, services and infrastructure • Promote conservation and ecological restoration	• Water scarcity • Poor transport infrastructure • Almost all roads in the area are gravel • Declining mining industry



15.3 Broader socio-economic considerations

Addressing the following issues are beyond the scope and mandate of this SEA process and any recommendations made here will in no way be legally implemented through the SEA process. This subsection has been prepared as a contribution to the discussion on how best to optimise the positive and minimise the negative socio-economic impacts of renewable energy development in South Africa.

- <u>Macro- and Micro-economic Benefits</u>

Most communities in South Africa require additional socio-economic investment for which funding is currently not available. Such investment is required to improve the quality of social services as well as to support enterprise development. Socio-economic development initiatives associated with renewable energy projects have the potential to benefit local communities, while even greater indirect benefits can potentially be derived from contributions to the local and national economic bases. Moreover, the greatest potential benefit of renewable energy is in contributing to energy security in a competitive and sustainable manner, which results in direct and indirect national and global benefits.

The establishment of the renewable energy industry is resulting in significant industrial investment and development to the country, while at the same time producing much needed and competitively priced sustainable energy. These important direct and indirect macro-economic benefits of renewable energy should not be overshadowed by direct micro-economic benefits at a local scale.

- <u>Development Clustering</u>

Considering the fact that most communities in the country are in need of socio-economic investment which could be provided by renewable energy development, the question arises whether it is sensible to cluster development in some areas. In principle, a larger concentration of renewable energy projects in an area (e.g. REDZ) provides a greater opportunity for such projects to make a meaningful contribution towards addressing the needs of the local communities. On the other hand, the clustering of development could reduce the number of local communities that benefit from renewable energy development.

Taking into account that the greatest benefit of renewable energy is its macro-economic contribution to the national economy, and that the magnitude of this benefit is primarily dependent on the price of energy, the cost of development becomes the key consideration when responding to this question.

Cost effectiveness of renewable energy development is dependent on many factors, among which resource and infrastructure availability. While the resource is immovable, the necessary supporting infrastructure can be developed where needed. With available infrastructure, especially the grid, fast being depleted or not existing in good wind and solar resource areas, major investment is required to facilitate continued cost effective renewable energy development.

The most cost effective manner to develop and utilise new infrastructure is to cluster development in high potential areas and share infrastructure to achieve economies of scale. This would decrease the overall price of renewable energy and ultimately result in the greatest economic benefit to the country.

Clustering of renewable energy development is already, and will keep occurring in areas with high resources and available infrastructure, regardless of whether REDZs are adopted. The adoption of REDZs will, however, direct clustering to areas that are strategically best suited for it, and allow for proactive and timely groundwork (including grid access) in such areas to optimise positive and minimises negative social and environmental impacts.

- <u>Wider Distribution of Local Benefits</u>

The potential issue of renewable energy clusters resulting in fewer local communities directly benefiting from socio-economic initiatives can be addressed though a wider distribution of these benefits (e.g. regional or provincial) once the immediate local community has benefited sufficiently. More collaborative and efficient management of local economic benefits resulting from clustered development might also result in more benefits being available to be spread to more communities.

- <u>Targeting Regional Service Centres in Rural Areas</u>

Directing renewable energy clusters further away from large cities, as might result from the adoption of REDZs, could reduce local socio-economic benefits to urban areas where the need might be high. Although the social needs around larger cities might be the greatest due to more people being present, the potential positive impact that renewable energy development could have in these sizable and well established economies is limited. On the other hand renewable energy development in remote and rural areas has the potential to make a meaningful contribution to these smaller local economies. Developments in rural areas might, however, run the risk of insufficient services (e.g. work force, accommodation, and engineering services) and local communities being too small to absorb local economic benefits wastages. The optimal location of renewable energy clusters are thus likely to be in rural areas and near regional service delivery centres which can provide the required services, while the development still has the potential to make a meaningful contribution to the local economy.

- <u>Land Prices</u>

By identifying REDZs as priority areas for renewable energy development there is a risk that land prices might increase in these areas and adversely affect energy prices. This might occur either due to speculation or a shortage of land which would lead to inflated rental prices and limited competitiveness. With the eight proposed REDZs covering approximately 80 000 km^2 and 17 154 farm portions over five provinces, the supply of land available for the development of wind and solar PV projects in these areas is unlikely to be exhausted soon. Furthermore, development will not be limited to the REDZs, which means that all suitable land outside the REDZs will still be in competition with land inside the REDZs. Although there might be a premium on land inside the REDZs, it is envisaged that the amount of land available both inside and outside the REDZs will provide for enough competition to avoid significant escalation in land prices in REDZs.

The fact that the REDZs allow for several areas in the country to be unlocked simultaneously (e.g. the required infrastructure such as electricity grid be made available) is likely to increase the competitiveness of the industry. In the absence of the REDZs process that allows for proactive investment in infrastructure, a lack of infrastructure and the reactive development thereof is likely to severely limit competition. Only the few areas with available infrastructure would be able to compete, and land prices in these areas would increase significantly. The most important factor influencing land prices is thus the availability of suitable land with the required infrastructure to allow for sufficient competition, and the REDZs are intended to facilitate this.

Speculation also has the potential of increasing land prices in any area earmarked for development. Such speculation cannot be managed without regulation, which is not being considered. The best mitigation measures to manage speculative price increases would firstly be to ensure that sufficient suitable land with the required infrastructure is available for development, making it impossible for speculators to hold development to ransom. Secondly, it would be to ensure that individual stakeholders do not have access to information that is not available to all. The identification, planning and implementation of REDZs must, therefore, be transparent and in the public domain.

The establishment of renewable energy projects in areas that are used to generate revenue from the natural landscape (e.g. eco-tourism and game farming) can negatively impact the revenue generated from such activities. Since land values are linked to future revenue potential, the negative impact of renewable energy development in such areas could result in the decrease in the value of surrounding land used for tourism. Most of the land used for such purposes is owned privately and the decision as to whether the benefits of renewable energy development outweigh the impacts resides with individual owners. Where neighbouring properties might be affected in this regard it is important for the relevant stakeholders to be adequately consulted and this impact to be taken into consideration when assessing the appropriateness of a renewable energy development.

- <u>Phased Development</u>

Renewable energy development is characterised by large initial capital investment and major service requirements during the shorter construction phase. These requirements then significantly decrease for the remainder of the project's operational lifetime. Irregular surges in development do not only lead to unsustainable short term positive socio-economic impacts (e.g. only temporary employment and temporary service demands), but also lead to pronounced negative impacts due to the local community and social services not being adapted to such a situation (e.g. policing, educational and housing shortages). The larger and more irregular the surges in development, the less significant the positive and more severe the negative local socio-economic impacts. These irregular surges could result when several projects utilising the full capacity of a new substation are allocated in a single year, and none thereafter. A gradual and phased allocation of substation capacity over several years would thus avoid such surges.

Temporary positive socio-economic impacts can be optimised through the gradual and phased roll-out of renewable energy development within a specific area (e.g. REDZs). Such sustained development would afford the local community and economy the time to evolve and take better advantage of opportunities arising from renewable energy development. Specialised local businesses, a highly skilled local workforce, as well as additional local housing and accommodation can all be developed over time to support sustained development.

Perhaps more importantly, the negative socio-economic impacts associated with service shortages and migrant worker influxes can be greatly reduced by allowing a gradual adaptation of the local community. The development of industry specific local skills, knowledge and services over time would reduce the need for importing external skills and services, and thus decrease negative impacts associated with worker influxes.

- <u>Preparation and Collaboration</u>

The greatest socio-economic impacts associated with renewable energy developments occur during the construction phase. While socio-economic investment is most necessary during this time, they are generally only initiated once the project is operational and earning revenue. Communication and consultation with the local community prior to the commencement of a renewable energy development is also necessary to ensure that expectations are realistic in order to prevent future disappointment, conflict and disruptions. An accurate and consistent message must be communicated regarding proposed development and associated positive and negative impacts.

Through early communication with local communities it is possible to identify the local community's needs which can then be translated into potential socio-economic initiatives. Such initiatives might not only include the establishment of infrastructure or services, but also long term maintenance thereof. Optimal socio-economic initiatives should have a real impact on the lives of local communities and not only a few individuals, and should result in the development of sustainable and independent communities rather than communities reliant on continuous external support. The evaluation of potential opportunities should be consistent and in terms of a formal framework based on appropriate objectives. Moreover, the framework should ensure that a local community's needs are not addressed repetitively (e.g. two sport fields being built on either side of town), and that initiatives are spread at different spatial levels, for example ranging from immediately local, REDZs, provincial, to national.

The establishment of a central renewable energy implementation office could assist in accomplishing all of the above. Such a centralised office would also reduce the overall amount of funds intended for community investment that is spent on establishing and maintaining several implementation offices in the same area. Each development area (e.g. REDZs) might require such an office that has the mandate to do the preparatory work, including engaging with the community, facilitating the proactive establishment of required social infrastructure, and identifying appropriate socio-economic investment opportunities that can be taken up by projects when they arrive. Such an office can also be responsible for general liaison between renewable energy industry and other stakeholders in the area (including local government), while also assisting local government with capacity building to support renewable energy development. In general, such an office would be responsible for all matters related to facilitating renewable energy development in the area.

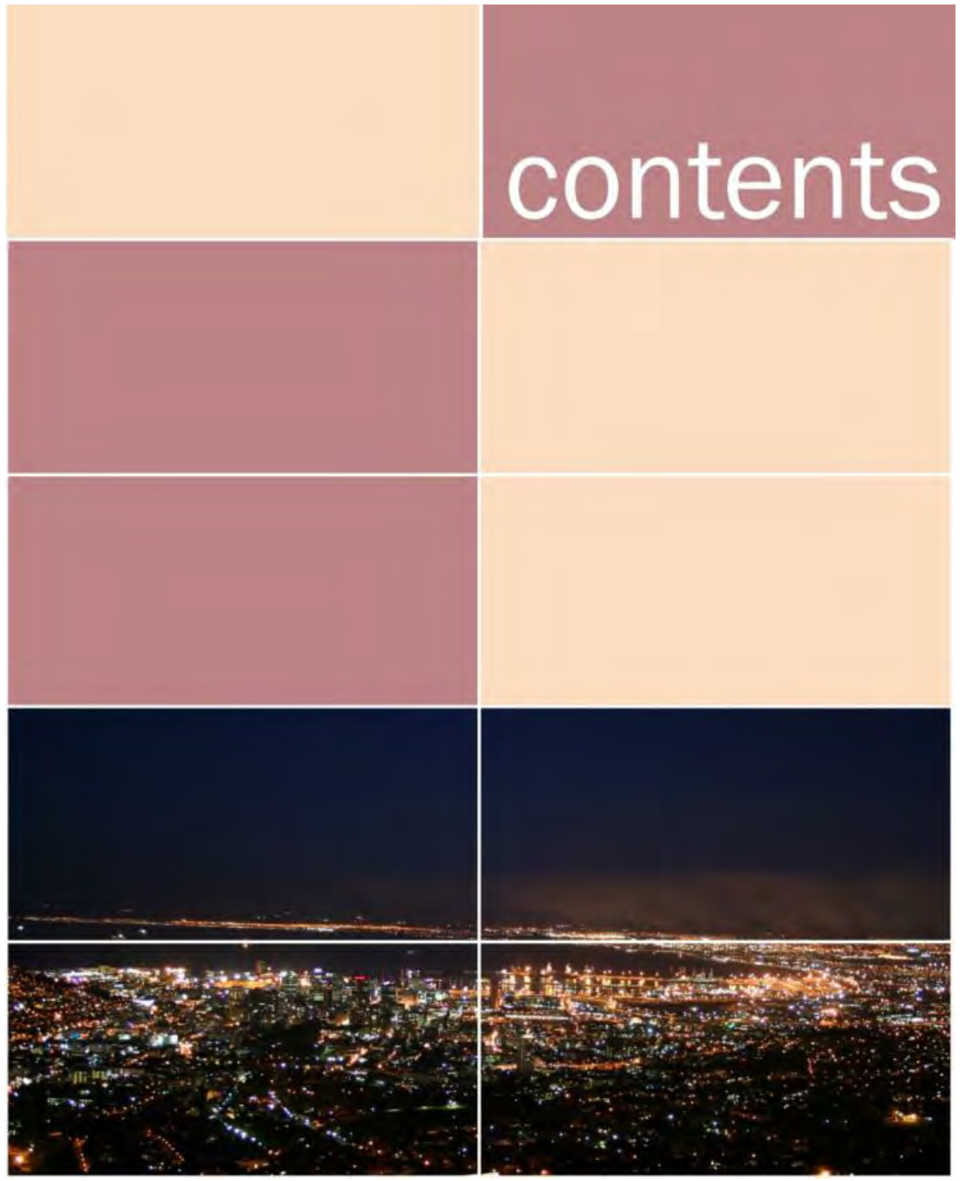
- <u>Summarising Considerations Going Forward:</u>

Managing the socio-economic impacts associated with renewable energy development, and the optimisation thereof, is ultimately a complex issue that needs to be investigated and discussed further. In summary, the following considerations should form part of such discussions:

- The greatest socio-economic benefit of renewable energy development is at a macro-economic scale, and should not be overlooked by overemphasizing direct micro-economic benefits at a local scale;
- The clustering of renewable energy facilities allows for more cost effective development which translates to greater national and local socio-economic benefits;
- The increased local economic benefits can be spread wider after it has sufficiently benefited the immediate local community;
- A gradual phasing of development over several years in the same area would afford the local community and economy the time to evolve and take better advantage of opportunities arising from renewable energy development;
- A central renewable energy implementation office, or similar agency, in each REDZ would enable local capacity building, effective engagement with communities, identification and implementation of optimal socio-economic investment initiatives, and collaborative investment leading to cumulative positive impacts; and
- A formal framework based on appropriate socio-economic objectives should be developed to guide the identification of appropriate socio-economic investment opportunities.

PART 4

Renewable Energy Development Zones (REDZs)



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Introduction

After identifying the Focus Areas (FAs) as being of strategic importance for large scale wind and solar photovoltaic (PV) development, and having completed the scoping assessments, the eight FAs are put forward for adoption as Renewable Energy Development Zones (REDZs). In order to inform future planning and strategic investment in these areas it is necessary to estimate the potential development capacity for each of the REDZs.

Wind and solar PV developments already proposed in and around the proposed REDZs are evaluated in this part of the report to provide a first indication of the minimum development potential in these areas. The size of the proposed REDZs, their environmental sensitivities, and the development density limit guidelines specified in Part 3: Section 2 (Landscape Assessment) are then used to estimate the probably development potential for these areas. Since both the sensitivity and density limits are subject to project level assessments, the estimated development capacities presented in this section are only indicative values which could be much greater or smaller in reality.

Considering that electricity grid evacuation capacity is currently one of the greatest constraints to renewable energy development in South Africa, and probably the greatest determinant of the success of REDZs, the current and potential future transmission substations in and around the proposed REDZs have also been evaluated in this final part of the report.

The purpose of Part 4 is to provide an overview of the development and evacuation capacities in the proposed REDZs and, in addition to Part 1 of this report, provide a closing summary of the way forward.

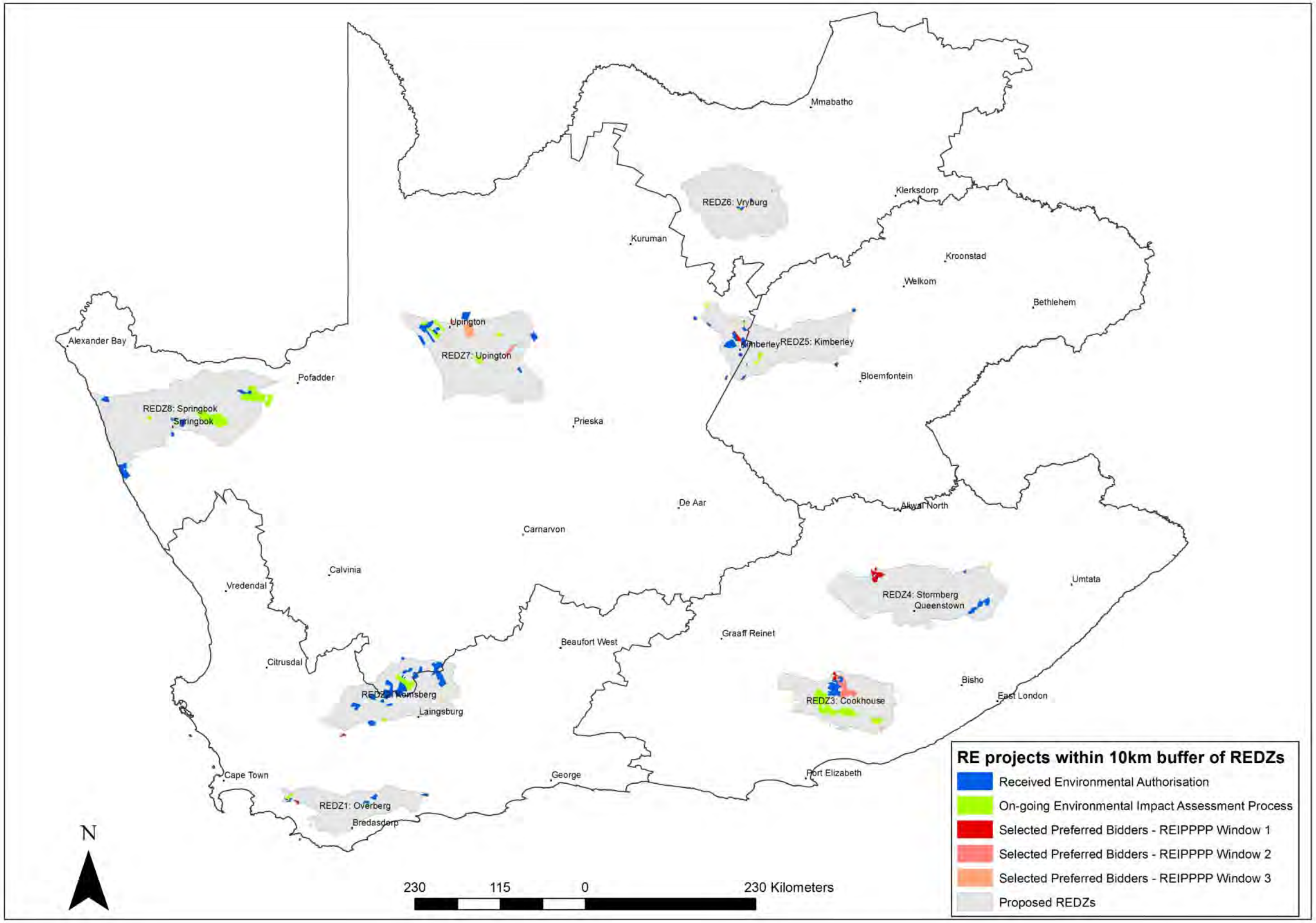
Section 1. Existing and Proposed Generation Capacity

Projects that have already received or are in the process of applying for environmental authorisation can be considered to represent the absolute minimum development potential proposed by developers in REDZs. The presence of such projects in the proposed REDZs, especially if they have been successful in the REI4P bidding process, is an indication of the viability of these areas for wind and solar PV development.

In December 2013 there were a total of approximately 13.5 GW, or 118 wind and solar PV projects either proposed or under construction in and around the areas being put forward as REDZs. Table 1 and Map 1 provide an overview of the wind and solar PV projects that have already received, or were in the process of applying for environmental authorisation in and around (within 10 km) of the proposed REDZs by December 2013. While the 11 (6 wind and 5 solar PV) rounds 1 to 3 preferred bidder projects in the proposed REDZs confirm the economic viability of these areas, the additional 104 projects (approximately 32 wind projects representing 6 844 MW capacity and 72 solar PV projects representing 5 971 MW capacity) confirms sufficient development capacity in and around the proposed REDZs.

Table 1: Existing and proposed generation capacity that have already received, or are in the process of applying for Environmental Authorisation (EA) in the proposed REDZs by December 2013

	Existing and Proposed Generation Capacity																									
	Wind								Solar PV								Wind and/or Solar PV								Total	
	Preferred Bidder		Approved EA		EA in Process		Total		Preferred Bidder		Approved EA		EA in Process		Total		Preferred Bidder		Approved EA		EA in Process		Total			
	Number	MW	Number	MW	Number	MW	Number	MW	Number	MW	Number	MW	Number	MW	Number	MW	Number	MW	Number	MW	Number	MW	Number	MW	Number	MW
REDZ1	1	26	3	363	4	536	8	925	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	925
REDZ2	0	0	6	2131	3	420	9	2551	1	36	1	10	0	0	2	46	0	0	2	870	0	0	2	870	13	3467
REDZ3	4	379	3	770	3	980	10	2129	0	0	1	14	4	300	5	314	0	0	0	0	0	0	0	0	15	2443
REDZ4	1	97	2	117	1	180	4	394	0	0	1	9	0	0	1	9	0	0	0	0	0	0	0	0	5	403
REDZ5	0	0	0	0	0	0	0	0	3	172	21	899	6	340	30	1411	0	0	0	0	0	0	0	0	30	1411
REDZ6	0	0	0	0	0	0	0	0	0	0	6	295	1	75	7	370	0	0	0	0	0	0	0	0	7	370
REDZ7	0	0	0	0	0	0	0	0	1	9	12	685	8	1800	21	2494	0	0	0	0	0	0	0	0	21	2494
REDZ8	0	0	2	127	3	350	5	477	0	0	7	219	6	325	13	544	0	0	0	0	1	1000	1	1000	19	2021
Total	6	502	16	3508	14	2466	36	6476	5	217	49	2131	25	2840	79	5188	0	0	2	870	1	1000	3	1870	118	13534



Map 1: Existing and proposed renewable energy projects that have already received, or are in the process of applying for Environmental Authorisation (EA) in the proposed REDZs by December 2013

Section 2. Estimated Development Capacity

2.1 Combined Environmental Sensitivities

In order to estimate the development capacities of the proposed REDZs it was first necessary to determine the overall combined environmental sensitivity. The combined sensitivity was then used to eliminate those areas in the proposed REDZs that are potentially unsuitable for development (i.e. all Very High sensitivity areas) before using the remaining areas to estimate development capacities. The combination of the sensitivity of the individual components is achieved by merging the "relative sensitivity maps[1]" to determine the highest sensitivity rating identified for any specific area. The combined sensitivity maps thus only provide an indicative sensitivity based on the highest level of sensitivity identified, but do not consider the potential accumulation of sensitivities.

The combination of the environmental sensitivity maps undertaken in this section is not meant to inform any environmental assessment. Such assessment can only be based on the individual sensitivity maps to inform the level of assessment required for that specific sensitivity. The combination of the sensitivity maps undertaken in this section is only to inform the estimation of development capacities of the proposed REDZs. The fact that very little Low and Medium sensitivity areas are to be found on the combined sensitivity maps does, however, indicates that the avoidance of all highly sensitive areas is generally not possible, and that without reasonable and responsible solutions to balance competing interests renewable energy development cannot take place.

The sensitivity of the following components assessed in Part 3 of this report are included in the combined sensitivity maps:

- Agriculture
- Landscape
- Heritage
- Terrestrial and Aquatic Biodiversity
- Birds
- Bats
- Civil Aviation
- Defence
- Telecommunication
- Weather Services
- The Square Kilometre Array
- Mining
- Noise
- Flicker

The development footprint limits based on agricultural sensitivity, as determined in Part 3: Section 1 of this report, only allow for solar PV development in areas identified as having a low agricultural sensitivity. During the combination of the sensitivity of the individual components it was thus assumed that all areas that do not have a low agricultural sensitivity are potentially unsuitable for solar PV development. In other words, all Very High, High and Medium agricultural sensitivity areas were eliminated for solar PV development.

After the elimination of the Very High sensitivity areas, the development capacity of the remaining areas was calculated according to their associated development density limit guidelines in MW/km^2. These density limits were determined in the Landscape Assessment presented in Part 3: Section 2 of this report.

The combined sensitivity maps as well as the size and landscape sensitivity of the remaining areas are illustrated in Figures 1 to 8 below.

[1] The "relative sensitivity maps" contain the four tiers of sensitivity for each component considered in Part 3 Sections 1 to 14.

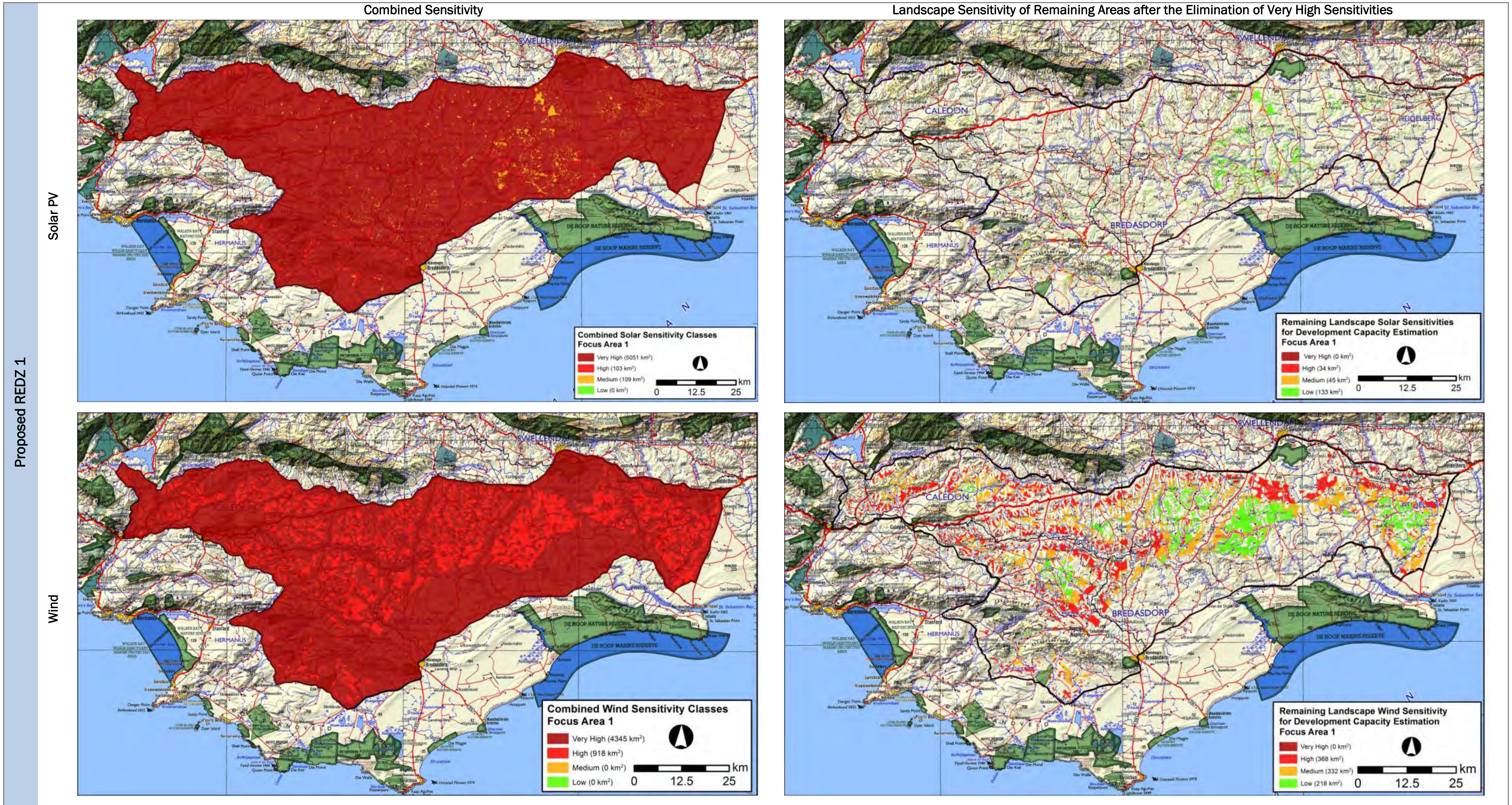


Figure 1: Proposed Overberg REDZ 1 combined sensitivities (left) and landscape sensitivity of remaining areas after the elimination of combined very high sensitivities

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Proposed REDZ 2

Combined Sensitivity | Landscape Sensitivity of Remaining Areas after the Elimination of Very High Sensitivities

Solar PV

Wind

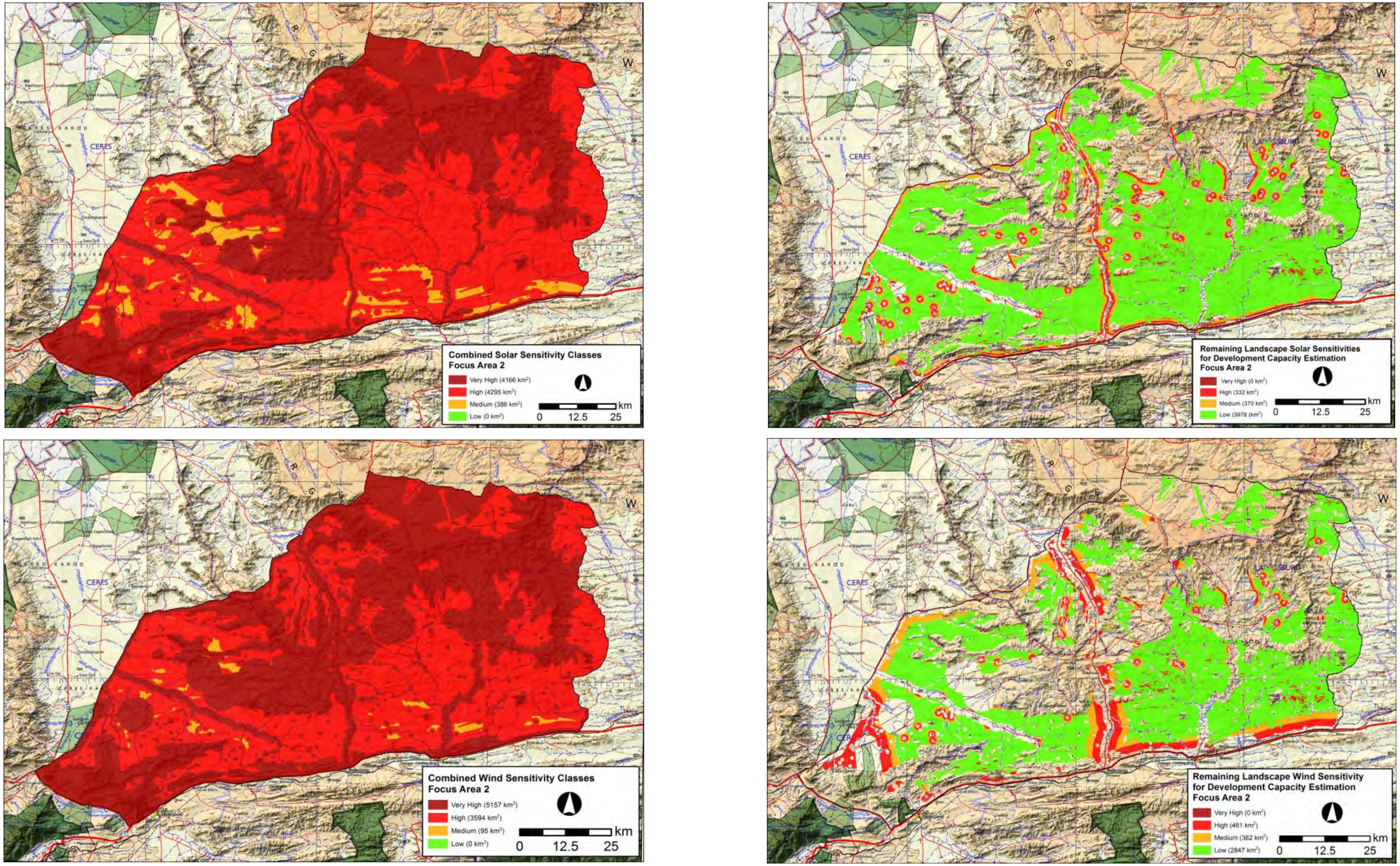

Figure 2: Proposed Komsberg REDZ 2 combined sensitivities (left) and landscape sensitivity of remaining areas after the elimination of combined very high sensitivities

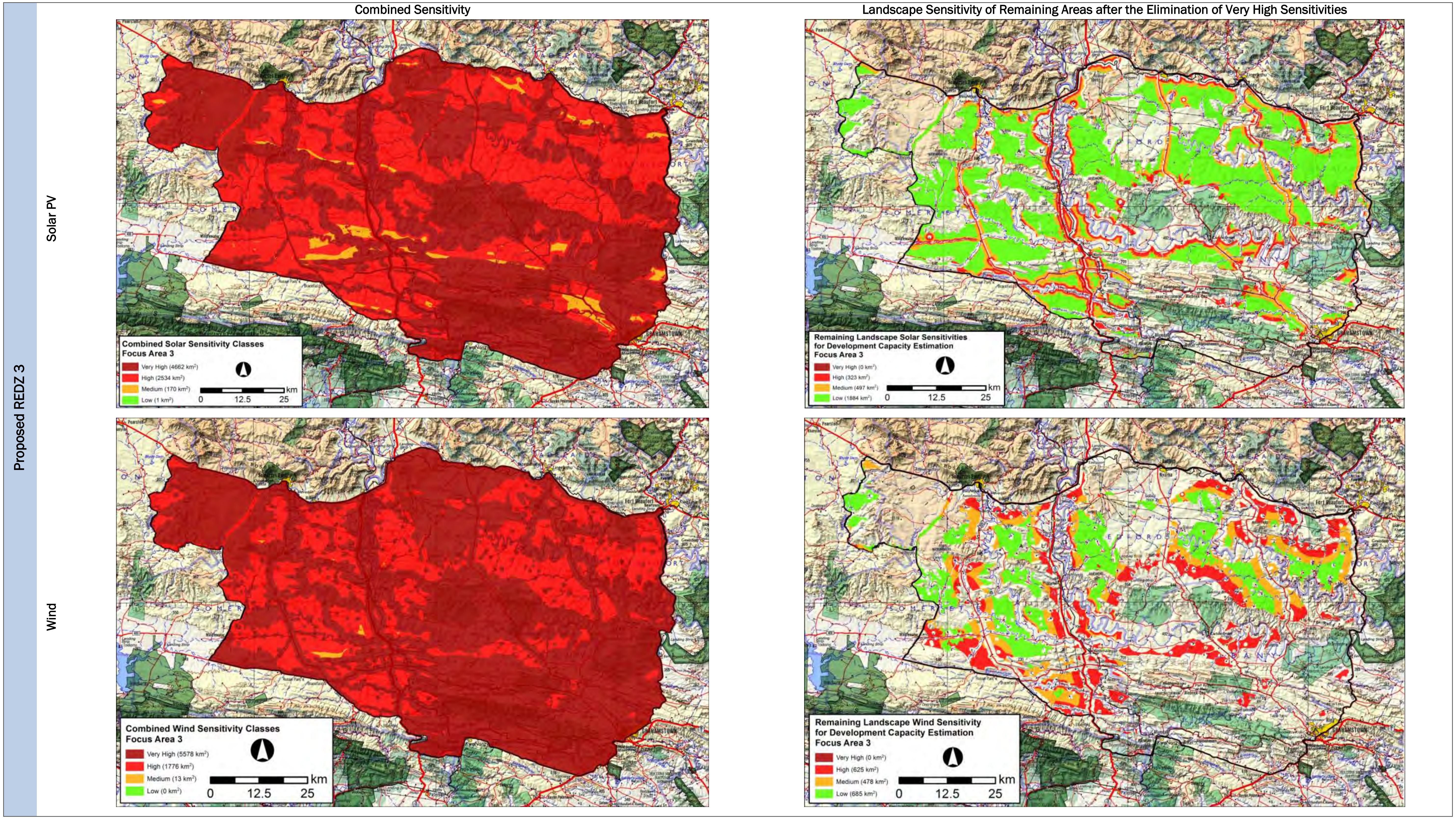

Figure 3: Proposed Cookhouse REDZ 3 combined sensitivities (left) and landscape sensitivity of remaining areas after the elimination of combined very high sensitivities

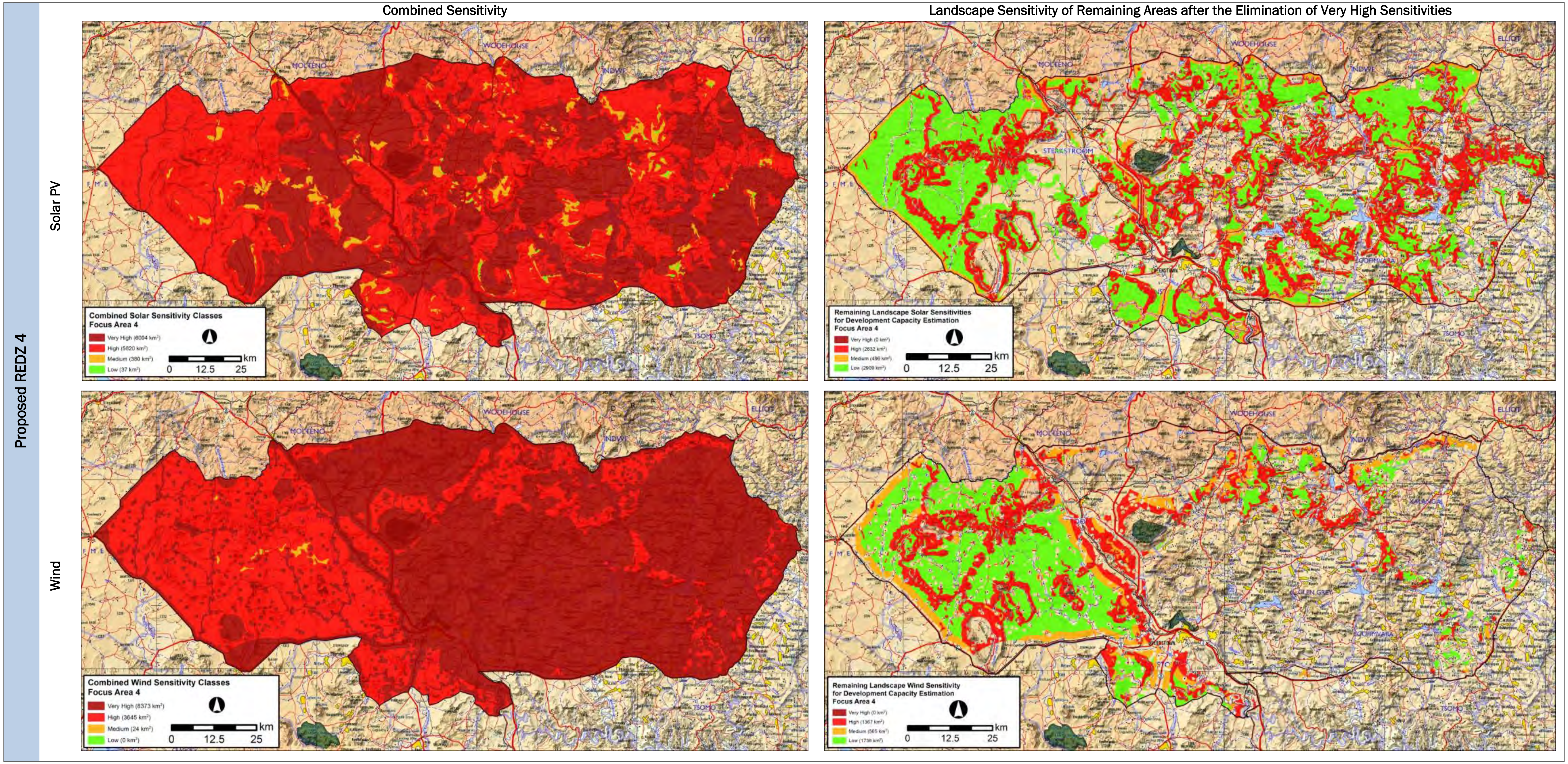

Figure 4: Proposed Stormberg REDZ 4 combined sensitivities (left) and landscape sensitivity of remaining areas after the elimination of combined very high sensitivities

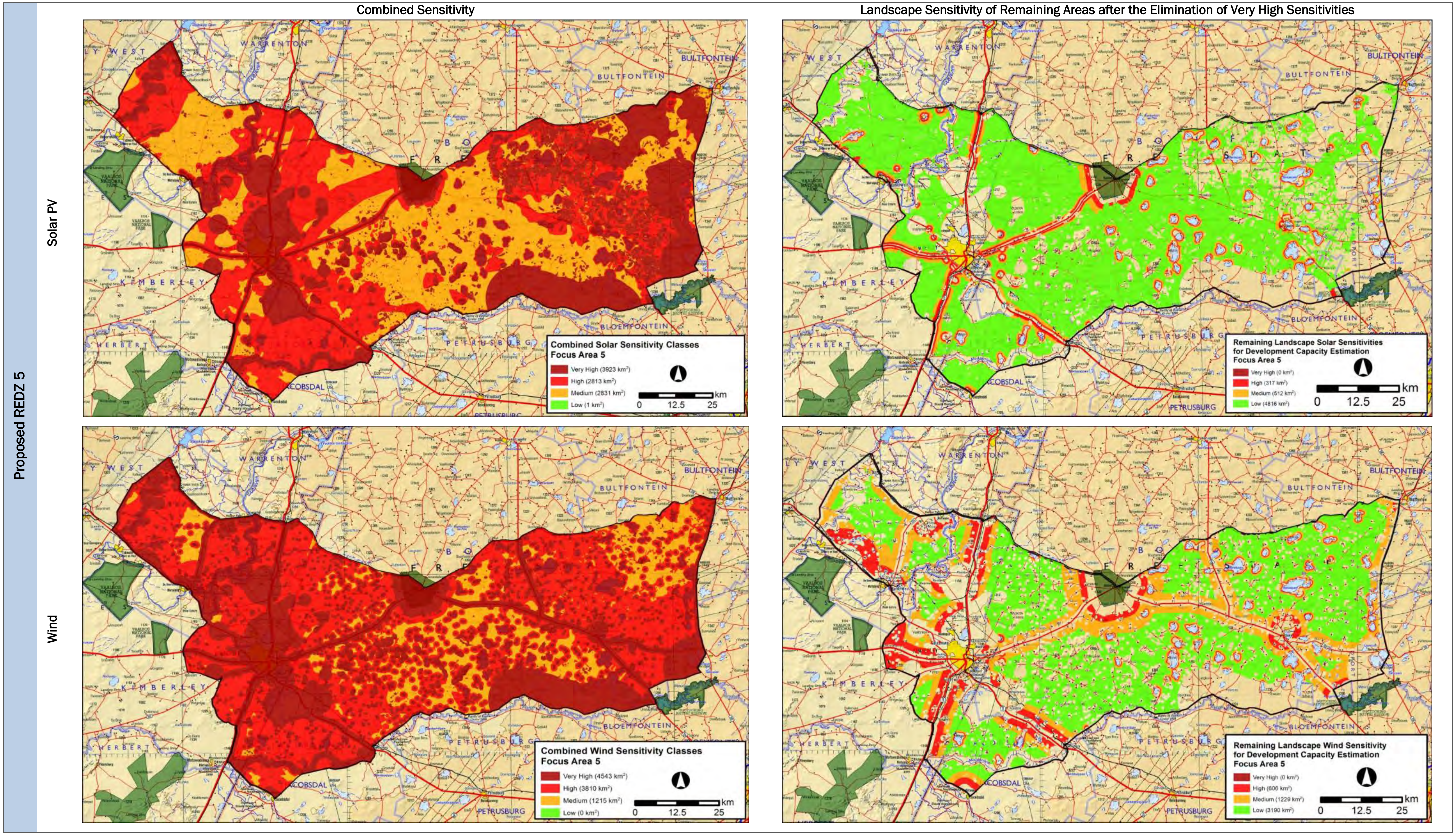

Figure 5: Proposed Kimberley REDZ 5 combined sensitivities (left) and landscape sensitivity of remaining areas after the elimination of combined very high sensitivities

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Proposed REDZ 6

Solar PV

Wind

Combined Sensitivity

Landscape Sensitivity of Remaining Areas after the Elimination of Very High Sensitivities

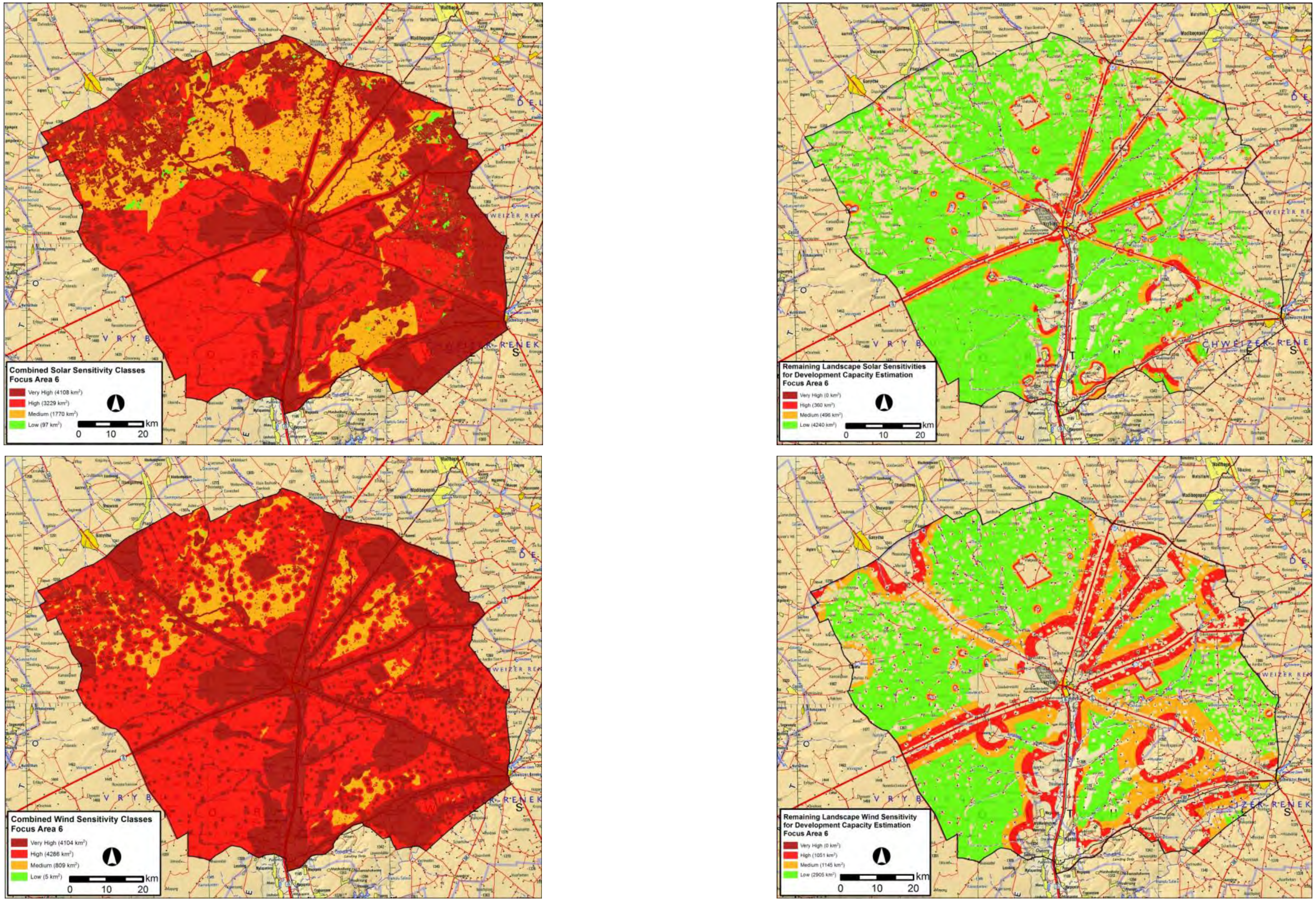


Figure 6: Proposed Vryburg REDZ 6 combined sensitivities (left) and landscape sensitivity of remaining areas after the elimination of combined very high sensitivities

Proposed REDZ 7

Combined Sensitivity | Landscape Sensitivity of Remaining Areas after the Elimination of Very High Sensitivities

Solar PV

Wind

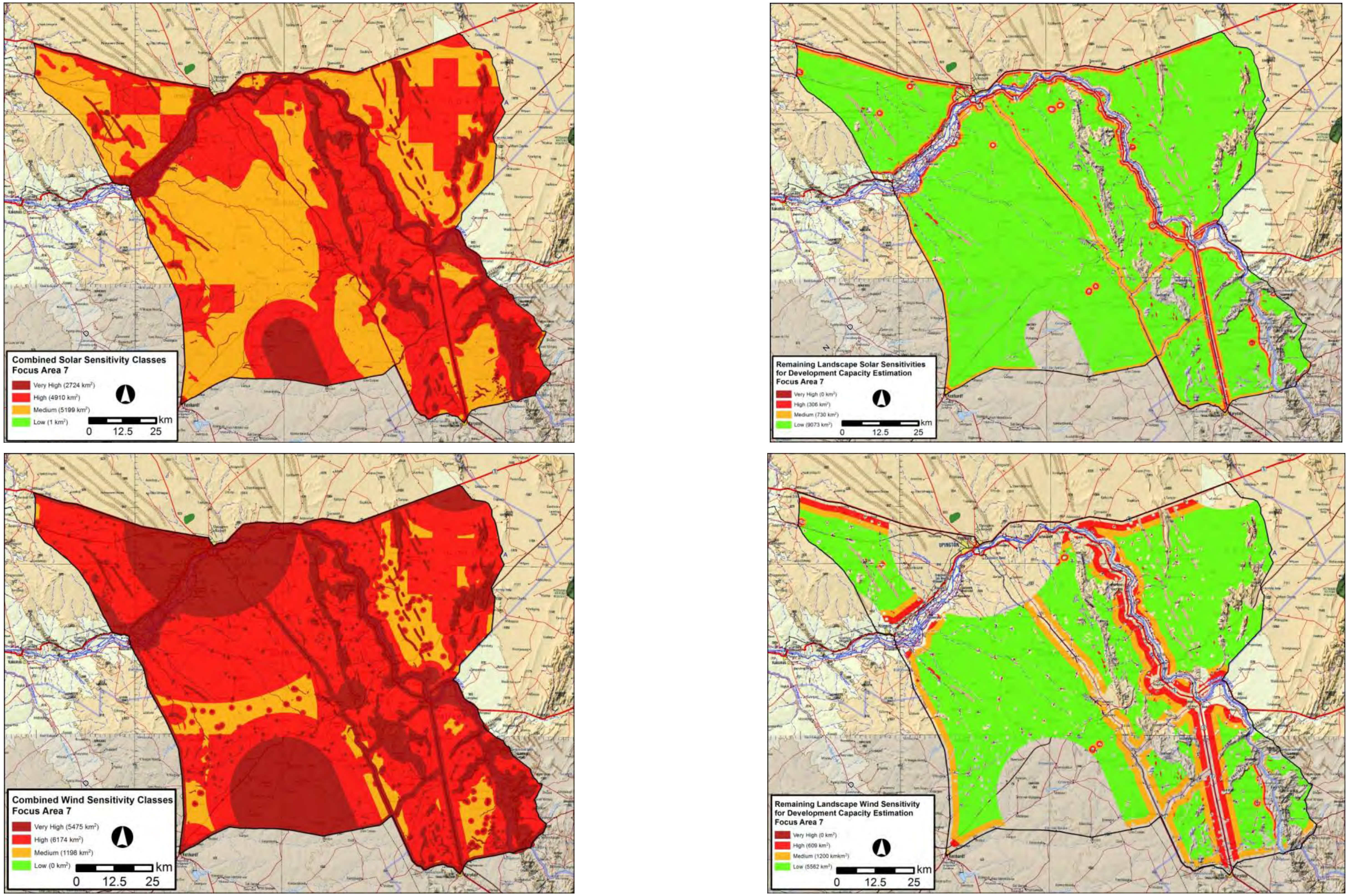


Figure 7: Proposed Upington REDZ 7 combined sensitivities (left) and landscape sensitivity of remaining areas after the elimination of combined very high sensitivities

Proposed REDZ 8

	Combined Sensitivity	Landscape Sensitivity of Remaining Areas after the Elimination of Very High Sensitivities
Solar PV		
Wind		

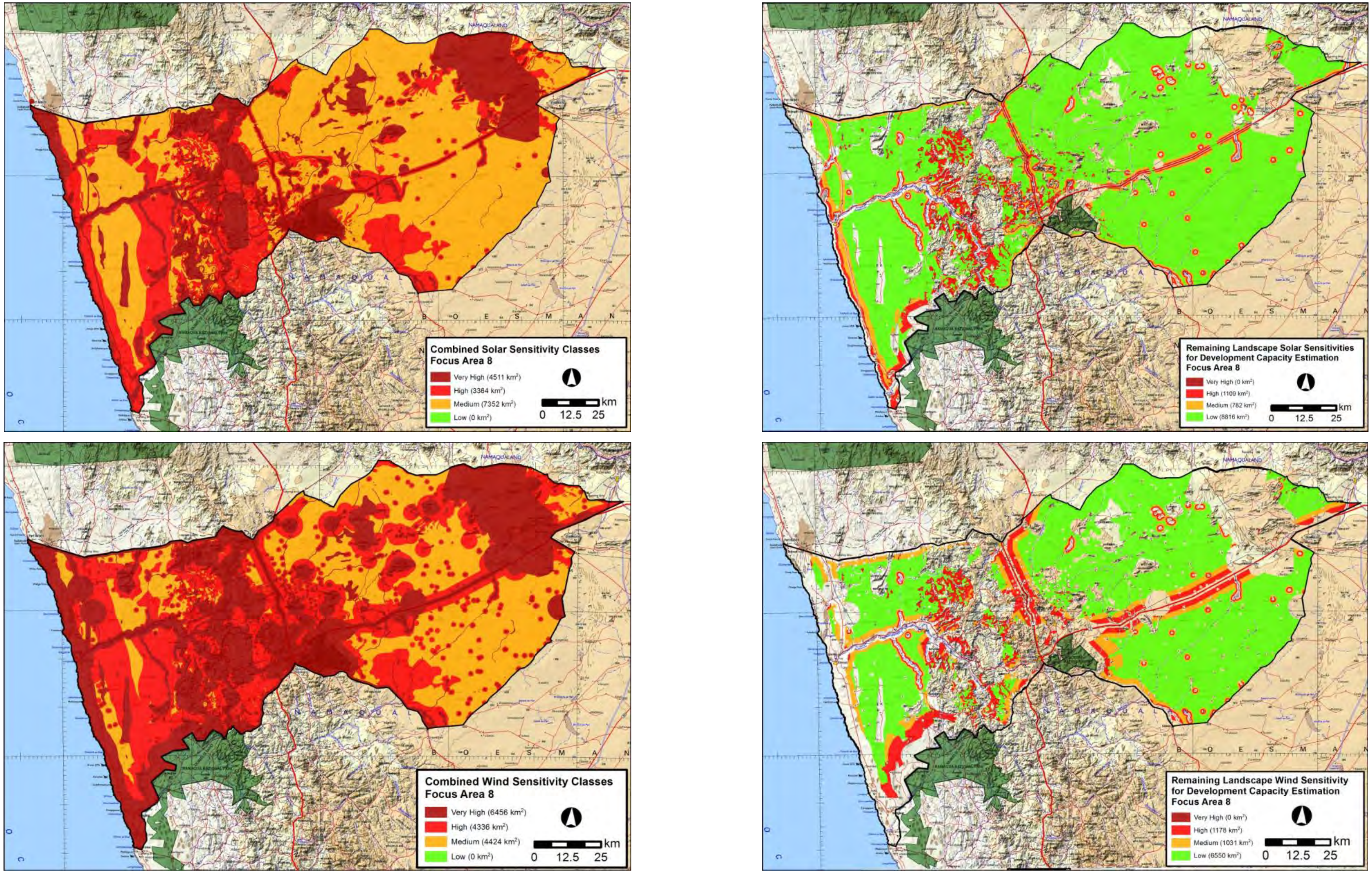


Figure 8: Proposed Springbok REDZ 8 combined sensitivities (left) and landscape sensitivity of remaining areas after the elimination of combined very high sensitivities

2.2 Calculations

After determining the size as well as landscape sensitivity of the areas in the REDZs that are not considered to be potentially unsuitable for development, and subsequently applying the associated development density limits as determined in Part 3: Section 2 of this report, it was possible to calculate the estimated development capacity for each of the REDZs (see Table 3). The estimated development capacity is subject to change based on project level assessments that will further inform the site specific sensitivities and development density limits, and could thus be significantly greater or smaller than calculated here.

The estimation of the development capacity does not take into consideration the variation in resource potential within the proposed REDZs, but rather assumes a homogeneous and suitable resource for the entire area. Even though it is known that some portions of the proposed REDZs might not have a suitable resource, the fact that these areas were identified for their high development potential (which includes resource potential, infrastructure availability and socio-economic needs) makes them generally suitable for development. While it is recognised that not all of the remaining areas (i.e. after the elimination of Very High sensitivity areas) have suitable resource potential, this would be partially compensated by project level assessments and mitigation measures allowing for development in areas currently mapped as having Very High sensitivity.

The estimation of the wind and solar PV development capacity assumes that the same land is available for both types of development. In order to avoid double counting when estimating the overall combined development capacity for each proposed REDZ it was necessary to make assumptions with regard to what portion of the available land could potentially be used for each technology. The estimated development capacities for wind and solar PV were then adjusted accordingly before determining the overall combined estimated development capacity. The assumptions were broadly based on the relative potential for wind and solar PV development in each proposed REDZ (see Table 1).

Based on the mentioned assumptions the proposed REDZs are estimated to collectively represent approximately 15.5 GW of wind and 166 GW of solar PV potential development capacity.

Table 2: Assumptions with regard to the percentage of available land that potentially could be used for each technology

	Portion of capacity considered for estimation of overall combined capacity		Notes
	Wind	Solar	
REDZ 1: Overberg	90%	10%	With relatively low solar irradiance, and limited large land portions that are not under cultivation, significant solar PV development is unlikely in this area.
REDZ 2: Komsberg	75%	25%	Existing solar PV projects indicate that this area has a relatively good solar resource. It also has a high wind resource potential that can be exploited when grid infrastructure becomes available.
REDZ 3: Cookhouse	90%	10%	With relatively low solar resource potential, and limited large and flat land portions, significant solar PV development is unlikely in this area.
REDZ 4: Stormberg	90%	10%	This area has been identified for its high wind potential. Even though marginal, compared to higher resource areas in the country, some of the best solar resource in the Eastern Cape province is found in the north of the site.
REDZ 5: Kimberley	0%	100%	Solar resource potential in these areas is known to be high. Wind data were not available for this assessment and since not wind projects are proposed in these areas it is for now assumed the wind resource is not exploitable.
REDZ 6: Vryburg	0%	100%	
REDZ 7: Upington	0%	100%	
REDZ 8: Springbok	50%	50%	Both wind and solar resources in this area are considered to be of high potential.

Table 3: Overview of generation capacity estimations

	Total Area (km^2)	Total Nr of Farm Portions	Estimated Development Capacities After Removal of Very High Sensitivities											
			Wind						Solar PV					
			Landscape Sensitivity class	Area (km^2)	Density Limit Guideline (MW/km^2)	Estimated Capacity (MW installed)	Total Capacity Potential (MW installed)	Portion of Capacity based on % allocation	Landscape Sensitivity class	Area (km^2)	Density Limit Guideline (MW/km^2)	Estimated Capacity (MW installed)	Total Capacity Potential (MW installed)	Portion of Capacity based on % allocation
REDZ1			High	368	0.8	294.4			High	34	2.5	85		
Wind 90%	5263	2472	Medium	332	1.1	365.2	965	868	Medium	45	4.2	189	1112	111
Solar PV 10%			Low	218	1.4	305.2			Low	133	6.3	838		
REDZ2			High	461	0.8	368.8			High	332	2.5	830		
Wind 75%	8846	561	Medium	382	1.1	420.2	4775	3581	Medium	370	4.2	1554	27445	6861
Solar PV 25%			Low	2847	1.4	3985.8			Low	3978	6.3	25061		
REDZ3			High	625	0.8	500			High	323	2.5	808		
Wind 90%	7366	2409	Medium	478	1.1	525.8	1985	1786	Medium	497	4.2	2087	14764	1476
Solar PV 10%			Low	685	1.4	959			Low	1884	6.3	11869		
REDZ4			High	1367	0.8	1093.6			High	2632	2.5	6580		
Wind 90%	12041	2892	Medium	565	1.1	621.5	4146	3731	Medium	496	4.2	2083	26990	2699
Solar PV 10%			Low	1736	1.4	2430.4			Low	2909	6.3	18327		
REDZ5			High	606	0.8	484.8			High	317	2.5	793		
Wind 0%	9568	2985	Medium	1229	1.1	1351.9	6303	0	Medium	512	4.2	2150	33284	33284
Solar PV 100%			Low	3190	1.4	4466			Low	4816	6.3	30341		
REDZ6			High	1051	0.8	840.8			High	360	2.5	900		
Wind 0%	9204	2699	Medium	1145	1.1	1259.5	6167	0	Medium	496	4.2	2083	29695	29695
Solar PV 100%			Low	2905	1.4	4067			Low	4240	6.3	26712		
REDZ7			High	609	0.8	487.2			High	306	2.5	765		
Wind 0%	12833	1888	Medium	1200	1.1	1320	9594	0	Medium	730	4.2	3066	60991	60991
Solar PV 100%			Low	5562	1.4	7786.8			Low	9073	6.3	57160		
REDZ8			High	1178	0.8	942.4			High	1109	2.5	2773		
Wind 50%	15214	1240	Medium	1031	1.1	1134.1	11247	5623	Medium	782	4.2	3284	61598	30799
Solar PV 50%			Low	6550	1.4	9170			Low	8816	6.3	55541		
Total	80335	17146					45180	15590					255879	165917

Section 3. Evacuation Capacity

With the capacity of the electrical grid to evacuate generation capacity becoming one of the greatest hurdles for renewable energy development in South Africa, and potentially also being the most important factor determining the success of the REDZs, the current and potential future transmission substations in and around the proposed REDZs were evaluated. The current transmission substations in the proposed REDZs with their remaining capacity to connect additional renewable energy projects after the 3rd bidding round, as well as potential future transmission substations in or near the proposed REDZs with their evacuation capacities and likely construction timeframes, were provided by Eskom (see Table 4).

It must be noted that the location and funding for these potential future substations are not yet confirmed. The realisation, location, prioritisation and timeframes of the future potential substations are dependent on the successful implementation of the REDZs. With an urgent need for the development of several substations across the country, and limited resources available to do so, the successful adoption and implementation of the REDZs as areas associated with SIP 8 could potentially provide the justification required to secure funding and prioritise investment in these areas. The degree to which the REDZs are taken up by industry could further inform the prioritisation of investment among the different REDZs. The information with regard to potential future substations provided in this section is thus subject to change.

The currently available transmission level evacuation capacity in the proposed REDZs is 2.3 GW, with an additional 17.5 GW potentially becoming available within the next 3 - 10 years (see Table 4).

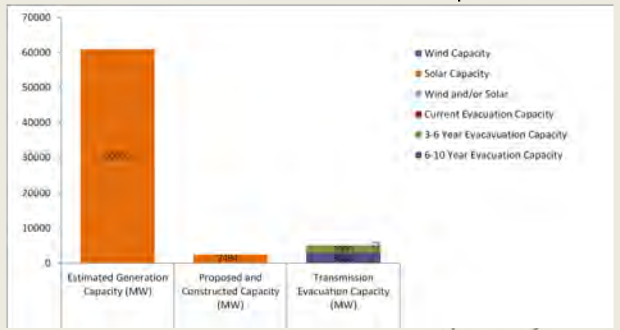
Table 4: Overview of transmission evacuation capacity estimations

	Estimated Development Capacity Potential			Transmission Connection and Evacuation Capacities									
	Wind	Solar PV	Total	Current (C)			Medium Term Future (3 - 6 years) (M)			Long Term Future (6 - 10 years) (L)			Total
	Estimated MW Capacity	Estimated MW Capacity	Estimated MW Capacity	MTS Substation	GCCA 2016 Capacity	REDZ Total (MW) (C)	MTS Substation	New Capacity	REDZ Total (MW) (M)	MTS Substation	New Capacity	REDZ Total (MW) (L)	REDZ Total (MW) (C+M+L)
REDZ1 Wind 90% Solar PV 10%	600	100	700	None	0	0	Vryheid *	500	500	Houhoek Ext *	500	500	1000
REDZ2 Wind 75% Solar PV 25%	2500	4000	6500	Kappa Komsberg	0 0	0	Koruson (Kappa)	500	500	Koruson (Kappa) Ext Komsberg B #	500 1500	2000	2500
REDZ3 Wind 90% Solar PV 10%	1200	400	1600	Poseidon 220kV Poseidon 400kV	120 266	386	None	0	0	Poseidon B Ext #	1500	1500	1886
REDZ4 Wind 90% Solar PV 10%	2500	1500	4000	Delphi	45	45	None	0	0	Delphi B #	1500	1500	1545
REDZ5 Wind 10% Solar PV 90%	400	18000	18400	Boundary Perseus	220 800	1020	None	0	0	Boundary B *	1000	1000	2020
REDZ6 Wind 10% Solar PV 90%	400	16000	16400	Mookodi	531	531	Mookodi Ext *	1000	1000	Mookodi B #	1000	1000	2531
REDZ7 Wind 10% Solar PV 90%	600	34000	34600	Garona Aries	75 0	75	Garona B * Upington *	1000 1000	2000	Garona B Ext # Upington Ext # Aries #	1000 1000 1000	3000	5075
REDZ8 Wind 50% Solar PV 50%	3900	19000	22900	Aggeneis Gromis	195 45	240	None	0	0	Gromis B # Nama B # Aggeneis B #	1000 1000 1000	3000	3240
Total	12100	93000	105100			2297			4000			13500	19797

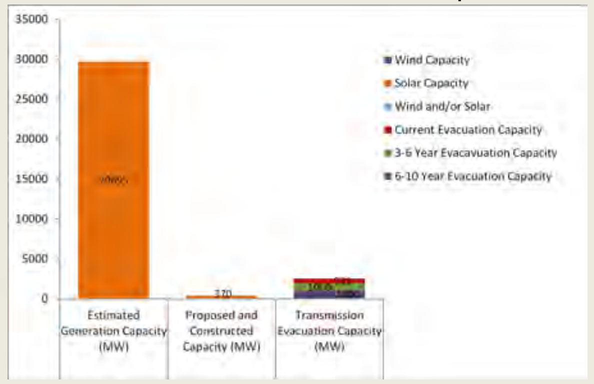
NOTES: All Medium and Long Term Future projects are not yet funded
* new transmission lines are needed but are already in future transmission plans
# new transmission lines are needed and are not yet in future transmission plans

Section 4: REDZs Summary

REDZ7: Upington
Total area: 12833 km²
Total number of farm portions: 1888
Generation and Transmission Evacuation Capacities:

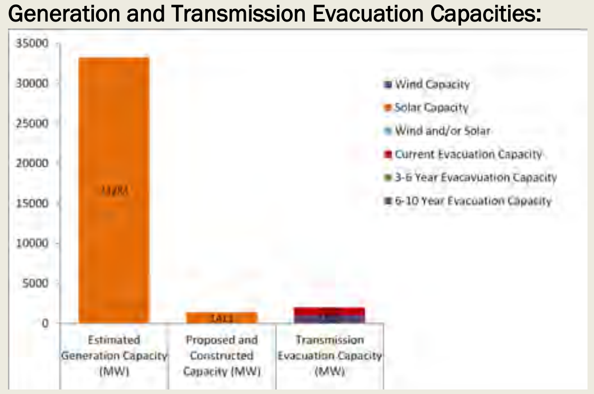


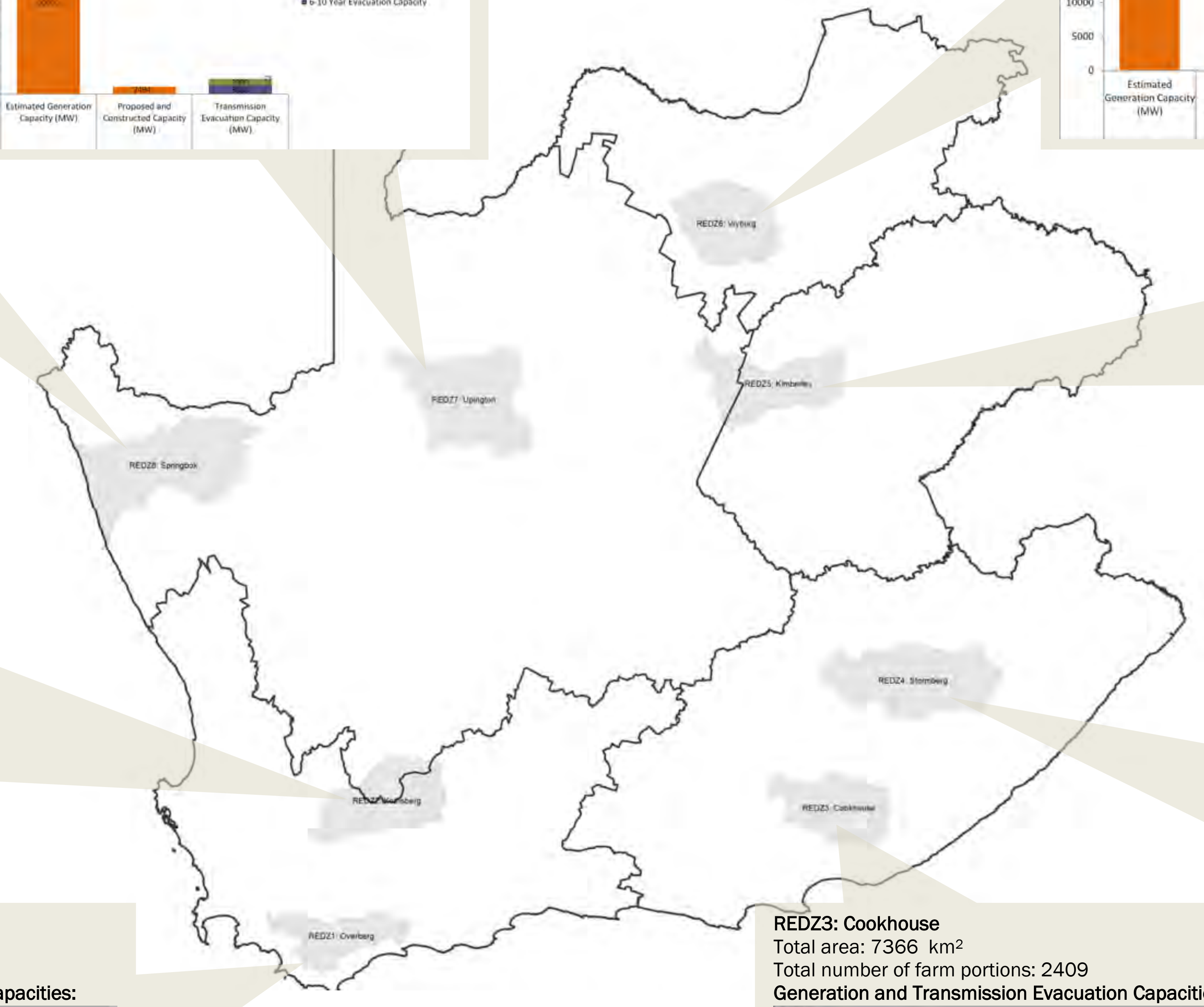
REDZ6: Vryburg
Total area: 9204 km²
Total number of farm portions: 2699
Generation and Transmission Evacuation Capacities:



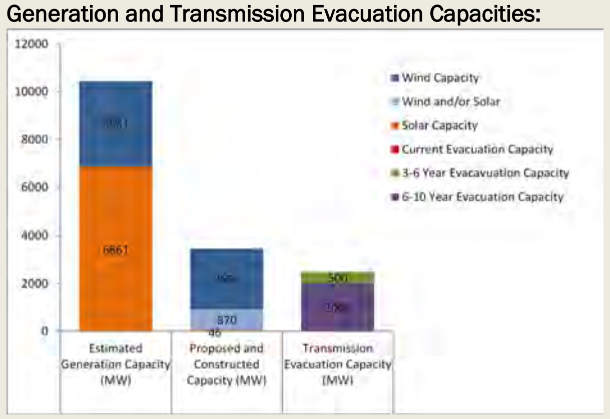
REDZ8: Springbok
Total area: 15214 km²
Total number of farm portions: 1240
Generation and Transmission Evacuation Capacities:

REDZ5: Kimberley
Total area: 9568 km²
Total number of farm portions: 2985
Generation and Transmission Evacuation Capacities:

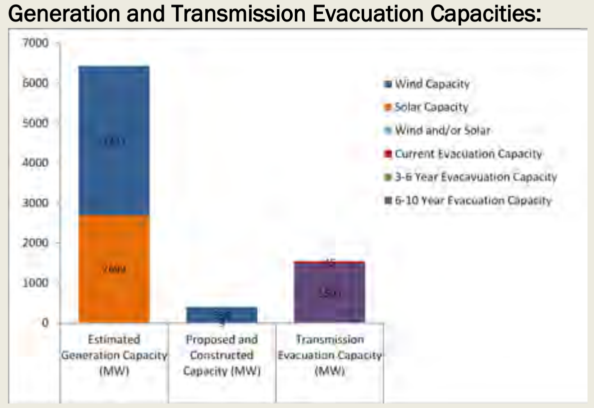




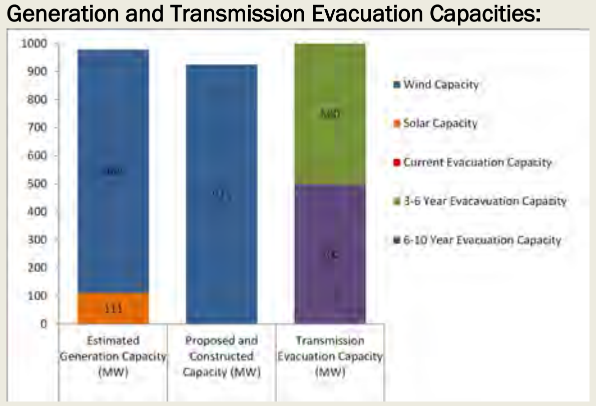
REDZ2: Komsberg
Total Area: 8846 km²
Total number of farm portions: 561
Wind capacity
Generation and Transmission Evacuation Capacities:



REDZ4: Stormberg
Total area: 12041 km²
Total number of farm portions: 2892
Generation and Transmission Evacuation Capacities:



REDZ1: Overberg
Total Area: 5263 km²
Total number of farm portions: 2472
Generation and Transmission Evacuation Capacities:



REDZ3: Cookhouse
Total area: 7366 km²
Total number of farm portions: 2409
Generation and Transmission Evacuation Capacities:

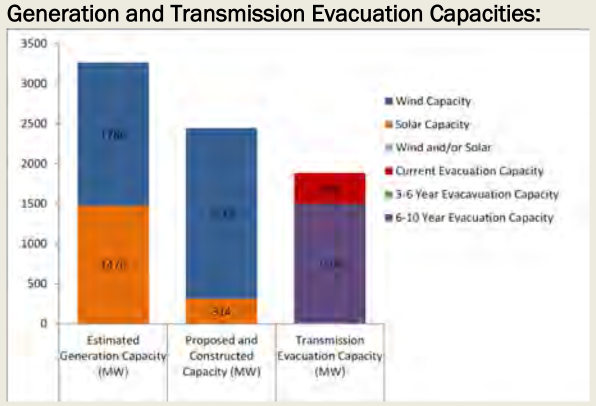


Figure 9: Proposed REDZs summary

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Section 5. Way Forward

The outputs of the SEA in the form of maps and development protocols will be put forward for adoption and released for public comments through publication in the *Government Gazette*. The gazetting process is envisaged to take place in 2015 and will also constitute the formal public consultation process on the outcomes of the SEA process.

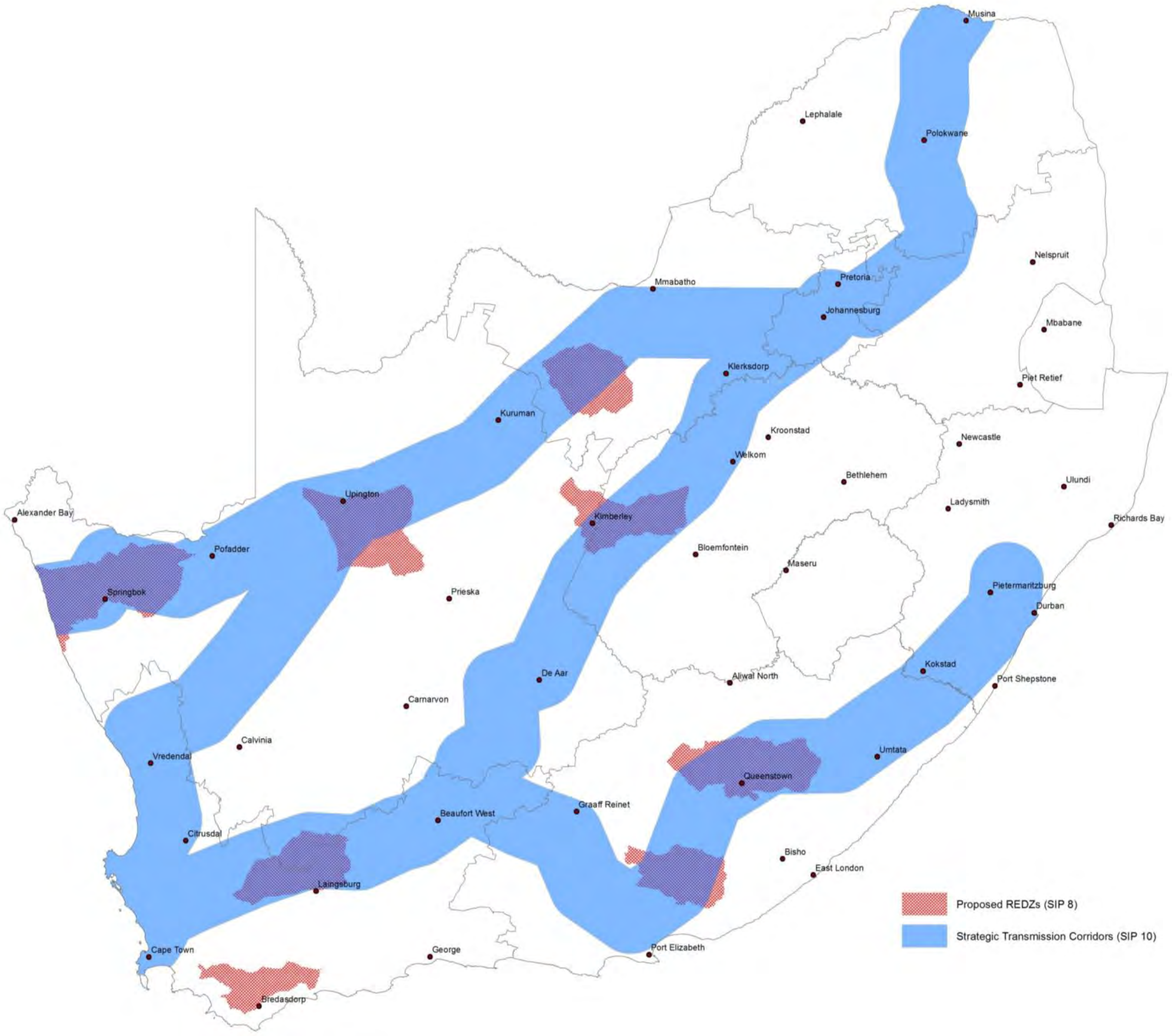
The formal adoption of the REDZs and their associated development protocols will result in a streamlined environmental assessment process in the form of a Basic Assessment, and its associated public participation process, being applicable to wind and solar PV development in the REDZs.

The gazetting process will also constitute the official adoption of the REDZs as geographical areas associated with SIP 8 and give effect to Sections 7 and 8 the Infrastructure Development Act no. 23 of 2014, as well as Chapter 8 of the draft 2014 Regulations under the Spatial Planning and Land Use Management Act (SPLUMA) no. 16 of 2013. Under this legislation, the Presidential Infrastructure Coordination Committee (PICC) will give priority to the planning, approval and implementation of wind and solar PV development in the REDZs. Local municipalities will further consider the REDZs for local planning purposes (e.g. including REDZs into Spatial Development Frameworks).

The formal adoption of the REDZs as geographical areas associated with SIP 8 based on their strategic importance for large scale wind and solar PV development will provide the required justification for proactive investment to be made into these areas. Proactive investment into grid infrastructure will be a key factor determining the success of the REDZs. The adoption of REDZs is not intended to constrain any development outside these areas and all projects inside and outside REDZs must be considered on their own merits. Proactive investment should thus be prioritised in the REDZs, but not limited to these areas. The SEA process is also intended to be iterative with new data and learning to be taken into consideration to revise and identify additional REDZs in parts of the country that have not yet been assessed.

In order to integrate the planning for large scale strategic infrastructure development at a national level, as intended by the SIP programme, the outputs of this SEA will be taken into consideration when undertaking strategic planning for other SIPs. The proposed REDZs have, for example, already been taken into consideration when identifying draft strategic transmission corridors as part of the Electrical Grid Infrastructure (EGI) SEA[2], commissioned by the DEA in support of SIP 10. The overlap between the draft strategic transmission corridors and the proposed REDZs is illustrated in Map 1. The EGI SEA makes provision for the streamlined development of the transmission infrastructure required for the success of the REDZs.

[2] https://egi.csir.co.za/



Map 2: Draft EGI SEA strategic transmission corridors informed by the proposed REDZs