PROPOSED HAGA HAGA WIND ENERGY FACILITY, EASTERN CAPE PROVINCE

VISUAL IMPACT ASSESSMENT

Produced for:

The Developer

On behalf of:

CES - Environmental and Social Advisory Services
PO Box 934, Grahamstown, 6140
W: cesnet.co.za E: info@cesnet.co.za

Produced by:

Lourens du Plessis (PrGISc) t/a LOGIS
PO Box 384, La Montagne, 0184
M: 082 922 9019 E: lourens@logis.co.za
W: logis.co.za

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1. STUDY APPROACH

1.1. Qualification and Experience of the Practitioner

Lourens du Plessis (t/a LOGIS) is a *Professional Geographical Information Sciences (GISc) Practitioner* registered with The South African Geomatics Council (SAGC), and specialises in Environmental GIS and Visual Impact Assessments (VIA).

He has been involved in the application of Geographical Information Systems (GIS) in Environmental Planning and Management since 1990. He has extensive practical knowledge in spatial analysis, environmental modeling and digital mapping, and applies this knowledge in various scientific fields and disciplines. His GIS expertise are often utilised in Environmental Impact Assessments, Environmental Management Frameworks, State of the Environment Reports, Environmental Management Plans, tourism development and environmental awareness projects.

He holds a BA degree in Geography and Anthropology from the University of Pretoria and worked at the GisLAB (Department of Landscape Architecture) from 1990 to 1997. He later became a member of the GisLAB and in 1997, when Q-Data Consulting acquired the GisLAB, worked for GIS Business Solutions for two years as project manager and senior consultant. In 1999 he joined MetroGIS (Pty) Ltd as director and equal partner until December 2015. From January 2016 he worked for SMEC South Africa (Pty) Ltd as a technical specialist until he went independent and began trading as LOGIS in April 2017.

Lourens has received various awards for his work over the past two decades, including EPPIC Awards for ENPAT, a Q-Data Consulting Performance Award and two ESRI (Environmental Systems Research Institute) awards for *Most Analytical* and *Best Cartographic Maps*, at Annual International ESRI User Conferences. He is a co-author of the ENPAT book and has had several of his maps published in various tourism, educational and environmental publications.

He is familiar with the "Guidelines for Involving Visual and Aesthetic Specialists in EIA Processes" (Provincial Government of the Western Cape: Department of Environmental Affairs and Development Planning) and utilises the principles and recommendations stated therein to successfully undertake visual impact assessments. Although the guidelines have been developed with specific reference to the Western Cape province of South Africa, the core elements are more widely applicable (i.e. within the Eastern Cape Province).

CES - Environmental and social advisory services (CES) appointed Lourens du Plessis as an independent specialist consultant to undertake the visual impact assessment for the proposed Haga Haga Wind Energy Facility (WEF). He will not benefit from the outcome of the project decision-making.

1.2. Assumptions and Limitations

This assessment was undertaken during the planning stage of the project and is based on information available at that time. It is assumed that all information regarding the project details provided by CES is correct and relevant to the proposed project.

1.3. Level of Confidence

Level of confidence[1] is determined as a function of:

- The information available, and understanding of the study area by the practitioner:
    - 3: A high level of information is available of the study area and a thorough knowledge base could be established during site visits, surveys etc. The study area was readily accessible.
    - 2: A moderate level of information is available of the study area and a moderate knowledge base could be established during site visits, surveys etc. Accessibility to the study area was acceptable for the level of assessment.
    - 1: Limited information is available of the study area and a poor knowledge base could be established during site visits and/or surveys, or no site visit and/or surveys were carried out.

- The information available, understanding of the study area and experience of this type of project by the practitioner:
    - 3: A high level of information and knowledge is available of the project and the visual impact assessor is well experienced in this type of project and level of assessment.
    - 2: A moderate level of information and knowledge is available of the project and/or the visual impact assessor is moderately experienced in this type of project and level of assessment.
    - 1: Limited information and knowledge is available of the project and/or the visual impact assessor has a low experience level in this type of project and level of assessment.

These values are applied as follows:

Table 1: Level of confidence.

	Information on the project & experience of the practitioner			
Information on the study area		**3**	**2**	**1**
	3	9	6	3
	2	6	4	2
	1	3	2	1

*The level of confidence for this assessment is determined to be **9** and indicates that the author's confidence in the accuracy of the findings is high:*

- The information available, and understanding of the study area by the practitioner is rated as **3** and
- The information available, understanding and experience of this type of project by the practitioner is rated as **3**.

1.4. Methodology

The study was undertaken using Geographical Information Systems (GIS) software as a tool to generate viewshed analyses and to apply relevant spatial criteria to the proposed facility. A detailed Digital Terrain Model (DTM) for the study area was created from topographical data provided by NASA in the form of a 30m SRTM (Shuttle Radar Topography Mission) elevation model.

[1] Adapted from Oberholzer (2005).

The Plan of Study for the Visual Impact Assessment (VIA) is stated below.

The VIA will be determined according to the nature, extent, duration, intensity or magnitude, probability and significance of the potential visual impacts, and will propose management actions and/or monitoring programs, and may include recommendations related to the wind turbine generator (WTG) layout.

The visual impact will be determined for the highest impact-operating scenario (worst-case scenario) and varying climatic conditions (i.e. different seasons, weather conditions, etc.) will not be considered.

The VIA will consider potential cumulative visual impacts, or alternatively the potential to concentrate visual exposure/impact within the region (if applicable).

The following VIA-specific tasks have been undertaken:

- **Determine potential visual exposure**

The visibility or visual exposure of any structure or activity is the point of departure for the visual impact assessment. It stands to reason that if (or where) the proposed facility and associated infrastructure were not visible, no impact would occur.

The viewshed analyses of the proposed facility and the related infrastructure are based on a 30m SRTM digital terrain model of the study area.

The first step in determining the visual impact of the proposed facility is to identify the areas from which the structures would be visible. The type of structures, the dimensions, the extent of operations and their support infrastructure are taken into account.

- **Determine visual distance/observer proximity to the facility**

In order to refine the visual exposure of the facility on surrounding areas/receptors, the principle of reduced impact over distance is applied in order to determine the core area of visual influence for this type of structure.

Proximity radii for the proposed infrastructure are created in order to indicate the scale and viewing distance of the facility and to determine the prominence of the structures in relation to their environment.

The visual distance theory and the observer's proximity to the facility are closely related, and especially relevant, when considered from areas with a high viewer incidence and a predominantly negative visual perception of the proposed facility.

- **Determine viewer incidence/viewer perception (sensitive visual receptors)**

The next layer of information is the identification of areas of high viewer incidence (i.e. main roads, residential areas, settlements, etc.) that would be exposed to the project infrastructure.

This is done in order to focus the attention on areas where the perceived visual impact of the facility will be the highest and where the perception of affected observers will be negative.

Related to this data set, is a land use character map, that further aids in identifying sensitive areas and possible critical features (i.e. tourist facilities, national parks, etc. – if applicable), that should be addressed.

- **Determine the visual absorption capacity of the landscape**

This is the capacity of the receiving environment to absorb the potential visual impact of the proposed facility. The VAC is primarily a function of the vegetation, and will be high if the vegetation is tall, dense and continuous. Conversely, low growing sparse and patchy vegetation will have a low VAC.

The VAC would also be high where the environment can readily absorb the structure in terms of texture, colour, form and light / shade characteristics of the structure. On the other hand, the VAC for a structure contrasting markedly with one or more of the characteristics of the environment would be low.

The VAC also generally increases with distance, where discernable detail in visual characteristics of both environment and structure decreases.

- **Calculate the visual impact index**

The results of the above analyses are merged in order to determine the areas of likely visual impact and where the viewer perception would be negative. An area with short distance visual exposure to the proposed infrastructure, a high viewer incidence and a predominantly negative perception would therefore have a higher value (greater impact) on the index. This focusses the attention to the critical areas of potential impact and determines the potential **magnitude** of the visual impact.

Geographical Information Systems (GIS) software will be used to perform all the analyses and to overlay relevant geographical data sets in order to generate a visual impact index.

- **Determine impact significance**

The potential visual impacts are quantified in their respective geographical locations in order to determine the significance of the anticipated impact on identified receptors. Significance is determined as a function of extent, duration, magnitude (derived from the visual impact index) and probability. Potential cumulative and residual visual impacts are also addressed. The results of this section is displayed in impact tables and summarised in an impact statement.

- **Propose mitigation measures**

The preferred alternative (or a possible permutation of the alternatives) will be based on its potential to reduce the visual impact. Additional general mitigation measures will be proposed in terms of the planning, construction, operation and decommissioning phases of the project.

- **Reporting and map display**

All the data categories, used to calculate the visual impact index, and the results of the analyses will be displayed as maps in the accompanying report. The methodology of the analyses, the results of the visual impact assessment and the conclusion of the assessment will be addressed in the VIA report.

- **Site visit and photo simulations**

A site visit was undertaken (July 2020) in order to verify the results of the spatial analyses and to identify any additional site specific issues that may need to be addressed in the VIA report.

Photographs from strategic viewpoints were taken in order to simulate realistic post construction views of the WEF. This aids in visualising the perceived visual impact of the proposed WEF and place it in spatial context.

2. BACKGROUND AND PROPOSED INFRASTRUCTURE

The Developer is proposing the establishment of a Wind Energy Facility (WEF) to generate approximately 150 Megawatts (MW) of renewable energy on 53 properties near Kei Mouth in the Amathole District Municipality (Great Kei Local Municipality) in the Eastern Cape Province. The project is collectively referred to as the **Haga Haga WEF** as it is located north of the small coastal town of Haga Haga.

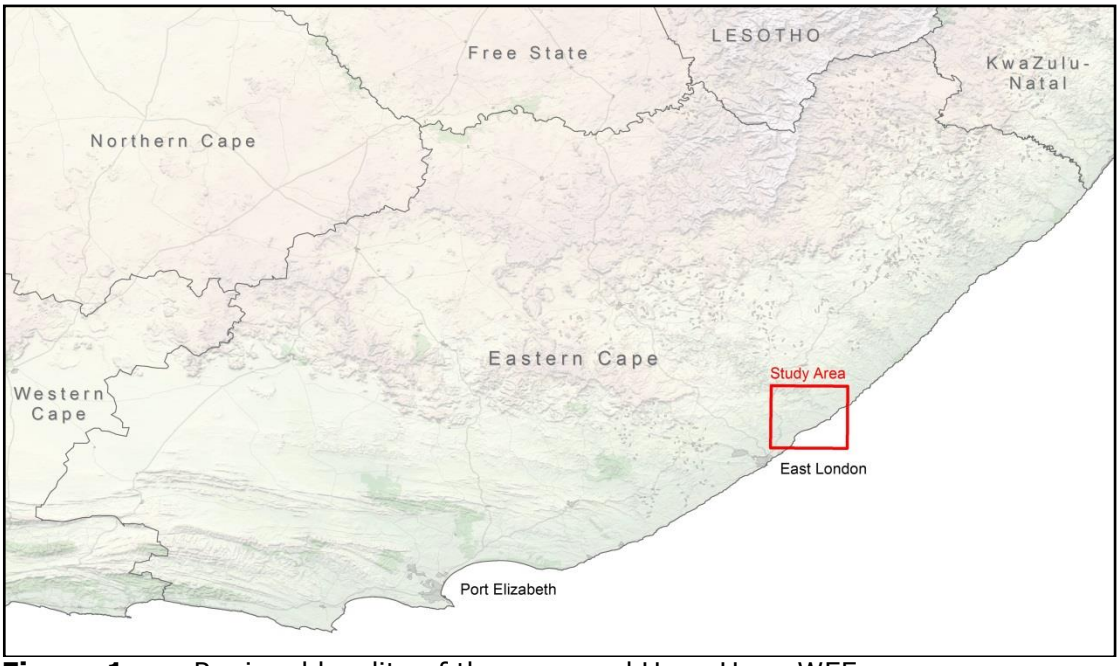


Figure 1: Regional locality of the proposed Haga Haga WEF.

A WEF generates electricity by means of wind turbines that harness the wind of the area as a renewable source of energy. Wind energy generation, or wind farming as it is commonly referred to, is generally considered to be an environmentally friendly electricity generation option.

In order to optimise the use of the wind resource and the amount of power generated by the facility, the number of wind turbines erected in the area as well as the careful placement of the turbines in relation to the topography must be considered.

The Developer intends to construct up to 36 wind turbine generators (WTG) on the properties listed below:

Table 2: Farm portions comprising the Haga Haga WEF project boundary.

Surveyor General 21 Digit Key	Parcel Number
C04000000000007100002	2/71
C04000000000011200000	112
C04000000000011300000	113

C04000000000011500000	RE/115
C04000000000011500001	1/115
C04000000000013100000	131
C04000000000013200000	RE/132
C04000000000013300000	133
C04000000000013400000	134
C04000000000013500000	135
C04000000000013600000	136
C04000000000013700000	137
C04000000000013800000	138
C04000000000013900000	139
C04000000000014000000	140
C04000000000014100000	141
C04000000000014200000	142
C04000000000014300000	143
C04000000000022600000	226
C04000000000022700000	227
C04000000000022800000	228
C04000000000022900000	229
C04000000000023000000	230
C04000000000023100000	231
C04000000000023200000	232
C04000000000023300000	233
C04000000000023600000	236
C04000000000023700000	237
C04000000000023800000	238
C04000000000023900000	239
C04000000000024000000	240
C04000000000024100000	RE/241
C04000000000024200000	242
C04000000000024300000	243
C04000000000024400000	244
C04000000000024500000	245
C04000000000024800000	248
C04000000000025300001	1/253
C04000000000025400000	254
C04000000000025500000	255
C04000000000025600000	256
C04000000000026800000	268
C04000000000027000000	270
C04000000000027100001	1/271
C04000000000027200000	272
C04000000000028000000	280
C04000000000028100000	281
C04000000000028200006	6/282
C04000000000028200007	7/282
C04000000000028300000	283
C04000000000044600000	446
C04000000000044700000	447
C04000000000045200000	452

Note: This table represents a list of all the farm portions located within the Haga Haga WEF project boundary as provided by CES. It should be noted that the table excludes one property (C04000000000024100001 (1/241)) within the project boundary, that appears to not be affiliated with the project.

Each wind turbine is expected to consist of a concrete foundation, a steel tower, a hub (placed at 180m above ground level) and three turbine blades attached to the hub. The rotor diameter is expected to be 200m, culminating in an overall height of 280m (maximum blade tip height) per wind turbine. Variations of the above dimensions may occur, depending on the preferred supplier or commercial availability of wind turbines at the time of construction.

Additional infrastructure may include the following:

- Cabling between the components;
- Internal access roads to each turbine;
- A workshop area for control, maintenance and storage;
- Battery Energy Storage System; and
- A Substation to facilitate the connection between the facility and the grid.

The construction phase of the WEF is dependent on the number of turbines ultimately erected and is estimated at one week per turbine. The construction phase is expected to be 2 years. The lifespan of the facility is approximated at 20 to 25 years.

3. SCOPE OF WORK

This report is the undertaking of a Visual Impact Assessment (VIA) of the proposed/preferred WTG layout as determined by the project proponent after consideration of the Scoping Phase environmental and social sensitivities.

The determination of the potential visual impacts is undertaken in terms of nature, extent, duration, magnitude, probability and significance of the construction and operation of the proposed infrastructure.

The study area for the visual assessment encompasses a geographical area of approximately 2,486km² (the extent of the **Maps 1** to **6** displayed in this report) and includes a minimum 20km buffer zone from the proposed wind turbine structures.

Anticipated issues related to the potential visual impact of the proposed WEF include the following:

- The visibility of the facility from, and potential visual impact on observers travelling along the R349 arterial road and secondary (local) roads to Haga Haga and Morgans Bay located within the study area.

- The visibility of the facility from, and potential visual impact on built-up centres and populated places (i.e. the towns of Kei Mouth, Morgans Bay, Haga Haga and Chintsa) within the study area.

- The visibility of the facility from, and potential visual impact on rural settlements and farmsteads/homesteads (rural residences) within the study area.

- The potential visual impact of the facility on the visual character and sense of place of the region, with specific reference to the rural and natural landscape, and small coastal towns (tourist attractions) located along the Indian seaboard.

- The potential visual impact of ancillary infrastructure (i.e. the substation, cabling, internal access roads, etc.) on observers in close proximity of the facility.

- The potential visual impact of lighting of the facility in terms of light glare, light trespass and sky glow.

- The potential visual impact of shadow flicker.

- The potential cumulative visual impact of the proposed WEF and associated infrastructure in context of the operational Chaba WEF located within the study area.

- Potential visual impacts associated with the construction phase.

It is envisaged that the issues listed above may constitute a visual impact at a local and/or regional scale.

4. RELEVANT LEGISLATION AND GUIDELINES

The following legislation and guidelines have been considered in the preparation of this report:

- The Environmental Impact Assessment Regulations, 2014 (as amended);
- Guideline on Generic Terms of Reference for EAPS and Project Schedules (DEADP, Provincial Government of the Western Cape, 2011).

5. THE AFFECTED ENVIRONMENT

The project is proposed on portions of a number of different farms with a combined surface area of approximately 9,126ha. The final surface area (development footprint) to be utilised for the facility will be smaller (~75ha), depending on the type of turbine selected, the final site layout and the placement of wind turbines and ancillary infrastructure.

The site is located approximately 2.6km north of Haga Haga (at the closest boundary) with the closest turbine position located at a distance of just under 5km. Access to the site is provided by the R349 arterial road (to Kei Mouth) traversing north of proposed development site (northern turbines), the Morgans Bay secondary road (eastern turbines) and the Haga Haga secondary road (western turbines).

The region is officially referred to as the Amathole District and the site is located south of the Great Kei River, which formed the historical boundary between the Cape Province and the former independent state of Transkei (dissolved in 1994). The largest city within the region is East London, approximately 35km south-west of the site, with the N2 national road acting as the main connector between this city and site (via the R349).

The coastline of the former Transkei is referred to as the Wild Coast and has a rural and natural character. The rugged coastline is a popular tourist attraction for people who prefer the remoteness and undeveloped nature of the Wild Coast, to more conventional coastal destinations. Although the Wild Coast historically only incorporated the coast line of the Transkei, it now extends beyond the Great Kei River south to East London.

Popular, yet generally lesser known, tourist destinations within the study area include Chintsa, Bosbokstrand, Pullens Bay Resort, Haga Haga, Marshstrand, Morgans Bay and Kei Mouth. There are also a number of tourist facilities further

inland including, Wild Coast Horseback Adventures, The Cock Inn, Endalweni Private Game Reserve, OppiePlaas Cottages, Benmore Lodge, etc.

Topography, vegetation and hydrology

The study area is located on land that ranges in elevation from sea level at the coast to approximately 640m above sea level to the north-west of the site, where the N2 national road traverses near the Chaba Substation. This area is also the location of the operational Chaba WEF which currently consists of seven wind turbines. The proposed Haga Haga WEF development site is located approximately 18km south-east of the Chaba WEF, south of the R349 arterial road, along the south facing slopes of a prominent ridge located between the two WEFs.

The dominant topographical unit or terrain type of the study area is *highly dissected hills* brought about by the multitude of incised river valleys within the region. The largest of these is the Great Kei River valley followed by a host of other rivers that have carved smaller valleys across the landscape in a north-westerly to south-easterly direction. Some of these rivers include the Cintsa, Cefane, Kwenxura, Nyarha, Cwilli, Gxara, Ngogwane, Qolora, Haga-Haga, Mtendwe and Quko. The latter three rivers traverse the proposed development site before flowing into the Indian Ocean.

The farms comprising the proposed WEF span across two vegetation types namely; *Bisho Thornveld* and *Albany Coastal Belt.* The former falls within the Savanna Biome (Sub-Escarpment Savanna Bioregion) while the latter forms part of the Albany Thicket Biome. It should be noted, however, that large sections of the affected farms have been heavily transformed by agricultural activities and that the remaining natural vegetation is primarily found along steeper slopes and within river valleys.

The natural land cover within the study area is dominated by *thicket* and *dense bushland*, interspersed with *grassland*. As mentioned before, large tracts of land have been converted to pastures, or used for dryland agriculture. Refer to **Maps 1** and **2** for the topography and land cover maps of the study area.

Land use and settlement patterns

The study area has a rural and natural character with very few built structures outside of the little towns and settlements within the region. Exceptions occur where homesteads (rural residence or dwellings) are found and at the Chaba WEF, where seven wind turbines are operational and clearly noticeable from the N2 national road. Other than the power lines near this WEF and power lines located further south (near Chintsa), there are no major transmission networks or high voltage distribution power lines within the study area.

The region has very limited agricultural activity and crop production, and the general land use is described as *mixed farming*, i.e. predominantly cattle farming and some game farming, interspersed with dryland and subsistence farming within the Transkei. Large areas, especially within the remote upper reaches of the Great Kei River and along the coast line, are still in a natural state.

The area south of the Kei River has a relatively low population density (approximately 15 people per km^2) with the highest concentrations occurring in the small towns along the coast line and the settlements further inland. The Transkei has a higher population density (up to 200 people per km^2) brought about by the relocation of mainly Xhosa speaking people to this former homeland during the previous political dispensation.

As mentioned earlier, the coastline of the region is a popular tourist attraction, and as such tourism is considered to be an important industry, providing employment and income to the local population.

There are only a few proclaimed terrestrial protected areas within the study area, namely; Dunneden Private Nature Reserve, Long Beach Private Nature Reserve and Cape Henderson Nature Reserve. The Amathole Marine Protected Area is located offshore between Bosbokstrand and Kei Mouth[2].

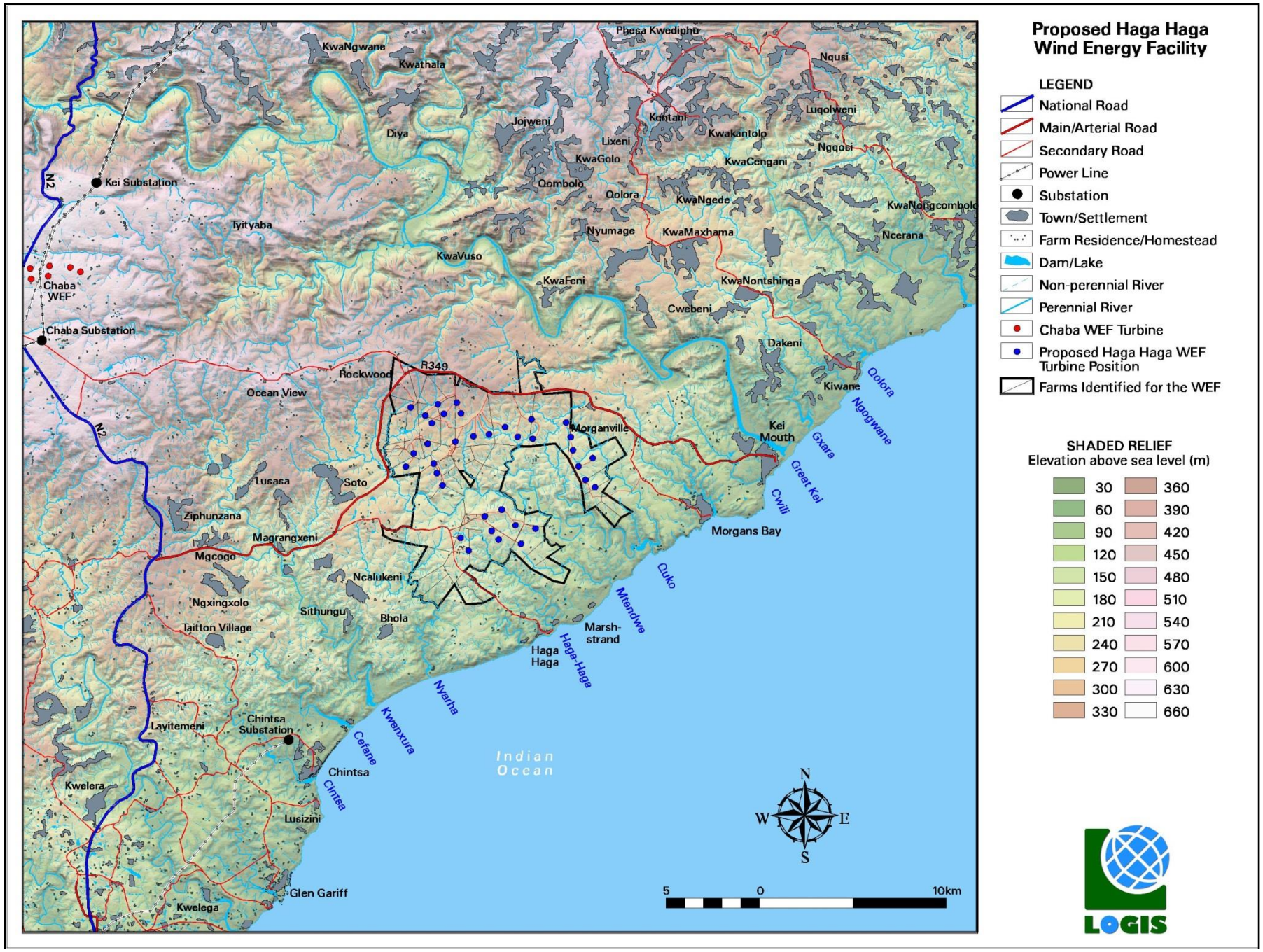
Figure 2: Wind turbines at the Chaba WEF. (*Photo credit: Google Earth, John Roskilly*).

[2] Sources: DEAT (ENPAT Eastern Cape), NBI (Vegetation Map of South Africa, Lesotho and Swaziland), NLC2013-14 (ARC/CSIR) and SAPAD2019-20 (DEA).

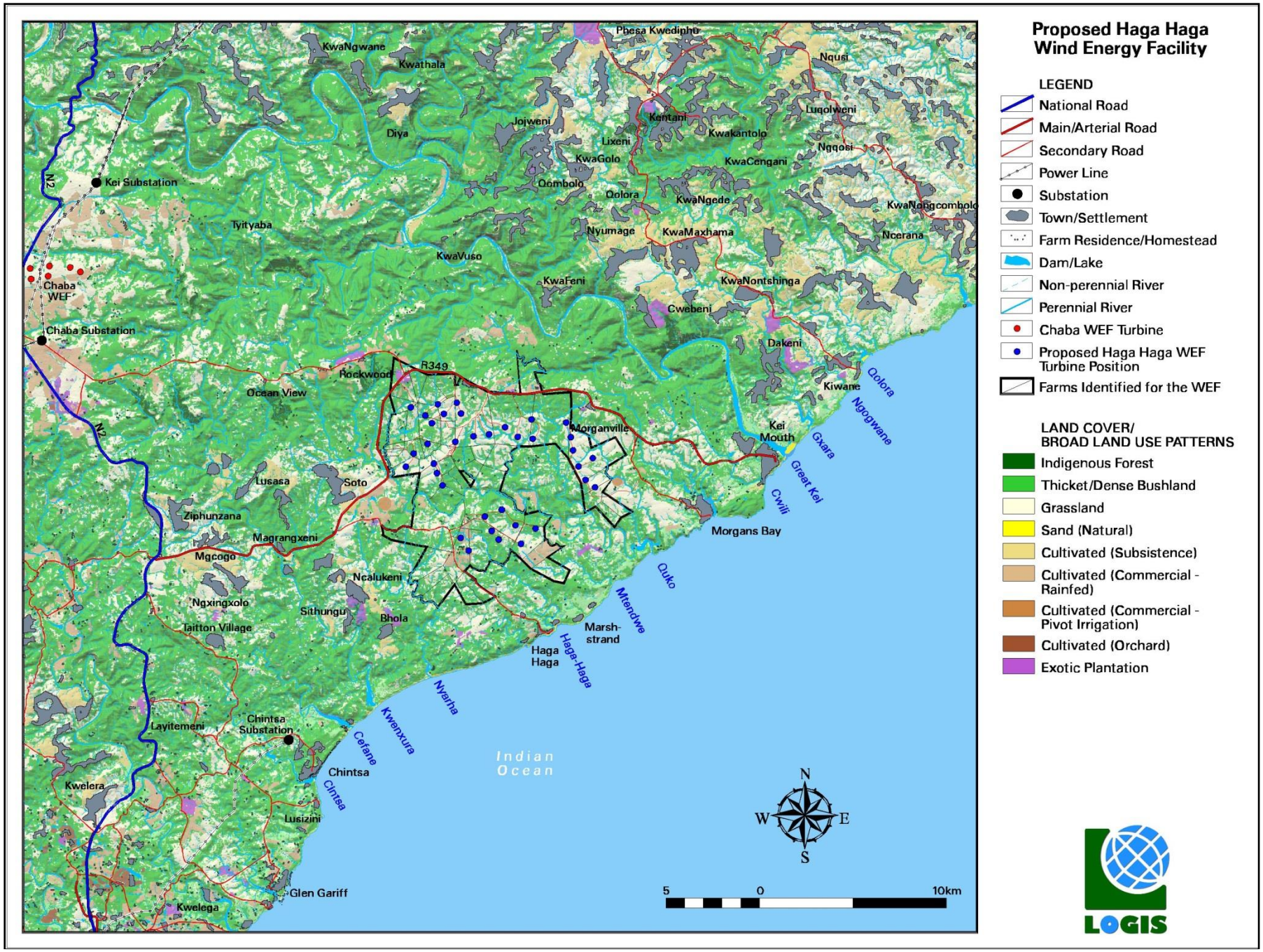
Figure 3: The study area as seen from the R349 arterial road.

Figure 4: Grassland and thicket within the study area.

Figure 5: The rugged Wild Coast coastline. (*Photo credit: Google Earth, Hendrik van den Berg*).



Map 1: Shaded relief map of the study area.



Map 2: Land cover and broad land use patterns.

6. RESULTS

6.1. Potential visual exposure

A visibility analysis was undertaken from each of the wind turbine positions (36 in total) at an offset of 180m (approximate hub-height) above ground level. The result of the visibility analysis is displayed on **Map 3**.

The viewshed analysis does not include the effect of vegetation cover or existing structures on the exposure of the proposed WEF, therefore signifying a worst-case scenario.

The result of the viewshed analysis displays the potential areas of visual exposure, as well as the potential frequency of exposure. The frequency of exposure indicates the number of turbines that may be exposed i.e. more turbines may be visible in the darker orange areas than in the yellow areas. Land that is more elevated is typically more exposed to the proposed WEF, whilst lower lying areas such as valleys are shielded, or not as exposed.

The core, uninterrupted area of visual exposure of the wind turbines is largely contained within a 5km radius of the structures. This is due to the location of the turbines within the relatively secluded catchment (watershed) basin of the Nyarha, Haga-Haga, Mtendwe, Quko, and Cwili Rivers. Another contributing factor containing the visual exposure is the strongly undulating plains, dissected hills and low mountains within the landscape. The visual exposure of the turbines, beyond a 5km radius, is largely restricted to the hilltops and ridges of the region.

Notwithstanding the generally contained visual exposure of the wind turbines, it is expected that they will be exposed to observers travelling along the arterial (R349) and secondary roads (to Haga Haga and Morgans Bay), as well as from the outlying parts of towns, settlements and residences (homesteads) within a 5 to 10km radius of the structures.

The towns, settlements and homesteads expected to be visually influenced are listed below.

Less than 5km from the wind turbines:

- Pine Tops
- Elgin
- Woodford
- Patryspoort
- Doringhoek
- Lily Vale
- Bachelor's Rest
- Hatchleydene
- Idlewild
- Spring Fountain
- Langrand
- Wildene
- Fort Warwick
- Rockwood
- Sunray (Wild Coast Horse Riding Adventures)
- Jesse Farm
- Kei Slopes

- Rhodes Dale
- Wembley
- Glen Ross (Cock Inn)
- Ewanrigg (Endalweni Private Game Reserve)
- Morganville
- Clearview
- Bayview
- Brooklyn
- Double Mouth (outlying areas)
- Black Rock
- Hillandale
- Avalon
- Orange Grove
- Laughing Waters
- Haga Haga (outlying areas)
- Mtwentwe (OppiePlaas)
- Irisdale (Miarestate Hotel and Spa)
- Rooiwal
- Golden Slopes
- Woodbury
- Valencia
- Idlewood
- Carolina
- Bloemhof
- Blue Gums
- Soto (outlying areas)
- A number of unknown/unidentified residences

Located within a 5-10km radius:

- Hagadash
- Joe's Folly
- St. Anthony's
- Manor
- Geluk
- Ocean View
- Hartland
- Essex
- Kei Flats
- Rocky Ridge
- Benmore (lodge)
- Kei Mouth Pineries

Outlying parts of the following settlements

- Bhola
- Ncalukeni
- Belekumntwana
- Mngqalasini
- KwaVuso
- Nyumage
- KwaFeni
- Zimbaba
- Cwebeni
- Sizini
- Dakeni
- Cwilli
- A number of unknown/unidentified settlements

Located just beyond a 10km radius:

- Welland
- Belladonna

Outlying parts of the following settlements:

- Silatsha
- Mgcogo
- Qolora
- KwaMaxhama

It is envisaged that the structures, where visible from shorter distances (e.g. less than 10km), may constitute a high visual prominence, potentially resulting in a high to very high visual impact.

6.2. Cumulative visual assessment

Cumulative visual impacts can be defined as the additional changes caused by a proposed development in conjunction with other similar developments or as the combined effect of a set of developments. In practice the terms 'effects' and 'impacts' are used interchangeably.

Cumulative visual impacts may be:

- Combined, where several WEF's wind turbines are within the observer's arc of vision at the same time;
- Successive, where the observer has to turn his or her head to see the various WEF's wind turbines; and
- Sequential, when the observer has to move to another viewpoint to see different developments, or different views of the same development (such as when travelling along a route).

The visual impact assessor is required (by the competent authority) to identify and quantify the cumulative visual impacts and to propose potential mitigating measures. This is often problematic as most regulatory bodies do not have specific rules, regulations or standards for completing a cumulative visual assessment, nor do they offer meaningful guidance regarding appropriate assessment methods. There are also not any authoritative thresholds or restrictions related to the capacity of certain landscapes to absorb the cumulative visual impacts of wind turbines.

To complicate matters even further, cumulative visual impact is not just the sum of the impacts of two developments. The combined effect of both may be much greater than the sum of the two individual effects, or even less.

The cumulative impact of the WEF development on the landscape and visual amenity is a product of:

- The distance between individual WEFs (or turbines);
- The distance over which the wind turbines are visible;
- The overall character of the landscape and its sensitivity to the structures;
- The siting and design of the WEFs themselves; and
- The way in which the landscape is experienced.

The specialist is required to conclude if the proposed development will result in any unacceptable loss of visual resource considering all the projects proposed in the area.

For the purpose of this study, viewshed analyses from each WEF's wind turbines were undertaken in order to determine the area of potential combined visual exposure (i.e. where combined cumulative visual impacts may occur).

The proposed Haga Haga WEF wind turbine layout is located approximately 19km (at the closest) from the operational Chaba WEF.

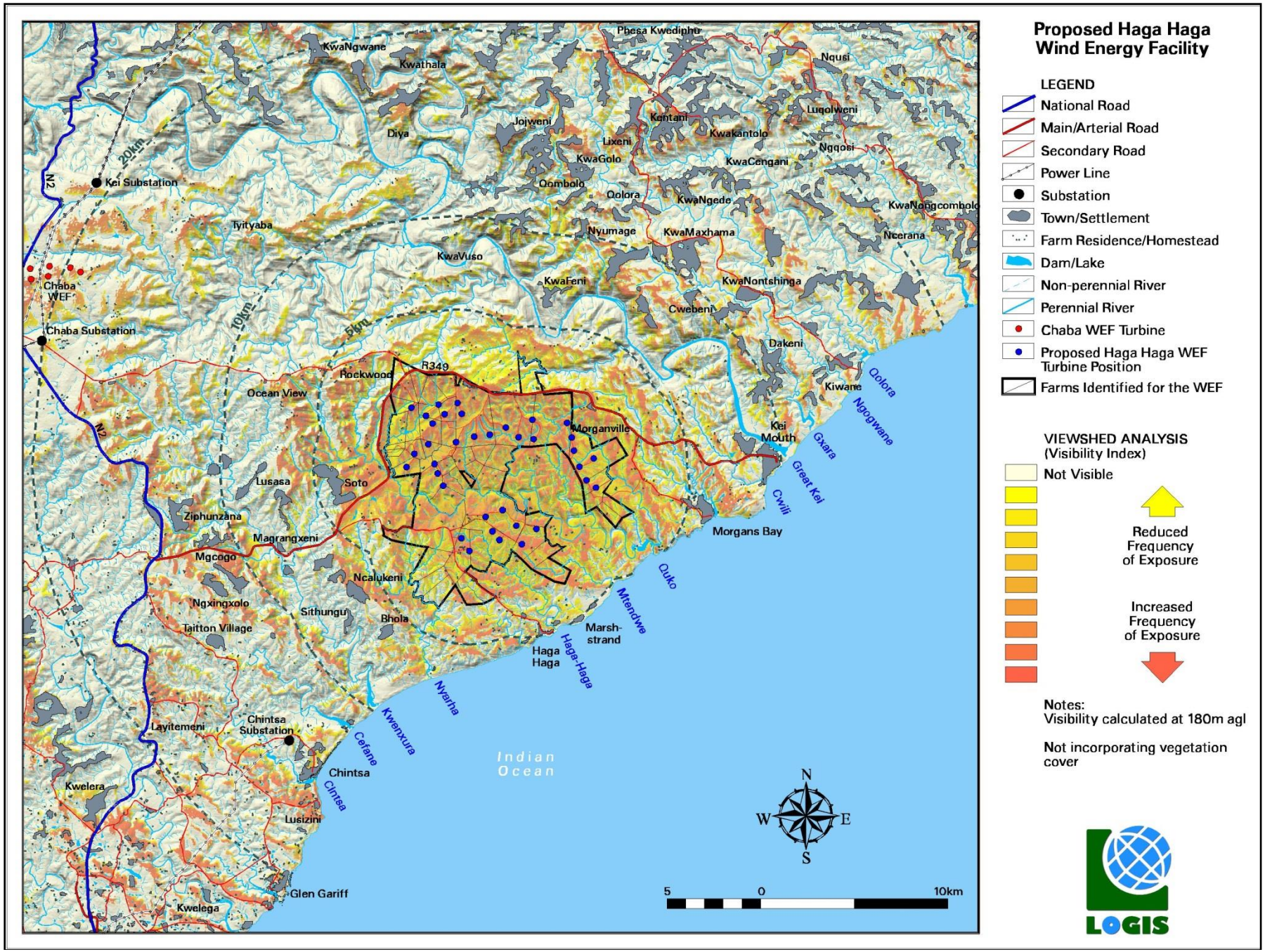
A visibility analysis of the Chaba WEF turbines was undertaken individually from each of the existing wind turbine positions (seven in total) at an offset of 100m (approximate hub-height) above ground level. The result of this viewshed analysis was overlain with the viewshed analysis of the proposed Haga Haga WEF (as discussed in the previous section) in order to identify the area of potential combined visual exposure (i.e. where both the proposed and existing structures may be visible).

The cumulative viewshed analysis is displayed on **Map 4**. The area of combined visual exposure is indicated in red/orange, Chaba wind turbine exposure in yellow and the additional area of exposure for the Haga Hagas WEF in green.

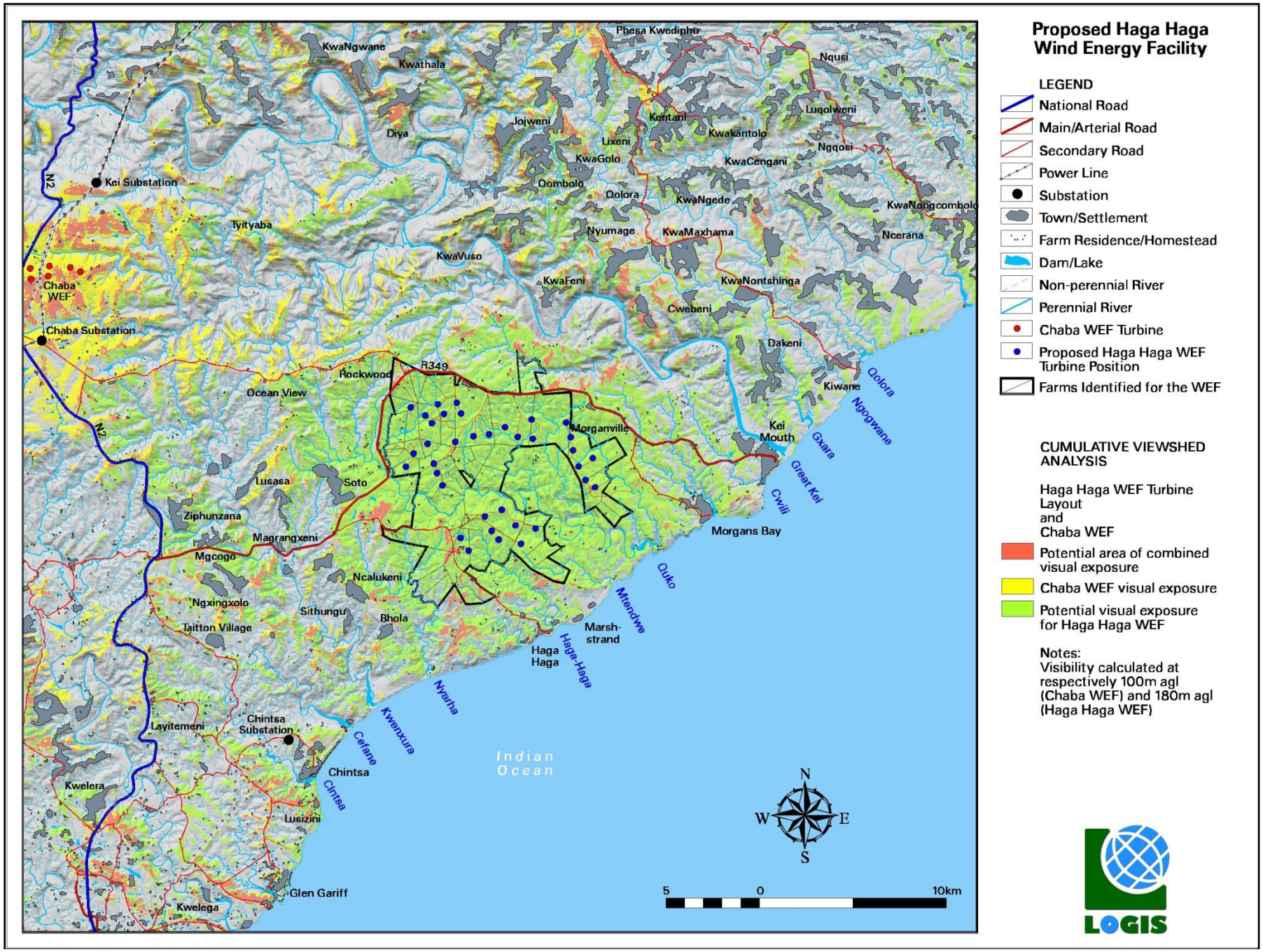
Results

There is a very limited correlation (or overlap) between the visual exposure of the two tested wind turbine layouts. This is due to the relatively long distance between the two WEFs, the strongly undulating nature of the topography located between them and the generally secluded position of the proposed Haga Haga WEF within the region. Additional to this, the Chaba WEF only consists of seven wind turbines, generally considered to be a small WEF by international and even local standards.

It is therefore concluded that the overall cumulative visual impact is expected to be negligible, or very low, at worst.



Map 3: Viewshed analysis of the proposed Haga Haga WEF.



Map 4: Cumulative viewshed analysis of the proposed Haga Haga and Chaba WEF turbines.

6.3. Visual distance / observer proximity to the WEF

The proximity radii are based on the anticipated visual experience of the observer over varying distances. The distances are adjusted upwards for larger WEFs (e.g. more than 50 wind turbines) and downwards for smaller WEFs (e.g. less than 50 turbines). This methodology was developed in the absence of any known and/or accepted standards for South African WEFs.

The principle of reduced impact over distance is applied in order to determine the core area of visual influence for these types of structures. It is envisaged that the nature of the structures and the rural character of the study area would create a significant contrast that would make the facility visible and recognisable from greater distances.

The proximity radii for the wind turbines were created in order to indicate the scale and viewing distance of the facility and to determine the prominence of the structures in relation to their environment.

The proximity radii, based on the dimensions of the proposed development footprint are indicated on **Map 5**, and include the following:

- 0 - 5km. Short distance view where the WEF would dominate the frame of vision and constitute a very high visual prominence.

- 5 – 10km. Short to medium distance view where the structures would be easily and comfortably visible and constitute a high visual prominence.

- 10 - 20km. Medium to long distance view where the facility would become part of the visual environment, but would still be visible and recognisable. This zone constitutes a moderate visual prominence.

- > 20km. Long distance view of the facility where the structures are not expected to be immediately visible and not easily recognisable. This zone constitutes a lower visual prominence for the facility.

Figure 6: Schematic representation of a wind turbine from 1, 2, 5 and 10km under perfect viewing conditions.

The visual distance theory and the observer's proximity to the facility are closely related, and especially relevant, when considered from areas with a high viewer incidence and a potentially negative visual perception of the proposed facility.

6.4. Viewer incidence / viewer perception

The number of observers and their perception of a structure determine the concept of visual impact. If there are no observers or if the visual perception of the structure is favourable to all the observers, there would be no visual impact.

It is necessary to identify areas of high viewer incidence and to classify certain areas according to the observer's visual sensitivity towards the proposed WEF and its related infrastructure. It would be impossible not to generalise the viewer incidence and sensitivity to some degree, as there are many variables when trying to determine the perception of the observer; regularity of sighting, cultural background, state of mind, purpose of sighting, etc. which would create a myriad of options.

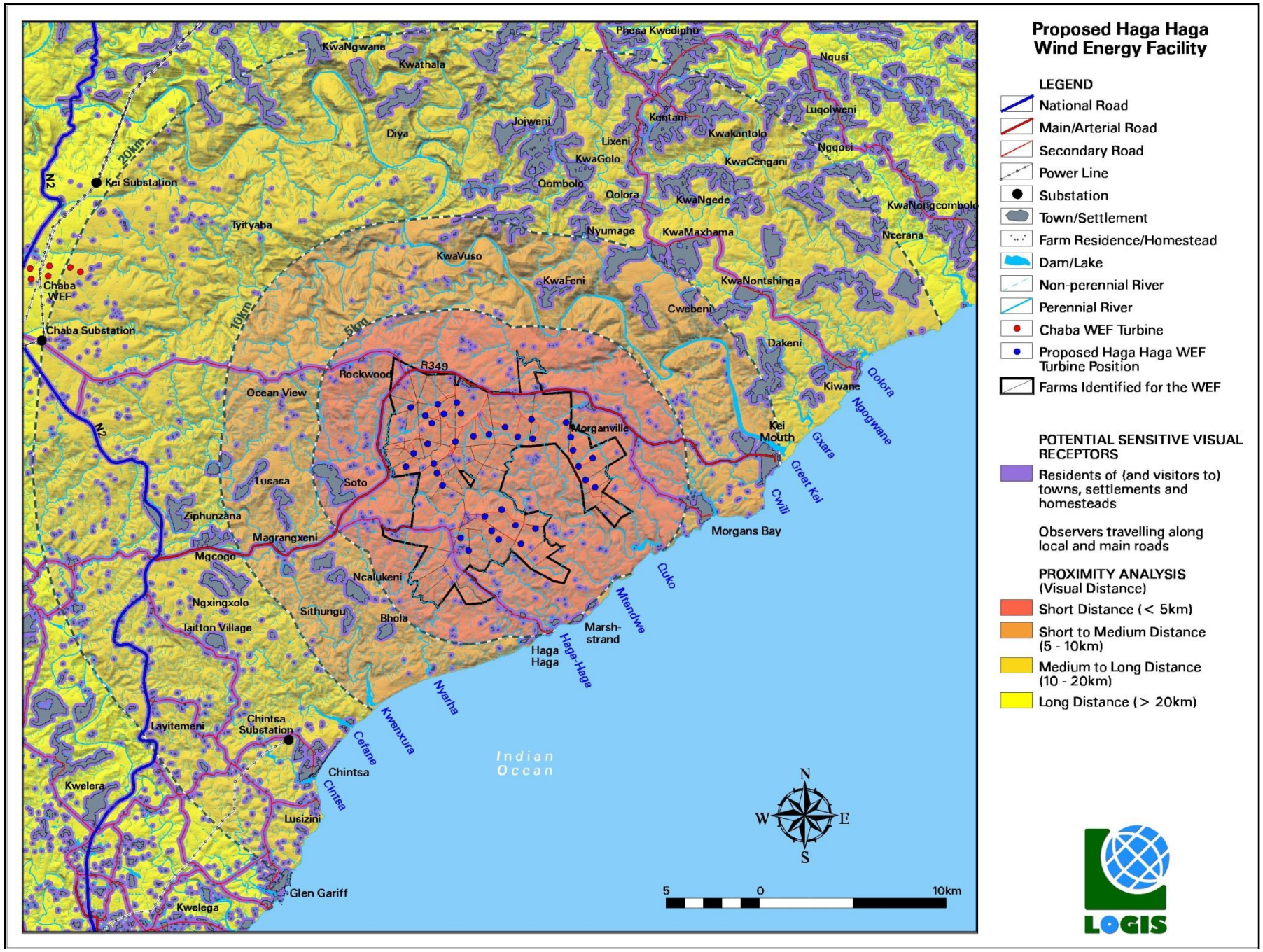
Viewer incidence is calculated to be the highest along the arterial and secondary roads within the study area. Commuters and tourists using these roads may be negatively impacted upon by visual exposure to the WEF.

Viewer incidence is generally low within a 5 to 10km radius of the proposed WEF; however, the region has a high tourism value and inherent sense of place based on its location along the Indian seaboard. Residents and visitors to this area are

therefore seen as sensitive visual receptors upon which the construction of the WEF could have a potential negative visual impact. Potential sensitive visual receptors include mainly residents of settlements and homesteads, and visitors travelling along the access roads to coastal destinations.

The author is not aware of any specific or formal objections to the WEF. However, for the purpose of this study (and as a worst case scenario), it is assumed that all the above mentioned receptors may experience the WEF as intrusive.

Refer to **Map 5** for the location of the potential sensitive visual receptors discussed above.



Map 5: Proximity analysis and potential sensitive visual receptors.

6.5. Visual absorption capacity

The land cover within the study area is dominated by *thicket and dense bushland, grassland* and *cultivated land / agricultural fields* or *pastures.*

Thicket and dense bushland is described as:

Natural / semi-natural tree and / or bush dominated areas, where typically canopy heights are between 2 - 5 m, and canopy density is typically > ± 75%, but may include localised sparser areas down to ± 60%22. Includes dense bush, thicket, closed woodland, tall, dense shrubs, scrub forest and mangrove swamps. Can include self-seeded bush encroachment areas if sufficient canopy density.

Grassland is described as:

Natural / semi-natural grass dominated areas, where typically the tree and / or bush canopy densities are typically < ± 20 %, but may include localised denser areas up to ± 40 %, (regardless of canopy heights). It includes open grassland, and sparse bushland and woodland areas, including transitional wooded grasslands. May include planted pasture (i.e. grazing) if not irrigated. Irrigated pastures will typically be classified as cultivated.

Cultivated land / agricultural fields (rain-fed) are described as:

Cultivated lands used primarily for the production of rain-fed, annual crops for commercial markets. It is typically represented by large field units, often in dense local or regional clusters. In most cases the defined cultivated extent represents the actual cultivated or potential extent.

Overall, the Visual Absorption Capacity (VAC) of the receiving environment and especially the area in close proximity to the proposed WEF is deemed low by virtue of the nature of the vegetation (grassland and planted pastures) and the low occurrence of urban development.

The significant height of wind turbine structures adds to the potential visual intrusion of the WEF against the background of the horizon. In addition, the scale and form of the structures mean that it is unlikely that the environment will visually absorb them in terms of texture, colour, form and light/shade characteristics.

Where *thicket and dense bushland* occurs, or where exotic vegetation had been planted along roads, or at homesteads and settlements, the VAC will be higher.

Within the built-up areas of Haga Haga, Morgans Bay and Kei Mouth the VAC will be of relevance, due to the presence of buildings and structures, referred to as visual clutter. In this respect, the presence of the built-up environment will absorb the visual impact.

6.6. Visual impact index

The combined results of the visual exposure, viewer incidence/perception and visual distance of the proposed Haga Haga WEF are displayed on **Map 6**. Here the weighted impact and the likely areas of impact have been indicated as a visual impact index. Values have been assigned for each potential visual impact per data category and merged in order to calculate the visual impact index.

An area with short distance visual exposure to the proposed infrastructure, a high viewer incidence and a potentially negative perception would therefore have a

higher value (greater impact) on the index. This helps in focussing the attention to the critical areas of potential impact and determining the potential **magnitude** of the visual impact.

General

The index indicates that potentially sensitive visual receptors within a 5km radius of the WEF may experience a **very high** visual impact. The magnitude of visual impact on sensitive visual receptors subsequently subsides with distance to; **high** within a 5 – 10km radius and **moderate** within a 10 – 20km radius. Receptors beyond 20km are expected to have a **low** potential visual impact. Potentially affected visual receptors located within a 10km radius of the proposed WEF are shown on **Map 7**.

The WEF may have a **very high** visual impact on the following observers:

Residents of and visitors to:

- Pine Tops
- Elgin
- Woodford
- Patryspoort
- Doringhoek
- Lily Vale
- Bachelor's Rest
- Hatchleydene
- Idlewild (1 and 2)
- Spring Fountain

Note:
The location of these properties on the farms earmarked for the Haga Haga WEF reduces the probability of this impact occurring i.e. it is assumed that they are supportive of the WEF development.

Residents of and visitors to:

- Langrand
- Wildene
- Fort Warwick
- Rockwood
- Sunray (Wild Coast Horse Riding Adventures)
- Jesse Farm
- Kei Slopes
- Rhodes Dale
- Wembley
- Glen Ross (Cock Inn)
- Ewanrigg 1
- Ewanrigg 2 (Endalweni Private Game Reserve)
- Morganville (Kei Mouth Motorcycle Museum)
- Clearview
- Bayview
- Brooklyn
- Double Mouth (outlying areas)
- Black Rock
- Hillandale
- Avalon
- Orange Grove
- Laughing Waters

- Haga Haga (outlying areas)
- Mtwentwe (OppiePlaas Self Catering Cottages)
- Irisdale (Miarestate Hotel and Spa)
- Rooiwal
- Golden Slopes
- Woodbury
- Valencia
- Idlewood
- Carolina
- Bloemhof
- Blue Gums
- Soto (outlying areas)
- Unknown/unidentified residence No. 1 (C04000000000024100001) located within the WEF development area
- Unknown/unidentified residences No. 2 and 3 located south of the WEF development area
- Unknown/unidentified residences No. 4 and 5 located east of the WEF development area
- Unknown/unidentified residence No. 6 located west of the WEF development area

Observers travelling along the:

- R349 arterial road
- The Haga Haga secondary road
- The Morgans Bay secondary road

The WEF may have a **high** visual impact on the following observers:

Residents of/visitors to:

- Hagadash
- Joe's Folly
- St. Anthony's
- Manor
- Geluk
- Ocean View
- Hartland
- Essex
- Kei Flats
- Rocky Ridge
- Benmore (lodge)
- Kei Mouth Pineries (1 and 2)

Outlying parts of the following settlements:

- Bhola
- Ncalukeni
- Belekumntwana
- Mngqalasini
- KwaVuso
- Nyumage
- KwaFeni
- Zimbaba
- Cwebeni
- Sizini
- Dakeni
- Cwilli

- Unknown/unidentified settlements (no's. 7 and 8)

The WEF may have a **moderate** visual impact on the following observers:

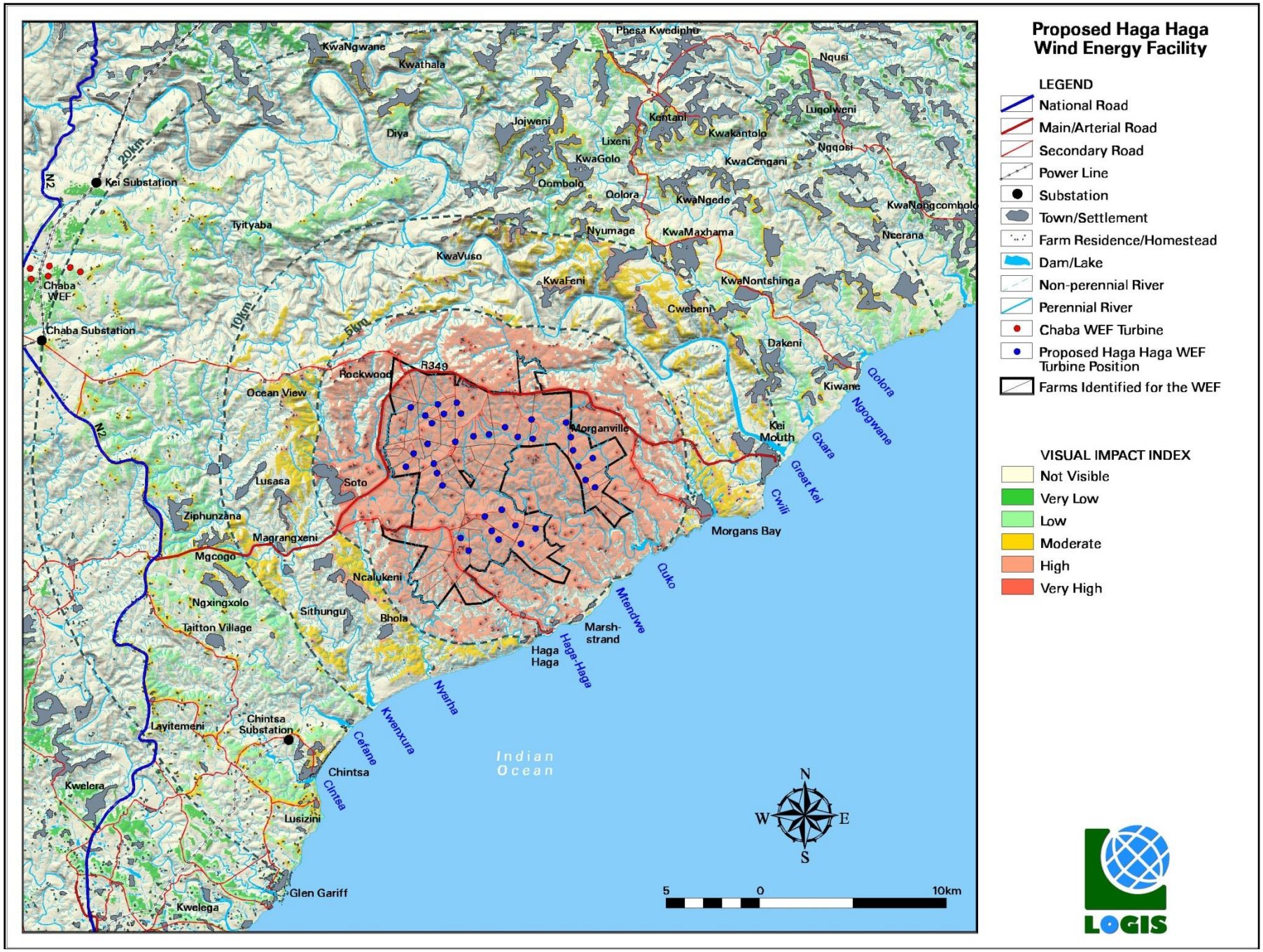
Residents of:

- Welland
- Belladonna

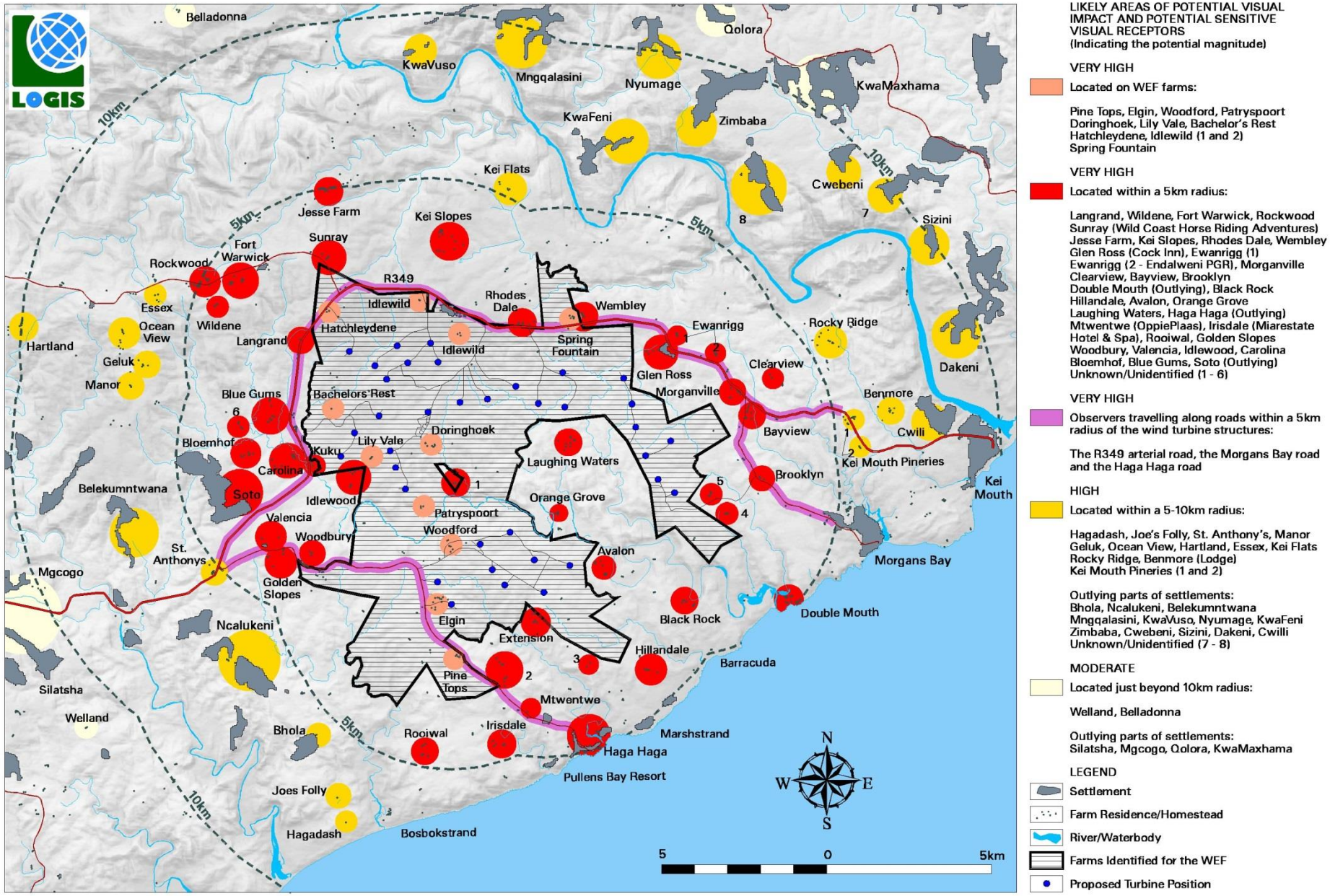
Outlying parts of the following settlements:

- Silatsha
- Mgcogo
- Qolora
- KwaMaxhama

Note:
Where homesteads are derelict or deserted, the visual impact will be non-existent, until such time as it is inhabited again.



Map 6: Visual impact index.



Map 7: Potentially affected sensitive visual receptors.

6.7. Visual impact assessment: impact rating methodology

The previous section of the report identified specific areas where likely visual impacts would occur. This section will attempt to quantify these potential visual impacts in their respective geographical locations and in terms of the identified issues (see Chapter 3: SCOPE OF WORK) related to the visual impact.

The methodology for the assessment of potential visual impacts states the **nature** of the potential visual impact (e.g. the visual impact on users of major roads in the vicinity of the proposed alignment) and includes a table quantifying the potential visual impact according to the following criteria:

- **Extent** - site only (very low = 1), local (low = 2), regional (medium = 3), national (high = 4) or international (very high = 5)[3].
- **Duration** - very short (0-1 yrs. = 1), short (2-5 yrs. = 2), medium (5-15 yrs. = 3), long (>15 yrs. = 4), and permanent (= 5).
- **Magnitude** - None (= 0), minor (= 2), low (= 4), medium/moderate (= 6), high (= 8) and very high (= 10)[4].
- **Probability** – very improbable (= 1), improbable (= 2), probable (= 3), highly probable (= 4) and definite (= 5).
- **Status** (positive, negative or neutral).
- **Reversibility** - reversible (= 1), recoverable (= 3) and irreversible (= 5).
- **Significance** - low, medium or high.

The **significance** of the potential visual impact is equal to the **consequence** multiplied by the **probability** of the impact occurring, where the consequence is determined by the sum of the individual scores for magnitude, duration and extent (i.e. **significance = consequence (magnitude + duration + extent) x probability**).

The significance weighting for each potential visual impact (as calculated above) is as follows:

- <30 points: Low (where the impact would not have a direct influence on the decision to develop in the area)
- 30-60 points: Medium/moderate (where the impact could influence the decision to develop in the area)
- >60: High (where the impact must have an influence on the decision to develop in the area)

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[3] Local = within 5km of the development site. Regional = between 5-10km from the development site.

[4] This value is read from the visual impact index. Where more than one value is applicable, the higher of these will be used as a worst case scenario.

6.8. Visual impact assessment

The primary visual impacts of the proposed WEF are assessed as follows:

6.8.1. Construction impacts

Potential visual impact of construction on sensitive visual receptors in close proximity to the proposed WEF.

During construction, there may be a noticeable increase in heavy vehicles utilising the roads to the development site that may cause, at the very least, a visual nuisance to other road users and land owners in the area.

Construction activities may potentially result in a **moderate** (significance rating = 48) temporary visual impact, both before and after mitigation (significance rating = 30).

Table 3: Visual impact of construction on sensitive visual receptors in close proximity to the proposed WEF.

Nature of Impact: Visual impact of construction activities on sensitive visual receptors in close proximity to the proposed WEF.		
	Without mitigation	***With mitigation***
Extent	Local **(2)**	Local **(2)**
Duration	Short term **(2)**	Short term **(2)**
Magnitude	High **(8)**	Moderate **(6)**
Probability	Highly Probable **(4)**	Probable **(3)**
Significance	Moderate **(48)**	Moderate **(30)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation: Planning: ➢ Retain and maintain natural vegetation in all areas outside of the development footprint. Construction: ➢ Ensure that vegetation is not unnecessarily removed during the construction period. ➢ Plan the placement of lay-down areas and temporary construction equipment camps in order to minimise vegetation clearing (i.e. in already disturbed areas) where possible. ➢ Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads. ➢ Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed of regularly at licensed waste facilities. ➢ Reduce and control construction dust using approved dust suppression techniques as and when required (i.e. whenever dust becomes apparent). ➢ Restrict construction activities to daylight hours whenever possible in order to reduce lighting impacts. ➢ Rehabilitate all disturbed areas immediately after the completion of construction works.
Cumulative impacts: None.
Residual impacts: None, provided that rehabilitation works are carried out as specified.

6.8.2. Potential visual impact on sensitive visual receptors (residents and visitors) located within a 5km radius of the wind turbine structures

The construction of the Haga Haga WEF is expected to have a **high** visual impact (significance rating = 64) on observers/visitors residing at homesteads within a 5km radius of the wind turbine structures. This includes:

- Langrand
- Wildene
- Fort Warwick
- Rockwood
- Sunray (Wild Coast Horse Riding Adventures)
- Jesse Farm
- Kei Slopes
- Rhodes Dale
- Wembley
- Glen Ross (Cock Inn)
- Ewanrigg 1
- Ewanrigg 2 (Endalweni Private Game Reserve)
- Morganville (Kei Mouth Motorcycle Museum)
- Clearview
- Bayview
- Brooklyn
- Double Mouth (outlying areas)
- Black Rock
- Hillandale
- Avalon
- Orange Grove
- Laughing Waters

- Haga Haga (outlying areas)
- Mtwentwe (OppiePlaas Self Catering Cottages)
- Irisdale (Miarestate Hotel and Spa)
- Rooiwal
- Golden Slopes
- Woodbury
- Valencia
- Idlewood
- Carolina
- Bloemhof
- Blue Gums
- Soto (outlying areas)
- Unknown/unidentified residence No. 1 (C04000000000024100001) located within the WEF development area
- Unknown/unidentified residences No. 2 and 3 located south of the WEF development area
- Unknown/unidentified residences No. 4 and 5 located east of the WEF development area
- Unknown/unidentified residence No. 6 located west of the WEF development area

The following WEF properties are provisionally included, due to their assumed support for the WEF.

- Pine Tops
- Elgin
- Woodford
- Patryspoort
- Doringhoek
- Lily Vale
- Bachelor's Rest
- Hatchleydene
- Idlewild (1 and 2)
- Spring Fountain

No mitigation of this impact is possible (i.e. the structures will be visible regardless), but general mitigation and management measures are recommended as best practice. The table below illustrates this impact assessment.

Table 4: Visual impact on observers (residents and visitors) in close proximity to the proposed wind turbine structures.

Nature of Impact: Visual impact on observers (residents at homesteads and visitors/tourists) in close proximity (i.e. within 5km) to the wind turbine structures		
	Without mitigation	***With mitigation***
Extent	Local **(2)**	Local **(2)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Very high **(10)**	Very high **(10)**
Probability	Highly probable **(4)**	Highly probable **(4)**
Significance	High **(64)**	High **(64)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No	No
Can impacts be	No, only best practice management measures can be	

mitigated?	implemented.
Generic best practise mitigation/management measures: Planning: ➢ Retain/re-establish and maintain natural vegetation in all areas outside of the development footprint/servitude. Operations: ➢ Maintain the general appearance of the facility as a whole. Decommissioning: ➢ Remove infrastructure not required for the post-decommissioning use. ➢ Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.	
Residual impacts: The visual impact will be removed after decommissioning, provided the WEF infrastructure is removed. Failing this, the visual impact will remain.	

6.8.3. Potential visual impact on sensitive visual receptors (observers travelling along roads) located within a 5km radius of the wind turbine structures

The construction of the Haga Haga WEF is expected to have a **high** visual impact (significance rating = 64) on observers traveling along the roads within a 5km radius of the wind turbine structures. This includes observers travelling along the:

- R349 arterial road
- The Haga Haga secondary road
- The Morgans Bay secondary road

No mitigation of this impact is possible (i.e. the structures will be visible regardless), but general mitigation and management measures are recommended as best practice. The table below illustrates this impact assessment.

Table 5: Visual impact on observers travelling along roads in close proximity to the proposed wind turbine structures.

Nature of Impact: Visual impact on observers travelling along the roads in close proximity (i.e. within 5km) to the wind turbine structures		
	Without mitigation	***With mitigation***
Extent	Local **(2)**	Local **(2)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Very high **(10)**	Very high **(10)**
Probability	Highly probable **(4)**	Highly probable **(4)**
Significance	High **(64)**	High **(64)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No, only best practice management measures can be implemented.	

Generic best practise mitigation/management measures: Planning: ➢ Retain/re-establish and maintain natural vegetation in all areas outside of the development footprint/servitude. Operations: ➢ Maintain the general appearance of the facility as a whole. Decommissioning: ➢ Remove infrastructure not required for the post-decommissioning use. ➢ Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.
Residual impacts: The visual impact will be removed after decommissioning, provided the WEF infrastructure is removed. Failing this, the visual impact will remain.

6.8.4. Potential visual impact on sensitive visual receptors within the region (5 – 10km radius)

The construction of the Haga Haga WEF could have a **moderate-high** visual impact (significance rating = 60) on residents of (or visitors to) homesteads within a 5 - 10km radius of the wind turbine structures.

The significance rating of the visual impact is dependent on the observer's potential indifference (**moderate**) or aversion/sensitivity (**high**) to the proposed WEF development.

Residents of/visitors to:

- Hagadash
- Joe's Folly
- St. Anthony's
- Manor
- Geluk
- Ocean View
- Hartland
- Essex
- Kei Flats
- Rocky Ridge
- Benmore (lodge)
- Kei Mouth Pineries (1 and 2)

Outlying parts of the following settlements:

- Bhola
- Ncalukeni
- Belekumntwana
- Mngqalasini
- KwaVuso
- Nyumage
- KwaFeni
- Zimbaba
- Cwebeni
- Sizini
- Dakeni
- Cwilli
- Unknown/unidentified settlements (no's. 7 and 8)

No mitigation of this impact is possible (i.e. the structures will be visible regardless), but general mitigation and management measures are recommended as best practice. The table below illustrates this impact assessment.

Table 6: Visual impact of the proposed wind turbine structures within the region.

Nature of Impact: Visual impact on observers travelling along the roads and residents at homesteads within a 5 – 10km radius of the wind turbine structures		
	Without mitigation	***With mitigation***
Extent	Regional **(3)**	Regional **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	High **(8)**
Probability	Highly probable **(4)**	Highly probable **(4)**
Significance	High **(60)**	High **(60)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No, only best practise measures can be implemented	
Generic best practise mitigation/management measures: Planning: ➢ Retain/re-establish and maintain natural vegetation in all areas outside of the development footprint/servitude. Operations: ➢ Maintain the general appearance of the facility as a whole. Decommissioning: ➢ Remove infrastructure not required for the post-decommissioning use. ➢ Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.		
Residual impacts: The visual impact will be removed after decommissioning, provided the WEF infrastructure is removed. Failing this, the visual impact will remain.		

6.8.6. Shadow flicker

Shadow flicker only occurs when the sky is clear, and when the turbine rotor blades are between the sun and the receptor (i.e. when the sun is low). De Gryse in Scenic Landscape Architecture (2006) found that "*most shadow impact is associated with 3-4 times the height of the object*". Based on this research, a 840m buffer along the edge of the outer most turbines is identified as the zone within which there is a risk of shadow flicker occurring.

There are no public roads or places of residence within the 840m buffer. The significance of shadow flicker is therefore anticipated to be **low** to **negligible**.

Table 7: Visual impact of shadow flicker on sensitive visual receptors in close proximity to the proposed WEF.

Nature of Impact: Visual impact of shadow flicker on sensitive visual receptors in close proximity to the proposed WEF.		
	Without mitigation	***With mitigation***
Extent	Local **(2)**	Local **(2)**

Duration	Long term **(4)**	Long term **(4)**
Magnitude	Low **(4)**	Low **(4)**
Probability	Improbable **(2)**	Improbable **(2)**
Significance	Low **(20)**	Low **(20)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	N.A. due to the low probability of occurrence	
Generic best practise mitigation/management measures: N.A.		
Residual impacts: N.A.		

6.8.7. Lighting impacts

Potential visual impact of operational, safety and security lighting of the facility at night.

The area immediately surrounding the proposed facility has a relatively low incidence of receptors and light sources, so light trespass and glare from the security and after-hours operational lighting for the facility will have some significance for visual receptors in close proximity.

Another source of glare light, albeit not as intense as flood lighting, is the aircraft warning lights mounted on top of the hub of the wind turbines. These lights are less aggravating due to the toned-down red colour, but have the potential to be visible from a great distance. This is especially true due to the strobing effect of the lights, a function specifically designed to attract the observer's attention. The Civil Aviation Authority (CAA) prescribes these warning lights and the potential to mitigate their visual impacts have traditionally been very low other than to restrict the number of lights to turbines that delineate the outer perimeter of the facility.

Figure 7: Aircraft warning lights fitted to the wind turbine hubs (Source: http://www.pinchercreekecho.com/2015/04/29/md-of-pincher-creek-takes-on-wind-turbine-lights.)

Some ground breaking new technology in the development of strobing lights that only activate when an aircraft is detected nearby. This may aid in restricting light pollution at night and should be investigated and implemented by the project proponent, if available and permissible by the CAA. This new technology is referred to as *needs-based night lights,* which basically deactivates the wind turbine's night lights when there is no flying object within the airspace of the WEF. The system relies on the active detection of aircraft by radar sensors, which relays a switch-on signal to the central wind farm control to activate the obstacle lights. See diagram in **Figure 8** below.[5]

[5] Source: Nordex Energy GmbH, 2019

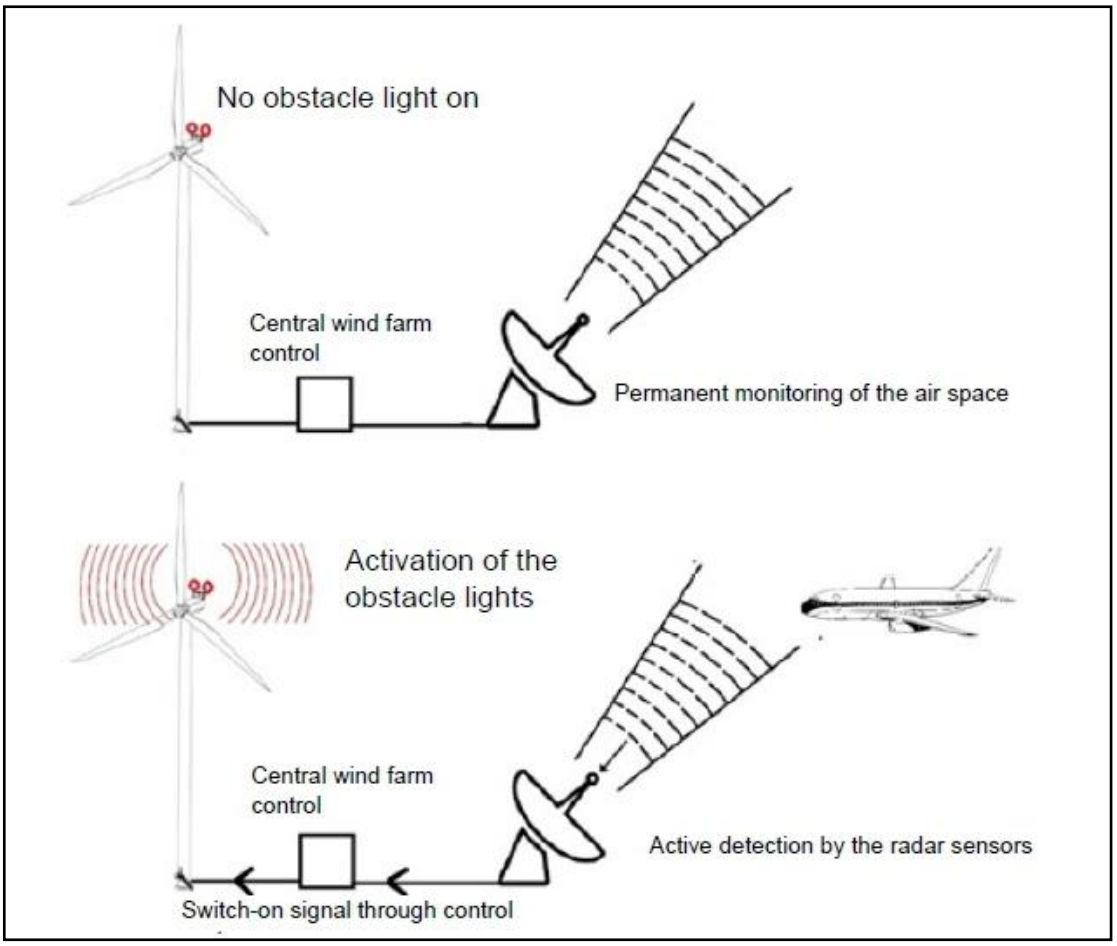


Figure 8: Diagram of the functional principle of the needs-based night lights.

Last is the potential lighting impact known as sky glow. Sky glow is the condition where the night sky is illuminated when light reflects off particles in the atmosphere such as moisture, dust or smog. The sky glow intensifies with the increase in the amount of light sources. Each new light source, especially upwardly directed lighting, contribute to the increase in sky glow.

This anticipated lighting impact is likely to be of **high** significance (rating = 60), and may be mitigated to **moderate** (rating = 45) especially within a 5 to 6km radius of the wind turbine structures.

Table 8: Impact table summarising the significance of visual impact of lighting at night on visual receptors in close to medium proximity to the proposed WEF.

Nature of Impact: Visual impact of lighting at night on sensitive visual receptors.		
	No mitigation	***Mitigation considered***
Extent	Local/Regional **(3)**	Local/Regional **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	High **(8)**
Probability	Highly probable **(4)**	Probable **(3)**
Significance	High **(60)**	Moderate **(45)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No	No

Can impacts be mitigated?	Yes
Mitigation: <u>Planning & operation</u>: ➢ Limit aircraft warning lights to the turbines on the perimeter according to CAA requirements, thereby reducing the overall impact. ➢ Install aircraft warning lights that only activate when the presence of an aircraft is detected, if permitted by CAA. ➢ Shield the sources of light by physical barriers (walls, vegetation, or the structure itself). ➢ Limit mounting heights of lighting fixtures, or alternatively use foot-lights or bollard level lights. ➢ Make use of minimum lumen or wattage in fixtures. ➢ Make use of down-lighters, or shielded fixtures. ➢ Make use of Low Pressure Sodium lighting or other types of low impact lighting. ➢ Make use of motion detectors on security lighting. This will allow the site to remain in relative darkness, until lighting is required for security or maintenance purposes.	
Cumulative impacts: The construction of an additional WEF may potentially increase the visual impacts associated with light pollution within an otherwise rural setting.	
Residual impacts: The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.	

6.8.8. Ancillary infrastructure

On-site ancillary infrastructure associated with the WEF includes a 33/132kV substation, underground 33kV cabling between the wind turbines, internal access roads, a workshop, office and Battery Energy Storage System. No dedicated viewshed analyses have been generated for the ancillary infrastructure, as the range of visual exposure will fall within that of the turbines. The anticipated visual impact resulting from this infrastructure is likely to be of **low** significance both before and after mitigation.

Table 9: Visual impact of the ancillary infrastructure.

Nature of Impact: Visual impact of the ancillary infrastructure on observers in close proximity to the structures.		
	Without mitigation	***With mitigation***
Extent	Local **(2)**	Local **(2)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Low **(4)**	Low **(4)**
Probability	Improbable **(2)**	Improbable **(2)**
Significance	Low **(20)**	Low **(20)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No, only best practise measures can be implemented	

Generic best practise mitigation/management measures: Planning: ➢ Retain/re-establish and maintain natural vegetation in all areas outside of the development footprint/servitude. Operations: ➢ Maintain the general appearance of the infrastructure. Decommissioning: ➢ Remove infrastructure not required for the post-decommissioning use. ➢ Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.
Residual impacts: The visual impact will be removed after decommissioning, provided the ancillary infrastructure is removed. Failing this, the visual impact will remain.

6.9. Visual impact assessment: secondary impacts

6.9.1. The potential impact on the sense of place of the region.

Sense of place refers to a unique experience of an environment by a user, based on his or her cognitive experience of the place. Visual criteria, specifically the visual character of an area (informed by a combination of aspects such as topography, level of development, vegetation, noteworthy features, cultural / historical features, etc.), play a significant role.

An impact on the sense of place is one that alters the visual landscape to such an extent that the user experiences the environment differently, and more specifically, in a less appealing or less positive light.

The greater environment has a rural, undeveloped character and a natural appearance. These generally undeveloped landscapes are considered to have a high visual quality. The coastal areas have an even greater visual attraction due to their ocean views and rugged coastline. The immediate threat of visual impacts on the character (or sense of place) of these coastal areas is largely mitigated by the fact that the turbines are placed beyond 5km from the coastline and the steep south-east elevation of the coastline shielding observers from the wind turbines.

The significance of the visual impacts on the sense of place within the **region** (i.e. beyond a 5-6km radius of the development and within the greater region) is expected to be of **moderate** significance.

No mitigation of this impact is possible (i.e. the structures will be visible regardless), but general mitigation and management measures are recommended as best practice. The table below illustrates this impact assessment.

Table 10: The potential impact on the sense of place of the region.

Nature of Impact: The potential impact on the sense of place of the region.		
	Without mitigation	***With mitigation***
Extent	Regional **(3)**	Regional **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Moderate **(6)**	Moderate **(6)**
Probability	Probable **(3)**	Probable **(3)**
Significance	Moderate **(39)**	Moderate **(39)**
Status (positive,	Negative	Negative

neutral or negative)		
Reversibility	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No, only best practise measures can be implemented	
Generic best practise mitigation/management measures: Planning: ➢ Retain/re-establish and maintain natural vegetation in all areas outside of the development footprint/servitude. Operations: ➢ Maintain the general appearance of the facility as a whole. Decommissioning: ➢ Remove infrastructure not required for the post-decommissioning use. ➢ Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.		
Residual impacts: The visual impact will be removed after decommissioning, provided the WEF infrastructure is removed. Failing this, the visual impact will remain.		

6.9.2. The potential cumulative visual impact of the wind farms on the visual quality of the landscape.

There is a very limited correlation (or overlap) between the visual exposure of the proposed Haga Haga WEF and the existing Chaba WEF. This is due to the relatively long distance between the two WEFs, the strongly undulating nature of the topography located between them and the generally secluded position of the proposed Haga Haga WEF within the region. Additional to this, the Chaba WEF only consists of seven wind turbines, generally considered to be a small WEF by international and even local standards.

The cumulative visual impact of the Chaba WEF and the proposed Haga Haga WEF is generally expected to be of **low** significance due to.

Table 11: The potential cumulative visual impact of wind farms on the visual quality of the landscape.

Nature of Impact: The potential cumulative visual impact of wind farms on the visual quality of the landscape.		
	Overall impacts of the proposed project considered in isolation	***Cumulative impact of the project and other projects in the area***
Extent	Regional **(3)**	Regional **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	Low **(4)**
Probability	Highly probable **(4)**	Improbable **(2)**
Significance	Moderate-High **(60)**	Low **(22)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No	
Mitigation measures: N.A.		

Residual impacts:
The visual impact will be removed after decommissioning, provided the WEF infrastructure is removed. Failing this, the visual impact will remain.

6.10. The potential to mitigate visual impacts

General mitigation

The primary visual impact, namely the appearance of the WEF (the wind turbines) is not possible to mitigate. The functional design of the turbines cannot be changed in order to reduce visual impacts.

Alternative colour schemes (i.e. painting the turbines sky-blue, grey or darker shades of white) are not permissible as the CAA's *Marking of Obstacles* expressly states, "*Wind turbines shall be painted bright white to provide the maximum daytime conspicuousness*".

Failure to adhere to the prescribed colour specifications will result in the fitting of supplementary daytime lighting to the wind turbines, once again aggravating the visual impact.

The overall potential for mitigation is therefore generally low or non-existent. The following mitigation is, however possible:

- It is recommended that vegetation cover (i.e. either natural or cultivated) be maintained in all areas outside of the actual development footprint, both during construction and operation of the proposed WEF. This will minimise visual impact as a result of cleared areas, power line servitudes and areas denuded of vegetation.

- Existing roads should be utilised wherever possible. New roads should be planned taking due cognisance of the topography to limit cut and fill requirements. Construction/upgrade of roads should be undertaken properly, with adequate drainage structures in place to forego potential erosion problems.

- In terms of onsite ancillary buildings and structures, it is recommended that it be planned so that the clearing of vegetation is minimised. This implies consolidating this infrastructure as much as possible and making use of already disturbed areas rather than undisturbed sites wherever possible.

- The Civil Aviation Authority (CAA) prescribes that aircraft warning lights be mounted on the turbines. However, it is possible to mount these lights on the turbines representing the outer perimeter of the facility. In this manner, fewer warning lights can be utilised to delineate the facility as one large obstruction, thereby lessening the potential visual impact.

- Install aircraft warning lights that only activate when the presence of an aircraft is detected, if permitted by CAA.

- Mitigation of other lighting impacts includes the pro-active design, planning and specification lighting for the facility. The correct specification and placement of lighting and light fixtures for the proposed WEF and ancillary infrastructure will go far to contain rather than spread the light. Mitigation measures include the following:

- Shielding the sources of light by physical barriers (walls, vegetation, or the structure itself);
- Limiting mounting heights of lighting fixtures, or alternatively using foot-lights or bollard level lights;
- Making use of minimum lumen or wattage in fixtures;
- Making use of down-lighters, or shielded fixtures;
- Making use of Low Pressure Sodium lighting or other types of low impact lighting.
- Making use of motion detectors on security lighting. This will allow the site to remain in relative darkness, until lighting is required for security or maintenance purposes.

- Mitigation of visual impacts associated with the construction phase, albeit temporary, would entail proper planning, management and rehabilitation of the construction site. Recommended mitigation measures include the following:

  - Ensure that vegetation is not unnecessarily cleared or removed during the construction period.
  - Reduce the construction period through careful logistical planning and productive implementation of resources.
  - Plan the placement of lay-down areas and any potential temporary construction camps in order to minimise vegetation clearing (i.e. in already disturbed areas) wherever possible.
  - Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.
  - Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed regularly at licensed waste facilities.
  - Reduce and control construction dust through the use of approved dust suppression techniques as and when required (i.e. whenever dust becomes apparent).
  - Restrict construction activities to daylight hours in order to negate or reduce the visual impacts associated with lighting.
  - Rehabilitate all disturbed areas, construction areas, roads, slopes etc. immediately after the completion of construction works. If necessary, an ecologist should be consulted to assist or give input into rehabilitation specifications.

- During operation, the maintenance of the turbines and ancillary structures and infrastructure will ensure that the facility does not degrade, therefore aggravating the visual impact.

- Roads must be maintained to forego erosion and to suppress dust, and rehabilitated areas must be monitored for rehabilitation failure. Remedial actions must be implemented as a when required.

- Once the facility has exhausted its life span, the main facility and all associated infrastructure not required for the post rehabilitation use of the site should be removed and all disturbed areas appropriately rehabilitated. An ecologist should be consulted to give input into rehabilitation specifications.

- All rehabilitated areas should be monitored for at least a year following decommissioning, and remedial actions implemented as and when required.

- Secondary impacts anticipated as a result of the proposed WEF (i.e. visual character and sense of place) are not possible to mitigate. There is also no mitigation to ameliorate the negative visual impacts on roads frequented by tourists and which provides access to tourist destinations within the region.

  Where sensitive visual receptors (as identified in **Section 6.8.2.**) are likely to be affected and where valid objections (as determined by the visual specialist) are raised by these receptors during the amendment process, it is recommended that the developer investigate the receptor's willingness (and the viability) of screening of visual impacts at the receptor site prior to construction commencing. This may entail the planting of natural vegetation, natural trees or the construction of screens in the pre-dominant direction of impact likely to be experienced by the principal receptor at the site. Ultimately, visual screening is most effective when placed at the receptor itself and should be considered in this context only.

Good practice requires that the mitigation of both primary and secondary visual impacts, as listed above, be implemented and maintained on an ongoing basis.

7. PHOTO SIMULATIONS

Photo simulations were undertaken (in addition to the above spatial analyses) in order to illustrate the potential visual impact of the proposed Haga Haga WEF within the receiving environment. The purpose of the photo simulation exercise is to support/verify the findings of the VIA, and is not an exercise to illustrate what the facility will look like from all directions (i.e. it is not an artist's impression).

The photo simulations indicate the anticipated visual alteration of the landscape from various sensitive visual receptors located at different distances from the facility. The simulations are based on the wind turbine dimensions and layout.

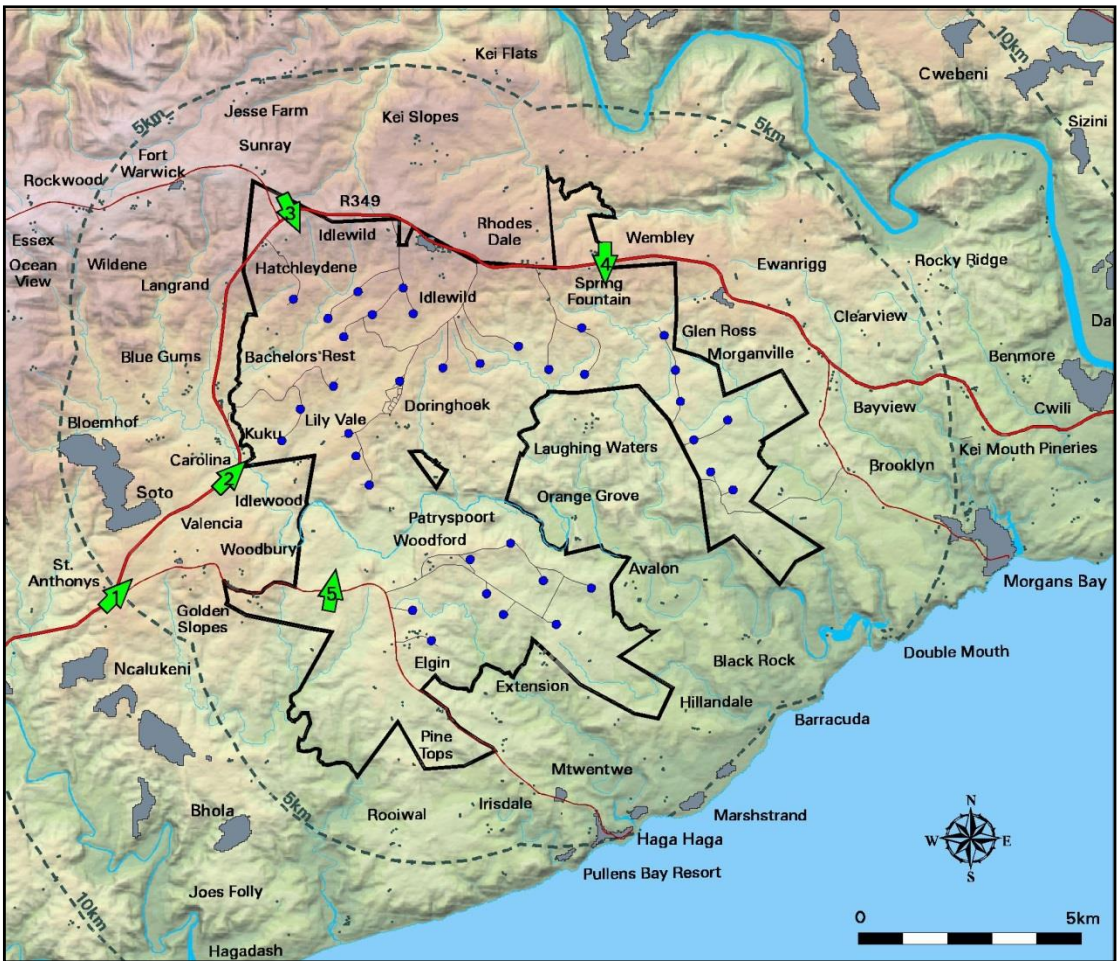
The photograph positions are indicated on **Map 8** below and should be referenced with the photo simulation being viewed in order to place the observer in spatial context.

The simulated views show the placement of the wind turbines during the long-term operation phase of the facility's lifespan. It is assumed that the necessary post-construction phase rehabilitation and mitigation measures, as proposed by the various specialists in the environmental impact assessment report, have been undertaken.

It is imperative that the natural vegetation be restored to its original (current) status for these simulated views to ultimately be realistic. The additional infrastructure (e.g. the proposed substation, access roads, etc.) associated with the facility is not included in the photo simulations.

The simulated wind turbines, as shown on the photographs, were adapted to the atmospheric conditions present when the original photographs were taken. This implies that factors such as haze and solar glare were also simulated in order to realistically represent the observer's potential view of the facility.

The photo simulations are displayed as "before" and "after" views of the affected landscape.



Map 8: Photograph positions.

7.1. Viewpoint 1: before construction (**Figure 9:** Photo simulation 1 - before).

7.2. Viewpoint 1: after construction (Figure 10: Photo simulation 1 - after). *The closest wind turbine is 5km from this point*.

7.3. Viewpoint 2: before construction (**Figure 11:** Photo simulation 2 - before).

7.4. Viewpoint 2: after construction (**Figure 12:** Photo simulation 2 - after). *The closest wind turbine is 1km from this point*.

7.5. Viewpoint 3: before construction (**Figure 13:** Photo simulation 3 - before).

7.6. Viewpoint 3: after construction (**Figure 14:** Photo simulation 3 - after). *The closest wind turbine is 2.3km from this point*.

7.7. Viewpoint 4: before construction (**Figure 15:** Photo simulation 4 - before).

7.8. Viewpoint 4: after construction (**Figure 16:** Photo simulation 4 - after). *The closest wind turbine is 1.6km from this point*.

7.9. Viewpoint 5: before construction (**Figure 17:** Photo simulation 5 - before).

7.10. Viewpoint 5: after construction (**Figure 18:** Photo simulation 5 - after). *The closest wind turbine is 2.6km from this point*.

9. CONCLUSION AND RECOMMENDATIONS

The visual impact assessment (VIA) practitioner takes great care to ensure that all the spatial analyses and mapping is as accurate as possible. The intention is to quantify, using visibility analyses, proximity analyses, photo simulations and the identification of sensitive receptors, the potential visual impacts associated with the Haga Haga WEF. These processes are deemed to be transparent and scientifically defensible when interrogated.

However, visual impact is ultimately a subjective concept. The *subjects* in this case are the residents of, and visitors to the region. The author has attempted to accurately capture the location of these *subjects* (i.e. sensitive visual receptors and areas of likely visual impact) to the best of his ability, drawing on years of experience as a VIA practitioner. The VIA further adopts a risk averse approach in so far as to assume that the perception of most (if not all) of the sensitive visual receptors (bar the landowners of the properties earmarked for the development), would be predominantly negative towards the development of a WEF in the region.

There are likely to be supporters of the Haga Haga WEF (as renewable energy generation is a global priority) amongst the population of the larger region, but they are largely expected to be indifferent to the construction of the WEF and not as vocal in their support for the wind farm as the detractors thereof.

The construction and operation of the proposed Haga Haga WEF and its associated infrastructure, will have a high visual impact on the study area, especially within (but not restricted to) a 5-6km radius of the proposed facility. The visual impact will differ amongst places, depending on the distance from the facility, but will generally be restricted inland of the coast line (i.e. it is not expected to hugely impact on the coastal destinations along the Indian seaboard). Tourist travelling to these destinations, or visiting tourist facilities further inland, will however be visually impacted. Residents of settlements and homesteads will likely experience similar visual impacts, where the wind turbine structures are visible.

The combined visual impact or cumulative impact of two wind energy facilities (i.e. the existing Chaba WEF and the proposed Haga Haga WEF) is not expected to increase the area of potential visual impact within the region. The intensity of visual impact (number of turbines visible) to exposed receptors, especially those located within a 5-6km radius of the proposed Haga Haga WEF, is not expected to increase when considered in conjunction with the Chaba WEF.

Overall, the significance of the visual impacts associated with the proposed Haga Haga WEF is expected to be high as a result of the generally undeveloped character of the landscape. The facility would be visible within an area that contains certain sensitive visual receptors who would consider visual exposure to this type of infrastructure to be intrusive. Such visual receptors include people travelling along roads, residents of rural homesteads and settlements and tourists passing through or holidaying in the region.

Conventional mitigation (e.g. such as screening of the structures) of the potential visual impacts is highly unlikely to succeed due to the nature of the development and the receiving environment. A number of mitigation measures have been proposed (**Section 6.10**). The proposed mitigation measures will primarily be effective in terms of mitigating lighting and construction phase visual impacts.

Note: Regardless of whether or not mitigation measures will reduce the significance of the anticipated visual impacts, they are considered to be good

practice and should all be implemented and maintained throughout the construction, operation and decommissioning phases of the proposed facility, should it be authorised.

10. IMPACT STATEMENT

The findings of the Visual Impact Assessment undertaken for the proposed Haga Haga WEF is that the visual environment surrounding the site, especially within a 5-6km radius, will be visually impacted upon for the anticipated operational lifespan of the facility (i.e. 20 - 25 years).

The following is a summary of impacts remaining:

- Construction phase activities may potentially result in a **moderate** temporary visual impact, both before and after mitigation

- The construction of the Haga Haga WEF is expected to have a **high** visual impact on observers/visitors residing at homesteads within a 5-6km radius of the wind turbine structures. No mitigation of this impact is possible.

- The construction of the Haga Haga WEF is expected to have a **high** visual impact on observers traveling along the roads within a 5-6km radius of the wind turbine structures. No mitigation of this impact is possible.

- The construction of the Haga Haga WEF could have a **moderate-high** visual impact on observers traveling along the roads and residents of homesteads within the region (5 - 10km radius of the wind turbine structures). The significance rating of the visual impact is dependent on the observer's potential indifference (**moderate**) or aversion/sensitivity (**high**) to the proposed wind farm development. No mitigation of this impact is possible.

- There are no public roads or places of residence within a 840m buffer from the wind turbine structures. The significance of shadow flicker is therefore anticipated to be **low** to **negligible**.

- The anticipated night-time lighting impact is likely to be of **high** significance and may be mitigated to **moderate**, provided that *needs-based aircraft warning lights* (if permitted by the CAA), is installed.

- The anticipated visual impact resulting from ancillary infrastructure is likely to be of **low** significance both before and after mitigation.

- The significance of the visual impacts on the sense of place within the region (i.e. beyond a 5-6km radius of the development and within the greater region) is expected to be of **moderate** significance.

- The cumulative visual impact of the Chaba WEF and the proposed Haga Haga WEF is generally expected to be of **low** significance.

The anticipated visual impacts listed above (i.e. post mitigation impacts) range from **high** to **low** significance. Anticipated visual impacts on sensitive visual receptors in close proximity to the proposed facility remain high and are not possible to mitigate. Even though it is possible that the potential visual impacts may exceed acceptable levels within the context of the receiving environment (an

area with an established tourism industry), the proposed WEF development is not considered to be fatally flawed.

A fatal flaw occurs when:

- There is non-compliance with Acts, Ordinances, By-laws and **adopted** policies relating to visual pollution, scenic routes, special areas or proclaimed heritage sites.

- Non-compliance with conditions of existing Records of Decision.

- Impacts that may be evaluated to be of high significance and that are considered by the **majority** of stakeholders and decision-makers to be unacceptable.[6]

It is likely that the WEF development will be met with (largely valid) concern and potential opposition from affected land owners and tour operators within the region. The fact that the visual impact is expected to be of high significance is undisputed. However, this report cannot categorically state that any of the above conditions were transgressed, nor can it (with the information available to the VIA practitioner) be empirically determined that the *statistical majority* of objecting stakeholders were exceeded. If evidence to the contrary surfaces during the progression of the development application, this statement may need to be revised.

11. MANAGEMENT PROGRAMME

The following management plan tables aim to summarise the key findings of the visual impact report and to suggest possible management actions in order to mitigate the potential visual impacts. The proposed management actions supersede all existing Environmental Authorisation (EA) conditions. Refer to tables overleaf.

[6] Source: Oberholzer, B. 2005

Table 12: Management programme – Planning.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the planning of the Proposed Haga Haga WEF.		
Project Component/s	The WEF and ancillary infrastructure (i.e. turbines, access roads, substation, Battery Energy Storage System, workshop and power lines).	
Potential Impact	Primary visual impact of the facility due to the presence of the turbines and associated infrastructure as well as the visual impact of lighting at night.	
Activity/Risk Source	The viewing of the above mentioned by observers on or near the site (i.e. within 5km of the site) as well as within the region.	
Mitigation: Target/Objective	Optimal planning of infrastructure to minimise visual impact.	
Mitigation: Action/control	**Responsibility**	**Timeframe**
Retain and maintain natural and / or cultivated vegetation in all areas outside of the development footprint.	Project proponent/ design consultant	Early in the planning phase.
Make use of existing roads wherever possible and plan the layout and construction of roads and infrastructure with due cognisance of the topography to limit cut and fill requirements.	Project proponent/ design consultant	Early in the planning phase.
Plan all roads, ancillary buildings and ancillary infrastructure in such a way that clearing of vegetation is minimised. Consolidate infrastructure and make use of already disturbed sites rather than undisturbed areas.	Project proponent/ design consultant	Early in the planning phase.
Consult a lighting engineer in the design and planning of lighting to ensure the correct specification and placement of lighting and light fixtures for the WEF and the ancillary infrastructure. The following is recommended: ○ Limit aircraft warning lights for the proposed WEF to the turbines on the perimeter, thereby reducing the overall requirement (CAA regulations/conditions permitting). ○ Install aircraft warning lights that only activate when an aircraft is detected (CAA regulations/conditions permitting). ○ Shield the sources of light by physical barriers (walls, vegetation, or the structure itself); ○ Limit mounting heights of fixtures, or use foot-lights or bollard lights; ○ Make use of minimum lumen or wattage in fixtures; ○ Making use of down-lighters or shielded fixtures; ○ Make use of Low Pressure Sodium lighting or other low impact lighting. ○ Make use of motion detectors on security lighting, so allowing the site to remain in darkness until lighting is required for security or maintenance purposes.	Project proponent / design consultant	Early in the planning phase.
Performance Indicator	Minimal exposure (limited or no complaints from I&APs) of ancillary infrastructure and lighting at night to observers on or near the site (i.e. within 5km) and within the region.	

Monitoring	Not applicable.

Table 13: Management programme – Construction.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the construction of the Proposed Haga Haga WEF.		
Project Component/s	Construction site and activities	
Potential Impact	Visual impact of general construction activities, and the potential scarring of the landscape due to vegetation clearing and resulting erosion.	
Activity/Risk Source	The viewing of the above mentioned by observers on or near the site.	
Mitigation: Target/Objective	Minimal visual intrusion by construction activities and intact vegetation cover outside of immediate construction work areas.	
Mitigation: Action/control	**Responsibility**	**Timeframe**
Ensure that vegetation is not unnecessarily cleared or removed during the construction period.	Project proponent / contractor	Early in the construction phase.
Reduce the construction period through careful logistical planning and productive implementation of resources.	Project proponent / contractor	Early in the construction phase.
Plan the placement of lay-down areas and temporary construction equipment camps in order to minimise vegetation clearing (i.e. in already disturbed areas) wherever possible.	Project proponent / contractor	Early in and throughout the construction phase.
Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.	Project proponent / contractor	Throughout the construction phase.
Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed regularly at licensed waste facilities.	Project proponent / contractor	Throughout the construction phase.
Reduce and control construction dust through the use of approved dust suppression techniques as and when required (i.e. whenever dust becomes apparent).	Project proponent / contractor	Throughout the construction phase.
Restrict construction activities to daylight hours in order to negate or reduce the visual impacts associated with lighting.	Project proponent / contractor	Throughout the construction phase.
Rehabilitate all disturbed areas, construction areas, servitudes etc. immediately after the completion of construction works. If necessary, an ecologist should be consulted to assist or give input into rehabilitation specifications.	Project proponent / contractor	Throughout and at the end of the construction phase.
Performance Indicator	Vegetation cover on and in the vicinity of the site is intact (i.e. full cover as per natural vegetation within the environment) with no evidence of degradation or erosion.	
Monitoring	Monitoring of vegetation clearing during construction (by contractor as part of construction contract). Monitoring of rehabilitated areas quarterly for at least a year following the end of construction (by contractor as part of construction contract).	

Table 14: Management programme – Operation.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the operation of the Proposed Haga Haga WEF.		
Project Component/s	The WEF and ancillary infrastructure (i.e. turbines, access roads, substation, Battery Energy Storage System, workshop and power lines).	
Potential Impact	Visual impact of facility degradation (including operational wind turbines) and vegetation rehabilitation failure.	
Activity/Risk Source	The viewing of the above mentioned by observers on or near the site.	
Mitigation: Target/Objective	Well maintained and neat facility.	
Mitigation: Action/control	**Responsibility**	**Timeframe**
Maintain the general appearance of the facility as a whole, including the turbines, servitudes and the ancillary buildings.	Project proponent / operator	Throughout the operation phase.
Maintain roads and servitudes to forego erosion and to suppress dust.	Project proponent / operator	Throughout the operation phase.
Monitor rehabilitated areas, and implement remedial action as and when required.	Project proponent / operator	Throughout the operation phase.
Performance Indicator	Well maintained and neat facility with intact vegetation on and in the vicinity of the facility.	
Monitoring	Monitoring of the entire site on an ongoing basis (by operator).	

Table 15: Management programme – Decommissioning.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the decommissioning of the Proposed Haga Haga WEF.		
Project Component/s	The WEF and ancillary infrastructure (i.e. turbines, access roads, substation, Battery Energy Storage System, workshop and power lines).	
Potential Impact	Visual impact of residual visual scarring and vegetation rehabilitation failure.	
Activity/Risk Source	The viewing of the above mentioned by observers on or near the site.	
Mitigation: Target/Objective	Only the infrastructure required for post decommissioning use of the site retained and rehabilitated vegetation in all disturbed areas.	
Mitigation: Action/control	**Responsibility**	**Timeframe**
Remove infrastructure not required for the post-decommissioning use of the site. This may include the turbines, substation, Battery Energy Storage System, power lines, ancillary buildings, masts etc.	Project proponent / operator	During the decommissioning phase.
Rehabilitate access roads and servitudes not required for the post-decommissioning use of the site. If necessary, an ecologist should be consulted to give input into rehabilitation specifications.	Project proponent / operator	During the decommissioning phase.
Monitor rehabilitated areas quarterly for at least a year following decommissioning, and implement remedial action as and when required.	Project proponent / operator	Post decommissioning.
Performance Indicator	Vegetation cover on and in the vicinity of the site is intact (i.e. full cover as per natural vegetation within the environment) with no evidence of degradation or erosion.	
Monitoring	Monitoring of rehabilitated areas quarterly for at least a year following decommissioning.	

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