SOUTH AFRICA MAINSTREAM RENEWABLE POWER DEVELOPMENTS PTY (LTD)

Proposed Construction of the Xha! Boom Wind Farm near Loeriesfontein, Northern Cape Province

Visual Impact Assessment Report – Scoping Phase

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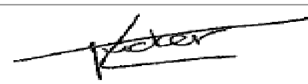
Signature:	
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REPUBLIC OF SOUTH AFRICA

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

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Application for authorisation in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2010

PROJECT TITLE

Proposed Xha! Boom Wind Farm near Loeriesfontein within the Hantam Local Municipality in the Northern Cape Province.

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The specialist appointed in terms of the Regulations

I, ___________**Andrea Gibb**_________________, declare that --

General declaration:

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of section 24F of the Act.

Signature of the specialist

SiVEST Environmental

Name of company (if applicable)

22 May 2017

Date

The specialist appointed in terms of the Regulations

I, **Stephan Jacobs**, declare that --

General declaration:

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
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- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
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Signature of the specialist

SiVEST Environmental

Name of company (if applicable)

22 May 2017

Date

SOUTH AFRICA MAINSTREAM RENEWABLE POWER DEVELOPMENTS PTY (LTD)

PROPOSED CONSTRUCTION OF THE XHA! BOOM WIND FARM NEAR LOERIESFONTEIN, NORTHERN CAPE PROVINCE

VISUAL IMPACT ASSESSMENT REPORT – SCOPING PHASE

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GLOSSARY OF TERMS

ABBREVIATIONS

DEIR	Draft Environmental Impact Report
DTM	Digital terrain model
DSR	Draft Scoping Report
EIA	Environmental Impact Assessment
FEIR	Final Environmental Impact Report
FSR	Final Scoping Report
GIS	Geographic Information System
I&AP	Interested and/or Affected Party
kV	Kilovolt
MW	Megawatt
NGI	National Geo-Spatial Information
SANBI	South African National Biodiversity Institute
VIA	Visual Impact Assessment

DEFINITIONS

Anthropogenic feature: An unnatural feature as a result of human activity.

Aspect: Direction in which a hill or mountain slope faces.

Cultural landscape: A representation of the combined worlds of nature and of man illustrative of the evolution of human society and settlement over time, under the influence of the physical constraints and/or opportunities presented by their natural environment and of successive social, economic and cultural forces, both external and internal (World Heritage Committee, 1992).

Sense of place: The unique quality or character of a place, whether natural, rural or urban. It relates to uniqueness, distinctiveness or strong identity.

Scenic route: A linear movement route, usually in the form of a scenic drive, but which could also be a railway, hiking trail, horse-riding trail or 4x4 trail.

Sensitive visual receptors: An individual, group or community that is subject to the visual influence of the proposed development and is adversely impacted by it. They will typically include locations of human habitation and tourism activities.

Study area: The study area is assumed to encompass a zone of 8km from the outer boundary of the proposed wind farm application site.

Vantage point: A point in the landscape from where a particular project or feature can be viewed.

Viewpoint: A point in the landscape from where a particular project or feature can be viewed.

Viewshed: The outer boundary defining a visual envelope, usually along crests and ridgelines.

Visual character: The physical elements and forms and land use related characteristics that make up a landscape and elicit a specific visual quality or nature. Visual character can be defined based on the level of change or transformation from a completely natural setting.

Visual contrast: The degree to which the development would be congruent with the surrounding environment. It is based on whether or not the development would conform with the land use, settlement density, forms and patterns of elements that define the structure of the surrounding landscape.

Visual envelope: A geographic area, usually defined by topography, within which a particular project or other feature would generally be visible.

Visual exposure: The relative visibility of a project or feature in the landscape.

Visual impact: The effect of an aspect of the proposed development on a specified component of the visual, aesthetic or scenic environment within a defined time and space.

Visual receptors: An individual, group or community that is subject to the visual influence of the proposed development but is not necessarily adversely impacted by it. They will typically include commercial activities and motorists travelling along routes that are not regarded as scenic.

Visual sensitivity: The inherent sensitivity of an area to potential visual impacts associated with a proposed development. It is based on the physical characteristics of the area (visual character), spatial distribution of potential receptors, and the likely value judgements of these receptors towards the new development, which are usually based on the perceived aesthetic appeal of the area.

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VISUAL IMPACT ASSESSMENT REPORT – SCOPING PHASE

1 INTRODUCTION

South Africa Mainstream Renewable Power Developments (Pty) Ltd (hereafter referred to as Mainstream) are proposing to construct a wind farm near Loeriesfontein in the Northern Cape Province. The proposed development is proposed to consist of a 235MW export capacity wind farm referred to as Xha! Boom Wind Farm.

SiVEST have been appointed by Mainstream to undertake the Environmental Impact Assessment (EIA) for the proposed construction of the Xha! Boom wind farm. As part of the EIA study, the need to undertake a visual impact assessment (VIA) has been identified. Accordingly, a desktop scoping-level visual impact assessment study has been conducted to identify key visual issues relating to the development of the wind farm within this context and determine the potential extent of visual impact. This is done by characterising the visual environment of the area and identifying areas of potential visual sensitivity that may be subject to visual impacts.

1.1 Project Description

At this stage it is proposed that the wind farm, comprising wind turbines and associated infrastructure will have a total generation capacity of up to 235MW. The wind farm will consist of up to 70 turbines, each with a generation capacity between 3 and 5MW. The generated electricity will be fed into the national grid at the Helios Substation via a 132kV power line. It should however be noted that this 132kV power line will require a separate Environmental Authorisation and is being conducted as a part of a separate Basic Assessment (BA) process. The 132kV power line has been mentioned for background information but will be authorised under a separate BA to allow for handover to Eskom. The key components of the project are detailed below.

1.1.1 Turbines

The size of the wind turbines will depend on the developable area and the total generation capacity that can be produced as a result. The wind turbines will therefore have a hub height of up to 160m and a rotor diameter of up to 160m (**Figure 1)**. The blade rotation direction will depend on wind measurement information received later in the process. The electrical generation capacity for each turbine will range between 3 and 5MW, depending on the final wind turbine selected for the proposed development.

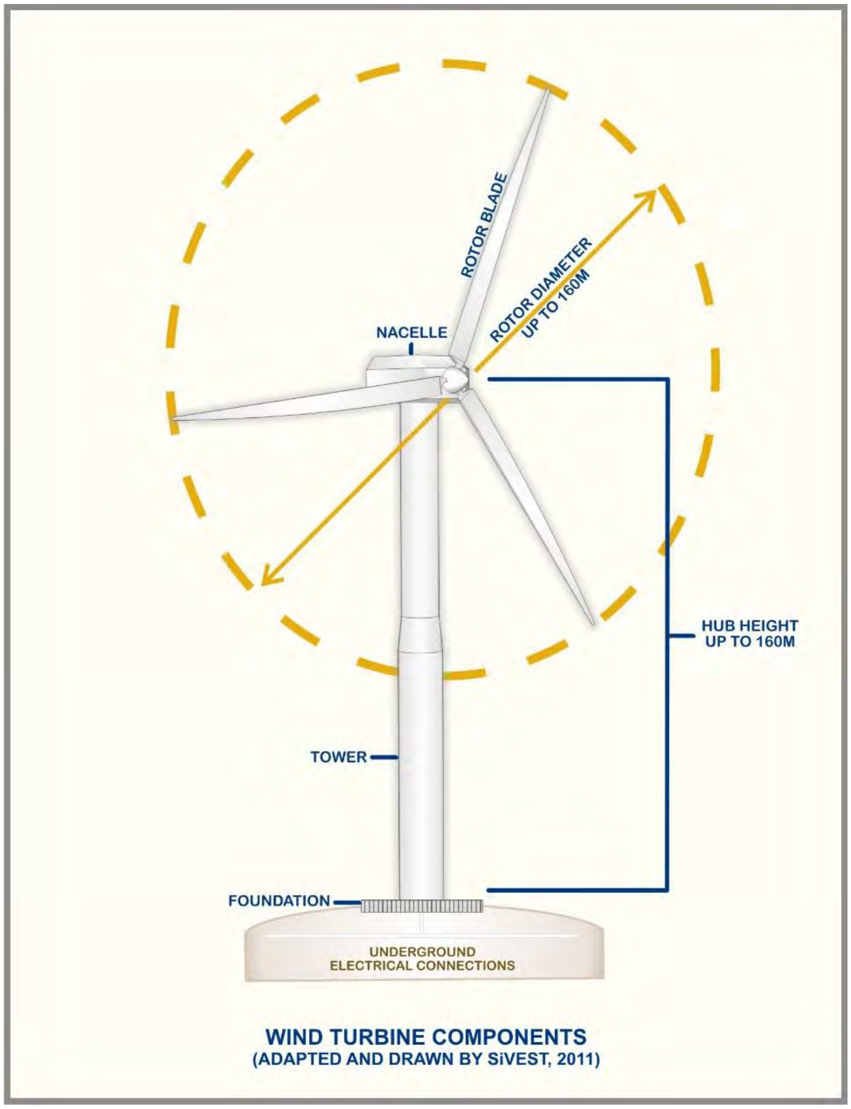


Figure 1: Typical components of a wind turbine

1.1.2 Wind Farm Electrical Infrastructure

The wind turbines will be connected to the substation using buried (up to a depth of 1,5m) medium voltage cables (**Figure 2**) except where a technical assessment of the proposed design suggests that overhead lines are appropriate, such as over rivers and gullies. Where overhead power lines are to be constructed, monopole tower structures will be used in combination with the steel lattice towers at bend points. The dimensions of the monopole structures will depend on grid safety requirements and the grid operator. The exact location of the towers and the final design will depend on Eskom's requirements. As mentioned, the proposed wind farm will connect to the national grid at Helios substation via a 132kV power line with a length of up to 48km. As previously mentioned however, the 132kV power line associated with the proposed wind farm will require a separate Environmental Authorisation and is being conducted as a part of a separate Basic Assessment (BA) process. The 132kV power line has been mentioned for background information but will be authorised under a separate BA to allow for handover to Eskom.

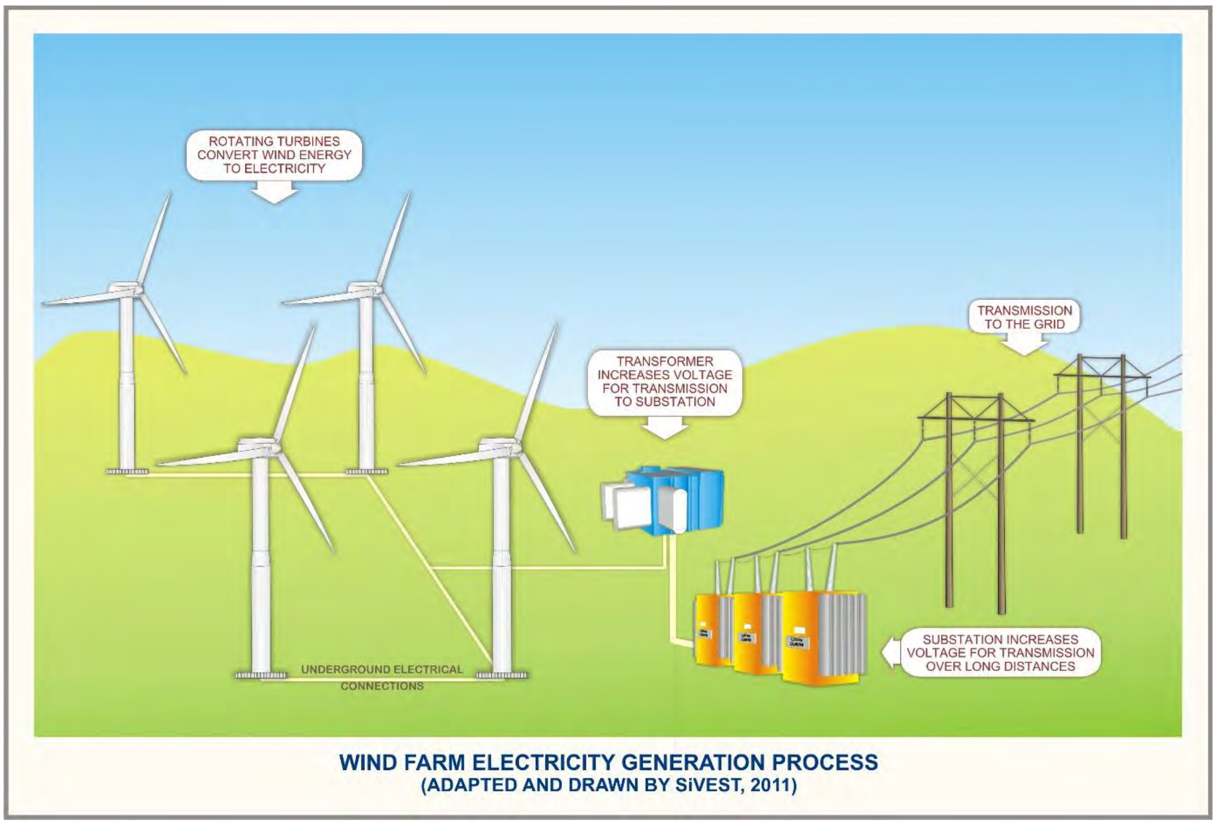


Figure 2: Conceptual wind farm electricity generation process showing electrical connections

A new substation and associated transformers will be developed which will supply the generated electricity to the national grid. The connection from the substation to the national grid line will be an overhead power line as mentioned above.

1.1.3 Roads

Internal access roads with a maximum width of 13.5m are initially being proposed for the construction phase. This is however only temporary as the width of the proposed internal access roads will be reduced to approximately 6m for maintenance purposes during the operational phase.

1.1.4 Construction Lay Down Area

A temporary construction lay down area will be constructed for the proposed development and will include an access road and a contractor's site office.

1.1.5 Other Infrastructure

Other infrastructure includes the following:

- Operation and maintenance (O&M) buildings; and
- Fencing.

1.2 Site Location

The proposed wind farm is located approximately 68km north of Loeriesfontein in the Northern Cape Province, within the Hantam Local Municipality (**Figure 3**). The application site as shown on the locality map below (**Figure 4**) comprises the entire portion of Portion 2 of the Farm Georgs Vley No. 217 and is approximately 3804ha in extent. The buildable area of the site will however be significantly smaller than this and will be determined by sensitive areas identified during the EIA.

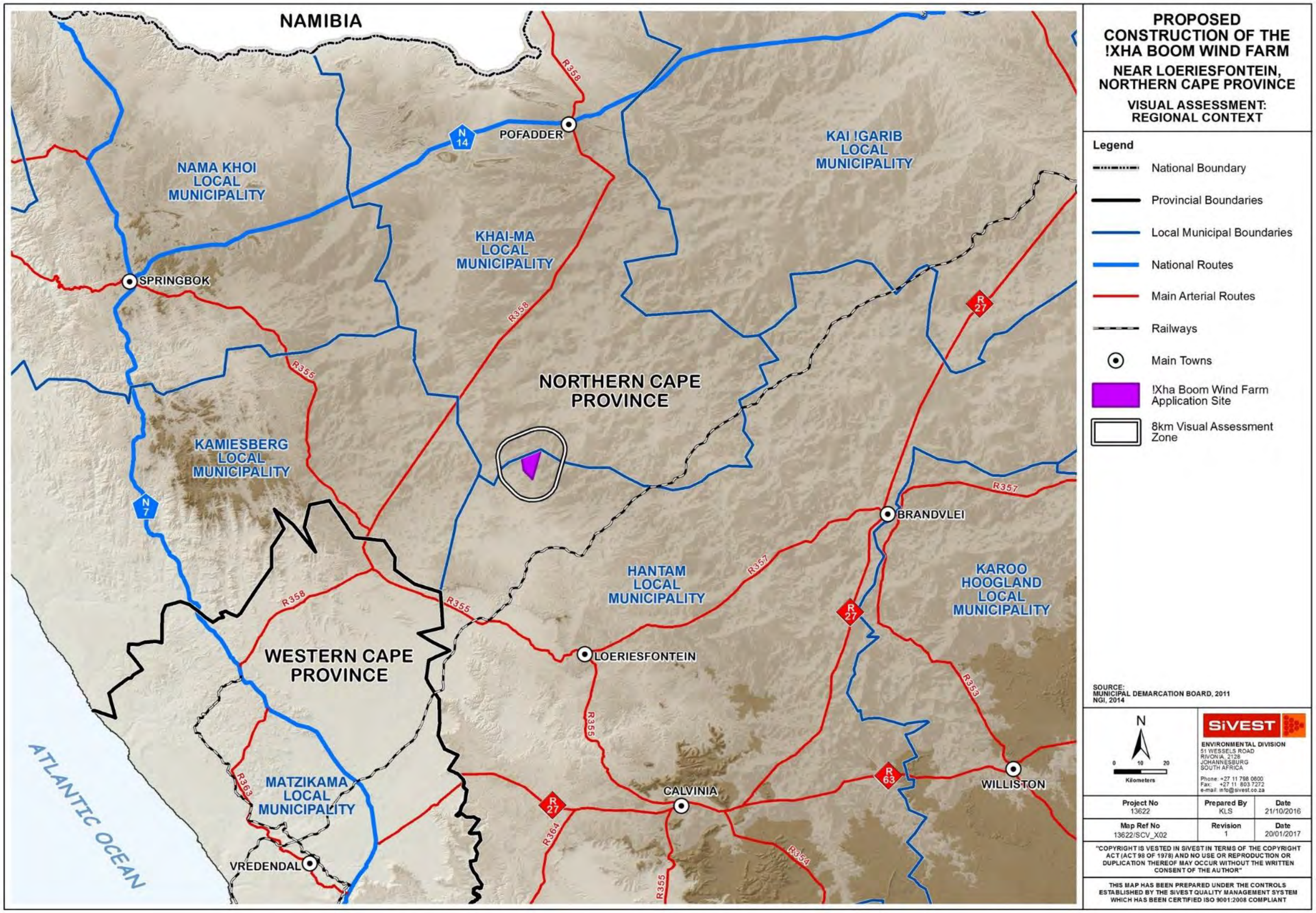


Figure 3: Regional Context Map

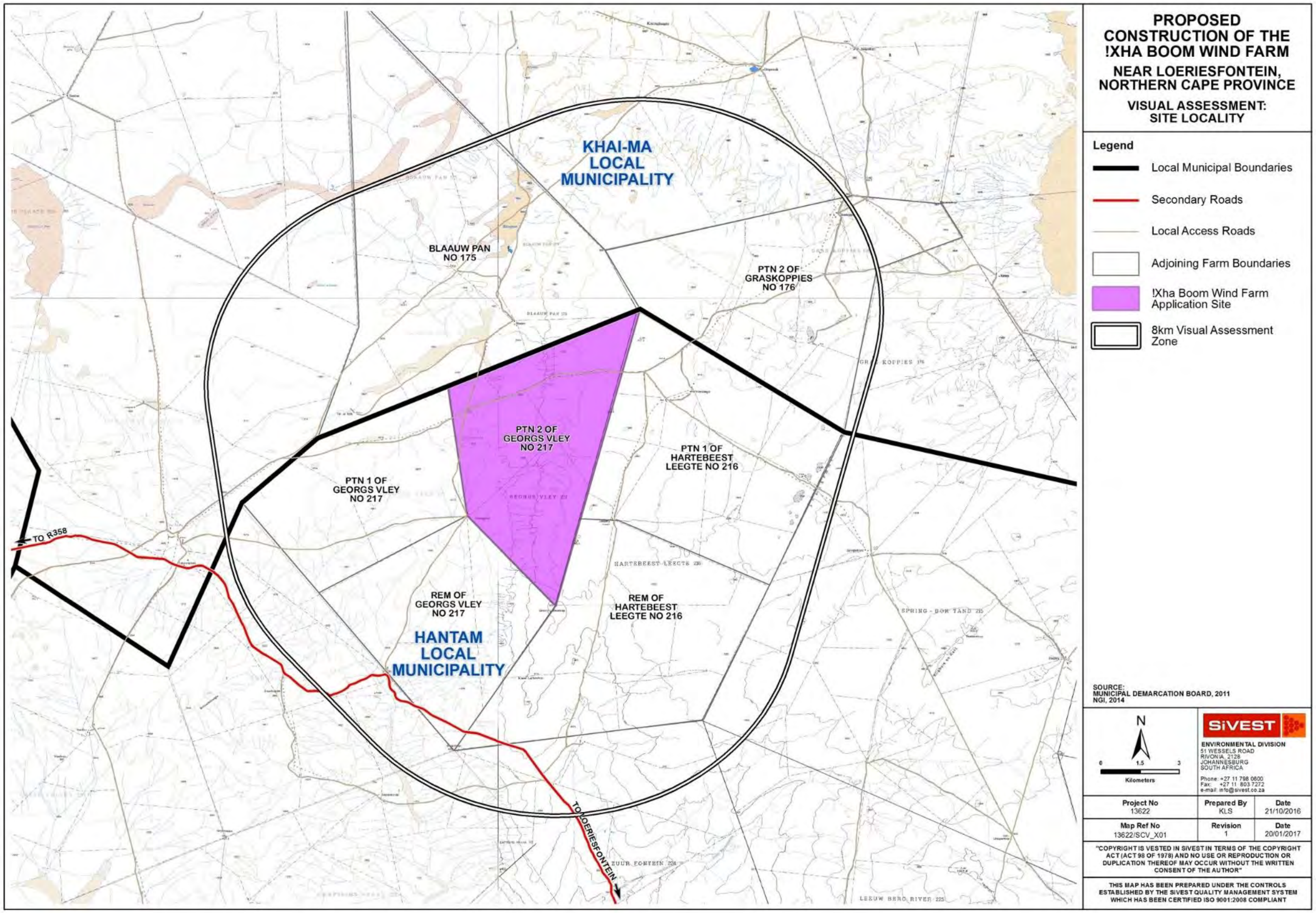


Figure 4: Locality Map

1.3 Assumptions and Limitations

- The identification of visual receptors has been based on a combination of desktop assessment as well as field-based observation. Initially Google Earth imagery was used to identify potential receptors within the study area. Thereafter a site visit was undertaken from the 05th to the 09th of December 2016 in order to verify the sensitive visual receptors within the study area and assess the visual impact of the development from these receptor locations. Due to the extensive area covered by the study area, a number of broad assumptions have been made in terms of the sensitivity of the receptors to the proposed development. It should be noted that not all receptor locations would necessarily perceive the proposed development in a negative way. This is usually dependent on the use of the facility and the economic dependency on the scenic quality of views from the facility. Sensitive receptor locations typically include sites that are likely to be adversely affected by the visual intrusion of the proposed development. They include; tourism facilities and scenic locations within natural settings. The presence of a receptor in an area potentially affected by the proposed development does not thus necessarily mean that a visual impact will be experienced.

- Given the nature of the receiving environment and the height of the proposed wind turbines, the study area or visual assessment zone is assumed to encompass a zone of 8km from the proposed wind farm – i.e. an area of 8km from the boundary of the wind farm application site. This 8km limit on the visual assessment zone was applied because distance is a critical factor when assessing visual impacts and although the wind farm may still be visible beyond 8km, the degree of visual impact would diminish considerably. As such the need to assess the impact on potential receptors beyond this distance would not be warranted.

- Due to the varying scales and sources of information as well as the fact that only 20m contours were available to establish the Digital Terrain Model (DTM); maps and visual models may have minor inaccuracies. As such, only large scale topographical variations have been taken into account and minor topographical features or small undulations in the landscape may not be depicted on the DTM.

- No feedback regarding the visual environment has been received from the public participation process to date, however any feedback from the public during the review period of the Draft Scoping Report (DSR) will be incorporated into further drafts of this report.

- As previously mentioned, ground-truthing was undertaken during the scoping phase of this study. The visual sensitivity of each receptor location was therefore investigated and explored during the scoping phase of the study. The visual sensitivity of each receptor location will however be investigated and explored further in the next phase of the study.

- During the site visit, it was observed that a few of the farmsteads / residential dwellings identified via desktop means (i.e. Google Earth) have been abandoned and no one is currently residing within them. No further assessment was therefore undertaken from these abandoned farmsteads / residential dwellings and they were eliminated from the list of potentially sensitive receptor locations for the purpose of this study.

- Operational and security lighting will be required for the proposed wind energy facility and the associated infrastructure proposed within the development footprint. At the time of undertaking the visual study no information was available regarding the type and intensity of lighting required and therefore the potential impact of lighting at night has not been assessed at a detailed level. As such, the night-time environment in the study area was not characterised and will need to be assessed in the next phase of this study.

- At the time of undertaking the visual study no specific information was available regarding the design and layout of services and infrastructure associated with the proposed development. The potential visual impact of the typical infrastructure associated with a wind energy facility has been assessed.

- This scoping phase visual assessment has been based on the entire development area. As such, no visualisation modelling or three dimensional simulations have been compiled at this stage as the scoping phase findings will advise the final layout. This will therefore be undertaken in the next phase of the study, should the need be proven by stakeholder / I&AP feedback.

- A cumulative impact assessment has been undertaken to provide a representation of the number of proposed renewable energy facilities likely to be visible from each potentially sensitive receptor location, if they were all constructed. Factors affecting visibility, such as localised screening from trees or topographical undulations have not been factored into the cumulative impact assessment.

- No layout information could be sourced for each proposed renewable energy facility planned in close proximity to the proposed Xha! Boom Wind Farm. The distance of the potentially sensitive receptor locations from the actual layout could therefore not be utilised to determine whether the receptor is likely to be visually exposed to the development. As such, the distance from the farm on which each development is proposed was used to calculate the cumulative visual impact.

- Most rainfall within the area occurs from February to March, during the late summer months. It should be noted that the fieldwork was undertaken at the beginning of December

2016, during early summer. During winter months up until early summer, the visual impact of the proposed development may be greater, particularly from farmhouses surrounded by tall deciduous trees. As such, the surrounding vegetation is expected to provide less potential screening than in the late summer months.

- The weather conditions in the study area also have certain visual implications and are expected to affect the visual impact of the proposed development to some degree. As mentioned above, the fieldwork was undertaken during the early summer months which are characterised by clear weather conditions. It should be noted that clear conditions would make the wind turbines appear to contrast more with the surrounding environment than they would contrast on a cloudy overcast day. As such, where conditions are overcast and the wind turbines are against the cloudy (white) sky, there will be less of a visual contrast than on a clear day. The weather conditions during the time of the study were therefore taken into consideration when undertaking this scoping phase VIA. In addition, the weather conditions during the time of the study will be taken into consideration when undertaking the impact rating for each identified sensitive and potentially sensitive receptor locations in the next phase of the study.

1.4 Assessment Methodology

As mentioned above, this scoping level VIA has been based on a combination of desktop-level assessment as well as field based observation. This scoping phase VIA has therefore initially been undertaken at a desktop-level and thereafter included a site visit.

In the first stage of the study the visual environment of the study area was characterised based on a number of factors such as land use, topography and vegetation cover, to provide an assessment of the area's visual character, and the potential of the area to absorb the visual impacts. Digital information from spatial databases such as National geo-spatial information (NGI) and South African National Biodiversity Institute (SANBI) were sourced to provide information on land use and vegetation cover in the study area.

The potential visual issues associated with the proposed wind farm were determined based on the characterisation of the visual environment and inherent visual sensitivity of the area. Receptor locations and routes that are potentially sensitive to the visual intrusion of the proposed wind farm were also identified, in order to ascertain if a more focussed assessment needs to be undertaken in the next phase of the EIA.

1.4.1 Fieldwork and photographic review

A four (4) day site visit was undertaken between the 05th and the 09th of December 2016 (early summer). The study area for the proposed wind farm was visited in order to;

- verify the landscape characteristics identified via desktop means;
- verify the sensitivity of visual receptor locations identified via desktop means; and
- identify any additional visually sensitive receptor locations within the study area.

1.4.2 Physical landscape characteristics

A site visit and digital information from spatial databases such as the National Geo-spatial Information (NGI), the South African National Land Cover (2014) and the South African National Biodiversity Institute (SANBI) were sourced to provide baseline information on the topography, vegetation and land use in the study area. These physical landscape characteristics are important factors which influence the visual character and visual sensitivity of the study area.

1.4.3 Identification of sensitive receptors

During the scoping phase potentially sensitive visual receptor locations and routes within the study area, such as residences, were identified in order to ascertain if a more focused assessment needs to be undertaken in the next phase of the EIA.

1.4.4 Impact Assessment

A rating matrix was used to objectively evaluate the significance of the visual impacts associated with the proposed development, both before and after implementing mitigation measures. Mitigation measures were identified (where possible) in an attempt to minimise the visual impact of the proposed development. The rating matrix made use of a number of different factors including geographical extent, probability, reversibility, irreplaceable loss of resources, duration, cumulative effect and intensity, in order to assign a level of significance to the visual impact of the project.

1.4.5 Consultation with I&APs

Continuous consultation with Interested and Affected Parties (I&APs) undertaken during the public participation process will be used (where available) to help establish how the proposed development will be perceived by the various receptor locations and the degree to which the impact will be regarded as negative. Although I&APs have not as yet provided any feedback in this regard, the report will be updated to include relevant information as and when it becomes available.

2 FACTORS INFLUENCING VISUAL IMPACT

2.1 Subjective experience of the viewer

The perception of the viewer/receptor toward an impact is highly subjective and involves 'value judgements' on behalf of the receptor. It is largely based on the viewer's perception and is usually dependent on the age, gender, activity preferences, time spent within the landscape and traditions of the viewer (Barthwal, 2002). This is important, as certain receptors may not consider the wind farm to be a negative visual impact as it is often associated with employment creation, social upliftment and the general growth and progression of an area, and could even have positive connotations.

2.2 Visual environment

Wind farm developments are likely to be perceived as visually intrusive in areas that have a natural scenic quality and where tourism activities, based upon the enjoyment of or exposure to the scenic or aesthetic character of the area, are practiced. Residents and visitors to these areas may regard the wind farm as an unwelcome intrusion which degrades the natural character and scenic beauty of the area, and which would potentially even compromise the practising of tourism activities in the area. Wind farms are not features of the natural environment, but are rather a representation of human (anthropogenic) alteration. Thus when placed in a largely natural landscape, they could be perceived to be highly incongruous in this context.

The presence / existence of other anthropogenic objects associated with the built environment may not only obstruct views but also influence the perception of whether a development is a visual impact. In industrial areas where structures, buildings and other infrastructure exist, the visual environment could be considered to be 'degraded' and thus the introduction of a wind farm into this setting may be considered to be less of a visual impact than if there was no existing built infrastructure visible. In this case value may not be placed on the aesthetic quality of the landscape, and the wind farm may not necessarily be considered to be visually intrusive.

2.3 Type of visual receptor

Visual impacts can be experienced by different types of receptors, such as people driving along roads, or people living / working in the area in which the wind farm would be visible. The receptor type in turn affects the nature of the typical 'view', with views being permanent in the case of a residence or other place of human habitation, or transient in the case of vehicles moving along a road. The nature of the view experienced affects the intensity of the visual impact experienced.

It is important to note that visual impacts are only experienced when there are receptors present to experience this impact; thus in the context where there are no human receptors or viewers present there are not likely to be any visual impacts experienced.

2.4 Viewing distance

Viewing distance is a critical factor in the experiencing of visual impacts, as beyond a certain distance, even large developments tend to be much less visible, and difficult to differentiate from the surrounding landscape. The visibility of an object is likely to decrease exponentially as one moves away from the source of impact, with the impact at 1000m being a quarter of the impact at 500m away (**Figure 5**). At 5000m away or more, the impact would be negligible (Hull, R.B., et al: 1998).

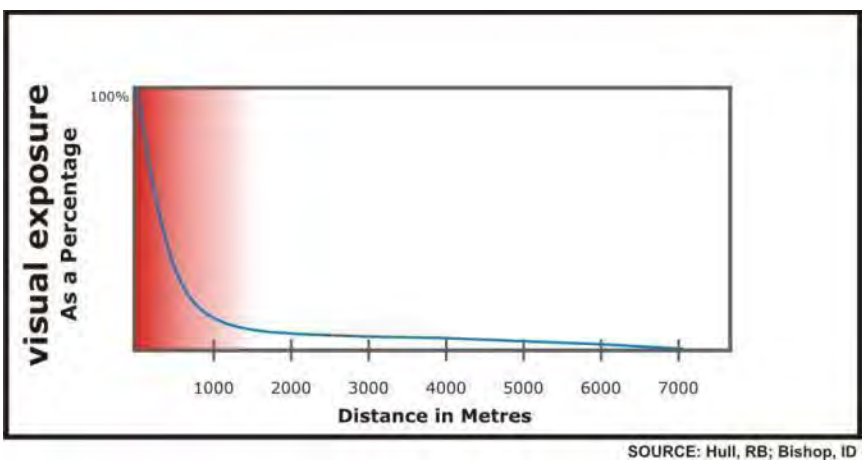


Figure 5: Diagram illustrating diminishing visual exposure over distance

3 VISUAL CHARACTER AND SENSITIVITY OF THE STUDY AREA

The physical and land use related characteristics are outlined below as they are important factors contributing to the visibility of a development and visual character of the study area. Defining the visual character is an important part of assessing visual impacts as it establishes the visual baseline or existing visual environment in which the development would be constructed. The visual impact of a development is measured according to this visual baseline by establishing the degree to which the development would contrast with or conform to the visual character of the surrounding area. The inherent sensitivity of the area to visual impacts or visual sensitivity is thereafter determined, based on the visual character, the economic importance of the scenic quality of the area, inherent cultural value of the area and the presence of visual receptors.

3.1 Physical and Land Use Characteristics

3.1.1 Topography

The topography within and in the immediate vicinity of the site proposed for the wind farm is characterised by a flat to gently undulating landscape with gentle slopes (typical of much of the Karoo) (**Figure 6**). It should be noted that the topography in certain parts of the wider visual assessment zone is characterised by the presence of localized hills / ridges / koppies which create areas of localised hilly topography (**Figure 7**). In addition, the Klein and Groot Rooiberg and Leeuwberg koppies can also be found in the wider area and form an area of localised hilly topography to the south-east of the proposed Xha! Boom wind application site. It should however be noted that all three (3) of the above-mentioned koppies are located outside of the visual assessment zone. Immediately north and north-east of the site the presence of a number of large pans signals that the topography is very flat and thus very poorly drained. It should however be noted that the largest of these pans, namely 'Konnes se Pan', is located outside of the visual assessment zone. (**Figure 8**). Within the proposed wind farm site the topography is characterised by relatively flat terrain that slopes down gradually from a slight ridge in the eastern section of the site.

A map showing the topography within and in the immediate vicinity of the proposed application site is provided in **Figure 10**.

Figure 6: View of the topography within the immediate vicinity of the site proposed for the Xha! Boom Wind Farm showing the flat to gently undulating landscape with gentle slopes.

Figure 7: View of some of the localised hills / ridges/ koppies which can be found within certain parts of the wider visual assessment zone and create areas of localised hilly topography.

Figure 8: View of one (1) of the large pans (namely 'Konnes se Pan') which can be found to the north-east of the site proposed for the Xha! Boom Wind Farm. This pan is however located outside of the visual assessment zone.

<u>Visual Implications</u>

The flat terrain that occurs over most of the site results in generally wide-ranging vistas throughout the study area (**Figure 9**), and the horizon is usually visible across an entire 360° arc of the viewer. The only exception to this flat topography is the presence of the localised hills / ridges / koppies which can be found within certain parts of the wider visual assessment zone and the range of hills located some distance to the south and south-west of the site, which will constrain the viewshed. Bearing in mind that wind turbines are very large structures (over 160m in height when the rotor blades are taken into account), these could be visible from a very wide radius around the site, except from areas to the south-east of the site where koppies and localised hilly topography will shield the proposed development. These above-mentioned areas are however located outside of the visual assessment zone and are thus not expected to have an effect on the visibility of the wind turbine structures. It should be noted that the areas of localised hilly topography which are found within certain parts of the wider study area are also expected to shield the proposed development to a degree. Thus there would be very little shielding to lessen the visual impact of the wind turbines from any locally-occurring receptor locations.

Figure 9: Generally wide-ranging vistas found throughout the study area as a result of the flat terrain that occurs over most of the site.

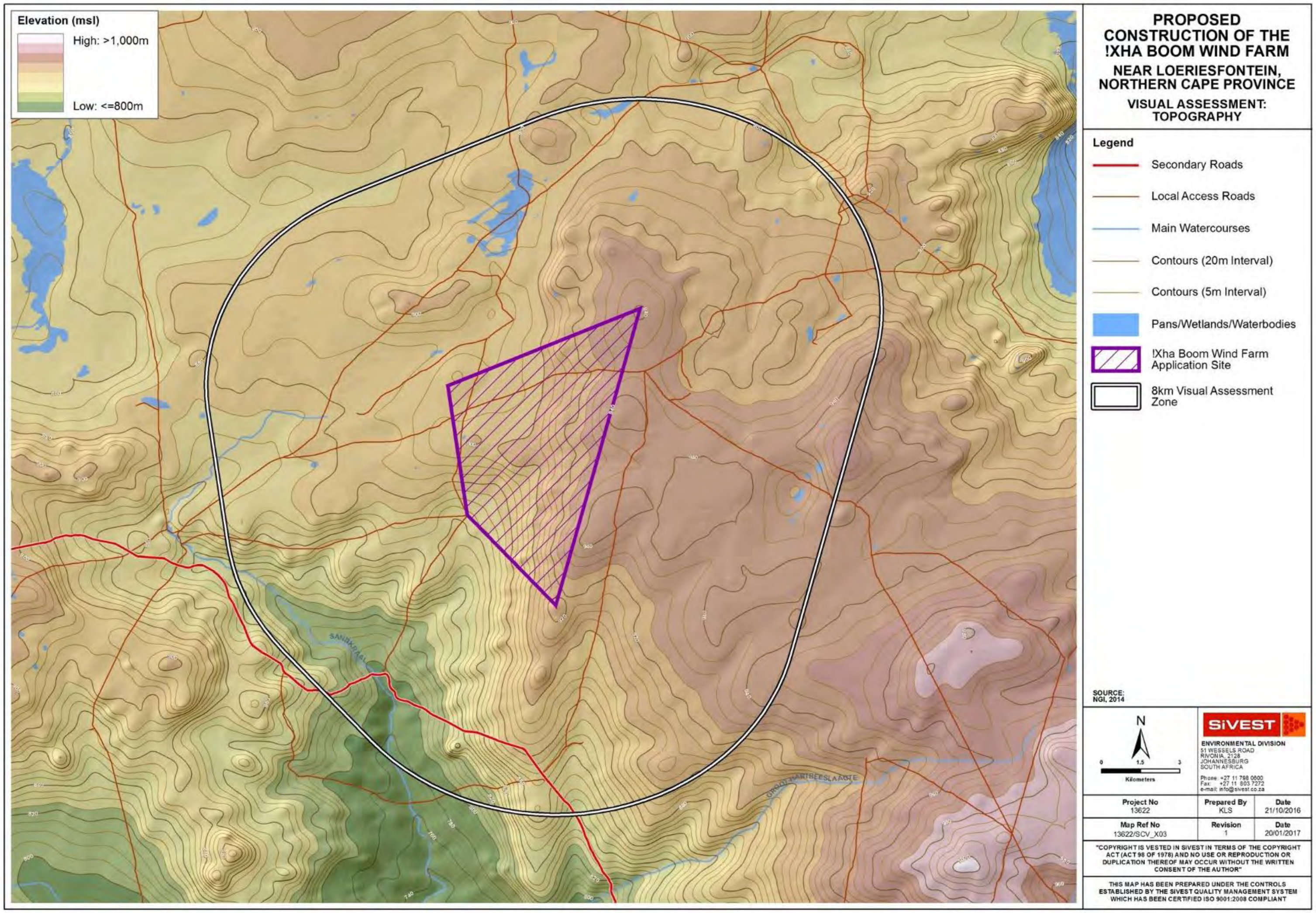


Figure 10: Topography Map

3.1.2 Vegetation

Majority of the site is covered by the Western Bushmanland Klipveld vegetation unit which is characterised by very sparsely populated plains with a desert appearance (rocky pavements built of rounded, dark-coloured rocks and boulders) supporting succulent dwarf shrubs, with microphyllous non-succulent shrubs and drought-tolerant grasses. In addition, there is an occasional mass display of annual spring flora. It should also be noted that smaller parts in the northern and eastern sections of the proposed application site are covered by the Bushmanland Basin Shrubland vegetation unit (**Figure 15**). This vegetation unit is characterised by dwarf shrubland dominated by a mixture of low sturdy and spiny shrubs. The aridity of the area has restricted the vegetation to low shrubs around 30-40 cm in height, distributed uniformly across the landscape, except in areas of disturbance where patches of bare earth occur (**Figure 11**). Some tree species (some relatively large and some low) can however also be found within certain parts of the study area (**Figure 13**). In other parts, man has had an impact on the natural vegetation, especially around some farmsteads, where over many years' tall exotic trees and other typical garden vegetation have been established (**Figure 14**).

Figure 11: Typical vegetation cover found within majority of the study area.

Figure 12: Typical vegetation cover found within the proposed Xha! Boom wind application site.

Figure 13: Example of the tree species (some relatively large and some low) which can be found in parts of the visual assessment zone.

Figure 14: Example of tall trees that have been established around a farmhouse in the area

Visual Implications

The natural short vegetation cover will offer no visual screening. Parts of the visual assessment zone are however characterised by the presence of some tree species (some relatively large and some low). These trees occur naturally in certain areas of the visual assessment zone and are expected to contribute to the overall natural character of the study area as well as provide some form of screening from the proposed development. In addition, tall exotic trees may effectively screen the proposed development from farmhouses, where these trees occur in close proximity to the farmhouse and are located directly in the way of views to the site.

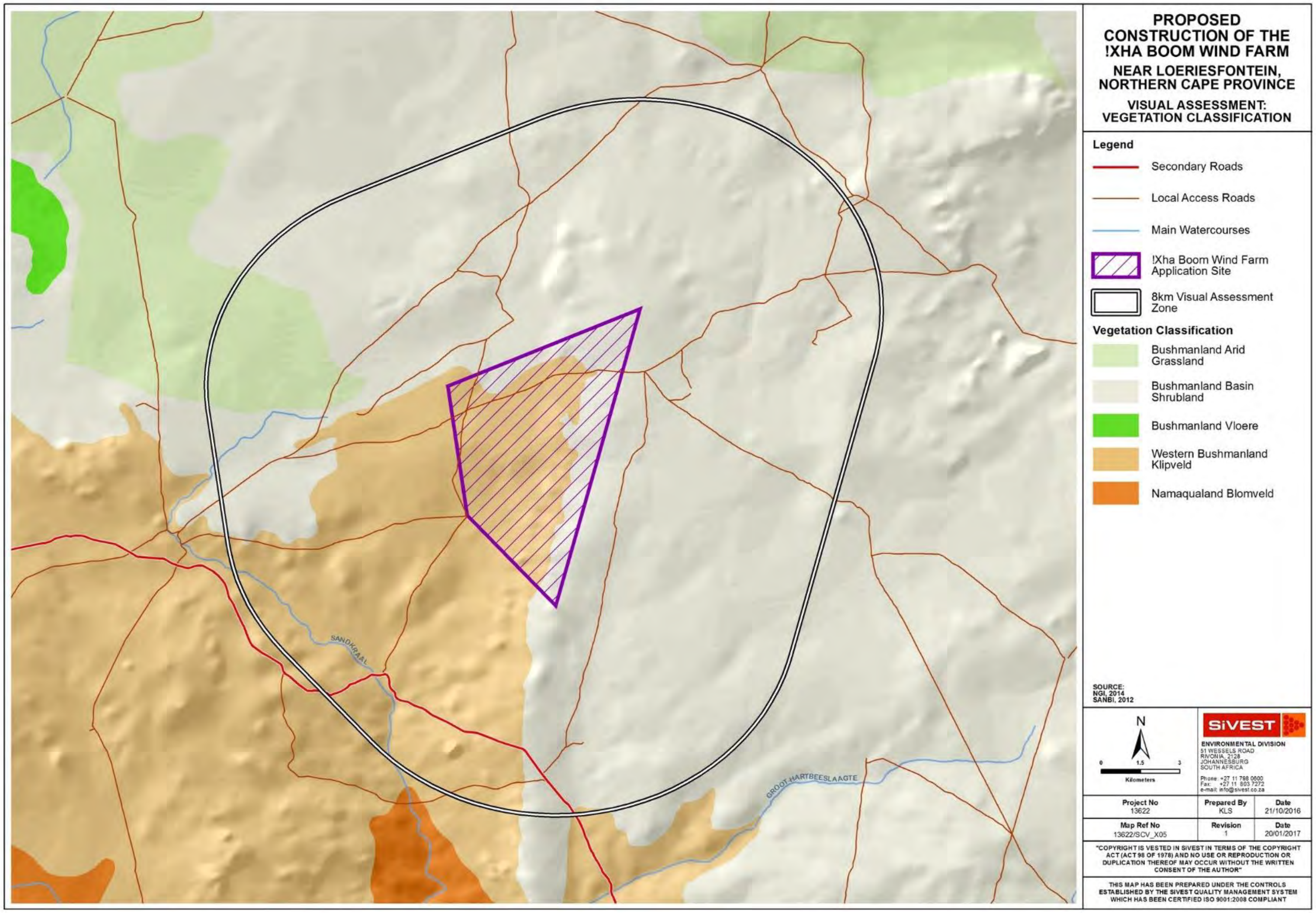


Figure 15: Vegetation Classification Map

3.1.3 Land Use

Much of the land use in the wider study area is classified as bare (non-vegetated) although the north-western and western sectors of the visual assessment zone are characterised by grassland and low shrubland (**Figure 19**). Sheep farming (**Figure 16**) is the dominant activity in the study area although the arid nature of the climate restricts stocking densities which has resulted in relatively large the farms across the area. The study area is therefore sparsely populated, and human-related infrastructure is largely restricted to isolated farmsteads and gravel access roads. The area is regarded as largely uninhabited and the closest built up area is the small town of Loeriesfontein approximately 68km to the south of the site.

Figure 16: Typical view of the sheep farming activities which are dominant within the study area.

It should be noted that the study area is also characterised by the presence of certain pastoral elements (**Figure 17**). These elements can be found throughout the study area and are typically present in areas where sheep farming is taking place.

Figure 17: Example of typical pastoral elements which can be found within parts of the study area, especially in areas where sheep farming is taking place. These elements are expected to give the surrounding area a more pastoral feel.

It should also be noted that quarrying activities are taking place on the eastern edge of ‘Konnes se Pan’, which is located to the north-east of the proposed Xha! Boom wind application site. As previously mentioned however, this pan is located outside of the visual assessment zone. As such, the quarrying activities are taking place outside of the visual assessment zone and therefore there is no significant instance of transformation in the study area.

Visual Implications

The general lack of human habitation and associated human infrastructure, has an obvious impact on the sense of place, giving the area a largely natural, rural feel (**Figure 18**). The pastoral elements which are present in parts of the study area, especially where sheep farming is taking place, are however expected to give the surrounding area a more pastoral feel.

Figure 18: Typical natural or rural visual character found within the study area.

The influence of the level of human transformation on the visual character of the area is described in more detail below.

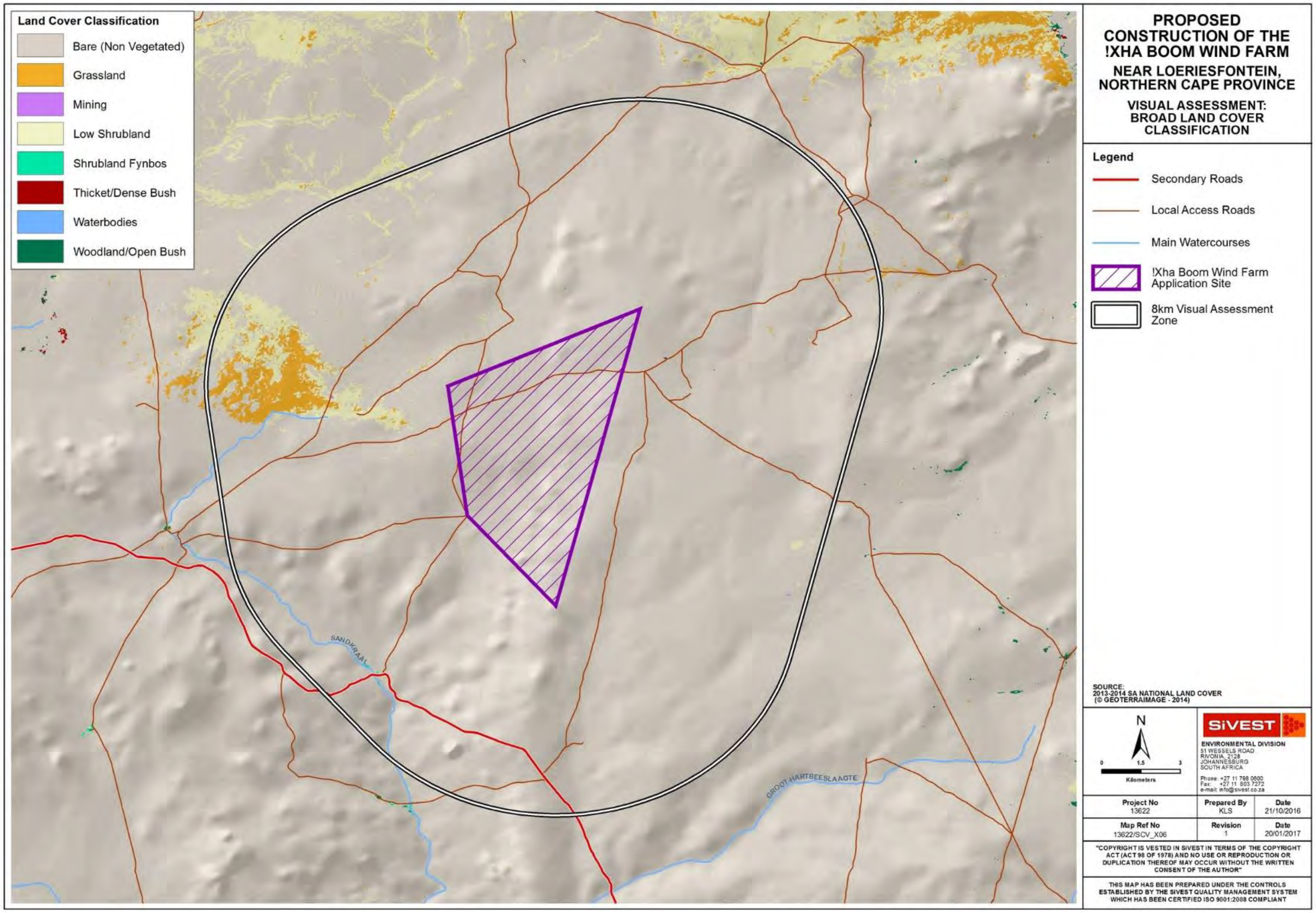


Figure 19: Land Use Classification Map

3.2 Visual Character

The above physical and land use-related characteristics of the study area contribute to its overall visual character. Visual character can be defined based on the level of change or transformation from a completely natural setting, which would represent a natural baseline in which there is little evidence of human transformation of the landscape. Varying degrees of human transformation of a landscape would engender differing visual characteristics to that landscape, with a highly modified urban or industrial landscape being at the opposite end of the scale to a largely natural undisturbed landscape. Visual character is also influenced by the presence of built infrastructure such as buildings, roads and other objects such as telephone or electrical infrastructure.

Most of the study area is considered to have a natural (almost vacant) visual character as natural shrub land prevails throughout the site and there is minimal human habitation and associated infrastructure. In addition, the predominant land use (sheep farming) has not transformed the natural landscape and the area has thus largely retained its natural rural character. It should however be noted that the study area is also characterised by the presence of certain pastoral elements, which are expected to give the surrounding area a more pastoral feel. As mentioned above, built infrastructure within the proposed site is limited to isolated farmhouses, gravel farm roads and farm boundary fences. In addition, quarrying activities are taking place on the eastern edge of ‘Konnes se Pan’, which is located to the north-east of the proposed Xha! Boom wind application site. This pan is however located outside of the visual assessment zone and as such, the quarrying activities are also taking place outside of the visual assessment zone. There is therefore there no significant instance of transformation in the study area.

The relatively low density of human transformation throughout the surrounding area is an important component contributing to the largely natural visual character of the study area. This is important in the context of potential visual impacts associated with the proposed development of a wind farm as introducing this type of development could be considered to be a degrading factor in this context.

It should however be noted that several renewable energy facilities (solar and wind) are proposed within relatively close proximity to the proposed wind farm. These facilities and their associated infrastructure typically consist of very large structures which are highly visible. As such, these facilities will significantly alter the visual character and baseline in the study area once constructed and make it appear to have a more industrial-type visual character. The Loeriesfontein Wind Farm can be found approximately 29km to the east of the proposed Xha! Boom Wind Farm application site and is currently operational (**Figure 20**). This wind farm is however located outside of the visual assessment zone and is therefore not expected to alter the visual character of the study area.

Figure 20: View of the Loeriesfontein Wind Farm which has been constructed approximately 29km to the east of the proposed Xha! Boom Wind Farm application site. This wind farm is however located outside of the visual assessment zone and is therefore not expected to alter the visual character of the study area.

The greater area surrounding the proposed development site is an important component when assessing visual character. The area can be considered to be typical of a Karoo or “platteland” landscape that would characteristically be encountered across the high-lying dry western and central interior of South Africa. Much of South Africa’s dry Karoo interior consists of wide open, uninhabited spaces sparsely punctuated by widely scattered farmsteads and small towns. Traditionally the Karoo has been seen by many as a dull, lifeless part of the country that was to be crossed as quickly as possible on route between the major inland centres and the Cape coast, or between the Cape and Namibia. However, in the last couple of decades this perception has been changing, with the launching of tourism routes within the Karoo, and the promotion of tourism in this little visited, but large part of South Africa. In a context of increasing urbanisation in South Africa’s major centres, the Karoo is being marketed as an undisturbed getaway, especially as a stop on a longer journey from the northern parts of South Africa to the Western and Eastern Cape coasts. Examples of this may be found in the relatively recently published “Getaway Guide to Karoo, Namaqualand and Kalahari” (Moseley and Naude-Moseley, 2008). Although the small town of Loeriesfontein may be used by tourists as a stop-over destination, the proposed wind farm is located approximately 68km to the north of the town and would therefore not influence these visitors. None of the roads passing near the proposed development are considered to be tourism routes.

The typical Karoo landscape can also be considered a valuable ‘cultural landscape’ in the South African context. Although the cultural landscape concept is relatively new, it is becoming an increasingly important concept in terms of the preservation and management of rural and urban settings across the world (Breedlove, 2002).

Cultural Landscapes can fall into three categories (according to the Committee's Operational Guidelines):

i) "a landscape designed and created intentionally by man";
ii) an "organically evolved landscape" which may be a "relict (or fossil) landscape" or a "continuing landscape";
iii) an "associative cultural landscape" which may be valued because of the "religious, artistic or cultural associations of the natural element"

The typical Karoo landscape consisting of wide open plains, and isolated relief, interspersed with isolated farmsteads, windmills and stock holding pens, is an important part of the cultural matrix of the South African environment. The Karoo farmstead is also a representation of how the harsh arid nature of the environment in this part of the country has shaped the predominant land use and economic activity practiced in the area, as well as the patterns of human habitation and interaction. The presence of small Karoo towns, such as Loeriesfontein, engulfed by an otherwise rural environment, form an integral part of the wider Karoo landscape. As such, the Karoo landscape as it exists today has value as a cultural landscape in the South African context. In the context of the types of cultural landscape listed above, the Karoo cultural landscape would fall into the second category, that of an organically evolved, “continuing” landscape.

The study area, as visible to the viewer, represents a typical Karoo cultural landscape. This is important in the context of potential visual impacts associated with the proposed development of a wind farm as introducing this type of development could be considered to be a degrading factor in the context of the natural Karoo character of the study area, as discussed further below.

3.3 Visual Sensitivity

Visual Sensitivity can be defined as the inherent sensitivity of an area to potential visual impacts associated with a proposed development. It is based on the physical characteristics of the area (i.e. topography, landform and land cover), the spatial distribution of potential receptors, and the likely value judgements of these receptors towards a new development (Oberholzer: 2005). A viewer’s perception is usually based on the perceived aesthetic appeal of an area and on the presence of economic activities (such as recreational tourism) which may be based on this aesthetic appeal.

In order to assess the visual sensitivity of the area SiVEST has developed a matrix based on the characteristics of the receiving environment which, according to the Guidelines for Involving Visual and Aesthetic Specialists in the EIA Processes, indicate that visibility and aesthetics are likely to be 'key issues' (Oberholzer: 2005).

Based on the criteria in the matrix (**Table 1**), the visual sensitivity of the area is broken up into a number of categories, as described below:

i) **High** - The introduction of a new development such as a wind farm would be likely to be perceived negatively by receptors in this area; it would be considered to be a visual intrusion and may elicit opposition from these receptors

ii) **Moderate** - Presence of receptors, but due to the nature of the existing visual character of the area and likely value judgements of receptors, there would be limited negative perception towards the new development as a source of visual impact.

iii) **Low** - The introduction of a new development would not be perceived to be negative, there would be little opposition or negative perception towards it.

The table below outlines the factors used to rate the visual sensitivity of the study area. The ratings are specific to the visual context of the receiving environment within the study area.

Table 1: Environmental factors used to define visual sensitivity of the study area

FACTORS	**RATING**									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Pristine / natural character of the environment										
Presence of sensitive visual receptors										
Aesthetic sense of place / scenic visual character										
Value to individuals / society										
Irreplaceability / uniqueness / scarcity value										
Cultural or symbolic meaning										
Scenic resources present in the study area										
Protected / conservation areas in the study area										
Sites of special interest present in the study area										
Economic dependency on scenic quality										
Local jobs created by scenic quality of the area										
International status of the environment										
Provincial / regional status of the environment										
Local status of the environment										
**Scenic quality under threat / at risk of change										

**Any rating above '5' for this specific aspect will trigger the need to undertake an assessment of cumulative visual impacts.

Low						Moderate								High
10	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**	**110**	**120**	**130**	**140**	**150**

Based on the above factors, the study area is rated as having a moderately-low visual sensitivity. This is mainly owing to the relatively uninhabited character of the area. An important factor contributing to the visual sensitivity of an area is the presence, or absence of visual receptors that may value the aesthetic quality of the landscape and depend on it to produce revenue and create jobs. As described below, very few potentially sensitive receptors are present in the study area. Although no formal protected areas or leisure / nature-based tourism activities exist within the study area, the area would still be valued as a typical Karoo cultural landscape.

As previously mentioned, the Loeriesfontein Wind Farm can be found approximately 29km to the east of the proposed Xha! Boom Wind Farm application site and is currently operational. This wind farm is however located outside of the visual assessment zone and is not expected to alter the visual character of the study area. Other renewable energy facilities (solar and wind) are however proposed and/or being constructed within relatively close proximity to the proposed project. As such, an assessment of the cumulative impact that will be experienced from each potentially sensitive receptor was subsequently undertaken in the scoping phase of this study (**section 7**).

3.4 Visually Sensitive Areas on the Site

During the scoping phase, all project specialists were requested to indicate environmentally sensitive areas within the application site. This exercise was undertaken to assist with determining the final placement and micro-siting the turbine layout within the site.

The aim of the assessment was to identify those parts of the application site where the establishment of wind turbines or other associated infrastructure would result in the greatest probability of visual impacts on potentially sensitive visual receptors, and should be precluded from the proposed development i.e. areas within the application site that should be avoided.

Different spatial characteristics were utilised to identify the visually sensitive areas within the proposed application site. In order to reduce the direct visual impact of the proposed turbines (especially those impacts related to shadow flicker), a buffer of 500m was recommended around all farmsteads located on or near the proposed development site. These buffers should be treated as exclusion zones in which no infrastructure, in particular turbines, should be allowed to be developed. This is done in order to prevent the impact of shadow flicker on people residing at the farmsteads. For more details regarding this impact refer to **Section 4.1.1** below.

Based on the above factors, a preliminary visual sensitivity map will be compiled and included in the EIA phase visual impact report.

It should be noted that a 500m buffer zone will typically be applied to any sensitive visual receptors identified within the proposed wind farm development area. Within this part of the development area the establishment of wind turbines or other associated infrastructure would result in the greatest probability of visual impacts (especially the impact of shadow flicker) on potentially sensitive visual receptors. These areas within the proposed development area should therefore be avoided. However, based on the findings of the field-based investigation, no sensitive visual receptors were identified within the proposed Xha! Boom Wind Farm development area. As such, the above-mentioned 500m buffer zone was not applied for the proposed Xha! Boom Wind Farm and thus the proposed development is not expected to have any on-site visually sensitive areas.

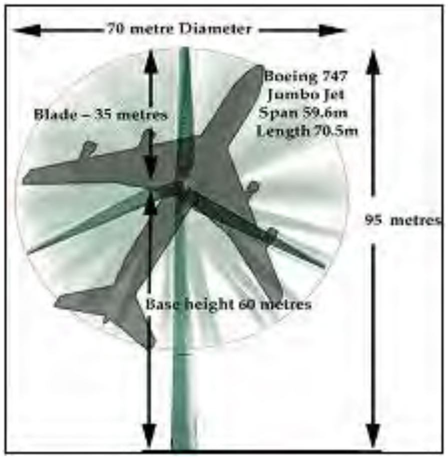
4 GENERIC VISUAL IMPACTS ASSOCIATED WITH THE WIND FARM

In this section, the typical visual issues / impacts related to the establishment of a wind farm are discussed. It is important to note that within a few years several wind energy facilities should be constructed in South Africa. The development and associated environmental assessment of wind energy facilities in South Africa is relatively new, and thus it is valuable to draw on international experience. This section of the report therefore draws on international literature and web material (of which there is significant material available) to describe the generic impacts associated with wind energy facilities.

4.1 Wind Energy Facilities

As previously mentioned, at this stage it is anticipated that the proposed project will consist of approximately 70 wind turbines and associated infrastructure with a total generation capacity of up to approximately 235MW. The wind turbines will have a hub height of up to 160m and a rotor diameter of up to 160m (approximate in height to a building of 53 storeys). The height of the turbines and the fact that a wind farm comprises a number of these turbines distributed across the site would results in the development typically being visible over a large area.

Internationally, studies have demonstrated that there is a direct correlation between the number of turbines and the degree of objection to a wind farm, with less opposition being encountered when fewer turbines are proposed (Devine-Wright, 2005). Certain objectors to wind farms also mention the “sky space” occupied by the rotors of a turbine. As well as height, "sky space" is an important issue. “Sky space” refers to the area in which the rotors would rotate. The diagram below indicates that the “sky space” occupied by rotors would be similar to that occupied by a jumbo jet (http://www.stopbickertonwindturbines.co.uk/ - page on visual impact).



The visual prominence of the development would be exacerbated within natural settings, in areas of flat terrain or if located on a ridge top. Even dense stands of wooded vegetation are likely to only offer partial visual screening, as the wind turbines are of such a height that they will rise above even mature large trees.

4.1.1 Shadow flicker

Shadow flicker is an effect which is caused when shadows repeatedly pass over the same point. It can be caused by wind turbines when the sun passes behind the hub of a wind turbine and casts a shadow that continually passes over the same point as the blade of the wind turbine rotates (http://www.ecotricity.co.uk).

The effect of shadow flicker is only likely to be experienced by people situated directly within the shadow cast by the blade of the wind turbine. As such, shadow flicker is only expected to have an impact on and cause health risks to people residing in houses located within close proximity of a wind turbine (less than 500m) and at a specific orientation, particularly in areas where there is little screening present. Shadow flicker may also be experienced by and impact on motorists if a wind turbine is located in close proximity to an existing road. The impact of shadow flicker can be effectively mitigated by choosing the correct site and layout for the wind turbines, taking the orientation of the turbines relative to the nearby houses and the latitude of the site into consideration. Tall structures and trees will also obstruct shadows and prevent the effect of shadow flicker from impacting on surrounding residents (http://www.ecotricity.co.uk).

4.1.2 Motion-based visual intrusion

An important component of the visual impacts associated with wind turbines is the *movement* of the rotors. Labelled as motion-based visual intrusion, this refers to the inclination of the viewer to focus on discordant, moving features when scanning the landscape. Evidence from surveys of public attitudes towards wind farms suggest that the viewing of moving blades is not necessarily perceived negatively (Bishop and Miller, 2006). The authors of the study suggest two possible reasons for this; firstly, when the turbines are moving they are seen as being 'at work', doing good and producing energy. Conversely, when they are stationary they are regarded as a visual intrusion that has no evident purpose. More interestingly, the second theory that explains this perception is related to the intrinsic value of wind in certain areas and how turbines may be an expression or extension of an otherwise 'invisible' presence.

Famous winds across the world include the Mistral of the Camargue in France, the Föhn in the Alps, or the Bise in the Lavaux region of Switzerland. The wind, in these cases, is an intrinsic component of the landscape, being expressed in the shape of trees or drifts of sands, but being otherwise invisible. The authors of the study argue that wind turbines in these environments give expression, when moving, to this quintessential landscape element. In a South African context, this phenomenon may well be experienced if wind farms are developed in areas where typical winds, like berg winds, or the south-easter in the Cape are an intrinsic part of the environment. In this way, it may even be possible that wind farms will, through time form part of the cultural landscape of an area, and become a representation of the opportunities presented by the natural environment.

4.1.3 Associated Infrastructure

The infrastructure associated with the proposed Xha! Boom Wind Farm will include the following:

- A new 132kV on-site Xha! Boom substation and associated infrastructure which will be used to connect the wind farm to the national network in order to export the generated electricity to the National grid. The connection from the on-site Xha! Boom substation to the turbines will be via medium voltage cables as discussed below.
- Medium voltage cables up to 1.5m deep connecting all wind turbines to the on-site Xha! Boom 132kV substation;
- Internal access roads with a maximum width of 13.5m are initially being proposed for the construction phase. This is however only temporary as the width of the proposed internal access roads will be reduced to approximately 6m for maintenance purposes during the operational phase. In addition, the internal access roads will include the net load carrying surface excluding any V drains that might be required;
- Double width roads will be required in strategic places for vehicle passing;

- A maximum of 10 000m² temporary lay down area including an access road and contractor's site office area of up to 5 000m²;
- Administration and warehouse buildings with a footprint of up to 5 000 m²;
- Borrow pits (if required); and
- Fencing (if required) of up to 5m where required. This will be either mesh or palisade.

The proposed 132kV on-site Xha! Boom substation is considered to be a large object and will typically be visible for great distances. Substations are not features of the natural environment, but are representative of human (anthropogenic) alteration. Thus when placed in largely natural landscapes, they will be perceived to be highly incongruous in this setting. Conversely, the presence of other anthropogenic objects associated with the built environment, especially other power lines or substations, may result in the visual environment being considered to be 'degraded' and thus the introduction of a substation into this setting may be less of a visual impact than if there was no existing built infrastructure visible.

As previously mentioned, the wind turbines will be connected to the proposed on-site substation using buried medium voltage cables. These cables may become a visual intrusion if placed in areas of the site that are visible to the surrounding areas, especially those areas that are located on low ridges and associated sloping ground. A trench dug for the cable (both during construction and post-construction once the trench has been back-filled) may become prominent if it creates a linear feature that contrasts with the surrounding vegetation.

A similar principle exists with respect to any access roads constructed in visible areas of the site. Roads are likely to be wider than cable trenches and thus could be even more greatly visible than the cable servitude. Cutting a 'terrace' into a steep side slope would increase the visibility and contrast the road against the surrounding vegetation.

Lastly, buildings placed in prominent positions such as on ridge tops may also break the natural skyline, drawing the attention of the viewer.

The visual impact of the associated infrastructure is generally not regarded as a significant factor when compared to the visual impact associated with wind turbines. They would however, magnify the visual prominence of the development if located on ridge tops or flat sites in natural settings where there is limited tall wooded vegetation present to conceal the impact.

5 SENSITIVE VISUAL RECEPTORS

A sensitive receptor location is defined as a location from where receptors would potentially be adversely impacted by a proposed development. This takes into account a subjective factor on behalf of the viewer – i.e. whether the viewer would consider the impact as a negative impact. As described above, the adverse impact is often associated with the alteration of the visual character of the area in terms of the intrusion of the wind farm into a 'view', which may affect the 'sense of place'. The identification of sensitive receptors is typically undertaken based on a number of factors which include:

- the visual character of the area, especially taking into account visually scenic areas and areas of visual sensitivity;
- the presence of leisure-based (especially nature-based) tourism in an area;
- the presence of sites / routes that are valued for their scenic quality and sense of place;
- the presence of homesteads / farmsteads in a largely natural setting where the development may influence the typical character of their views; and
- feedback from interested and affected parties, as raised during the public participation process conducted as part of the EIA study.

A distinction must be made between a receptor location and a sensitive receptor location. A receptor location is a site from where the proposed wind farm may be visible, but the receptor may not necessarily be adversely affected by any visual intrusion associated with the development. Receptor locations include locations of commercial activities and certain movement corridors, such as roads that are not tourism routes. Sensitive receptor locations typically include sites that are likely to be adversely affected by the visual intrusion of the proposed development. They include; tourism facilities, scenic sites and residential dwellings in natural settings.

Distance bands were used to assign zones of visual impact from the proposed development site, as the visibility of the development would diminish exponentially over distance (refer to section 2.4 above). As such, the proposed development would be more visible to receptors located within a short distance and these would experience a higher adverse visual impact than those located at a moderate or long distance from the proposed development.

Based on the height and scale of the project, the radii chosen to assign these zones of visual impact are as follows:

- 0 < 2km (high impact zone)
- 2 < 5km (moderate impact zone)
- 5km < 8km (low impact zone)

Only one (1) farmstead / homestead which houses a local farmer was identified within the study area. This dwellings are regarded as potentially sensitive visual receptors as it is located within a mostly rural setting and the proposed development will likely alter natural vistas experienced from this dwelling. The degree of visual impact experienced will vary from one inhabitant to another, as it is largely based on the viewer's perception. Factors influencing the degree of visual impact experienced by the viewer include the following:

- Value placed by the viewer on the natural scenic characteristics of the area.
- The viewer's sentiments toward the proposed structures. These may be positive (a symbol of progression toward a less polluted future) or negative (foreign objects degrading the natural landscape).
- Degree to which the viewer will accept a change in the typical Karoo character of the surrounding area.

Table 2 below provides details of the potentially sensitive places that have cultural and symbolic importance that were identified within the study area.

Table 2: Visual receptor locations potentially sensitive to the proposed Xha! Boom Wind Farm

Name		**Distance from the proposed Xha! Boom Wind development area**	**Visual Impact Zone**
VR5	Farmstead/Homestead	Approximately 7.4km	Low

There are no main or arterial roads in close enough proximity to the proposed development to be visually impacted by it. The district road that connects the town of Loeriesfontein with Granaatboskolk to the north, is some 4kms north-east of the study area and therefore well outside the visual impact zone (**Figure 21**). However, the district road that connects the town of Loeriesfontein with the R358 Regional Road to the west of the site, traverses the south-western section of the visual assessment zone and is therefore found within the visual impact zone. Despite the presence of this district road, there are no visually sensitive roads within the study area.

Figure 21: View of the district road that connects the town of Loeriesfontein with Granaatboskolk to the north. This district road is however found well outside the visual impact zone.

The potentially sensitive visual receptor locations in relation to the zones of visual impact are indicated in **Figure 22** below.

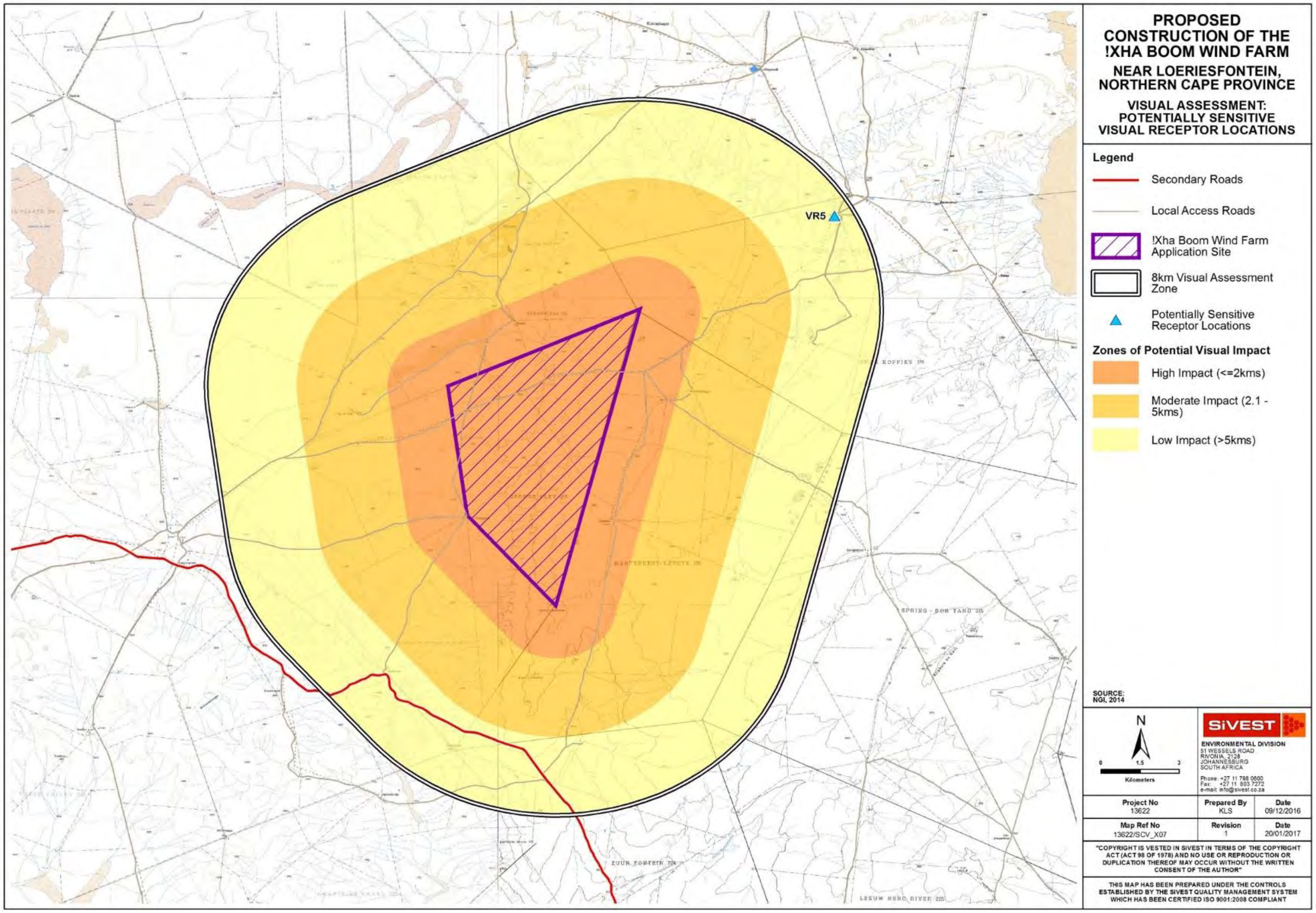


Figure 22: Potentially Sensitive Visual Receptors within the Study Area

6 IDENTIFICATION OF POTENTIAL VISUAL ISSUES / IMPACTS

The following potential visual issues / impacts are expected to occur due to the erection of wind turbines on the proposed development site near Loeriesfontein:

- The natural visual character of the surrounding area could be altered as a result of numerous proposed wind turbines being erected.
- Locating the wind farm on the generally flat terrain could result in the wind farm being highly visible for great distances, thus altering the relatively untransformed rural sense of place within the surrounding area.
- The visual intrusion of the proposed development could adversely affect farmsteads / homesteads surrounding the proposed wind farm.
- People residing within close proximity of proposed wind turbines could be negatively impacted as a result of shadow flicker, although this is unlikely due to the lack of dwellings in close proximity to the proposed development site.
- Vehicles and trucks travelling to and from the proposed site on the gravel access roads would increase dust emissions during both the construction and operational phases. The increased traffic on the gravel roads and the dust plumes could create a visual impact and may evoke negative sentiments from surrounding viewers.
- Surface disturbance during construction would expose bare soil which could visually contrast with the surrounding environment. In addition, temporarily stockpiling soil during construction may alter the flat landscape. Wind blowing over these disturbed areas could result in dust which would have a visual impact.
- Security and operational lighting at the wind farm could result in light pollution and glare, which could be an annoyance to surrounding viewers. The visual impact of lighting on the nightscape is largely dependent on the existing lighting present in the surrounding area at night. The night scene in areas where there are numerous light sources will be visually degraded by existing light pollution and therefore additional light sources are unlikely to have a significant impact on the nightscape. In contrast, introducing light sources into a relatively dark night sky will impact on the visual quality of the area at night. The impact would largely depend on the location of the proposed development in relation to existing light sources, the illumination fixtures utilised and the intensity of the lighting required for the proposed development.
- Aviation lighting placed on top of each wind turbine would create a network of red lights in the night-time sky and could potentially alter the night-time visual environment.

It should also be noted that at this stage, it is anticipated that the proposed development will include the construction of an on-site 132kV substation. The wind turbines of the proposed Xha! Boom Wind Farm will be connected to the on-site substation by underground cables which can be buried up to a depth of 1.5m. Overhead power lines may however be used to connect the wind turbines to the on-site 132kV substation if it is deemed necessary.

At this stage, the following potential visual issues / impacts may occur if the erection of overhead power lines is deemed necessary:

- The proposed power line would introduce a foreign linear element into the landscape which could alter the natural visual character of the surrounding area should these power lines traverse natural areas where other existing infrastructure is not present.
- The visual intrusion of the proposed power line could adversely affect farmsteads / homesteads located in close proximity to the power line in natural settings where other existing infrastructure is limited. In these natural areas, the power line would contrast with the surrounding area and may change the visual character of the landscape. However, the proposed wind farm would significantly alter the visual character once constructed, lessening the visual impact of the proposed power line on surrounding farmsteads.

Each of the above potential visual impacts, identified through this scoping phase visual assessment will be explored in further detail in the EIA phase visual impact assessment. The extent of the visual impact on the identified potentially sensitive farmsteads will need to be confirmed by further assessment.

6.1 Overall Visual Impact Rating

The EIA process requires that an overall rating for visual impact be provided to allow the visual impact to be assessed alongside other environmental parameters. SiVEST has developed an impact rating matrix for this purpose. The tables below present the impact matrix for visual impacts associated with the proposed construction and operation of the wind energy facility and the associated infrastructure.

Please refer to **Appendix A** for an explanation of the impact rating methodology

6.1.1 Planning

No visual impacts are expected during planning.

6.1.2 Construction

Table 3: Rating of visual impacts of the proposed Xha! Boom Wind Farm Facility during construction

IMPACT TABLE		
Environmental Parameter	Visual Impact	
Issue/Impact/Environmental Effect/Nature	During the construction phase, large construction vehicles and equipment will alter the natural character of the study area and expose visual receptors to visual impacts associated with construction. The construction activities may be perceived as an unwelcome visual intrusion, particularly in more natural undisturbed settings. Vehicles and trucks travelling to and from the proposed site on gravel access roads are also expected to increase dust emissions. The increased traffic on gravel roads and the resultant dust plumes could create a visual impact and may evoke negative sentiments from surrounding viewers. Surface disturbance during construction would also expose bare soil which could visually contrast with the surrounding environment. In addition, temporary stockpiling of soil during construction may alter the flat landscape. Wind blowing over these disturbed areas could result in dust which would have a visual impact.	
Extent	Local / District (2)	
Probability	Probable (3)	
Reversibility	Completely reversible (1)	
Irreplaceable loss of resources	Marginal loss (2)	
Duration	Short term (1)	
Cumulative effect	Medium cumulative effects (3)	
Intensity/magnitude	Medium (2)	
Significance Rating	**Prior to mitigation measures:** Low negative impact **After mitigation measures:** Low negative impact	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	3	2

Reversibility	1	1
Irreplaceable loss	2	1
Duration	1	1
Cumulative effect	3	3
Intensity/magnitude	2	2
Significance rating	-24 (negative low)	-20 (negative low)
Mitigation measures	▪ Carefully plan to reduce the construction period. ▪ Minimise vegetation clearing and rehabilitate cleared areas as soon as possible. ▪ Maintain a neat construction site by removing rubble and waste materials regularly. ▪ Make use of existing gravel access roads where possible. ▪ Ensure that dust suppression techniques are implemented on all access roads.	

** Please note in the context of the visual environment 'resources' are defined as scenic / natural views that are almost impossible to replace.*

Table 4: Rating of visual impacts of the infrastructure associated with the Xha! Boom Wind Energy Farm during construction

IMPACT TABLE	
Environmental Parameter	Visual Impact
Issue/Impact/Environmental Effect/Nature	During the construction of the underground cables, overhead power lines (if required), on-site 132kV substation, access roads and building infrastructure, large construction vehicles and equipment could exert a visual impact by altering the visual character of the surrounding area and exposing sensitive visual receptor locations to visual impacts associated with the construction phase. The construction activities may be perceived as an unwelcome visual intrusion, particularly in more natural undisturbed settings. Vehicles and trucks travelling to and from the proposed site on gravel access roads are also expected to increase dust emissions. The increased traffic on the gravel roads and the resultant dust plumes could create a visual impact and may evoke negative sentiments from surrounding viewers. Surface disturbance during construction would also expose bare soil which could visually contrast with the surrounding environment. In addition, temporarily stockpiling soil during construction

	may alter the flat landscape. Wind blowing over these disturbed areas could result in dust which would have a visual impact.	
Extent	Local/district (2)	
Probability	Probable (3)	
Reversibility	Completely reversible (1)	
Irreplaceable loss of resources	No loss (1)	
Duration	Short term (1)	
Cumulative effect	Medium cumulative effects (3)	
Intensity/magnitude	Medium (2)	
Significance Rating	**Prior to mitigation measures:** Low negative impact **After mitigation measures:** Low negative impact	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	3	2
Reversibility	1	1
Irreplaceable loss	1	1
Duration	1	1
Cumulative effect	3	3
Intensity/magnitude	2	2
Significance rating	-22 (low negative)	-20 (low negative)
Mitigation measures	▪ All reinstated cable trenches should be re-vegetated with the same vegetation that existed prior to the cable being laid. ▪ Carefully plan to reduce the construction period. ▪ Minimise vegetation clearing and rehabilitate cleared areas as soon as possible. ▪ Maintain a neat construction site by removing rubble and waste materials regularly. ▪ Make use of existing gravel access roads where possible. ▪ Ensure that dust suppression techniques are implemented on all access roads	

** Please note in the context of the visual environment 'resources' are defined as scenic / natural views that are almost impossible to replace.*

6.1.3 Operation

Table 5: Rating of visual impacts of the proposed Xha! Boom Wind Energy Facility during operation

IMPACT TABLE		
Environmental Parameter	Visual Impact	
Issue/Impact/Environmental Effect/Nature	The proposed Xha! Boom Wind Farm could exert a visual impact by altering the visual character of the surrounding area and exposing sensitive visual receptor locations, such as farmsteads / homesteads, to visual impacts. The development may be perceived as an unwelcome visual intrusion, particularly in more natural undisturbed settings. Maintenance vehicles may need to access the wind energy facility via gravel access roads and are expected to increase dust emissions in doing so. The increased traffic on the gravel roads and the dust plumes could create a visual impact and may evoke negative sentiments from surrounding viewers. Security and operational lighting at the proposed wind energy facility could result in light pollution and glare, which could be an annoyance to surrounding viewers	
Extent	Local/district (2)	
Probability	Definite (4)	
Reversibility	Irreversible (4)	
Irreplaceable loss of resources	Marginal (2)	
Duration	Long term (3)	
Cumulative effect	High cumulative effects (4)	
Intensity/magnitude	Medium (2)	
Significance Rating	**Prior to mitigation measures:** Medium negative impact **After mitigation measures:** Medium negative impact	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	4	4
Reversibility	4	4
Irreplaceable loss	2	2
Duration	3	3
Cumulative effect	4	3

Intensity/magnitude	2	2
Significance rating	-38 (medium negative)	-36 (medium negative)
Mitigation measures	▪ Where possible, fewer but larger turbines with a greater output should be utilised rather than a larger number of smaller turbines with a lower capacity. ▪ Light fittings for security at night should reflect the light toward the ground and prevent light spill. ▪ Ensure that dust suppression techniques are implemented on all access roads	

** Please note in the context of the visual environment 'resources' are defined as scenic / natural views that are almost impossible to replace.*

Table 6: Rating of visual impacts of the infrastructure associated with the proposed Xha! Boom Wind Farm during operation

IMPACT TABLE	
Environmental Parameter	Visual Impact
Issue/Impact/Environmental Effect/Nature	The proposed underground cables, overhead power lines (if required), on-site 132kV substation, access roads and building infrastructure could exert a visual impact by altering the visual character of the surrounding area and exposing sensitive visual receptors to visual impacts. The development may be perceived as an unwelcome visual intrusion, particularly in more natural undisturbed settings. Maintenance vehicles may need to access the infrastructure associated with the wind energy facility via gravel access roads and are expected to increase dust emissions in doing so. The increased traffic on the gravel roads and the resultant dust plumes could create a visual impact and may evoke negative sentiments from surrounding viewers. Security and operational lighting at the associated infrastructure could result in light pollution and glare, which could be an annoyance to surrounding viewers
Extent	Local / District (2)
Probability	Probable (3)
Reversibility	Partly reversible (2)
Irreplaceable loss of resources	No loss of resource (1)

Duration	Long term (3)	
Cumulative effect	Low cumulative effect (2)	
Intensity/magnitude	Medium (2)	
Significance Rating	**Prior to mitigation measures:** Low negative impact **After mitigation measures:** Low negative impact	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	3	3
Reversibility	2	2
Irreplaceable loss	1	1
Duration	3	3
Cumulative effect	2	2
Intensity/magnitude	2	1
Significance rating	-26 (low negative)	-13 (low negative)
Mitigation measures	▪ Light fittings for security at the on-site 132kV substation at night should reflect the light toward the ground and prevent light spill. ▪ The operations and maintenance buildings should not be illuminated at night. ▪ If overhead power lines are required, align power lines to run parallel to existing power lines and other linear impacts, where possible. ▪ Bury cables underground where possible. ▪ The operation and maintenance building should be painted with natural tones that fit with the surrounding environment. Non-reflective surfaces should be utilised where possible. ▪ Ensure that dust suppression techniques are implemented on all access roads. ▪ Select the alternatives that will have the least impact on visual receptors.	

** Please note in the context of the visual environment 'resources' are defined as scenic / natural views that are almost impossible to replace.*

6.1.4 Decommissioning

Visual impacts during the decommissioning phase are potentially similar to those during the construction phase.

7 CUMULATIVE IMPACTS

Although it is important to assess the visual impacts of the proposed wind farm itself, it is equally important to assess the cumulative visual impact that could materialise in the area should other renewable energy developments (both wind and solar facilities) be granted authorisation to proceed. Cumulative impacts are the combined impacts from different developments / facilities which, in combination, result in significant impacts that may be larger than sum of all the impacts.

These renewable energy facilities and their potential for large scale visual impacts could significantly alter the sense of place and visual character in the study area, if constructed. It must be noted that for the purpose of this study, renewable energy developments within a 55km radius of the Xha! Boom Wind application site were identified and mapped. The cumulative visual impact experienced by each visual receptor will however depend on the number of proposed developments within an 8km radius of the receptor location, as beyond the 8km radius the visual impact of the development would diminish to an insignificant level.

The proposed renewable energy developments identified are indicated in **Table 7** and **Figure 23** below.

Table 7: Renewable energy developments proposed within a 55km radius of the Xha! Boom Wind Farm application site

Development	Current status of EIA/development	Proponent	Capacity	Farm details
Dwarsrug Wind Farm	Environmental Authorisation issued	Mainstream Renewable Power	140MW	Remainder of Brak Pan No 212
Khobab Wind Farm	Under Construction	Mainstream Renewable Power	140MW	Portion 2 of the Farm Sous No 226
Loeriesfontein 2 Wind Farm	Under Construction	Mainstream Renewable Power	140MW	Portions 1& 2 of Aan de Karree Doorn Pan No 213

Wind farm	Environmental Authorisation issued, however the project is no longer active.	Mainstream Renewable Power	50MW	Portion 1 of the Farm Aan de Karree Doorn Pan No 213
Hartebeest Leegte Wind Farm	EIA ongoing	Mainstream Renewable Power	140MW	Remainder of Hartebeest Leegte No 216
Itemba Wind Farm	EIA ongoing	Mainstream Renewable Power	140MW	Portion 2 of Graskoppies No 176 & Portion 1 of Hartebeest Leegte No 216
Graskoppies Wind Farm	EIA ongoing	Mainstream Renewable Power	140MW	Portion 2 of Graskoppies No 176 & Portion 1 of Hartebeest Leegte No 216
Loeriesfontein PV3 Solar Energy Facility	Environmental Authorisation issued	Mainstream Renewable Power	100MW	Portion 2 of Aan de Karree Doorn Pan No 213
Hantam PV Solar Energy Facility	Environmental Authorisation issued	Solar Capital (Pty) Ltd	Up to 525MW	Remainder of Narosies No 228
PV Solar Power Plant	Environmental Authorisation issued	BioTherm Energy	70MW	Portion 5 of Kleine Rooiberg No 227
Kokerboom 1 Wind Farm	Environmental Impact Assessment (EIA) underway	Business Venture Investments No. 1788 (Pty) Ltd (BVI)	240MW	Remainder of the Farm Leeuwbergrivier No. 1163 & Remainder of the Farm Kleine Rooiberg No. 227
Kokerboom 2 Wind Farm	Environmental Impact Assessment (EIA) underway	Business Venture Investments No. 1788 (Pty) Ltd (BVI)	240MW	Remainder of the Farm Leeuwbergrivier No. 1163 & Remainder of the Farm Kleine

				Rooiberg No. 227

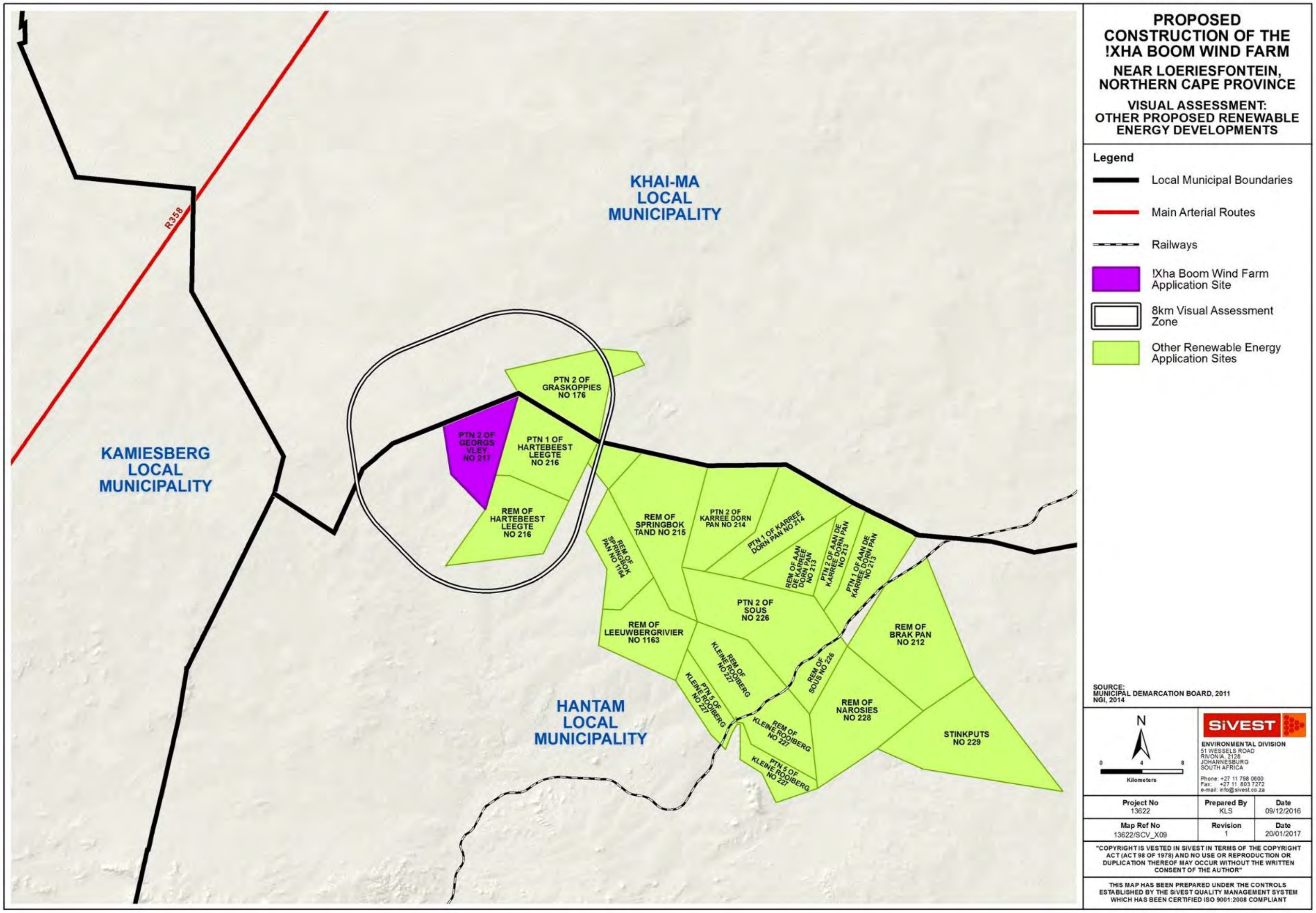


Figure 23: Renewable energy facilities proposed within a 55km radius of the Xha! Boom Wind Farm application site

Scattered farmsteads / homesteads identified in the study area are regarded as potentially sensitive visual receptor locations and it was noted that some of these dwellings are located within 8kms of certain of the additional proposed renewable energy developments, specifically the Graskoppies, Hartebeest Leegte and Ithemba wind farms which all form part of the greater Leeuwberg Wind Farms Project. It is therefore likely that these receptors will experience some visual impacts if these three additional wind farms are all constructed. However, it must be noted that these receptors will need to be investigated further during the EIA phase when fieldwork is undertaken and more information becomes available.

8 CONCLUSION

A scoping-level study has been conducted to identify the potential visual impact and issues related to the development of the Xha! Boom Wind Farm near Loeriesfontein, in the Northern Cape Province. The study area has a largely natural, untransformed visual character although there are several renewable energy developments (solar and wind) proposed within relatively close proximity to the proposed wind farm. These facilities and their associated infrastructure, will significantly alter the visual character and baseline in the study area once constructed and make it appear to have a more industrial-type visual character. The proposed wind energy facility development is likely to visually influence only one (1) farmstead / homestead identified within the visual assessment zone, therefore this is regarded as a potentially sensitive visual receptor location. The sensitivity of the receptor location will need to be confirmed through further assessment in the next phase of the study. The nature of the visual impacts associated with a development of this size on the receptor in the study area could be significant.

An overall impact rating was also conducted as part of the scoping phase in order to allow the visual impact to be assessed alongside other environmental parameters. The assessment revealed that overall the proposed Xha! Boom Wind Farm is expected to have a low visual impact during construction and a medium visual impact during operation, with relatively few mitigation measures available. In addition, the infrastructure associated with the proposed Xha! Boom Wind Farm would have a low visual impact during construction and a low visual impact during operation.

There is no preference between the two (2) proposed 132kV onsite IPP Substation alternatives from a visual perspective. The close proximity of the substation locations and the flat nature of the topography are expected to result in equal visual impacts.

Further assessment will however be required in the EIA-phase to investigate the sensitivity of the receptor locations to visual impacts associated with the proposed development and to quantify the impacts that would result.

8.1 Methodology for Further Assessment

The focus of the EIA phase VIA will be to undertake a more detailed GIS-based assessment in order to quantify the magnitude and significance of the visual impacts of the proposed development in both a day-time and night-time context.

This assessment will focus on areas where potential sensitive receptors are located. Should data be available, digital terrain models and viewsheds will be generated for the areas of focus. This analysis will be conducted using ArcGIS software in conjunction with the Spatial Analyst and 3D Analyst extensions where necessary. The assessment will rely on site visits to each potentially sensitive receptor location to identify the extent of visual impact of the proposed wind farm from these locations. A further assessment of the intensity of potential visual impact, expressed in terms of bands of differing visual significance will be undertaken. The fieldwork will also allow for the correction and refinement of the baseline information.

The overall significance of visual impacts associated with the proposed wind energy facility will be assessed through a rating matrix. Once this has been undertaken, measures to mitigate potential visual impacts will be identified, and if practical, layout alternatives within the application site will be considered and recommended to minimise visual impact of the proposed development.

A separate rating matrix will be used to assess the visual impact of the proposed development on the sensitive receptor locations, as identified. This matrix is based on the distance of a receptor from the proposed development, the primary focus / orientation of the receptor, the presence of screening factors, the visual character and sensitivity of the area and the visual contrast of the development with the typical elements and forms in the landscape.

Thereafter, the alternatives will be comparatively assessed, in order to determine the preferred alternative from a visual perspective.

Interested and Affected Parties will be consulted through the public participation process being undertaken as part of the EIA process, in order to establish how the proposed wind farm will be perceived from the various receptor locations and the degree to which this impact will be regarded as negative.

It is envisaged that the main deliverable of the study would be the generation of a spatial databases / maps indicating the zones of visual impact, as well as a detailed report indicating the findings of the study.

9 REFERENCES

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Appendix A

IMPACT RATING METHODOLOGY

IMPACT RATING METHODOLOGY

The determination of the effect of an environmental impact on an environmental parameter (in this instance, wetlands) is determined through a systematic analysis of the various components of the impact. This is undertaken using information that is available to the environmental practitioner through the process of the environmental impact assessment. The impact evaluation of predicted impacts was undertaken through an assessment of the significance of the impacts.

Determination of Significance of Impacts

Significance is determined through a synthesis of impact characteristics which include context and intensity of an impact. Context refers to the geographical scale (i.e. site, local, national or global) whereas intensity is defined by the severity of the impact (e.g. the magnitude of deviation from background conditions, the size of the area affected, the duration of the impact and the overall probability of occurrence). Significance is calculated as per the example shown in Table 1.

Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The total number of points scored for each impact indicates the level of significance of the impact.

Impact Rating System Methodology

Impact assessments must take account of the nature, scale and duration of effects on the environment whether such effects are positive (beneficial) or negative (detrimental). Each issue / impact is usually assessed according to the project stages:

- planning
- construction
- operation
- decommissioning

In this case, a unique situation is present whereby various scenarios have been posed and evaluated accordingly. A brief discussion of the impact and the rationale behind the assessment of its significance has also been included.

Rating System Used To Classify Impacts

The rating system is applied to the potential impact on the receiving environment and includes an objective evaluation of the mitigation of the impact. Impacts have been consolidated into one rating. In assessing the significance of each issue, the following criteria (including an allocated point system) is used:

Table 1. Example of the significance impact rating table.

NATURE		
Includes a brief description of the impact of environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted upon by a particular action or activity.		
GEOGRAPHICAL EXTENT		
This is defined as the area over which the impact will be expressed. Typically, the severity and significance of an impact have different scales and as such bracketing ranges are often required. This is often useful during the detailed assessment of a project in terms of further defining the determined.		
1	Site	The impact will only affect the site
2	Local/district	Will affect the local area or district
3	Province/region	Will affect the entire province or region
4	International and National	Will affect the entire country
PROBABILITY		
This describes the chance of occurrence of an impact		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).
REVERSIBILITY		
This describes the degree to which an impact on an environmental parameter can be successfully reversed upon completion of the proposed activity.		
1	Completely reversible	The impact is reversible with implementation of minor mitigation measures
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.

3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible and no mitigation measures exist.
IRREPLACEABLE LOSS OF RESOURCES		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource.	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.
4	Complete loss of resources	The impact is result in a complete loss of all resources.
DURATION		
This describes the duration of the impacts on the environmental parameter. Duration indicates the lifetime of the impact as a result of the proposed activity		
1	Short term	The impact and its effects will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase (0 – 1 years), or the impact and its effects will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact and its effects will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 50 years).
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered transient (Indefinite).
CUMULATIVE EFFECT		
This describes the cumulative effect of the impacts on the environmental parameter. A cumulative effect/impact is an effect which in itself may not be significant but may become significant if added to other existing or potential impacts emanating from other similar or diverse activities as a result of the project activity in question.		

1	Negligible Cumulative Impact	The impact would result in negligible to no cumulative effects
2	Low Cumulative Impact	The impact would result in insignificant cumulative effects
3	Medium Cumulative impact	The impact would result in minor cumulative effects
4	High Cumulative Impact	The impact would result in significant cumulative effects
INTENSITY / MAGNITUDE		
Describes the severity of an impact		
1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component but system/ component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.
4	Very high	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired (system collapse). Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.
SIGNIFICANCE		
Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. This describes the significance of the impact on the environmental parameter. The calculation of the significance of an impact uses the following formula: **(Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity.**		

The summation of the different criteria will produce a non weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.		
Points	**Impact Significance Rating**	**Description**
6 to 28	Negative Low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
6 to 28	Positive Low impact	The anticipated impact will have minor positive effects.
29 to 50	Negative Medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
29 to 50	Positive Medium impact	The anticipated impact will have moderate positive effects.
51 to 73	Negative High impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
51 to 73	Positive High impact	The anticipated impact will have significant positive effects.
74 to 96	Negative Very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
74 to 96	Positive Very high impact	The anticipated impact will have highly significant positive effects.

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