Visual Impact Assessment

For ESKOM Matimba B

Power Transmission Integration

MATIMBA - DINALEDI

Report

PROPOSED ESKOM MATIMBA B POWER TRANSMISSION INTEGRATION LIMPOPO AND NORTH WEST PROVINCES

VISUAL IMPACT ASSESSMENT

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Introduction

Increased energy demand has resulted in the need to supplement the existing 765kW power lines and power stations in the Limpopo and North West Provinces. A number of power lines have been proposed to supply new sub stations. This study deals specifically with the proposed addition of two 400kV transmission power lines to the Dinaledi substation located near Brits also from Matimba looped into the Spitskop substation and the expansion of the existing substations of Spitskop and Dinaledi accommodate the new 400kV transmission power lines. As part of the environmental evaluation, Newtown Landscape Architects (NLA) was commissioned to carry out a specialist study on their potential visual impact, which forms part of the Environmental Impact Assessment process.

Approach

Landscape character, landscape quality and "sense of place" were used to rate the value of the visual resource of the study area. The extent to which this resource will be affected by the proposed development was determined. The intensity of the impact was established using visibility, visual intrusion, visual exposure and sensitivity criteria. The significance of the impact was then further qualified with spatial scale, duration, and degree of certainty criteria.

Visual resource

The landscape was divided into its basic landscape character units, each with its own set of physical, visual and aesthetic characteristics. The main units included water bodies, landform and vegetation, infrastructure and conservation/tourism areas. The units were rated in terms of their inherent visual value. GIS maps were produced according to visual value criteria, resulting in a Landscape Sensitivity map, highlighting areas of high to low sensitivity and visual value. Figure 5 is the graphic result of this exercise.

Sensitive Viewers

Sensitive viewing areas are considered to be views to the project from residential properties surrounding the site, public rights of way, tourist destinations and natural conservation areas. Areas considered not sensitive would be where industry or mining activities occur. In order to aid in the process of identifying sensitive viewing areas within the proposed corridor, a GIS study was conducted by mapping the above-mentioned elements. Each aspect was awarded a buffer zone of 5km. Where separate aspects overlapped, a higher rating was awarded to that area. Figure 6 is the graphic result of this exercise.

Visual impact

The intensity of visual impact was determined using visibility, visual intrusion, visual exposure and viewer sensitivity criteria. When the intensity of impact is qualified with spatial, duration and probability criteria the significance of the impact was be predicted (refer to Appendices B and C).

Due to the linear nature of the project, a number of potential conflict areas in terms of their potential visual impact were identified. These potential conflict areas were rated in terms of the intensity of visual impact and the significance of each impact. Concluding from the rating and assessment of each area, it was surmised that the construction of the two 400kV lines from Matimba B to Dinaledi sub station would have a ***moderate negative*** impact on the surrounding landscape. It is however imperative that the specific potential conflict areas be considered and the mitigation measures sucessfully implemented.

Figure 9 indicates the preferred corridors, eliminating those options that feature either unmitigatable or too large a number of potential conflict areas. This should however not be considered the final corridor, as the mitigation measures for the potential conflict areas on these lines should be incorporated in the location of the final corridors. The following general mitigation measures should be followed for the entire project:

- The proposed corridor should never be allowed to traverse the crest of a hill. All lines should be located at the base of a hill and continued along the valleys encompassed by hills.
- Where possible, the proposed corridor should continue adjacent to an existing corridor.
- The mixing of pylon-types should be avoided to reduce visual conglomeration and create the illusion of visual harmony.

GLOSSARY OF TERMS

Zone of Potential Influence
The area defined as the radius about an object beyond which the visual impact of its most visible features will be insignificant.

Landscape Character
The individual elements that make up the landscape, including prominent or eye-catching features such as hills, valleys, woods, trees, water bodies, buildings and roads. They are generally quantifiable and can be easily described.

Sense of Place
Sense of place is the unique value that is allocated to a specific place or area through the cognitive experience of the user or viewer.

Aesthetic value
Aesthetic value is the emotional response derived from the experience of the environment with its particular natural and cultural attributes. The response can be either to visual or non-visual elements and can embrace sound, smell and any other factor having a strong impact on human thoughts, feelings and attitudes (Ramsay 1993). Thus aesthetic value encompasses more than the seen view, visual quality or scenery, and includes atmosphere, landscape character and sense of place (Schapper 1993).

Visibility
The area/points from which project components will be visible.

Viewshed
The two dimensional spatial pattern created by an analysis that defines areas, which contain all possible observation sites from which an object would be visible.

Visual Intrusion
The nature of intrusion of an object on the visual quality of the environment resulting in its compatibility (absorbed into the landscape elements) or discord (contrasts with the landscape elements) with the landscape and surrounding land uses.

Visual exposure
Visibility and visual intrusion qualified with a distance rating to indicate the degree of intrusion.

Viewer Sensitivity
Sensitivity of visual receptors (viewers) to the proposed development for example high sensitivity when viewed from tourism, residential or public rights of way and low sensitivity when viewed from within industrial mining areas.

Landscape Sensitivity
Sensitivity of the landscape to the proposed development for example high sensitivity when a landscape of particular distinctive character is susceptible to small changes and low sensitivity for a relatively unimportant landscape, the nature of which is potentially tolerant of substantial change.

Landscape impact
Landscape effects derive from changes in the physical landscape, which may give rise to changes in its character and how this is experienced (Institute of Environmental Assessment & The landscape Institute 1996).

Visual impact
Visual effects relate to the changes that arise in the composition of available views as a result of changes to the landscape, to people's responses to the changes, and to the overall effects with respect to visual amenity (Institute of Environmental Assessment & The landscape Institute 1996). *Intensity* of impact is initially established using visibility, exposure and intrusion criteria and then qualified with duration, probability and spatial criteria to determine the *significance* of impact.

EIA Regulations
Regulations as per Government Notice (GN) R1183 of 5 Sep 1997, amended by GN R 1645 of 11 Dec 1998, GN R 670 of 10 May 2002 and GN R 782 and R 783 of 7 June 2002, under Section 26 of the Environmental Conservation Act (73 of 1989).

1.0 INTRODUCTION

Increased energy demand has resulted in the need to supplement the existing 765kW power lines and power stations in the Limpopo and North West Provinces. A number of power lines have been proposed to supply new sub stations. These include two 400kV lines from Matimba B to Dinaledi substation near Ga-Rankuwa and Brits in the North West via Spitskop. The proposed project additionally includes the upgrade of the Spitskop and Dinaledi substations.

As part of the environmental evaluation, Newtown Landscape Architects (NLA) was commissioned to carry out a specialist study on the visual impact, which forms part of the Environmental Impact Assessment process.

1.1 Project

This study deals specifically with the proposed addition of two 400kV transmission power lines to the Dinaledi substation located near Brits also from Matimba looped into the Spitskop substation and the expansion of the existing substations of Spitskop and Dinaledi accommodate the new 400kV transmission power lines.

1.2 Study Area

The study area is located in the northern part of South Africa. It stretches over two provinces, including the Limpopo and North West Provinces. The northern boundary of the study area is defined by the Matimba substation close to Lephalale. From here, the study area includes the town of Dwarsberg in the west and continues to include the Borakalalo Nature Reserve in the east. From Borakalalo it extends southwards to include the town of Brits and then Rustenburg, which then also represent the southern boundary of the site. Refer to Figure 1 Study Area Locality

1.3 Terms of Reference

To assess the potential impact of the proposed development on the visual environment to identify areas to avoid in determining the power line corridors.

2.0 AIM OF THE STUDY

The primary visual concern is of the potential impact from the physical presence of the power transmission line and associated impacts on views to residents, tourists and people passing through the study area. The main aim of the study is to ensure that the visual consequences of the proposed transmission lines are understood and adequately considered in the environmental planning process.

3.0 METHODOLOGY

To evaluate the impacts of the power transmission line, the inherent scenic value of the landscape (visual resource) first needs to be determined. Data collected during a site visit allowed for a comprehensive description and valuation of the receiving environment. The full visual impact process is indicated in Image 2. The following method was used for the project:

- Conduct a field survey to study the area to the extent that a professional opinion can be given of the potential impact on the visual environment and the sense of place of the proposed transmission line;
- Describe the visual resource (i.e. receiving environment);
- Describe and map the landscape character of the study area. The description of the landscape will focus on the nature and character of the landscape rather than the response of a viewer;
- Describe the sense of place of the study area as to the uniqueness and distinctiveness of the landscape. The primary informant of these qualities is the spatial form and character of the natural landscape together with the cultural transformations associated with the historic/current use of the land;
- Describe the quality of the landscape (visual resource). Aesthetic appeal is described using recognized contemporary research in perceptual psychology as the basis;
- Rate the impact on the visual environment and sense of place of the proposed transmission lines based on a professional opinion and the method described below; and
- Suggest measures that could mitigate the negative impacts of the proposed project.

4.0 APPROACH

The assessment of likely effects on a landscape resource and on visual amenity is complex, since it is determined through a combination of quantitative and qualitative evaluations. (The Landscape Institute with the Institute of Environmental Management and Assessment (2002)). When assessing visual impact the worst-case scenario is taken into account. Landscape and visual assessments are separate, although linked, procedures.

The landscape, its analysis and the assessment of impacts on the landscape all contribute to the baseline for visual impact assessment studies. The assessment of the potential impact on the landscape is carried out as an impact on an environmental resource, i.e. the physical landscape. Visual impacts, on the other hand, are assessed as one of the interrelated effects on people (i.e. the viewers and the impact of an introduced object into a particular view or scene).

4.1 The Visual Resource

Landscape character, landscape quality (Warnock, S. & Brown, N. 1998) and "sense of place" (Lynch, K. 1992) are used to evaluate the visual resource i.e. the receiving environment. A qualitative evaluation of the landscape is essentially a subjective matter. In this study the aesthetic evaluation of the study area is determined by the professional opinion of the author based on site observations and the results of contemporary research in perceptual psychology. The criteria given in Appendix A are used to assess landscape quality, sense of place and ultimately to determine the aesthetic value of the study area.

4.2 Landscape Impact

The landscape impact of a new development is measured as the change to the fabric, character and quality of the landscape caused by the physical presence of the new development. Identifying and describing the nature and magnitude of change in the landscape brought about by the proposed project is based on the professional opinion of the author. It is imperative to depict the change to the landscape in as realistic a manner as possible (Zube et. al.; Van Dortmont in Lange 1994).

4.3 Visual Impact

Visual impacts are a subset of landscape impacts. Visual impacts relate to the changes that arise in the composition of available views as a result of changes to the landscape, to people's responses to the changes, and to the overall effect with respect to visual amenity. Visual impact is therefore measured as the change to the existing visual environment (i.e. views) caused by the intervention and the extent to which that change compromises (negative impact) or enhances (positive impact) or maintains the visual quality of the scene as perceived by people visiting, working or living in the area. This approach reflects the layman's concerns, which normally are:

- Will I be able to see the new development?
- What will it look like?
- Will the development affect views in the area and if so how?

Landscape and visual impacts do not necessarily coincide. Landscape impacts can occur in the absence of visual impacts, for instance where a development is wholly screened from available public views, but nonetheless results in a loss of landscape elements and landscape character within a localized area (the site and its immediate surrounds).

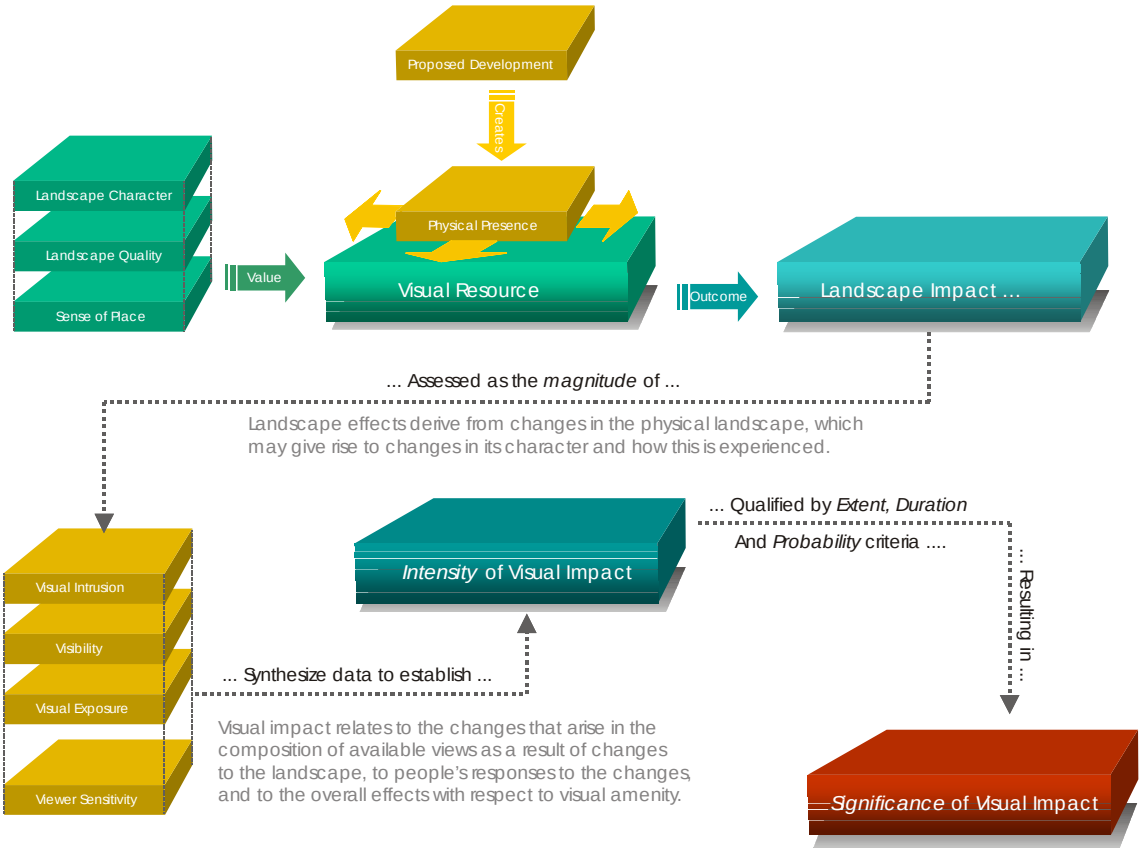
4.4 Intensity of Visual Impact

The intensity of visual impact is determined using visual intrusion, visibility and visual exposure criteria (Hull, R.B. and Bishop, I.E. 1988), qualified by the sensitivity of viewers (visual receptors) towards the proposed development. The intensity of visual impact is therefore concerned with:

- The overall impact on the visual amenity, which can range from degradation through to enhancement;
- The direct impacts of the proposed project upon views of the landscape through intrusion or obstruction;
- The reactions of viewers who may be affected.

For a detailed description of the methodology used in this study, refer to Appendices A and B. Image 1 below graphically illustrates the visual impact process.

Image 1: Visual Impact Process



4.5 Significance of Visual Impact

The significance of impact was determined using a ranking scale, based on terminology from the Department of Environmental Affairs and Tourism's (DEAT) guideline document on EIA Regulations, April 1998. The following criteria are used:

Occurrence, based on

- Probability of occurrence (how likely is it that the impact may occur?), and
- Duration of occurrence (how long may it last).

Severity, based on

- Intensity of impact (will the impact be of High, Moderate or Low intensity?) and
- Scale/extent of impact (will the impact affect the national, regional or local environment, or only that of the site?)

Refer also to Appendix C for a detailed description

4.0 DESCRIPTION OF THE PROJECT

The following is a description of the physical elements of the proposed project.

4.1 Power Lines

For both the Dinaledi 400kV power lines the expected tower design will be the now standard cross-rope suspension tower for power lines over normal terrain and for fairly straight and level alignments. Currently this option is both the most cost effective and environmentally suitable option. Strain towers will likely be utilised where difficult terrain is encountered or line deviations of more than 3° is unavoidable.

The proposed 400kV cross-rope pylons are normally in the order of 38m in height with a minimum conductor clearance of 8.1m. The standard servitude size for 400kV transmission power lines is 55m and Pylons are placed between 350m and 500m apart over the power line length depending on terrain and route angles.

Eskom-TS obtains a right of use over the servitude area that allows the company to utilise the servitude land for purposes of electricity transmission to the approved design and technical constraints as approved by the relevant authority in terms of a RoD to be issued in terms of the relevant legislation and pertaining to the environmental impact report (EIR). The right obtained by the company also entails certain restrictions on land owners over whose land the servitude is secured as well as allowances. These would include restrictions and/or allowances on certain activities within the servitude area in terms of a contract reached between the applicable landowner and Eskom-TS.

The following are examples of restrictions:

- No building of houses, sheds or similar constructions that could affect or be affected by the power line and pylons.
- No blocking of access to the servitude area that would deny Eskom maintenance operators any possibility of entering and/or servicing the servitude area.
- No utilisation of spill points within the servitude area.
- No blasting or excavating within the servitude area without prior approval from Eskom.

The following are examples of allowances:

- Grazing and dry-land cultivation activities within the servitude area.
- Vegetation clearing and animal movement within the servitude area.
- Placing of topsoil berms not exceeding certain dimensions under the power lines or within the servitude area.

4.2 Spitskop Substation Expansion

The Spitskop substation will have to be upgraded to receive the 2 X 400kV transmission power lines from Matimba B as well as to allow for the 2 X 400kV transmission power lines that will leave the substation to link up with the Dinaledi substation. Changes on some of the equipment and layouts relating to other services from the substation will also be required in order to be able to conduct the above upgrading.

The 400kV system expansion will comprise the following bay:-

- •4 x equipped feeder bay with double busbar selection and bypass (Matimba 1, Matimba 2, Matimba ‘B’ (Limpopo) 2 and Dinaledi 2)
- Underpasses for the following feeders: Matimba ‘B’ (Limpopo) 1 (Feeder 1), Matimba 2 (Feeder 3) Matimba ‘B’ (Limpopo) 2 (Feeder 6), Dinaledi 2 (Feeder 4), Dinaledi 1 (Feeder 7) and Bighorn 1 (Feeder 2)
- 2 x equipped bus coupler bays (Bus Coupler ‘A’ and Bus Coupler ‘B’)
- 4 x equipped bus section bays (No.2 Bus Section 1, No.1 Bus Section 2, No.2 Bus Section 3 and No.1 Bus Section 4)
- 2 x equipped bus section isolator bays (No.2 Bus Section 2 Isolator and No.1 Bus Section 3 Isolator)

The following are the project activity aspects for the Spitskop extension:

- Yard Stone:
  New yard stone is required in newly extended 275kV and 400kV yards areas. Clear areas in existing yard for equipment foundations, stockpile yard stone and replace when complete.
- Structural Steel:
  Provide support Steelwork for busbars, stringers, equipment, and as per Steelwork Marking Plan.
- Operational:
  The Operational Lighting is to be extended and integrated for the new terraced areas.
- Drainage:
  Storm-water drainage is to be extended and integrated for the new terraced areas.
- Roads:
  Extend the 6m concrete access road between the 275kV and 400kV yards by120m to the east and 90m to the west as per the Road Layout. The tar road requires some rerouting as per Road Layout.
- Fencing:
  Sections of fencing will have to be removed and new fencing placed around the expanded areas.
- Foundations, plinths and trenches:
  Provide support foundations for busbar stringers columns, equipment, and extend the cable trenches as per bay layouts.
- Buildings:
  A new Control building with Battery room and offices is to be built. A new steel stores building & flammable store is required.
- Earthwork:
  The existing 400kV yard terrace is to be extended to the east by 120m, to the west by 90m and to the south by a maximum of 90m. The eastern extension is to accommodate a bus section and 2 feeders and a bus coupler, the western extension is to accommodate a bus section, a 275kV line overpass, a feeder and a bus coupler. The terraced area to south is required for the line crossings that are to be realised using substation steelwork.
- Geotechnical:
  Since the 400kV yard expansion is rather large, it is recommended that a geotechnical investigation be carried out to determine soil conditions. This will be conducted during the technical EIA phase.

4.3 Dinaledi Substation Expansion

The Dinaledi substation will have to be upgraded to receive the additional 2 X 400kV transmission power lines. Complete details on the Dinaledi substation are not available at this stage. The project aspects of the Spitskop are however expected to be applicable for the Dinaledi Substation expansion.

5.0 THE ENVIRONMENTAL SETTING

5.1 Existing Land Use

The proposed power transmission integration study area follows a general north (Matimba power station) to south (Dinaledi substation) orientation. The majority of the land in the study area is privately owned and managed. Many of these properties feature game farms, with the remainder comprising of agricultural land. The rest of the study area features community settlements, nature reserves and mining activities. The towns of Thabazimbi and Northam fall within the study area, whereas the larger towns of Rustenburg, Brits located within the southernmost section of it. State owned railway and road servitudes are regularly crossed. In terms of land use, the study area in its entirety will be discussed.

5.1.1 Residential

Residential properties and areas are concentrated around the various towns and community settlements. The majority of community settlements are distributed in the southern part of the study area. The largest concentration of residential areas include the area northeast of Brits, which include densely populated urban residential areas, along with the more dispersed community settlements scattered throughout the area. Another large concentration of residential properties is located north and east of the Pilansberg National Park. This continues northwards to include the town of Northam and Swartklip Mine town. Widely dispersed private farmland is found throughout the study area. Most of these are currently game farms, with a portion still utilised for agricultural purposes. See Figure 4: Residential and Tourism.

5.1.2 Tourism

The various nature reserves constitute the major tourist attractions within the area. The Pilansberg Nature Reserve is the largest reserve within the area. Other reserves include the Ben Alberts, the Thaba Thelo Eco Park, Rhino Bushveld Eco Park, Borakalalo Game Reserve and Madeleine Robinson. . Only the western portion of the Marakele Nature Reserve is included in the study area. Many of the private game farms also feature tourist facilities. Bed and breakfast businesses have been established within the main towns of the study area. The R510, R517 and a few local roads have been identified as tourist routes by the local tourism authority. See Figure 4: Residential and Tourism.

5.1.3 Agricultural

The majority of commercial farmland is situated in the central portion of the study area. These farms include dryland or irrigated agricultural activities and is primarily located in the area immediately north of the Pilansberg Nature Reserve and in the area between the Ben Alberts and Atherstone Nature Reserves. The southern section features a large percentage of subsistence farming associated with the number of community settlements in this area. The northern section of the study area is predominantly used for grazing or game farms, with agricultural farming only occurring close to perennial rivers and valleys. See Figure 2: Vegetation.

5.1.4 Transportation systems

Two main transportation systems provide access to and through the study area, and comprise of national, provincial and local (farm) road systems and railway servitudes. The N4 constitutes the only main national road located immediately outside of the southern boundary of the study area. Provincial roads include the R511 from Brits to Thabazimbi, the R510 from Rustenburg to Thabazimbi and the R566 from Brits to Pilansberg. The remainder of the study area comprises of an extensive network of local and farm roads.

Two railway servitudes cross the study area from north to south. The main line runs from the Matimba substation roughly parallel to the R510 to Brits. The other, more secondary line runs along the R511 from Brits northwards. The main east-west lines include the lines from Northam to Dwaalboom. There are a large conglomeration of railway servitudes between Pilansberg and Marikana.

5.2 Landscape Character

Landscape character types are landscape units refined from the regional physiographic and cultural data derived from 1:50 000 maps, GIS maps with specific data sets and information gathered on the site visit. Dominant landform/land use features (e.g., hills, rolling plains, valleys and urban areas) of similar physiographic and visual characteristics typically define landscape character types.

The study area consists of three dominant natural landscape types: rocky hills and koppies, flat rolling plains, river valleys and their associated drainage lines. Two other types, mainly derived from man-made intervention, also occur within the study area. They are the built up areas (towns and mining infrastructure) and cultivated farmland.

The visual character of the study area is largely natural with concentrations of man made features around the towns and community settlements. Other man-made interventions include the existing railway and road servitudes, mining infrastructure, as well as the infrastructure and buildings associated with the farmsteads and game farms.

The entire study area is comprised of the savannah biome. The savannah biome is characterized by a grassy ground layer and a distinct upper layer of woody plants. The shrub-tree layer in the Bushveld typically varies from 3 to 7 m. The shrub-tree element may come to dominate the vegetation in areas which are being overgrazed.

The **northern** section of the study area features the Waterberg Moist Mountain Bushveld where the tree layer is characterized by larger trees. The shrub layer is moderately developed and the grass layer is moderately to well developed. Economic uses in this area include predominantly game and cattle farming, and ecotourism. The Marakele Nature Reserve in the southern part of this section of the study area predominantly features the Waterberg Moist Mountain Bushveld and represents a major ecotourism destination in the study area. The **northern section** also features the Sweet Bushveld, occuring along the Matlabas River valley. The vegetation structure is mostly short and shrubby with sandy, shallower and drier soils dominated by trees. Here the herbaceous layer is often dominated by grasses and dense, nearly impenetrable, thickets. Apart from cattle and game farming, this area also features the production of vegetables. The topography of the northern area is predominantly flat to gently rolling. With the Matimba substation situated within this area, a number of power lines with railway servitudes forms part of the visual landscape. See Views 22 – 30, Figures 17 – 19 Landscape Character. Refer to Figure 1 for the positions of the different views.

The majority of the study area is characterised by Mixed Bushveld. The Mixed Bushveld vegetation varies from a dense, short bushveld to a rather open tree savanna featuring larger trees. The area surrounding the town of Northam represents the **central section** of the study area and is predominantly characterized by the extensive mining activities on the hills surrounding the town. The other economic activities within this area include cattle and game farming and cultivated crops. South and west of Thabazimbi the landscape tends to become less hilly, characterized by a flat topography. See Views 10 -21, Figures 13 – 16 Landscape Character.

The **southern section** of the study area features a number of rocky outcrops within flat, rolling plains affording clear views towards the Water- and Magaliesberg. Many community settlements are dispersed throughout this area, presenting a disturbed landscape due to overgrazing and the proliferation of invasive species. A number of mines are situated in the western parts of this area. The Pilansberg Nature Reserve is located centrally in the study area, mainly representing the Mixed Bushveld vegetation type, but with a hilly topography. The southern part of the study area represents the Clay Thorn Bushveld and is dominated by various *Acacia* species and other woody species. This area is widely cultivated for crops such as wheat, maize and sunflowers and livestock farming. Additionally, this area features a conglomeration of substations, power lines, railway servitudes, national and public road networks, mining activities and towns including settlements. See Views 1 – 9, Figures 10 -12 Landscape Character.

5.3 Sense of Place

Central to the concept of sense of place is that the landscape requires uniqueness and distinctiveness. The primary informant of these qualities is the spatial form and character of the natural landscape taken together with the cultural transformations and traditions associated with the historic use and habitation of the area. According to Lynch (1992), sense of place, “is the extent to which a person can recognize or recall a place as being distinct from other places – as having a vivid, unique, or at least particular, character of its own.” Sense of place is the unique value that is allocated to a specific place or area through the cognitive experience of the user or viewer. In some cases these values allocated to the place are similar for a wide spectrum of users or viewers, giving the place a universally recognized and therefore, strong sense of place.

Because the sense of place of the site is derived from the emotional, aesthetic and visual response to the environment, it cannot be experienced in isolation. The landscape context must be considered. With this in mind, it is clear that the study area can be divided into two distinct areas: the northern section with a predominantly flat topography and similarly flat vegetation, and the southern section with a rolling topography interspersed with hills and even mountainous areas. The vegetation within this southern area range between flat to slightly taller thickets and trees. It is furthermore important to consider the fact that the southern area is more densely populated and built-up, whereas the northern area is predominantly devoid of settlements.

The overriding sense of place of the northern section of the study area is that of expansive, open natural veld with few human interventions. It is this quality of the landscape which landowners, but also visitors to the area admire most. This resulted in a number of game farms and lodges located within this area. In some instances the landscape displays a pastoral character that is derived from agricultural activities. A large part of this section is characterised by the presence of existing power lines, which diminishes the sense of place within these areas.

The southern section of the study area displays a stronger sense of place than the northern part. This is primarily due to the fact that, coupled with the vast, expansive plains characteristic of the Sweet Bushveld, the area also features noteworthy topographical changes in the form of either rocky outcrops or extensive ridges spanning a few kilometres. This bestows a unique visual character to the area, increasing the sense of place. The presence of the numerous sub stations (Spitskop, Dwaalboom, Dinaledi, Marang) and their related infrastructure (mine, railways and power lines), scattered throughout the study area, diminishes the sense of place of these parts of the southern section of the study area.

6.0 VISUAL RESOURCE

6.1 Criteria to value a visual resource

Aesthetic value is the emotional response derived from the experience of the environment with its particular natural and cultural attributes. The response is usually to both visual and non-visual elements and can embrace sound, smell and any other factor having a strong impact on human thoughts, feelings and attitudes (Ramsay 1993). Thus aesthetic value is more than the combined factors of the seen view, visual quality or scenery. It includes atmosphere, landscape character and sense of place (Schapper 1993). Refer also to Appendix A for further elaboration.

Studies for perceptual psychology have shown human preference for landscapes with higher visual complexity, for instance scenes with water or topographic interest. On the basis of contemporary research, landscape quality increases where:

- Topographic ruggedness and relative relief increase;
- Water forms are present;
- Diverse patterns of grassland and trees occur;
- Natural landscape increases and man-made landscape decreases;
- Where land use compatibility increases. (Crawford 1994)

Aesthetic appeal (value) is therefore considered **high** when the following are present (Ramsay 1993):

- **Abstract qualities:** such as the presence of vivid, distinguished, uncommon or rare features or abstract attributes;
- **Evocative responses:** the ability of the landscape to evoke particularly strong responses in community members or visitors;
- **Meanings:** the existence of a long-standing special meaning to a particular group of people or the ability of the landscape to convey special meanings to viewers in general;
- **Landmark quality:** a particular feature that stands out and is recognised by the broader community.

And conversely, it would be **low** where:

- Limited patterns of grasslands and trees occur;
- Natural landscape decreases and man-made landscape increases;
- And where land use compatibility decreases (after Crawford 1994).

6.2 Visual Resource Value

In determining the quality of the visual resource, both the objective and the subjective or aesthetic factors associated with the landscape are considered. Many landscapes can be said to have a strong sense of place, regardless of whether they are considered to be scenically beautiful but where landscape quality, aesthetic value and a strong sense of place coincide - the visual resource or perceived value of the landscape is considered to be very high.

The landscape as described in Section 5.2.1 was divided into its basic landscape character units, each with its own set of physical, visual and aesthetic characteristics. The main units included water bodies, landform and vegetation, infrastructure and conservation/tourism areas. The units were rated in terms of visual value according to the following criteria:

Table 1: Visual Resource

ZONE	DESCRIPTION	RATING	
Water Bodies	Perennial Rivers, Dams & Wetlands	**High**	**3**
Landform	Mountains and Hills >1.1% slope	**High**	**3**
	Rolling plains with rocky outcrops 0.1 – 1.1% slope	**Medium**	**2**
	Flat plains 0 – 0.1% slope	**Low**	**1**
Vegetation	Woodland, Thicket and Bushveld types	**High**	**3**
	Grassland	**Medium**	**2**
	Degraded Land, Plantations and Agricultural Land	**Low**	**1**
Infrastructure	Roads, Power lines, Mines, Industrial Areas Urban Residential, Rural Settlements	**Low**	**1**
Conservation / Tourism	National Parks, Nature Reserves, Game Parks, Game Farms & Lodges	**High**	**3**

GIS maps were produced according to the above criteria (See Figures 2, 3, 4). Figure 5 represents the map that contains the combination of these aspects.

By studying Figure 5, it is clear that the majority of **water bodies** with a high visual value are present in the southern part of the study area. This is primarily due to the presence of the Crocodile, Hex and Elands Rivers with its associated dams (Vaalkop Dam, Bokpoort Dam). The central area features the Kolopeng River and Bierspruit with dam. The Matlabas and Crocodile Rivers in the north also constitute perennial rivers with a high visual value.

Figure 3 reveals that most **hills and rocky outcrops** are situated within the southern section of the study area. These landforms are considered to have a high visual value. The northern parts feature a more flat topography. The central section of the study area also features a number of ridges of a high visual value.

In terms of **vegetation**, Figure 2 and Views 22 – 30, Figures 17 – 19 Landscape Character, clarifies that the northern section of the study area is more visually pleasing due to the characteristics inherent of the predominant Bushveld vegetation (woodland and thicket) of that area. The southern section (see Views 1 – 9, Figures 10 -12 Landscape Character) is predominantly characterized by thicket-type vegetation. Furthermore, the northern section of the study area is less disturbed than the southern section, where subsistence farming and other agricultural activities occur. The central section feature larger areas of commercial farmland.

A number of land uses within the study area have a negative visual value. Their presence within a certain setting detracts from the inherent visual quality of that area. These land uses include roads, railways, existing power lines, mining areas, industrial areas and commercial areas. A combination of these land uses are illustrated in Figure 5.

A comprehensive analysis of the visual value of the entire study area was done by overlaying the collection of maps discussed above. A high to low visual resource value was generated by overlaying the different ratings for individual landscape units and the subsequent devaluation of those values in the event of an intersection with devaluating land uses. Figure 5 represents the conclusion of the exercise. It indicates that the areas with a high visual value are located throughout the study area. Furthermore, the study clarifies that the majority of the study area has a moderate visual value, as defined in the table below:

Table 2: Value of Visual Resource

High	Moderate	Low
The site is considered to have a *high* value because it is a: Landscape that exhibits a very positive character with valued features that combine to give the experience of unity, richness and harmony. It is a landscape that may be considered to be of particular importance to conserve and which may be sensitive change in general and which may be detrimental if change is inappropriately dealt with.	The site is considered to have a *moderate* value because it is a: **Landscape that exhibits some positive character but which have evidence of alteration /degradation/ 'erosion' of features resulting in areas of mixed character.** Potentially sensitive to change in general; again change may be detrimental if inappropriately dealt with but it may not require special or particular attention to detail.	The site is considered to have a *low* value because they comprise a: Landscape generally negative in character with few, if any, valued features. Alteration/degradation and 'erosion' of features is prevalent. Scope for positive enhancement would occur.

6.3 Views

Sensitive viewing areas are considered to be views to the project from residential properties surrounding the site, public rights of way, tourist destinations and natural conservation areas. Tourism is an industry based primarily on the subjective perspectives of visitors to an area. In destinations where tourism is focused on outdoors or based on natural elements, the tourism value rests largely on the experience which can be provided. This concludes that tourist facilities will constitute the highest viewer sensitivity. Areas considered not sensitive would be where industry or mining activities occur.

In order to aid in the process of identifying sensitive viewing areas within the proposed corridor, a GIS study was conducted by mapping the above-mentioned elements. Each aspect was awarded a buffer zone of 5km. Where separate aspects overlapped, a higher rating was awarded to that area. Figure 6 is the graphic result of this exercise and its conclusion discussed below.

6.3.1 Sensitive viewing areas

Roads and tourist routes in the vicinity of the proposed Matimba – Dinaledi transmission line include the R511 from Brits and the R556 to Pilansberg and Sun City. A local road in the vicinity of Ellisras is also considered a tourist route and, together with the northern section of the R510, is considered the only tourist route authorised by the local tourist authority. The R510 is not intersected by the proposed corridor in the north. However, for an approximately 10km section in the southern part of the study area, the proposed corridor runs alongside this route. Clear views of the proposed transmission lines would be afforded along the entire length of this part of the road. The R556 is not intersected by the proposed transmission lines.

A number of farmhouses and smallholdings and rural settlements are scattered throughout the study area. This is illustrated graphically in Figure 6 in the fact that most of the study area is covered in yellow, representing residential areas with a 5km buffer area surrounding these areas. Views from these areas are considered important and if compromised by the physical presence of the project will cause a negative impact for people living in and or visiting the area.

Where residential areas intersect each other or other sensitive viewing areas, the sensitivity of that specific area is heightened. This can be seen in the vicinity of the Dinaledi Substation, where tourist facilities area located on the edge of a large community settlement. The same can be said for the areas surrounding the Pilansberg, Vaalkop Dam and Ben Alberts Nature Reserve. Furthermore, a number of game lodges and game farms are located throughout the study area. These are predominantly concentrated within the northern parts of the study area, with a few within the central part. Views from these land uses are considered highly sensitive since the predominant users (tourists) visit these areas for the aesthetic quality of the landscape.

6.3.2 Visibility

In determining the visibility of the project, the worst-case scenario i.e. visibility of the project's features at a variety of heights and locations, was used. To do this, vantage points were assigned at offsets equivalent to three quarters of the height above ground level of the project's tallest structures/features, in this case the 400kV cross rope pylon. The 'zone of potential influence' (the area defined as the radius about the centre point of the project beyond which the visual impact of the most visible features will be insignificant) was established at 7.0km. Over 7.0km the impact of the proposed transmission lines would have diminished considerably due to the diminishing effect of distance and atmospheric conditions (haze) on visibility (also refer to Figure 7).

A viewshed analysis was undertaken for the entire length of the proposed Matima – Dinaledi Transmission lines**.** The spatial pattern generated by the viewshed analysis is illustrated in Figure 7 and indicates areas from which the project potentially can be seen.

It is clear from Figure 7 that, despite topographical relief, the proposed lines would be visible from most areas. This indicates a minimal capacity of the landscape to absorb the proposed lines. Additionally it emphasises the problematic nature of a linear project. However, one must take the cumulative effect of the flat to rolling topography and thicket to woodland vegetative cover into consideration. In instances where these occur, the flat landscape tends to absorb the power lines, and would they only be visible from areas within a 1km radius. This is however not the case in the presence of hill or rocky outcrops. If the line continues across these hills (over the crest or further down) and breaks the horizon line, the pylons would be clearly visible for further than 3 kilometres. In the event of the line travelling within the valleys contained by the hills, the lines would be visually absorbed and the impact thus minimised.

The northern parts of the study area, along with some areas within the southern parts, feature predominantly flat topography with woodland, leading to the fact that the visibility would be reduced in those areas. The central to southern parts feature an increased amount of rocky outcrops and hills. A few instances have been identified where the proposed line cross the crest of a hill (Area 2). These are **no-go** areas and should be mitigated. Furthermore, a number of cases have been identified where the proposed line travels close to the crest or along the base of hills or rocky outcrops. These areas have been indicated in Figure 3 and are considered sensitive.

Concluding from Figure 7, it is clear that the power lines would be visible from most areas within the study area (taking the above discussion into consideration). Only in the event of topographical changes are some areas excluded from the viewshed, but are these mostly further than 3km's from the proposed lines. The visibility of the entire project would thus generally be ***high to moderate***. The visibility of the identified potential conflict areas are indicated in Section 6.2 and should be read in conjunction with Figure 8.

7.0 LANDSCAPE and VISUAL IMPACT

7.1 Landscape Impact

The *landscape impact* (i.e. the change to the fabric and character of the landscape caused by the physical presence of a development) of the proposed Matima – Dinaledi Transmission lines and the proposed new Spitskop and Dinaledi substation upgrades will be ***low*** as the physical impact of the construction of the pylons on the landscape would be localised to only the corridor cleared for the positioning of the lines. The main disturbance would be during the construction phase, where vegetation clearance of the corridor would take place. After the construction of the pylons, the impact would be confined to the corridor itself.

However, as stated in the approach, the physical change to the landscape at the project site must be understood in visibility and aesthetic terms of the study area. The following sections discuss the effect that the proposed Matima – Dinaledi Transmission lines and the proposed new Spitskop and Dinaledi substation upgrades will have on the visual and aesthetic environment.

7.2 Intensity of Visual Impact

The intensity of visual impact is determined using visibility, visual intrusion, visual exposure and viewer sensitivity criteria. When the intensity of impact is qualified with spatial, duration and probability criteria the significance of the impact can be predicted (refer to Appendices B and C).

Visual intrusion deals with the notion of contextualism i.e. how well does a project component fit into the natural and cultural aesthetic of the landscape as a whole? Generally, an object will have a greater negative impact on a landscape considered to have high visual quality than on a landscape of low quality, because it has the most to lose.

The consequence of the intrusion and hence the impact on the sense of place, can then be measured in terms of the sensitivity of the affected landscape resource given the criteria listed below.

- Does the development have a negative, positive, or neutral effect on the quality/sense of place of the landscape?
- Does the development enhance or contrast with the patterns or elements that define the structure of the landscape?
- Does the design of the project enhance and promote cultural continuity (existing land use and patterns) or does it disrupt it?

Visual exposure relates directly to the distance of the view. It is a criterion used to account for the limiting effect of increased distance on visual impact. The impact of an object diminishes at an exponential rate as the distance between the observer and the object increases. Thus, the visual impact at 1000 m would be 25% of the impact as viewed from 500 m. At 2000 m it would be 10% of the impact at 500 m. The concept of foreground, middleground and background are incorporated in the discussion of visual exposure. The foreground is considered as the area up to 1km from the viewer. The middleground extends to between 1 and 3km's, and the background is further than 7km's. This concept is graphically illustrated in Figure 7.

The scale and linear characteristics of this project necessitates the identification of specific potential conflict areas within the proposed corridor. These areas were identified by overlaying the Landscape Sensitivity (Figure 5) with the Viewer Sensitivity (Figure 6) and highlighting those zones where sensitive areas overlapped. Furthermore, specific sensitive zones as identified for each aspect such as topography or tourist facilities were also illustrated on this map. The result of this map would be discussed in terms of the intensity of the visual impact and the resultant significance of the impact for that specific area. Figure 8 graphically illustrates the location of these potential conflict areas.

7.2.1 Area 1

Located in the northern section, this area is characterized by typical mixed bushveld vegetation, with woodland and thicket. See View 27, Figure 18. The tree cover is taller towards the east than the west reflecting the change in topography to the east of this area (Waterberg). Nevertheless, the site itself is characterised by a predominant flat to rolling topography. Sensitive land uses in this area include not only a host of farmhouses, but also a prominent game lodge, a tourist attraction with tour operators and hunting farms. The tourist facility and lodge fall within 1km from the corridor, resulting in a potential high visual exposure as the proposed power line would be located in the foreground of views from these areas. It is however important to note that the area has already been compromised by the presence of a number of transmission line corridors crossing the area. This effectively decreases the visual intrusion of the proposed line. An authorised tourist route traverses this area, increasing its sensitivity. However, this area falls within the zone characterised by predominantly flat topography with woodland, leading to the fact that the visibility would be reduced in this area (see Section.6.3.2).

Table 3: Intensity of Visual impact: Area 1

High	Moderate	Low	Positive
If the proposed power lines: - Has a substantial negative effect on the visual quality of the landscape; - Contrasts dramatically with the patterns or elements that define the structure of the landscape; - Contrasts dramatically with land use, settlement or enclosure patterns *Result*: (intensity) Notable change in landscape characteristics over an extensive area and intensive change over a localised area.	If the proposed power lines: - Has a moderate negative effect on the visual quality of the landscape; - Contrasts moderately with the patterns or elements that define the structure of the landscape; - Is not compatible with land use, settlement or enclosure patterns. Result: (intensity) **Moderate change in landscape characteristics over localised area.**	If the proposed power lines: - Has a minimal effect on the visual quality of the landscape; - Contrasts minimally with the patterns or elements that define the structure of the landscape; - Is partially compatible with land use, settlement or enclosure patterns. *Result*: (intensity) Imperceptible change.	If the proposed power lines: - Has a beneficial effect on the visual quality of the landscape; - Enhances the patterns or elements that define the structure of the landscape; - Is compatible with land use, settlement or enclosure patterns. *Result*: (intensity) Positive change.

7.2.2 Area 2

Area 2 A:
This area is located immediately north of the Mokgalwana settlement. The vegetation to the west displays a disturbed quality due to the area's predominant agricultural land use. However, one of the specific conflicts within this area results form the presence of the prominent Mmumbana hill north of the settlement. The surrounding landscape is largely flat to rolling, with the hill being a beacon within the area, increasing its sensitivity. The proposed line corridor traverses the crest of the hill, which will result in the lines and pylons being highly visible as they break the horizon. This would result in a high visual intrusion and a high visual exposure, as the settlement fall within 3km from the proposed corridor. Furthermore, an existing lodge to the north of the hill is also located within the corridor and within viewing distance from Mmumbana hill. The lodge falls within 1km from the corridor, resulting in a potential high visual exposure as the proposed power line would be located in the foreground of views from this area. It should also be noted that this area has already been compromised by the presence of a number of transmission line corridors crossing the area to the west of the proposed corridor, which could potentially decrease the visual intrusion.

Area 2 B:
The proposed corridor to the east traverses a highly sensitive crest of a ridge. This would result in the proposed lines being highly visible as they break the horizon line. The undisturbed and natural character of the surrounding landscape increases the sensitivity of this area. A number of game farms are located in the expansive area north of the range of hills. The views to the south include large agricultural fields and other infrastructure. This area itself has however not been compromised in any way by existing power lines or other infrastructure and is considered highly sensitive in terms of its inherent visual value.

Table 4: Intensity of Visual impact: Area 2

High Area 2 B	Moderate Area 2 A	Low	Positive
If the proposed power lines: - Has a substantial negative effect on the visual quality of the landscape; - Contrasts dramatically with the patterns or elements that define the structure of the landscape; - Contrasts dramatically with land use, settlement or enclosure patterns *Result*: (intensity) **Notable change in landscape characteristics over an extensive area and intensive change over a localised area.**	If the proposed power lines: - Has a moderate negative effect on the visual quality of the landscape; - Contrasts moderately with the patterns or elements that define the structure of the landscape; - Is not compatible with land use, settlement or enclosure patterns. Result: (intensity) **Moderate change in landscape characteristics over localised area.**	If the proposed power lines: - Has a minimal effect on the visual quality of the landscape; - Contrasts minimally with the patterns or elements that define the structure of the landscape; - Is partially compatible with land use, settlement or enclosure patterns. *Result*: (intensity) Imperceptible change.	If the proposed power lines: - Has a beneficial effect on the visual quality of the landscape; - Enhances the patterns or elements that define the structure of the landscape; - Is compatible with land use, settlement or enclosure patterns. *Result*: (intensity) Positive change.

7.2.3 Area 3

Area 3 A:
This is the largest potential conflict area, representing a stretch of land emanating from the Dinaledi substation towards the north, converging with the R511 towards Thabazimbi. The large concentration of game farms and lodges presents the predominant sensitive land use within this area. The area's sensitivity is exacerbated by the presence of settlements in the south and a number of farmsteads scattered throughout. The landscape presents undisturbed natural characteristics, with a rolling topography emphasised by the presence of sporadic rocky outcrops occurring throughout. It is again important to state that this specific area has already been compromised by the presence of existing lines and other infrastructure, which would diminish its impact. Most of the lodges within this area are located within 1km from the proposed corridor, increasing its visual exposure.

Area 3 B:
The R511 constitutes an unauthorised tourist route leading to the many tourist attractions of not only this specific area but also to the north. Roughly 10km of the proposed corridor would travel alongside this route, being highly visible to all users. The predominant land use along this section of the route is agriculture to the south and game farms to the north. The topography ranges from flat to gently rolling, increasing the potential visibility of the lines. The visual exposure of this section of the corridor would be high, as most views towards the proposed lines along the 10km stretch of the route would be in the foreground.

Table 5: Intensity of Visual impact: Area 3

High	Moderate Area 3 A & B	Low	Positive
If the proposed power lines: - Has a substantial negative effect on the visual quality of the landscape; - Contrasts dramatically with the patterns or elements that define the structure of the landscape; - Contrasts dramatically with land use, settlement or enclosure patterns *Result*: (intensity) Notable change in landscape characteristics over an extensive area and intensive change over a localised area.	If the proposed power lines: - Has a moderate negative effect on the visual quality of the landscape; - Contrasts moderately with the patterns or elements that define the structure of the landscape; - Is not compatible with land use, settlement or enclosure patterns. Result: (intensity) **Moderate change in landscape characteristics over localised area.**	If the proposed power lines: - Has a minimal effect on the visual quality of the landscape; - Contrasts minimally with the patterns or elements that define the structure of the landscape; - Is partially compatible with land use, settlement or enclosure patterns. *Result*: (intensity) Imperceptible change.	If the proposed power lines: - Has a beneficial effect on the visual quality of the landscape; - Enhances the patterns or elements that define the structure of the landscape; - Is compatible with land use, settlement or enclosure patterns. *Result*: (intensity) Positive chge.

(Note: Area 4 is discussed in the Matimba – Marang report)

7.3 Significance of Visual Impact

Table 6 below summarises the results of the criteria (refer to Appendix C for description of criteria) used to determine the significance of the visual impact. These results are based on worst-case scenarios when the impact of all aspects is taken together.

Visual resource impacts would result from the construction, operation, and maintenance of the proposed 400kV transmission lines. Specifically, impacts would result from the line being seen from sensitive viewpoints and from effects to the scenic values of the landscape. Impacts to views are the highest when viewers are identified as being sensitive to change in the landscape, and their views are focused on and dominated by the change. Visual impacts occur when changes in the landscape are noticeable to viewers looking at the landscape from their homes or from recreation and tourist destinations, travel routes, and especially in foreground views. The significance of visual impact is predicted using the worst-case operational scenario and is summarized for each alternative route in the tables below.

Mitigation measures to reduce the visual impact of 400kv power transmission lines are not generally possible after the alignment has been determined. Screening measures from sensitive viewing areas are difficult due to the open nature of the landscape and the harsh climatic conditions that would make it difficult to grow trees, which in any event would look out of place in the semi-arid landscape. To this end no mitigation measures, other than the preferred route alignment and specific measures for the mitigation of potential conflict areas have been proposed.

According to the results tabulated below in Table 6 the Visual Impact during the construction phase and operational phases will be moderate assuming that mitigation measures are adequately implemented.

Table 6: Visual Impacts Area 1

Issue/Impact	Impact					Significance
	Nature	Extent	Duration	Magnitude	Probability	
The power transmission line will cause a moderate change in landscape characteristics over an extensive area resulting in a moderate change to key views. Operational activities will add to the cumulative negative effect on the visual quality of the landscape.	Negative	2	4	6	4	**48 Medium**
Corrective / Mitigation Measures	Ensure that the proposed corridor runs adjacent to the existing lines.					

Table 7: Visual Impacts Area 2 A

Issue/Impact	Impact					Significance
	Nature	Extent	Duration	Magnitude	Probability	
The power transmission line will cause a moderate change in landscape characteristics over an extensive area resulting in a moderate change to key views. Operational activities will add to the cumulative negative effect on the visual quality of the landscape.	Negative	2	4	6	4	**48 Medium**
Corrective / Mitigation Measures	The crest of the Mmumbana hill should be avoided at all costs. The corridor should be positioned at the base of the hill, preferably to the west of it to screen some views from the nearby settlement.					

Table 8: Visual Impacts Area 2 B

Issue/Impact	Impact					Significance
	Nature	Extent	Duration	Magnitude	Probability	
The power transmission lines will cause a notable change in landscape characteristics over an extensive area (alternative 1A) and/or intensive change over a localized area resulting in major changes in key views (from N10 and at Orange River).	Negative	2	4	8	4	**56 Medium**
Corrective / Mitigation Measures	Avoid the crest of the ridge at all costs. It is recommended that this option be avoided due to the sensitive nature of the visual environment.					

Table 9: Visual Impacts Area 3 A

Issue/Impact	Impact					Significance
	Nature	Extent	Duration	Magnitude	Probability	
The power transmission line will cause a moderate change in landscape characteristics over an extensive area resulting in a moderate change to key views. Operational activities will add to the cumulative negative effect on the visual quality of the landscape.	Negative	2	4	6	4	**48 Medium**
Corrective / Mitigation Measures	It is proposed that the corridor be shifted north so as to avoid sensitive views from lodge and game farming and hunting areas.					

Table 9: Visual Impacts Area 3 B

Issue/Impact	Impact					Significance
	Nature	Extent	Duration	Magnitude	Probability	
The power transmission line will cause a moderate change in landscape characteristics over a localized area resulting in a moderate change to key views. Operational activities will add to the cumulative negative effect on the visual quality of the landscape.	Negative	2	4	6	4	**48 Medium**
Corrective / Mitigation Measures	It is proposed that the corridor be positioned in such a way that the R511 is only crossed at a single point. The crossing point of the existing power line is a preferable position.					

8.0 CONCLUSION

Due to the linear nature of the project, a number of potential conflict areas in terms of their potential visual impact had been identified. These potential conflict areas have been rated in terms of the intensity of visual impact and the significance of each impact. Concluding from the rating and assessment of each area, it can be surmised that the construction of the two 400kV lines from Matimba B to Dinaledi sub station would have a ***moderate negative*** impact on the surrounding landscape. It is however imperative that the specific potential conflict areas be considered and the mitigation measures successfully implemented.

Figure 9 indicates the preferred corridors, eliminating those options that feature too many potential conflict areas or landscapes with a high landscape sensitivity / visual resource value. These should however not be considered ithe final corridor, as the mitigation measures for the potential conflict areas on these lines should be incorporated in the placement of the final corridors.

The following general mitigation measures should be followed for the entire project:

- The proposed corridor should never be allowed to traverse the crest of a hill. All lines should be located at the base of a hill and continued along the valleys encompassed by hills.
- Where possible, the proposed corridor should continue adjacent to an existing corridor.
- The mixing of pylon-types should be avoided to reduce visual conglomeration and create the illusion of visual harmony.

9.0 REFERENCES

Australian Heritage Commission (1999), *Protecting Local Heritage Places*, Australian Heritage Commission, Canberra.

Crawford, D., (1994), Using remotely sensed data in landscape visual quality assessment, *Landscape and Urban Planning.* 30: 71-81.

Hull, R.B. and Bishop, I.E. (1988), Scenic Impacts of Electricity Transmission Mine: The Influence of Landscape Type and Observer Distance. *Journal of Environmental Management.* 1988 (27) 99-108.

The Landscape Institute with the Institute of Environmental Management and Assessment (2002), *Guidelines for Landscape and Visual Impact Assessment Second Edition,* Spon Press, London

Institute of Environmental Assessment & The landscape Institute (1996), *Guidelines for Landscape and Visual Impact Assessment,* E & FN Spon, London

Ittelson, W.H., Proshansky, H.M., Rivlin, L.g. and Winkel, G.H. (1974). *An Introduction to Environmental Psychology.* Holt, Rinehart and Winston, New York.

Lange, E. (1994), Integration of computerized visual simulation and visual assessment in environmental planning. *Landscape and Environmental Planning.* 30: p 99-112.

Lynch, K. (1992). *Good City Form*, The MIT Press, London. p131

Ramsay, J. (October 1993). Identification and assessment of aesthetic values in two Victorian forest regions. *More than meets the eye: identifying and assessing aesthetic value.* Report of the Aesthetic Value Workshop held at the University of Melbourne.

Schapper, J. (October 1993). The importance of aesthetic value in the assessment of landscape heritage. *More than meets the eye: identifying and assessing aesthetic value.* Report of the Aesthetic Value Workshop held at the University of Melbourne.

Warnock, S. & Brown, N., Putting Landscape First. *Landscape Design.* No. 268 March 1998. p 44-46.

Appendix A: **Determining a Landscape and Visual Resource**

Appendix B: **Method for Determining the Intensity of Landscape and Visual Impact**

Appendix C: **Significance of Impact Assessment Methodology**

Appendix D: **Criteria for Photo/Computer Simulation**

Appendix A: Determining a Landscape and Visual Resource

In order to reach an understanding of the effect of development on a landscape resource, it is necessary to consider the different aspects of the landscape as follows:

Landscape Elements and Character
The individual elements that make up the landscape, including prominent or eye-catching features such as hills, valleys, woods, trees, water bodies, buildings and roads. They are generally quantifiable and can be easily described.

Landscape character is the description of pattern, resulting from particular combinations of natural (physical and biological) and cultural (land use) factors and how people perceive these. The visual dimension of the landscape is a reflection of the way in which these factors create repetitive groupings and interact to create areas that have a specific visual identity. The process of landscape character assessment can increase appreciation of what makes the landscape distinctive and what is important about an area. The description of landscape character thus focuses on the *nature of the land*, rather than the response of a viewer.

Landscape Quality and Aesthetic Value
Studies for perceptual psychology have shown human preference for landscapes with a higher visual complexity particularly in scenes with water, over homogeneous areas. On the basis of contemporary research landscape quality increases when:

- Topographic ruggedness and relative relief increase;
- Where water forms are present;
- Where diverse patterns of grasslands and trees occur;
- Where natural landscape increases and man-made landscape decreases;
  And where land use compatibility increases and land use edge diversity decreases (Crawford 1994).

Aesthetic value is the emotional response derived from the experience of the environment with its particular natural and cultural attributes. The response can be either to visual or non-visual elements and can embrace sound, smell and any other factor having a strong impact on human thoughts, feelings and attitudes (Ramsay 1993). Thus aesthetic value encompasses more than the seen view, visual quality or scenery, and includes atmosphere, landscape character and sense of place (Schapper 1993). Refer also to Appendix A for further elaboration.

Aesthetic appeal (value) is considered high when the following are present (Ramsay 1993):

- *Abstract qualities*: such as the presence of vivid, distinguished, uncommon or rare features or abstract attributes;
- *Evocative responses*: the ability of the landscape to evoke particularly strong responses in community members or visitors;
- *Meanings*: the existence of a long-standing special meaning to a particular group of people or the ability of the landscape to convey special meanings to viewers in general;
- *Landmark quality*: a particular feature that stands out and is recognised by the broader community.

Sense of Place
Central to the concept of a sense of place is that the place requires uniqueness and distinctiveness. The primary informant of these qualities is the spatial form and character of the natural landscape together with the cultural transformations and traditions associated with historic use and habitation. According to Lynch (1992) sense of place "is the extent to which a person can recognize or recall a place as being distinct from other places - as having a vivid, or unique, or at least particular, character of its own". Sense of place is the unique value that is allocated to a specific place or area through the cognitive experience of the user or viewer. In some cases these values allocated to the place are similar for a wide spectrum of users or viewers, giving the place a universally recognized and therefore, strong sense of place.

Quality (value) of Visual Resource

In determining the quality of the visual resource both the objective and the subjective or aesthetic factors associated with the landscape are considered. Many landscapes can be said to have a strong sense of place, regardless of whether they are considered to be scenically beautiful but where landscape quality, aesthetic value and a strong sense of place coincide - the visual resource or perceived value of the landscape is considered to be very high.

When considering both objective and subjective factors associated with the landscape there is a balance between landscape character and individual landscape features and elements, which would result in the values as follows:

Value of Visual Resource

(After The Landscape Institute with the Institute of Environmental Management and Assessment (2002)

High	Moderate	Low
Areas that exhibit a very positive character with valued features that combine to give the experience of unity, richness and harmony. These are landscapes that may be considered to be of particular importance to conserve and which may be sensitive change in general and which may be detrimental if change is inappropriately dealt with.	Areas that exhibit positive character but which may have evidence of alteration to /degradation/erosion of features resulting in areas of more mixed character. Potentially sensitive to change in general; again change may be detrimental if inappropriately dealt with but it may not require special or particular attention to detail.	Areas generally negative in character with few, if any, valued features. Scope for positive enhancement frequently occurs.

Appendix B: Method for Determining the Intensity of Landscape and Visual Impact

For some topics, such as water or air quality, it is possible to use measurable, technical international or national guidelines or legislative standards, against which potential effects can be assessed. The assessment of likely effects on a landscape resource and on visual amenity is more complex, since it is determined through a combination of quantitative and qualitative evaluations. (The Landscape Institute with the Institute of Environmental Management and Assessment (2002).

Landscape impact assessment includes a combination of objective and subjective judgements, and it is therefore important that a structured and consistent approach is used. It is necessary to differentiate between judgements that involve a degree of subjective opinion (as in the assessment of landscape value) from those that are normally more objective and quantifiable (as in the determination of intensity of change). Judgement should always be based on training and experience and be supported by clear evidence and reasoned argument. Accordingly, suitably qualified and experienced landscape professionals carry out landscape and visual impact assessments (The Landscape Institute with the Institute of Environmental Management and Assessment (2002),

Landscape and visual assessments are separate, although linked, procedures. The landscape baseline, its analysis and the assessment of landscape effects all contribute to the baseline for visual assessment studies. The assessment of the potential effect on the landscape is carried our as an effect on an environmental resource, i.e. the landscape. Visual effects are assessed as one of the interrelated effects on population.

Landscape Effects (impact)
Landscape effects derive from changes in the physical landscape, which may give rise to changes in its character and how this is experienced. This may in turn affect the perceived value ascribed to the landscape. The description and analysis of effects on a landscape resource relies on the adoption of certain basic principles about the positive (or beneficial) and negative (or adverse) effects of change in the landscape. Due to the inherently dynamic nature of the landscape, change arising from a development may not necessarily be significant (Institute of Environmental Assessment & The Landscape Institute (2002)).

Visual effects (impact)
Visual effects relate to the changes that arise in the composition of available views as a result of changes to the landscape, to people's responses to the changes, and to the overall effects with respect to visual amenity. Visual impact is therefore measured as the change to the existing visual environment (caused by the physical presence of a new development) and the extent to which that change compromises (negative impact) or enhances (positive impact) or maintains the visual quality of the area.

To assess the intensity of visual impact four main factors are considered.

Visual Intrusion:	The nature of intrusion (physical characteristics) of a project component on the visual quality of the surrounding environment and its compatibility/discord with the landscape and surrounding land use;
Visibility:	The area/points from which project components will be visible;
Visual exposure:	Visibility and visual intrusion qualified with a distance rating to indicate the degree of intrusion;
Sensitivity:	Sensitivity of visual receptors to the proposed development.

Visual Intrusion
Visual intrusion deals with the notion of contextualism i.e. how well does a project component fit into the ecological and cultural aesthetic of the landscape as a whole? Generally, an object will have a greater negative impact on scenes considered to have high visual quality than on scenes of low quality because the most scenic view has the >most to lose=.

Photographic panoramas from key viewpoints before and after development are presented to illustrate the nature and change to the landscape created by the proposed development. A computer simulation technique is employed to superimpose a graphic of the development onto the panorama.

The extent to which the component fits or contrasts with the landscape setting can then be assessed using the following criteria.

- Does the physical development concept have a negative, positive or neutral effect on the quality of the landscape?
- Does the development enhance or contrast with the patterns or elements that define the structure of the landscape?
- Does the design of the project enhance and promote cultural continuity or does it disrupt it?

The consequence of the intrusion can then be measured in terms of the sensitivity of the affected landscape and visual resource given the criteria listed below. For instance, within an industrial area, a new sewage treatment works may have an insignificant landscape and visual impact; whereas in a *valued* landscape it might be considered to be an intrusive element. (Institute of Environmental Assessment & The landscape Institute (1996)).

Visual Intrusion (landscape receptor sensitivity)

High	Moderate	Low
If the physical presence of the project causes a notable change in landscape characteristics over an extensive area ranging to very intensive change over a more limited area; If the receiving landscape is of particular distinctive character susceptible to relatively small changes; Resulting in major changes in key views	If the physical presence of the project causes moderate changes in localised area; If the receiving landscape is moderately valued and is reasonable tolerant to change; Resulting in a moderate change to key views.	If the physical presence of the project causes virtually imperceptible change in any components of the landscape; If the receiving landscape is relatively unimportant, the nature of which is potentially tolerant of substantial change; Resulting in a minor change to key views.

Visual intrusion also diminishes with scenes of higher complexity, perhaps, as distance increases, the object becomes less of a focal point (more visual distraction), and the observer=s attention is diverted by the complexity of the scene (Hull and Bishop (1988)).

Visibility

A viewshed analysis was carried out to define areas, which contain all possible observation sites from which the development would be visible.

Topographic data was captured for the site and its environs at 10 m contour intervals to create the Digital Terrain Model (DTM). The DTM includes features such as vegetation, rivers, roads and nearby urban areas. These features were 'draped' over the topographic data to complete the model used to generate the viewshed analysis. The visibility of a development and its contribution to visual impact is predicted using the criteria listed below:

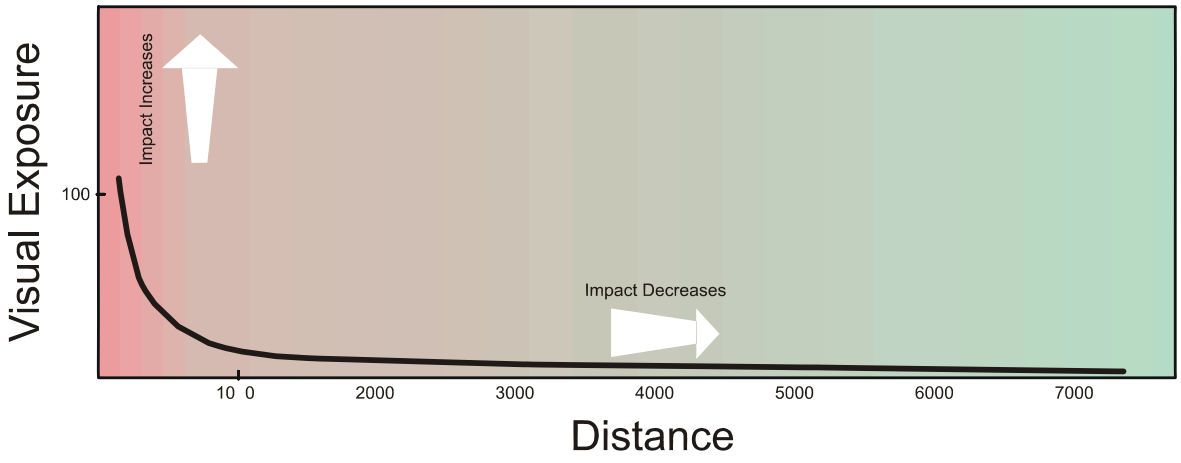
Visibility

High	Moderate	Low
Visual Receptors If the development is visible from over half the zone of potential influence, and/or views are mostly unobstructed and/or the majority of viewers are affected.	*Visual Receptors* If the development is visible from less that half the zone of potential influence, and/or views are partially obstructed and or many viewers are affected	*Visual Receptors* If the development is visible from less than a quarter of the zone of potential influence, and/or views are mostly obstructed and/or few viewers are affected.

Visual Exposure

Visual exposure relates directly to the distance of the view. It is a criterion used to account for the limiting effect of increased distance on visual impact. The impact of an object diminishes at an exponential rate as the distance between the observer and the object increases. Thus, the visual impact at 1000 m would be 25% of the impact as viewed from 500 m. At 2000 m it would be 10% of the impact at 500 m. The inverse relationship of distance and visual impact is well recognised in visual analysis literature (e.g.: Hull and Bishop (1988)) and is used as an important criteria for the study. This principle is illustrated in the figure below.

Effect of Distance on Visual Exposure



Sensitivity of Visual Receptors

When visual intrusion, visibility and visual exposure are incorporated, and qualified by sensitivity criteria (visual receptors) the intensity of the impact of the development can be determined.

High	Moderate	Low
For example viewed from residential properties, public rights of way, tourist attractions and or the majority of the I&AP's are opposed to the proposed extension to the power lines.	For example sporting and recreational facilities and/or there is a split between I&AP's who either support or oppose the proposed extension to the power lines.	For example, industry or mining and/or most I&AP's are supportive of the proposed extension to the power lines.

Intensity of the Visual Impact

The intensity of impact is assessed through a synthesis of visual intrusion, visibility, visual exposure and viewer sensitivity criteria. Once the intensity of impact has been established this value is further qualified with spatial, duration and probability criteria to determine the *significance* of the visual impact.

For instance, the fact that visual intrusion and exposure diminishes significantly with distance does not necessarily imply that the relatively small impact that exists at greater distances is unimportant. The level of impact that people consider acceptable may be dependent upon the purpose they have in viewing the landscape. A particular development may be unacceptable to a hiker seeking a natural experience, or a household whose view is impaired, but may be barely noticed by a golfer concentrating on his game or a commuter trying to get to work on time (Ittleson *et al.,* 1974).

In synthesising these criteria a numerical or weighting system is avoided. Attempting to attach a precise numerical value to qualitative resources is rarely successful, and should not be used as a substitute for reasoned professional judgement. (Institute of Environmental Assessment & The landscape Institute (1996)).

Appendix C: Method of Assessing Significant Impacts

Method of Assessing Significant Impacts

The assessment of impacts will largely be based on DEAT's (1998) Guideline Document: EIA Regulations. The assessment will consider impacts arising from the construction and operation phases of the proposed project both before and after the implementation of appropriate mitigation measures.

It is proposed that the impacts will be assessed according to the criteria outlined below. Each issue is ranked according to extent, duration, magnitude (intensity) and probability. From these criteria, a significance rating is obtained, the method and formula is described below.

Nature of Impact

The impacts are to be assessed as either having a:

- negative effect (i.e. at a `cost' to the environment),
- positive effect (i.e. a `benefit' to the environment), or
- neutral effect on the environment.

Extent of the Impact

(**1**) Site (i.e. within the boundaries of the study area),
(**2**) Local (i.e. the area within 10 km of the study area),
(**3**) Municipal
(**4**) Provincial (i.e. Northern Cape Province),
(**5**) National (i.e. South Africa), or
(**6**) International (i.e. Southern Africa and beyond).

Duration of the Impact

The length that the impact will last for is described as either:
(**1**) immediate (>1 year)
(**2**) short term (1-5 years),
(**3**) medium term (6-15 years),
(**4**) long term (the impact will cease after the operational life span of the project),
(**5**) permanent (no mitigation measure of natural process will reduce the impact after construction).

Magnitude of the Impact

The intensity or severity of the impacts is indicated as either:
(**0**) none (where the aspect will have no impact on the environment),
(**2**) Minor (where the impact affects the environment in such a way that natural, cultural and social functions and processes are not affected),
(**4**) Low (where the impact affects the environment in such a way that natural, cultural and social functions and processes are slightly affected),
(**6**) Moderate (where the affected environment is altered but natural, cultural and social functions and processes continue albeit in a modified way),
(**8**) High (where natural, cultural or social functions or processes are altered to the extent that it will temporarily cease), or
(**10**) Very high / don't know (where natural, cultural or social functions or processes are altered to the extent that it will permanently cease).

Probability of Occurrence

The likelihood of the impact actually occurring is indicated as either:
(**0**) None (the impact will not occur),
(**1**) improbable (the possibility of the impact materialising is very low as a result of design, historic experience, or implementation of adequate corrective actions)
(**2**) low probability (there is a possibility that the impact will occur),
(**3**) medium probability (the impact may occur),
(**4**) high probability (it is most likely that the impact will occur), or
(**5**) definite / don't know (the impact will occur regardless of the implementation of any prevention or corrective actions, or you don't know what the probability will be based on too little published information).

Significance of the Impact

Based on the information contained in the points above, the potential impacts are assigned a significance weighting (**S**). This weighting is formulated by adding the sum of the numbers assigned to extent (**E**), duration (**D**) and magnitude (**M**) and multiplying this sum by the probability (**P**) of the impact.

S=(E+D+M)P

The significance weightings are given below:

- (**<30**) low (i.e. where this impact would not have a direct influence on the decision to develop in the area),
- (**30-60**) medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated),
- (**>60**) high (i.e. where the impact must have an influence on the decision process to develop in the area).

The above significance rating methodology is presented in tabular form below:

Table A: Summary of Significance Rating Methodology

Significance Rating

Nature	Magnitude	Duration	Extent	Probability
Positive	10- Very High/ Unsure (environmental functions* permanently ceases)	5- Permanent	5- International	5- Definite/ Don't know
Negative	8- High (environmental functions temporarily ceases)	4- Long term (ceases after operation life of activity)	4- National	4- Highly probable (most likely to occur)
	6- Moderate (environmental functions altered but continue)	3- Medium term (5-15 years)	3- Regional (e.g. provincial)	3- Medium probability (distinct probability that impact will occur)
	4- Low	2- Short term (0-5 years)	2- Local (limited to site boundary and immediate surrounds)	2- Low probability (unlikely to occur)
	2- Minor	1- Immediate	1- Site only	1- Improbable (probability very low due to design or experience)
	0- None			0- None

Combining the consequence (magnitude, duration, and extent) with the probability of occurrence provides an overall significance rating (i.e. (magnitude+duration+extent) multiplied by probability = significance). Based on the overall significance rating the impact is assigned as having a low, medium or high significance. The criteria for the significance categories are as follows: <30 points = low significance; > 30 and <60 points = medium significance; and >60 = high significance.

The significance ratings applied to each impact will be used to provide a quantitative comparative assessment of the alternatives being considered. In addition, professional expertise and opinion of the specialists and the environmental consultants will be applied to provide a qualitative comparison of the alternatives under consideration. This process will identify the best route alignment for the proposed development.

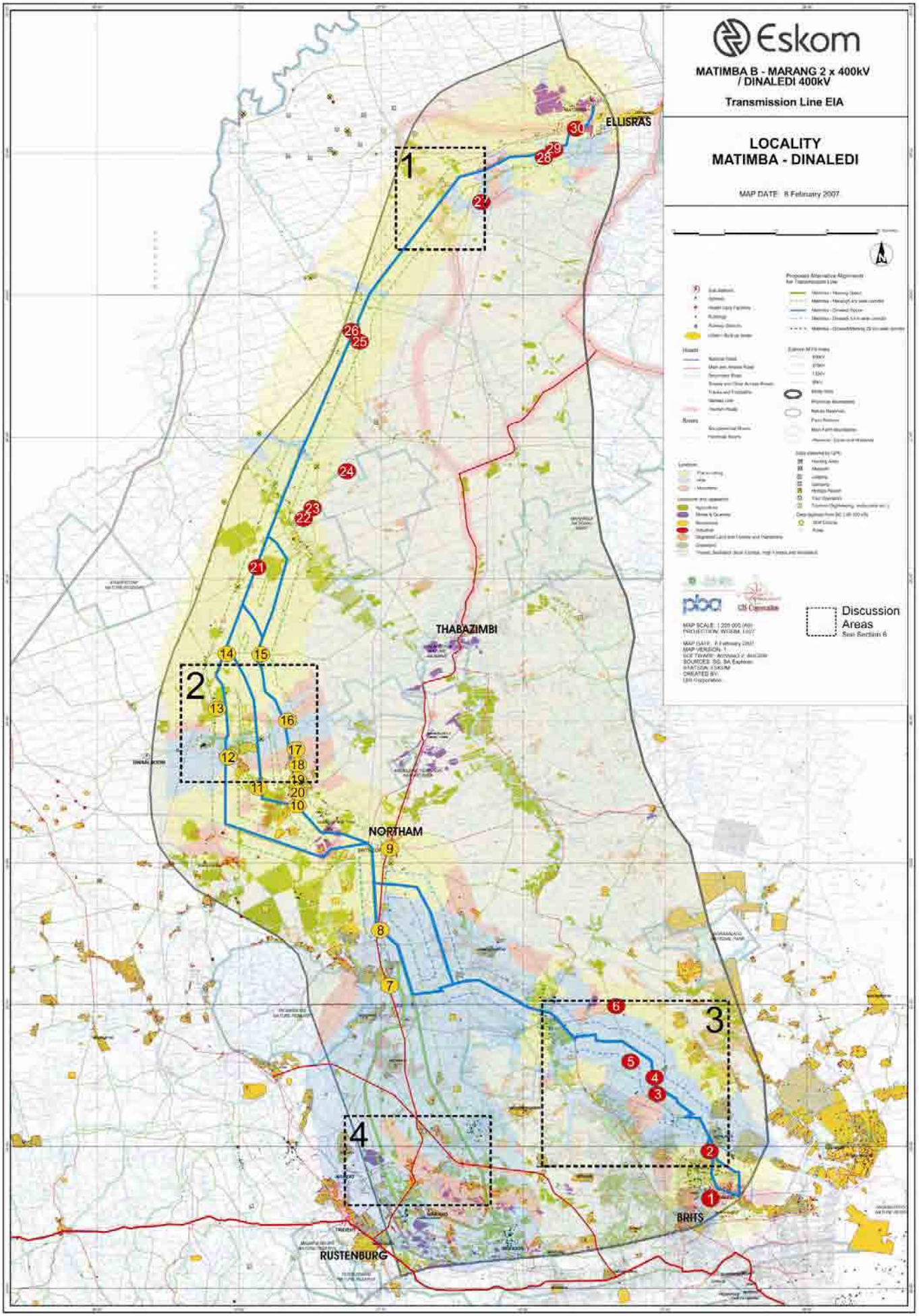


Figure 1 **LOCALITY** **Matimba B DINALEDI Transmission Line Integration**

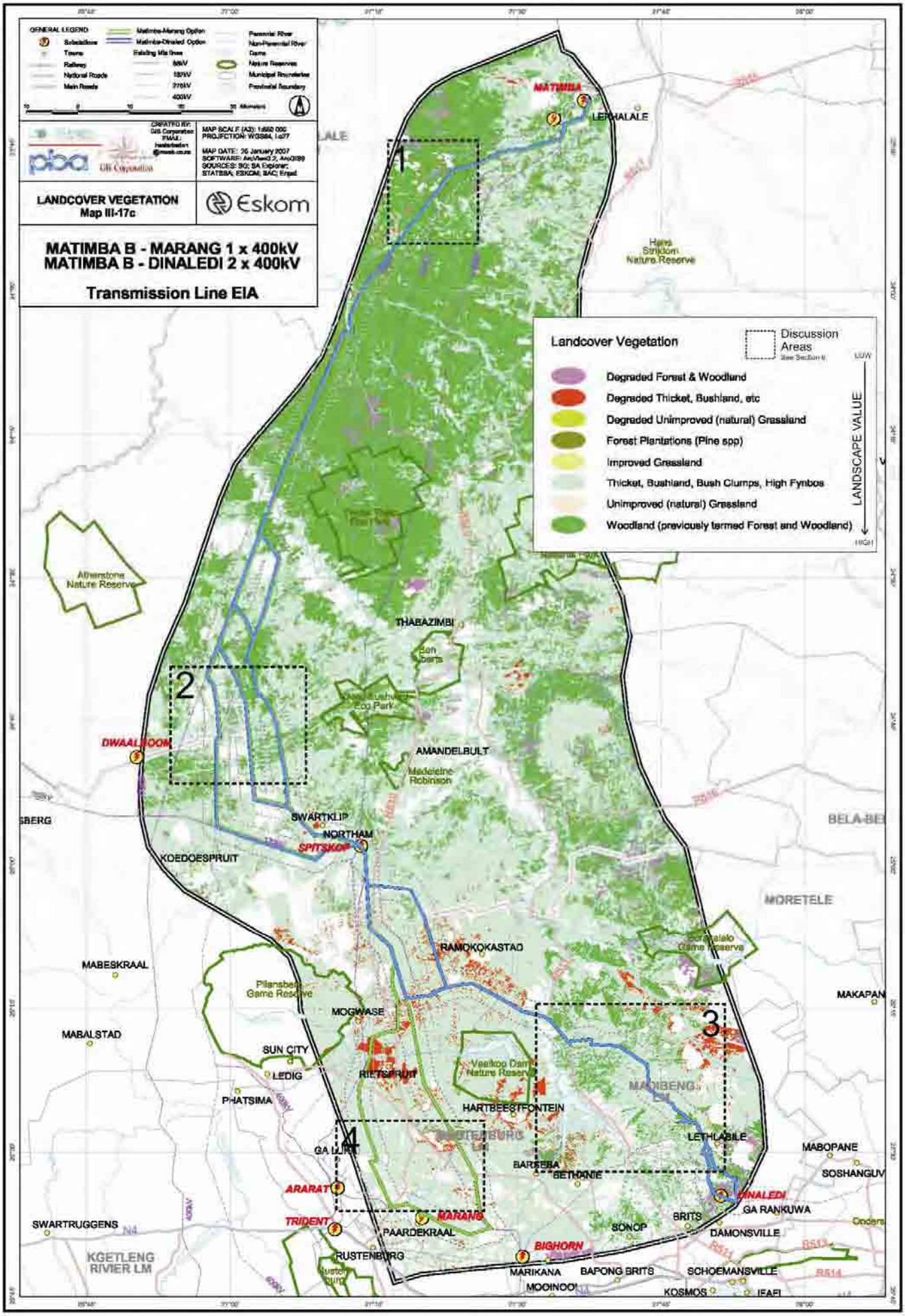


Figure 2 **VEGETATION** **Matimba B Transmission Line Integration**

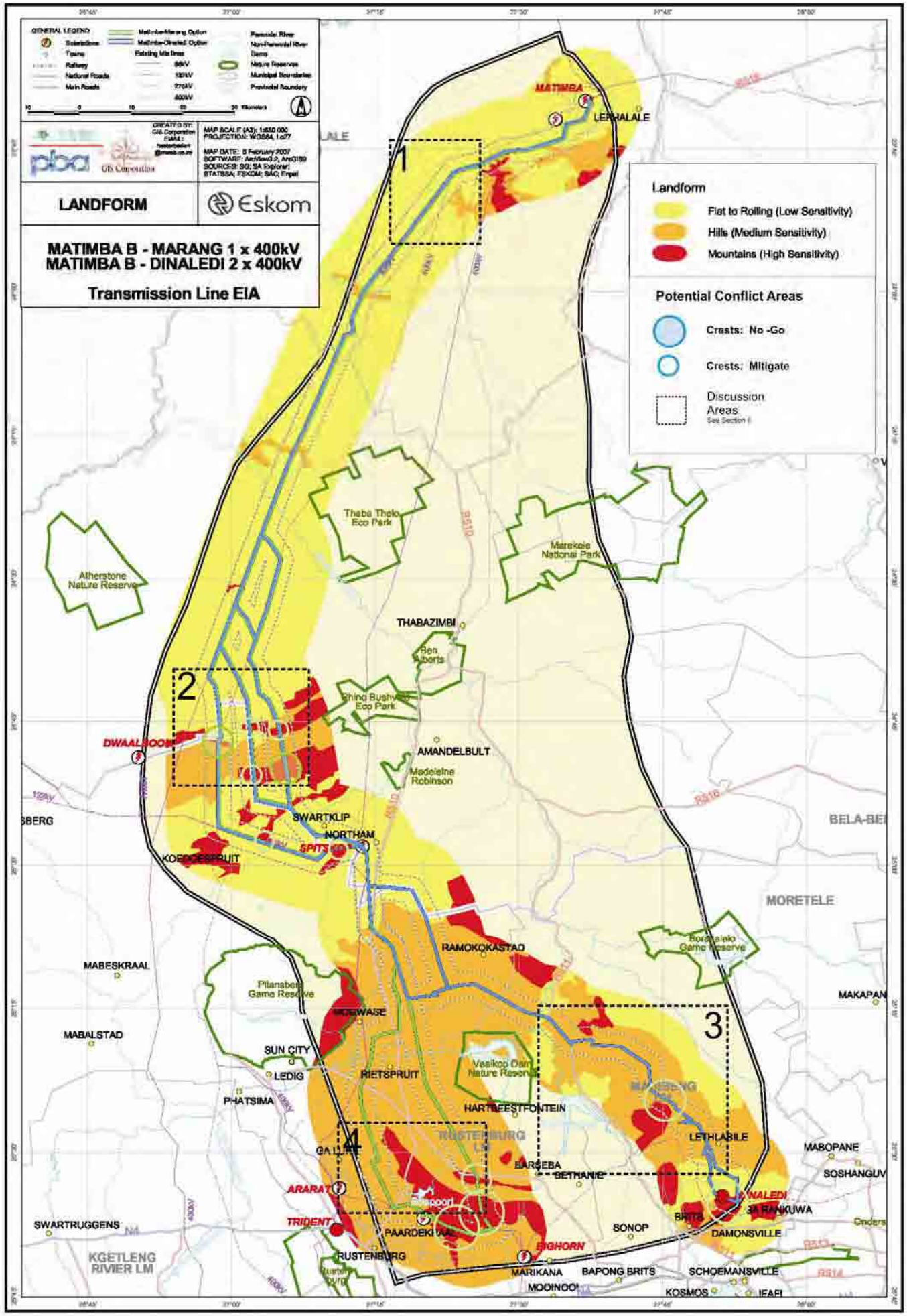


Figure 3 **LANDFORM** **Matimba B Transmission Line Integration**

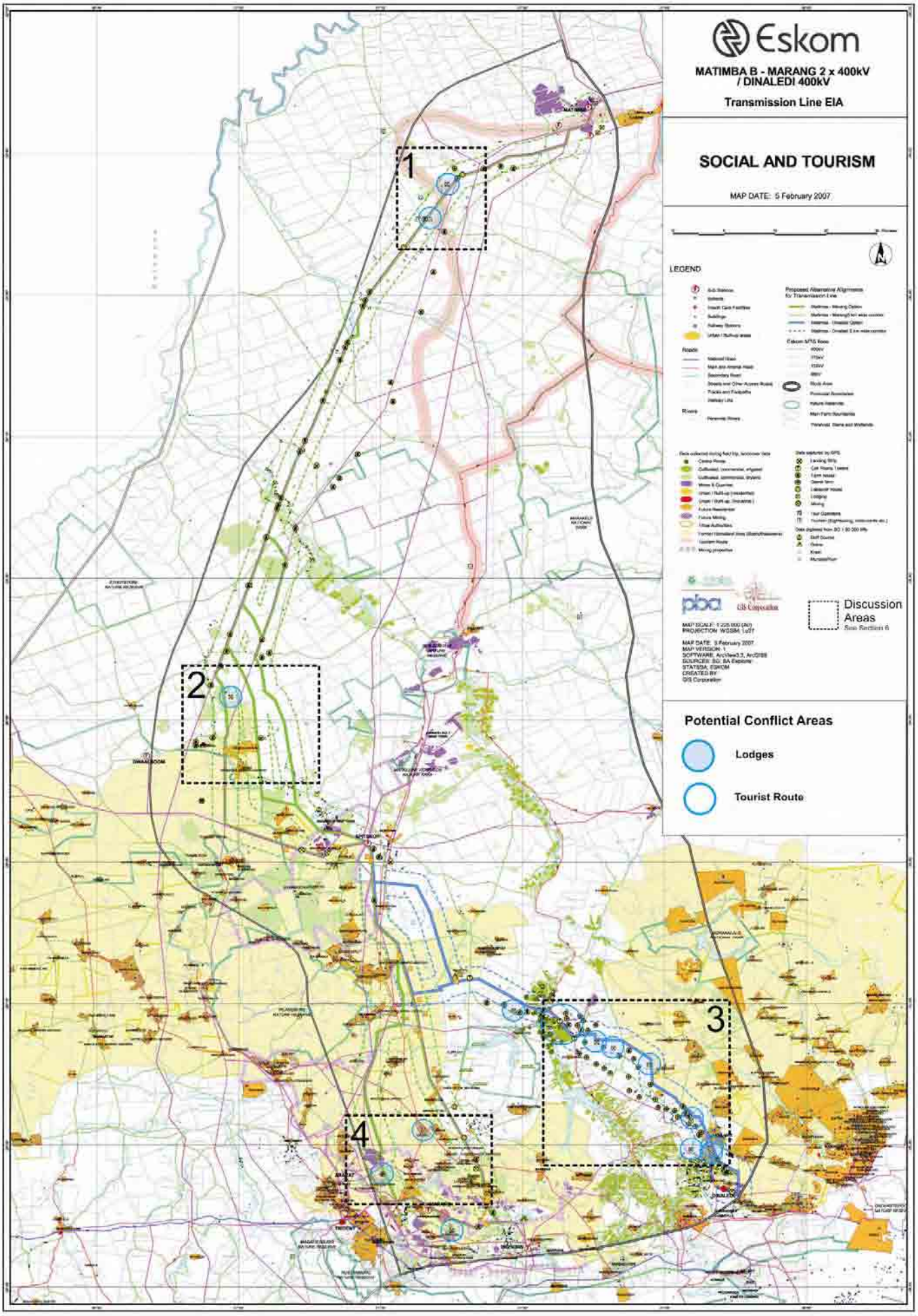


Figure 4 **RESIDENTIAL & TOURISM** **Matimba B Transmission Line Integration**

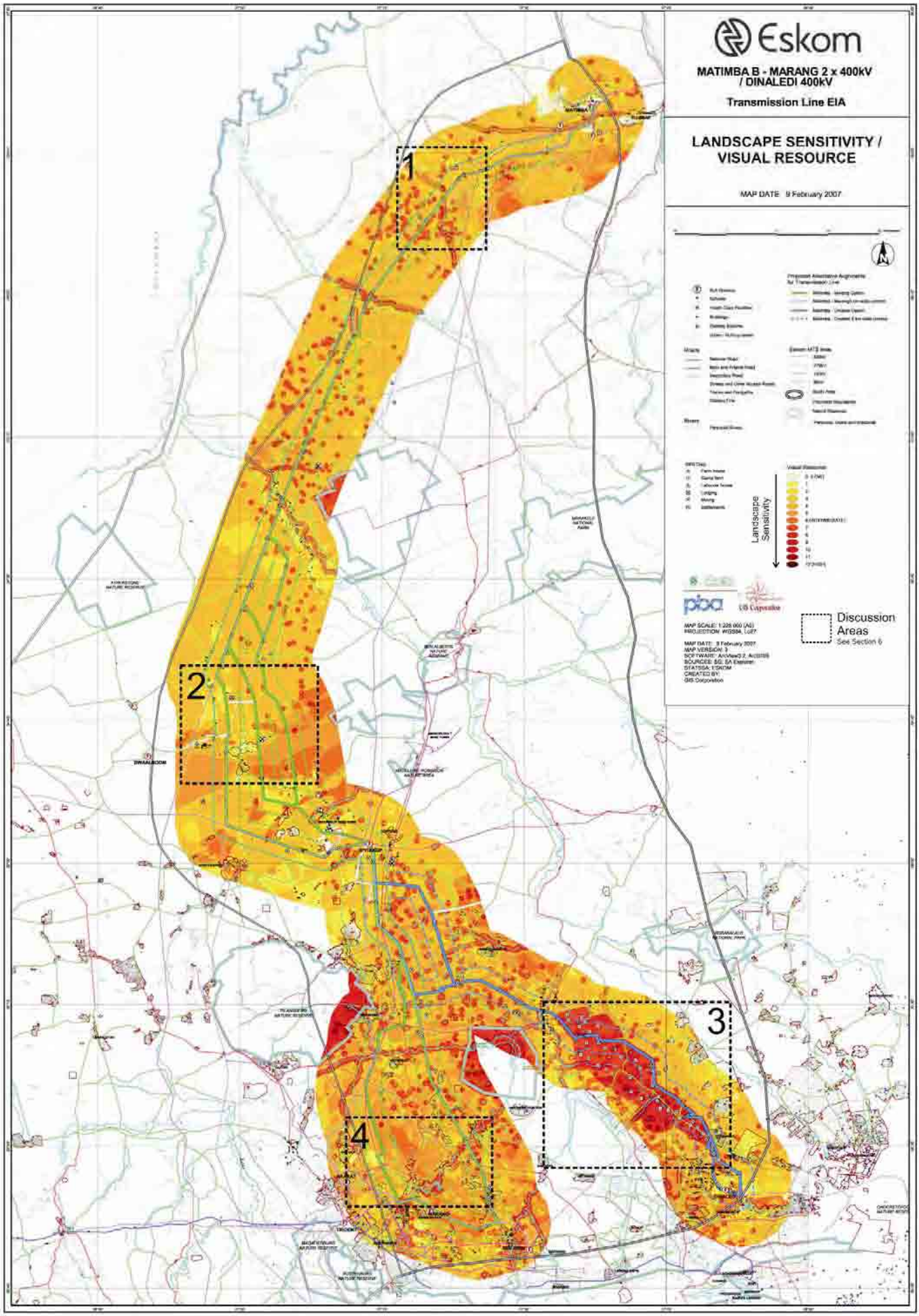


Figure 5 **LANDSCAPE SENSITIVITY** **Matimba B Transmission Line Integration**

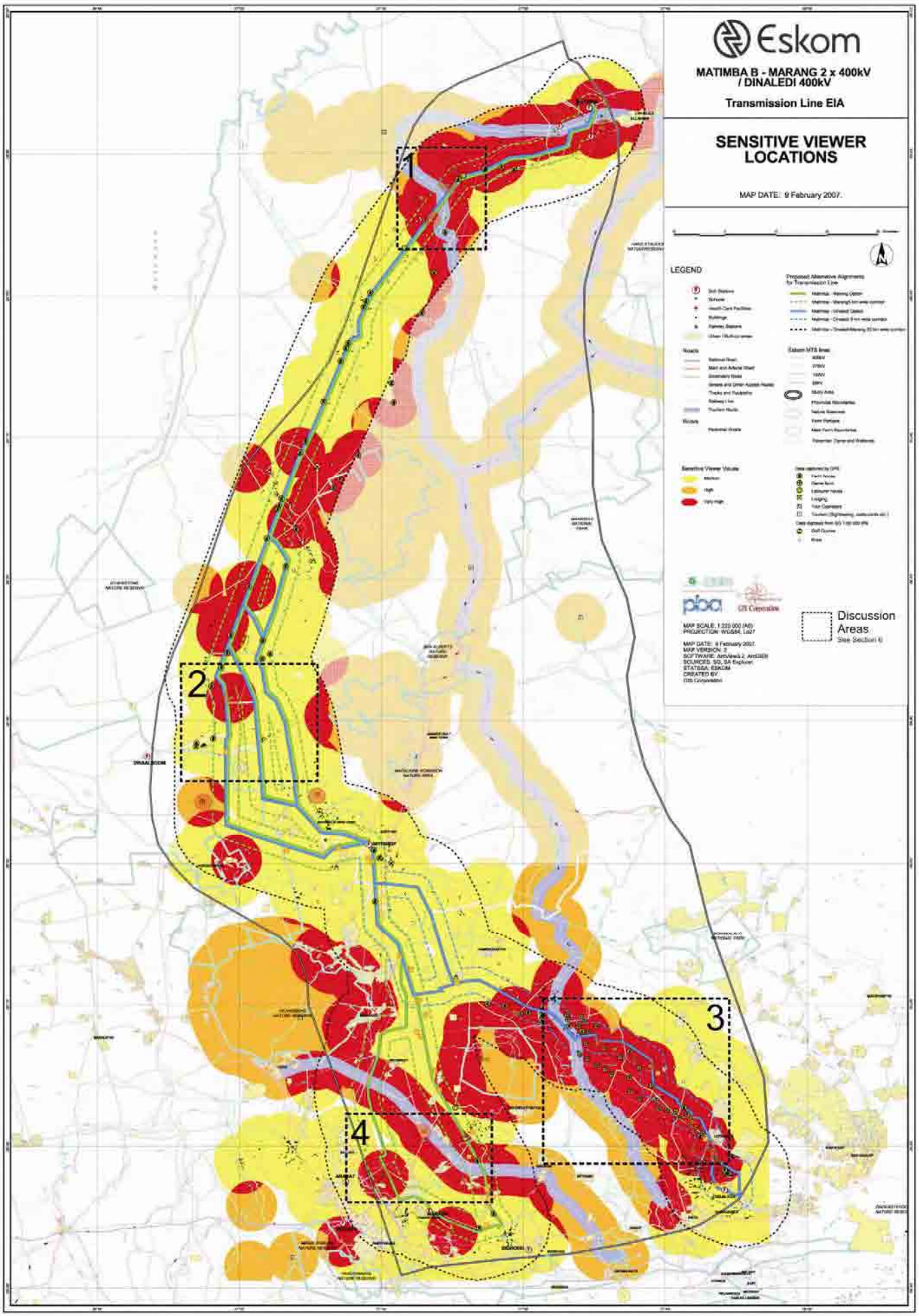


Figure 6 **VIEWER SENSITIVITY** **Matimba B Transmission Line Integration**

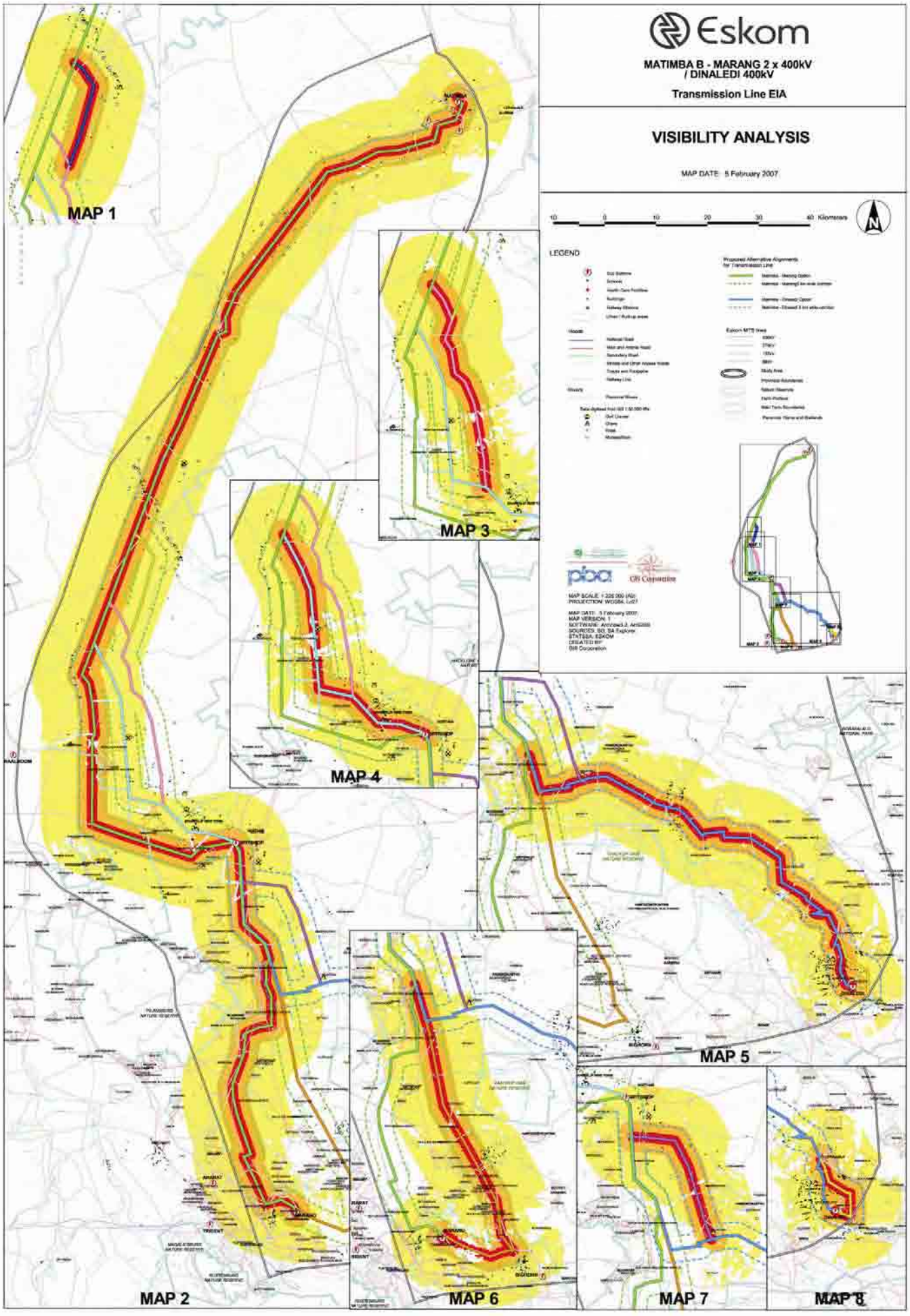


Figure 7 **VIEWSHED ANALYSIS** **Matimba B Transmission Line Integration**

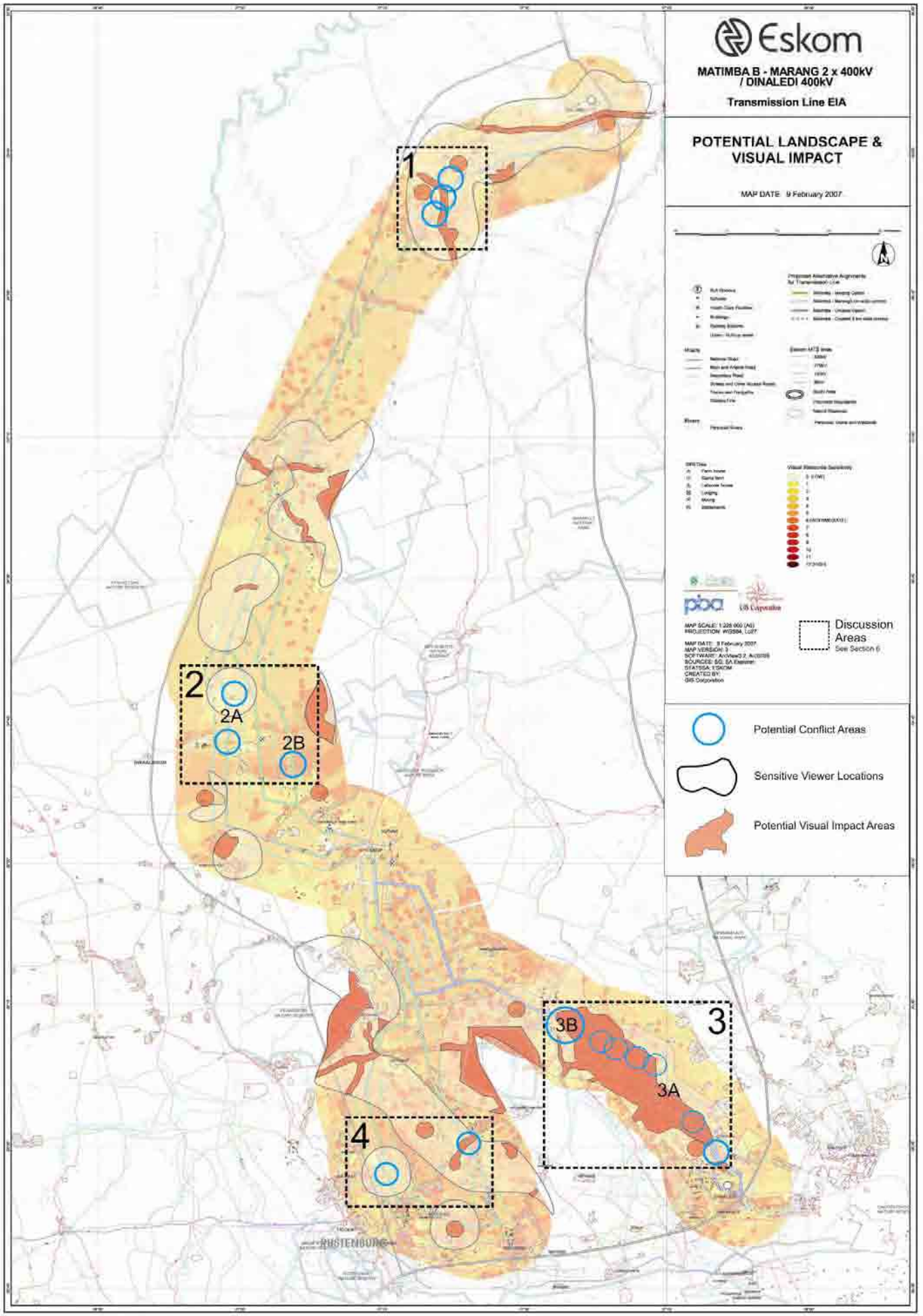


Figure 8 **POTENTIAL LANDSCAPE AND VISUAL IMPACT** **Matimba B Transmission Line Integration**

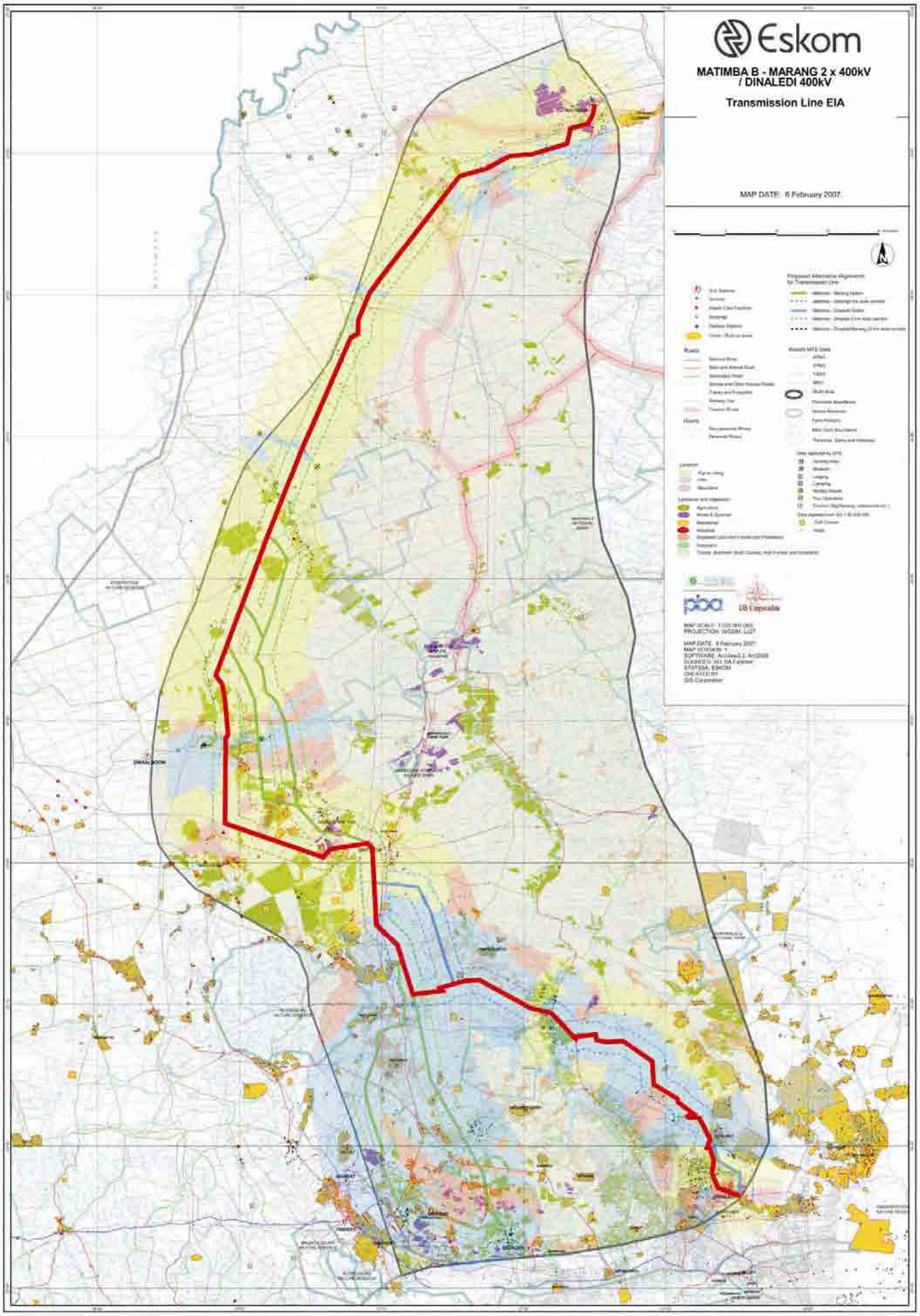


Figure 9 **PREFERRED ALIGNMENT: MATIMBA - DINALEDI** **Matimba B Transmission Line Integration**

View 1

View 2

View 3

Figure 10 **LANDSCAPE CHARACTER** **Matimba B DINALEDI Transmission Line Integration**

View 4

View 5

View 6

Figure 11 **LANDSCAPE CHARACTER** **Matimba B DINALEDI Transmission Line Integration**

View 7

View 8

View 9

Figure 12 **LANDSCAPE CHARACTER** **Matimba B DINALEDI Transmission Line Integration**

View 10

View 11

View 12

Figure 13 **LANDSCAPE CHARACTER** **Matimba B DINALEDI Transmission Line Integration**

View 13

View 14

View 15

Figure 14 **LANDSCAPE CHARACTER** **Matimba B DINALEDI Transmission Line Integration**

View 16

View 17

View 18

Figure 15 **LANDSCAPE CHARACTER** **Matimba B DINALEDI Transmission Line Integration**

View 19

View 20

Figure 16 **LANDSCAPE CHARACTER** **Matimba B DINALEDI Transmission Line Integration**

View 21

View 22

View 23

Figure 17 **LANDSCAPE CHARACTER** **Matimba B DINALEDI Transmission Line Integration**

View 24

View 25

View 26

View 27

Figure 18 **LANDSCAPE CHARACTER** **Matimba B DINALEDI Transmission Line Integration**

View 28

View 29

View 30

Figure 19 **LANDSCAPE CHARACTER** **Matimba B DINALEDI Transmission Line Integration**