THE PROPOSED GAMMA KAPPA 2ND 765KV TRANSMISSION POWERLINE AND SUBSTATIONS UPGRADE, NORTHERN AND WESTERN CAPE

(NEAS REFERENCE DEA/EIA/0001267/2012

DEA REFERENCE14/12/16/3/3/2/353)

VISUAL IMPACT ASSESSMENT

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EXECUTIVE SUMMARY

Nzumbululo Heritage Solutions (Pty) Ltd was appointed by Eskom (Pty) Ltd, as the independent environmental consultant to undertake the Environmental Impact Assessment (EIA) for the proposed Gamma-Kappa 765kV +/-370km Transmission power line and associated substation development along the servitude traversing from Northern to Western Cape Provinces. It is located between the Gamma Substation near Victoria West in the Northern Cape to the Kappa Substation near Touwsriver in the Western Cape.

Axis Landscape Architecture cc was appointed by Nzumbululo Heritage Solutions (Pty) Ltd as a sub-consultant to complete a Visual Impact Assessment. This Visual Impact Assessment (VIA) is a specialist study that forms part of the EIA and addresses the visual effects of the proposed transmission line on the receiving environment.

Three alternative routes have been proposed to connect to the two substations. The proposed routes stretch over approximately 370km. The study area contains the extent of the alignments and includes an approximate 5 km buffer area around the alignments.

PROJECT DESCRIPTION

The following project components will occur during the construction and operational phases of the project and are identified as elements that may cause a potential landscape and/or visual impact:

- Construction camps and lay-down yards;
- Access roads
- Substations; and
- Transmission Line.
- Of the four project components, the towers of the transmission line are expected to cause the greatest impacts. A brief description of the tower characteristics, the three alternatives and their individual routes are discussed in the following tables.

Type	Guyed Suspension tower	Cross Rope Suspension tower	Self Supporting Tower	Double Circuit Self supporting Suspension tower
Maximum Height	33 m	48m	30 m	36 m
Span	450 m	450 m	450 m	260 m
Servitude width	95 m	110 m	94 m	55m

DESCRIPTION OF ALTERNATIVE ALIGNMENTS	
ALTERNATIVES	**DESCRIPTION**
Alternative 1	Alternative 1 is proposed to run in a south easterly direction from the Gamma Substation east of Victoria West, crossing the N1, runs south for approximately 40km, turn west, passing south of Beaufort West, crossing the N1. It runs parallel with the N1 and existing railway line until Laingsburg, turn west until it reaches the Kappa Substation.
Alternative 2	Alternative 2 is proposed to run in a south easterly direction from the Gamma Substation east of Victoria West, crossing the N1, runs south of the N1, passing south of Beaufort West, crossing the N1 following existing power lines. It runs in a south western direction, south of Merweville until it reaches the Kappa Substation.
Alternative 3	Alternative 3 is proposed to run in a south easterly direction from the Gamma Substation east of Victoria West, crossing the N1before Three Sisters and and again after Three Sisters, runs north of the N1, passing north of Beaufort West. It runs in a south western direction, north of Merweville until it reaches the Kappa Substation

DESCRIPTION OF THE AFFECTED ENVIRONMENT

The study area consists of vacant and uninterrupted land as well as cultivated, residential, subsistence farming, and game farms. Extensive game faming and small stock farming activities are scattered through the study area.

Subsistence farming activities are concentrated around the small towns. Human settlements are scattered throughout the study area and the landscape are degraded around these settlements.

The landscape character changes through the study area. The study area is divided into distinct landscape types which are areas within the study area that are relatively homogenous in character (Swanwick, 2002). Landscape types are distinguished by differences in topographical features, vegetation communities and patterns, land use and human settlement patterns.

The assessment is done on a macro-scale and discusses the predominant landscape conditions and visual characteristics found in a particular landscape type.

Each landscape type is given a descriptive name which relates to the vegetation type, topography and/or land use of the region (Adapted from Van Riet et al, 1997);

- Touws River Karoo Region;
- Moordenaars Karoo Region; and
- Central Karoo Region.

FINDINGS AND RECOMMENDATIONS

LANDSCAPE CHARACTER SENSITIVITY

The sensitivity of the landscape character is an indication of " the degree to which a particular landscape can accommodate change from a particular development, without detrimental effects on its character" (GLVIA, 2002).

The majority of the study area is considered to have a moderately high landscape character sensitivity due to the undulating topography and undeveloped condition of the landscape, the generally high visual quality and the related tourism value that is placed on the visual resource. Low terrain variability mainly occurs through the study area where a moderately low VAC can be expected. Generally the vegetation cover is shrubland and scattered trees which will provide very little visual screening for the proposed transmission line.

The landscape character is considered moderately susceptible to change, whether it is a low intensity change over an extensive area or an acute change over a limited area. Generally, the vegetation occurring in the study area is rigid and recovers very slowly from surface disturbances.

SIGNIFICANCE OF LANDSCAPE IMPACTS

Landscape impacts are alterations to the fabric, character, visual quality and/or visual value which will either positively or negatively affect the landscape character. During the construction and operational phases, the project components are expected to impact on the landscape character of the landscape types it traverses.

The following table provides a summary of the anticipated landscape impacts that may occur as a result of the construction of the transmission line.

LANDSCAPE IMPACT								
Activity	**Nature of Impact**	**Extent of Impact**	**Duration of Impact**	**Severity of Impact**	**Probability of Impact**	**Significance without Mitigation**	**Significance with Mitigation**	**Level of Confidence**
Construction phase								
Alternative 1	Negative – Impacting on the visual quality of the landscape due to the presence of foreign elements and a loss of vegetation cover.	Local	Permanent if not mitigated	Moderate	Definite	Moderate	Low	High
Alternative 2				Moderate	Definite	Moderate	Low	High
Alternative 3				Moderate	Definite	Moderate	Low	High
Operational phase								
Alternative 1	Negative – Impacting on the visual quality of the landscape due the presence of a power line.	Local	Permanent	Moderate	Definite	Moderate	Low	High
Alternative 2				Low	Definite	Low	Low	High
Alternative 3				Moderate	Definite	Moderate	Low	High

Construction phase

The activities that are expected to cause landscape impacts and that are associated with the construction phase, are the establishment of the construction camps, construction of access roads and the clearance of the site. These activities will create surface disturbances which will result in the removal of vegetation and the exposure of the underlying soil.

The extent of the disturbances will generally affect a relative large footprint area. Access roads to the towers are expected to be a two-track dirt road which will create the minimum disturbance. During construction, the area around the individual towers will be disturbed.

The construction camps and lay-down yards are anticipated to disturb a much larger area. The size and location of the construction camps will play a major role in the severity of the landscape impact. Due to a lack of technical information, two options are considered namely; the location of construction camps in remote, virgin land, or in/adjacent existing settlements. The initial presence of a construction camp in a undeveloped landscape will cause a temporary and localised alteration to the landscape character. A construction camp located in or adjacent to an existing town or settlement will be easily associated with the town and therefore the presence of the town, mitigates the impact. The mitigating result is most effective, the bigger the town or settlement is.

Servitudes will generally be cleared of higher growing and dense vegetation to reduce biomass that may cause a fire hazard if ignited. The complete removal of high growing vegetation and scrubs will result in disturbed areas of exposed soil and difference in texture.

The exposed soil and change in texture will contrast severely with the intact vegetation around the disturbance footprint and servitudes.

Considering the moderately low VAC throughout most of the study area, the undisturbed condition of parts of the landscape and the recovery rate of the endemic vegetation, the *severity of landscape impact* during the construction stage is expected to be low for Alternative 2 and moderate for Alternatives 1 and 3. The impact will extend over the entire length of the different alignments and may vary in degrees of severity along the linear length as it transects landscape types of varying VAC. Surface disturbances are also minimised through, for example, utilising existing roads.

Operational phase

Surface disturbances created during construction may remain for an extended period during the operational phase. These are seen as residual affects carried forward from the construction phase and can be completely or substantially mitigated if treated appropriately during the construction phase.

An additional impact will be caused as a result of the presence of the completed transmission line, i.e. that of the evenly spaced towers of the lines, buildings and structures. The industrial character and the near monumental vertical scale of the towers will contrast with the diverse landscape character that prevails through most of the study area.

VIEWER SENSITIVITY

Within the receiving environment, specific viewers (visual receptors) experience different views of the visual resource and value it differently. They will be affected because of alterations to their views due to the proposed project. The visual receptors are grouped according to their similarities. The visual receptors included in this study are:

- Residents;
- Tourists; and
- Motorists.

To determine visual receptor sensitivity a, commonly used rating system is utilised. This is a generic classification of visual receptors and enables the visual impact specialist to establish a logical and consistent visual receptor sensitivity rating for viewers who are involved in different activities without engaging in extensive public surveys. The sensitivity of the identified visual receptors is discussed in Section 5.2.1.

SIGNIFICANCE OF VISUAL IMPACTS

Empirical research indicates that the visibility of a transmission tower, and hence the severity of visual impact, decreases as the distance between the observer and the tower increases. The landscape type, through which the transmission line crosses, can mitigate the severity of visual impact through topographical or vegetative screening. Bishop *et al* (1988) noticed that in some cases the tower may dominate the view for example, silhouetted against the skyline, or in some cases be absorbed in the landscape. A complex landscape setting with a diverse land cover and topographical variation has the ability to decrease the severity of visual impact more than a mundane landscape (Bishop *et al*, 1985).

The following tables summarise the visual impacts on residents, tourists and motorists.

VISUAL IMPACTS ON RESIDENTS

VISUAL IMPACT ON RESIDENTS								
Activity	**Nature of Impact**	**Extent of Impact**	**Duration of Impact**	**Severity of Impact**	**Probability of Impact**	**Significance without Mitigation**	**Significance with Mitigation**	**Level of Confidence**
Construction phase								
Alternative 1	Negative – Construction camp and lay-down yard may cause unsightly views.	Local	Temporary	Moderate	Definite	Low	Low	High
Alternative 2				Moderate	Definite	Low	Low	High
Alternative 3				Moderate	Definite	Low	Low	High
Operational phase								
Alternative 1	Negative – The presence of a power line intrudes on existing views and spoils the open panoramic views of the landscape.	Local	Permanent	Moderate	Definite	Low	Low	High
Alternative 2				Moderate	Definite	Low	Low	High
Alternative 3				Moderate	Definite	Low	Low	High

Generally, the study area is sparsely populated except around the human settlements, farms and towns. These communities are normally situated along main transportation routes, near agricultural areas or adjacent rivers or water resources

Residential areas and farm residents will experience an intrusion on their views due to the presence of the proposed Transmission Line. It is unpractical to discuss all, but they are recognised as the general population of the study area and are identified as affected visual receptors.

Considering the distribution of residents across the study area, it can be concluded that the entire study area has a low density of residents with the exception of higher concentrations of residents in the towns and human settlements.

Construction phase

During the construction phase, unsightly views may be created by the presence of construction camps and the lay-down yards. The duration of the potential visual impact will be temporary which will result in an anticipated *moderately low* significance of visual impact for all the alternatives. The visual exposure to the construction activity will initially be limited and only local residents will experience views of the site preparation activity. As the structures increase in scale and height, the ZVI increases, resulting in a greater number of affected viewers and a subsequent increase in visual exposure.

The cleared sites, construction camps and material lay-down yard will appear unsightly and out of character. Large scale construction elements such as cranes, will be highly visible and increase awareness of the construction activity over a considerable area. The visual intrusion caused during the construction stage will be moderate, but will be temporary in nature.

Operational phase

The residents of the residential areas and farming communities next to the power lines may experience a moderate degree of visual intrusion due to their proximity to all the Alternatives.

The presence of a transmission line in the visual field of the residents in this part of the study area will spoil the uncluttered panoramic views they currently experience. The silhouette of a transmission line on the horizon will be visible from a great distance and thus increase the ZVI considerably, potentially impacting on more residents.

VISUAL IMPACTS ON TOURISTS

VISUAL IMPACT ON TOURISTS								
Activity	**Nature of Impact**	**Extent of Impact**	**Duration of Impact**	**Severity of Impact**	**Probability of Impact**	**Significance without Mitigation**	**Significance with Mitigation**	**Level of Confidence**
Construction phase								
Alternative 1	Negative – Construction camp and lay-down yard may cause unsightly views and spoil the undisturbed views over the landscape.	At a number of point locations	Temporary	Moderate	Definite	Moderate	Low	High
Alternative 2				Low	Definite	Low	Low	High
Alternative 3				High	Definite	Moderate	Low	High
Operational phase								
Alternative 1	Negative – The presence of a power line intrudes on existing views of the landscape	Local	Permanent	Moderate	Definite	Moderate	Low	High
Alternative 2				Low	Definite	Low	Low	High
Alternative 3				High	Definite	Moderate	Low	High

The study area is renowned for its karoo and mountainous landscapes especially in the Karoo National Park as well as the central and southern regions. These characteristics provide the basis for the tourism industry which plays a role in the economy of the Western and Northern Cape Provinces. The entire study area is considered to have a moderately high tourism potential.

The type of tourist that visits this area is expected to travel considerably through the study area by vehicle. This implies that they will experience a large part of the study area in a relative short time span.

Construction phase

The temporary duration of the construction phase is expected to cause high visual impacts, especially Alternative 3. The location and size of the construction camps and lay-down yards will be crucial in regulating the impact. Detailed information is not available and it is anticipated that the visual impact will occur localised and that a small number of tourists will be adversely affected by these project components during construction.

Their exposure to possible unsightly views of the construction camps and the associated activity will however be minimal and localised.

The potential visual impact on tourists during the construction phase of the proposed project can be mitigated with relative ease except for Alternatives 2 and 3. The greatest factor to consider is the location of the construction camps from potential views that may be experienced from scenic routes or tourist hotspots.

Operational phase

Considering the extent of the proposed alternatives, a number of tourists will be affected during their visit to the study area. Although it is difficult to pinpoint particular locations in the study area that are of specific tourist value, since the entire study area bares some value, the most obvious concentration of tourists can be expected in the northern central part of the study area. For these tourists, Alternatives 2 and 3 will create alterations to their views. The presence of a transmission line in this undeveloped landscape will spoil the views that are experiencing. It can be concluded that Alternative 3 will cause a high visual intrusion in the views expected by tourists travelling through the study area.

VISUAL IMPACTS ON MOTORISTS

VISUAL IMPACT ON MOTORISTS								
Activity	**Nature of Impact**	**Extent of Impact**	**Duration of Impact**	**Severity of Impact**	**Probability of Impact**	**Significance without Mitigation**	**Significance with Mitigation**	**Level of Confidence**
Construction phase								
Alternative 1	Negative – Intruding on existing views of the landscape.	At a number of point locations	Short period	Moderate	Definite	Low	Low	High
Alternative 2				Moderate	Definite	Low	Low	High
Alternative 3				Moderate	Definite	Low	Low	High
Operational phase								
Alternative 1	Negative – Intruding on existing views of the landscape.	Local	Short period	Moderate	Definite	Low	Low	High
Alternative 2				Moderate	Definite	Low	Low	High
Alternative 3				High	Definite	Moderate	Low	High

The major routes in the study area are the N1, N12, R63, R61, R381, R353 and R354 connecting the towns and informal settlements. The secondary road network in the study area carries a much lower volume of motorists. Many of the roads are gravel roads which are mostly utilised by the local residents. Their duration of views will be temporary and it is expected that the visual intrusion that they will experience will be moderately low.

Construction phase

The potential visual impact that may be experienced by motorists during the construction phase is considered to be minimal. Limited information is available and the number, location and size of the construction camps and lay-down yards are essential for accurately assessing the visual impact. It is anticipated that views of the construction camps and lay-down yards of all the alternative routes will be visible from the major roads. The possibility that a construction camp will be established at this location is high and can be motivated from an accessibility point of view, due to the proximity to a major route.

The presence of the construction camp and lay-down yards may create unsightly views. Motorists' visual exposure to the impact will be brief and the severity of visual impact will be moderately low. The significance of potential visual impact is expected to be low.

Operational phase

The N1, R63, and N12 are the most prominent, carrying the highest volume of traffic. Alternative 1 will be the most visible from the N1 and N12. The severity and significance of visual impact for the proposed alternative 1 on motorists will be high and moderate for the other alternatives.

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RECOMMENDED MITIGATION MEASURES

In most cases, the landscape and visual impacts occurring during the construction phase can be mitigated relatively effectively. Rehabilitation of the disturbed areas will prevent the exposure of soil, which may cause a reduction in the visual quality of the study area. Sensitive positioning of the construction camps and lay-down yards should take advantage of the natural screening capacity of the study area by locating the camps outside of the views of sensitive visual receptors.

CONCLUSION

The three alternative Routes have been evaluated against international accepted criteria to determine the impact they will have on the landscape character and the viewers that have been identified in the study area.

The alternatives are rated according to preference by using a three-point rating system in Table 10, three (3) being the least preferred, to one (1) being the most preferred. The preference rating is informed by the impact assessment discussions in Section 5 and the overall performance of each alternative with regards to the impact on the landscape character and the identified viewers.

Evaluation of alternative alignments

ALTERNATIVES	PREFERENCE RATING
Alternative 1	2
Alternative 2	1
Alternative 3	3

Alternative 2 is regarded as the most preferred alternative. Its alignment along the existing transmission line and transmission servitude is considered to cause the least impact on the landscape character due to the reduced sensitivity of the landscape along the roads and servitudes.

The impact of Alternative 2 on visual receptors varies between residents, tourists and motorists. Alternative 2's great advantage lies in the less significant visual impact on tourists and residents as compared to the other alternatives. The public association with transmission lines and major public roads is a common perception which makes the co-existence of these two features more acceptable.

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LIST OF ABBREVIATIONS

EIA	Environmental Impact Assessment.
FHWA	Federal Highway Administration of the United States Department of Transportation. The publishers of the guide "*Visual Impact Assessment for High Projects*" 1981.
LCA	Landscape Character Assessment.
LT	Landscape Type
VAC	Visual Absorption Capacity
VIA	Visual Impact Assessment.
ULI	Urban Land Institute
ZVI	Zone of Visual Influence.

1. INTRODUCTION

Nzumbululo Heritage Solutions (Pty) Ltd was appointed by Eskom (Pty) Ltd, as the independent environmental consultant to undertake the Environmental Impact Assessment (EIA) for the proposed Gamma-Kappa 765kV +/-370km Transmission power line and associated substation development along the servitude traversing from Northern to Western Cape Provinces. It is located between the Gamma Substation near Victoria West in the Northern Cape to the Kappa Substation near Touwsriver in the Western Cape.

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Three alternative routes have been proposed to connect to the two substations. The proposed routes stretch over approximately 370km. The study area contains the extent of the alignments and includes an approximate 5 km buffer area around the alignments.

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1.1. BACKGROUND AND BRIEF

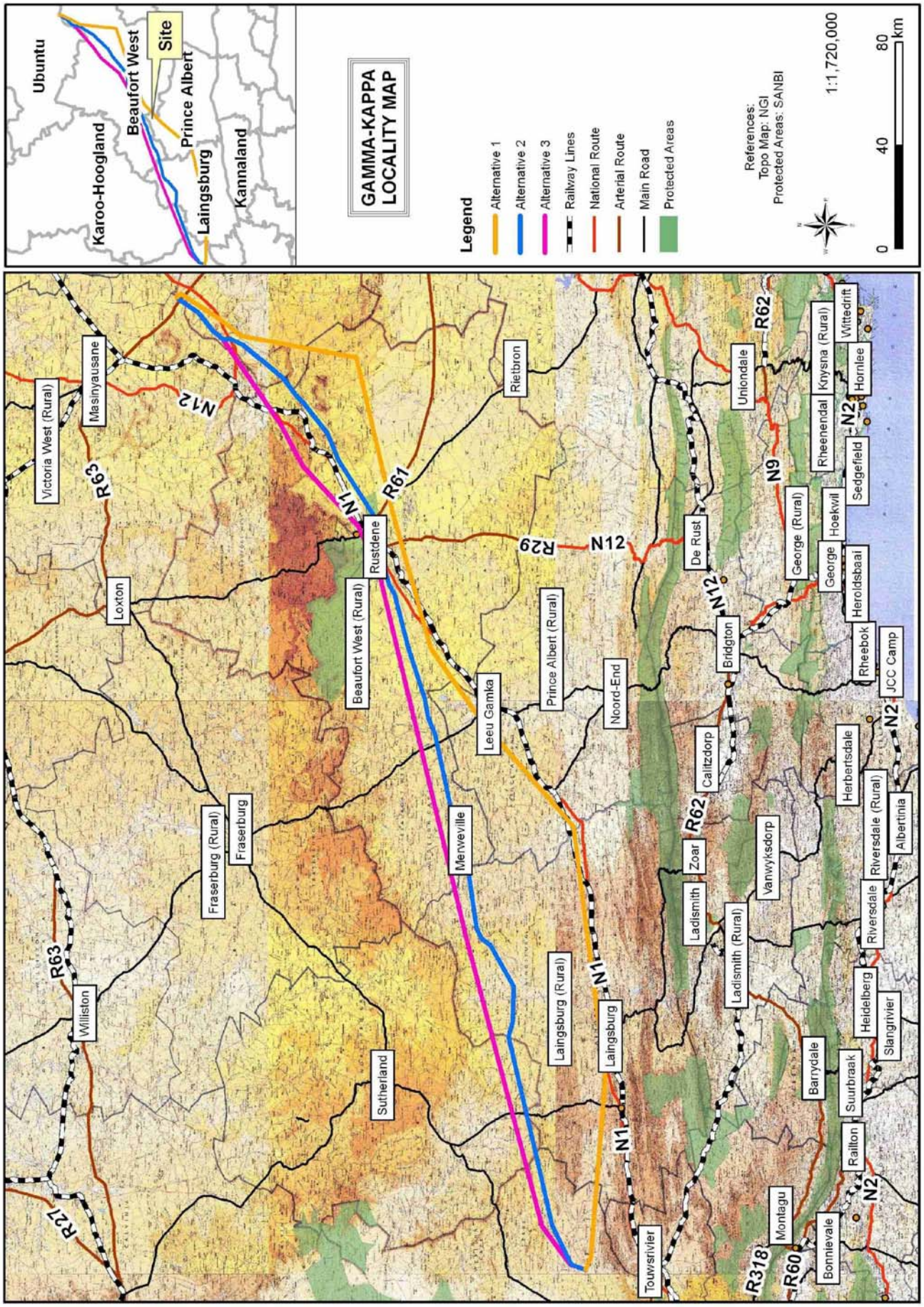
This VIA will conform to the requirements of a level three assessment which requires the realisation of the following objectives (Adapted from Oberholzer (2005)):

- Determination of the extent of the study area;
- Description of the proposed project and the receiving environment;
- Identification and description of the landscape character of the study area;
- Identification of the elements of particular visual value and -quality that could be affected by the proposed project;
- Identification of landscape- and visual receptors in the study area that will be affected by the proposed project and assess their sensitivity;
- Indication of potential landscape- and visual impacts;
- Assessment of the significance of the landscape- and visual impacts;
- Recommendations of mitigation measures to reduce and/or alleviate the potential adverse landscape- and visual impacts.

1.2. STUDY AREA

The study area includes the entire area covered by the alternative routes. The study area stretches from the existing Gamma Substation East of Victoria West in The Northern Cape Province to the Kappa Substation West of Touwsrivier in the Western Cape Province (Figure 1).

Figure 1: Locality Plan



2. STUDY APPROACH

2.1. INFORMATION BASE

This assessment was based on information from the following sources:

- Topographical maps and GIS generated data were sourced from the Surveyor General, Surveys and Mapping in Mowbray, Cape Town and ECOGIS (2013) respectively;
- Observations made and photographs taken during site visits;
- Technical information received from Eskom Transmission;
- Professional judgement based on experience gained from similar projects; and
- Literature research on similar projects.

2.2. ASSUMPTIONS AND LIMITATIONS

This assessment was undertaken during the conceptual stage of the project and is based on information available at the time.

- An exact commencement date for the construction phase is unknown. Construction is expected to commence as soon as approval is received from the relevant authorities;
- The exact location, size of construction camps and material lay-down yards are not yet specified at this stage of the project. It is anticipated that construction camps will be set up on farms at central locations next to the preferred alignment. The construction camps will consist of temporary structures such as tents or temporary buildings. Ablution facilities will also be associated with a construction camp and are expected to be portable toilets and temporary shower facilities;

2.3. LEVEL OF CONFIDENCE

The level of confidence assigned to the findings of this assessment is based on:

- The level of information available and/or understanding of the study area (rated 2); and
- The information available and/or knowledge and experience of the project (rated 3).

This visual impact assessment is rated with a general confidence level of 6. This rating indicates that the author's general confidence in the accuracy of the findings is *high* (Table 11). Where the confidence level of specific findings is not regarded as high, it is noted in the last column of each impact assessment table.

2.4. METHOD

A broad overview of the approach and methodology used in this assessment is provided below:

- The extent of the study area is determined and indicated in Figure1;
- The site is visited to establish a photographic record of the site, views and areas of particular visual quality and or -value;
- The project components and activities are described and assessed as potential elements of visual and landscape impacts;
- The receiving environment is described in terms of its prevailing landscape- and visual character;
- Landscape- and visual receptors that may be affected by the proposed project are identified and described;
- The sensitivity of the landscape- and visual receptors is assessed;
- The severity of the landscape- and visual impacts is determined;
- The significance of the visual and landscape impacts is assessed;

- Mitigation measures are proposed to reduce adverse impacts; and
- The findings of the study are documented in this Visual Impact Assessment.

3. PROJECT DESCRIPTION

3.1. OVERVIEW OF DEVELOPMENT

The project involves the construction of a 765kV transmission line from the Gamma Substation to the Kappa Substation as well as the upgrade of the two substations. The servitude required for the development along the route is 110m wide and approximately 370km in length between the origin and the end of the line.

3.2. ALTERNATIVE ALIGNMENTS

Table 1: Description of alternative alignments

ALTERNATIVES	DESCRIPTION (Refer to Figure 1)
Alternative 1	Alternative 1 is proposed to run in a south easterly direction from the Gamma Substation east of Victoria West, crossing the N1, runs south for approximately 40km, turn west, passing south of Beaufort West, crossing the N1. It runs parallel with the N1 and existing railway line until Laingsburg, turn west until it reaches the Kappa Substation.
Alternative 2	Alternative 2 is proposed to run in a south easterly direction from the Gamma Substation east of Victoria West, crossing the N1, runs south of the N1, passing south of Beaufort West, crossing the N1 following existing power lines. It runs in a south western direction, south of Merweville until it reaches the Kappa Substation.
Alternative 3	Alternative 3 is proposed to run in a south easterly direction from the Gamma Substation east of Victoria West, crossing the N1before Three Sisters and and again after Three Sisters, runs north of the N1, passing north of Beaufort West. It runs in a south western direction, north of Merweville until it reaches the Kappa Substation

3.3. PROJECT COMPONENTS AND ACTIVITIES

Each project component and activity will affect the receiving environment differently and is therefore discussed separately. The following project components will occur during the construction and operational phases of the project and are identified as elements that may cause a potential landscape and/or visual impact:

3.3.1. SUBSTATIONS

The two existing Substations, Kappa and Omega will be upgraded to accommodate the new 765kV Line. Each substation site will require a 765kV feeder bay, 400MVAr line reactors and extend the existing bus bar if necessary.

A level or stepped platform will be created with a buffer zone inside the fence. On the outskirts of this area will be several terminal gantries which are the termination points for the lines entering or leaving the substation. These structures will be approximately 45 meters tall.

3.3.2. CONSTRUCTION CAMPS AND LAY-DOWN YARDS

The construction phase is expected to continue for 12 months from the commencement date. Temporary construction camps will be present for the duration of the construction period. The appointed contractor will set up construction camps next to the proposed alignment where practical. The material lay-down yards is expected to be located adjacent the construction camps and will serve as storage areas for the construction material and equipment (Figure 2).

Various types of construction equipment will be required to erect the transmission towers and suspend the electrical cables between them. A TLB, cement truck and mobile crane will be used during the const\ruction phase in conjunction with between 10 and 40 labourers (Figure 3).

3.3.3. ACCESS ROADS

Where no access roads are available and vehicular access is required, roads will be constructed. Access may be by means of a two-track dirt road or a cleared corridor. It is expected that roads will be rehabilitated after the construction phase or maintained to facilitate access during periodic maintenance visits (Figure 2).

3.3.4. TRANSMISSION LINE

The completed transmission line will connect the Gamma and Kappa Substations. The direct linear distance between the two substations is approximately 370 km (Figure 1).

Four types of towers might be used depending on the terrain being crossed. The towers will consist of a lattice steel framework reaching a maximum height of 48 m with electrical cables suspended between them. The average spacing between the towers will be approximately 400 m. A working area of 100 m x 50 m will be cleared for each of the proposed towers. The Crossrope Suspension tower will be the preferred tower and the self-supporting strain tower will only be used where the alignment changes direction (Figure 4).

Table 2: Types and typical characteristics of proposed towers

Type	Guyed Suspension tower	Cross Rope Suspension tower	Self Supporting Tower	Double Circuit Self supporting Suspension tower
Maximum Height	33 m	48m	30 m	36 m
Span	450 m	450 m	450 m	260 m
Servitude width	95 m	110 m	94 m	55m

3.4. VISUAL CHARACTERISTICS OF PROJECT COMPONENTS

Visual character is based on human perception and the observer's response to the relationships between and composition of the visible project components. The transmission line, i.e. the towers and the cables suspended between each tower, is the most visible and permanent project component and is discussed in this section.

The towers have an industrial character enforced by the double steel pole and the electrical cables between the towers. It has a near monumental scale if compared to the predominantly rural and agricultural landscape. The entire transmission line will be perceived as a rhythmic arrangement of vertical towers forming a linear element through the landscape. The electrical cables emphasise the linear character of the transmission line but are easily absorbed in the background when viewed from distances greater than 10 km.

Figure 2: Example of a construction camp

Example of site offices

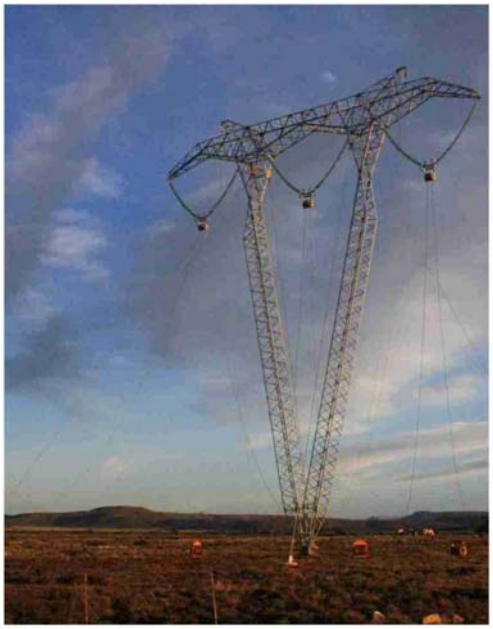
Example of bush clearing

Example of a construction camp

EXAMPLE OF CONSTRUCTION CAMPS GAMMA KAPPA 765kV LINE AND SUBSTATIONS UPGRADE	Compiled for: Axis Landscape Architects Reference:GAM2012- LANDS TYPES-A4.cdr Date: 2013-03-31	AXIS LANDSCAPE ARCHITECTURE

Figure 3: Typical construction equipment

CRANE



CABELING

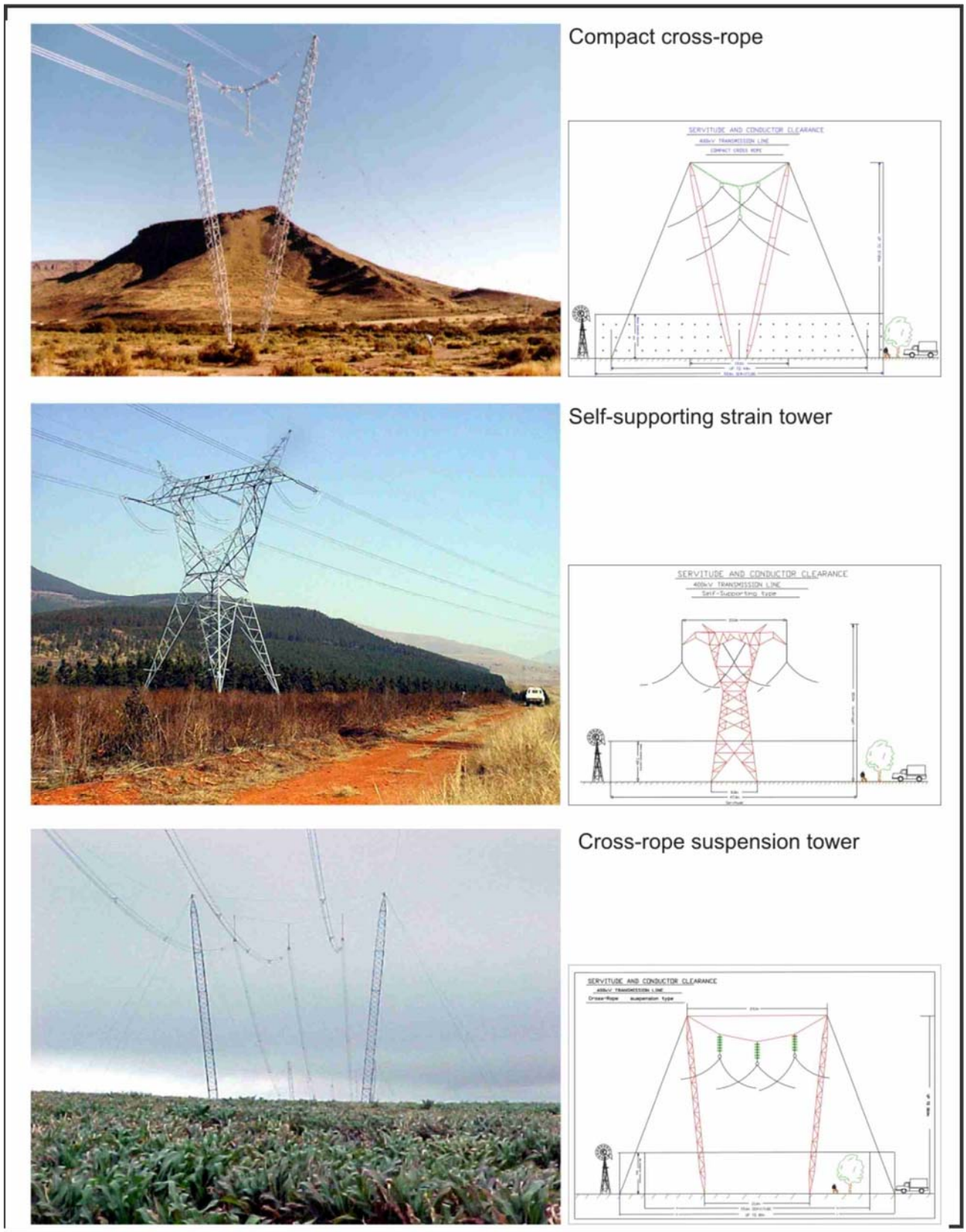
ROAD CROSSING

HELICOPTER

TENSIONER STATION

TYPICAL CONSTRUCTION EQUIPMENT GAMMA KAPPA 765kV LINE AND SUBSTATIONS UPGRADE	Compiled for: Axis Landscape Architects Reference:GAM2012- LANDS TYPES-A4.cdr Date: 2013-03-31	AXIS LANDSCAPE ARCHITECTURE

Figure 4: Tower Types



4. DESCRIPTION OF THE AFFECTED ENVIRONMENT

Landscape and visual impacts may result from changes to the landscape. A distinction should be made between impacts on the visual resource (landscape) and on the viewers. The former are impacts on the physical landscape that may result in changes to landscape character while the latter are impacts on the viewers themselves and the views they experience.

4.1. VISUAL RESOURCE

Visual resource is an encompassing term relating to the visible landscape and its recognisable elements, which through their co-existence, result in a particular landscape character.

4.1.1. LANDSCAPE CHARACTER

The study area is consists of vacant and uninterrupted land as well as cultivated, residential, subsistence farming, and game farms. Extensive game faming and small stock farming activities are scattered through the study area.

Subsistence farming activities are concentrated around the small towns. Human settlements are scattered throughout the study area and the landscape are degraded around these settlements.

The landscape character changes through the study area. The study area is divided into distinct landscape types which are areas within the study area that are relatively homogenous in character (Swanwick, 2002). Landscape types are distinguished by differences in topographical features, vegetation communities and patterns, land use and human settlement patterns.

The assessment is done on a macro-scale and discusses the predominant landscape conditions and visual characteristics found in a particular landscape type.

Each landscape type is given a descriptive name which relates to the vegetation type, topography and/or land use of the region (Adapted from Van Riet et al, 1997);

· Touws River Karoo Region;

· Moordenaars Karoo Region; and

· Central Karoo Region.

Touws River Karoo Region

The vegetation consists of the Lowland Succulent Karoo of the Succulent Karoo Biome. This represents an extremely arid vegetation type. The very low vegetation is dominated by the Vygie family. The lack of summer rains results in almost no grasses being prevalent in the vegetation type (Low and Rebelo, 1996).

The land use of this region are predominantly farming practices such as stock grazing and game farming.

Moordenaars Karoo Region

The Moordenaars Karoo Region consists mainly of the Escarpment Mountain Renosterveld of the Fynbos Biome, the Great Nama Karoo of the Nama Karoo Biome and the Upland Succulent Karoo of the Succulent Karoo Biome (Low and Rebelo, 1996).

The vegetation is generally very sparse and low throughout the region. It is charaterised by a rolling topography, low vegetation and perceived absence of human intervention or intrusion. Small stock farming with some wheat oats and barely production activities are scattered through the study area . The wild flowers are central to the local tourism industry.

Central Karoo Region

The Central Karoo Region consist of According to Low and Rebelo (1996) the vegetation of this region falls entirely within the Nama Karoo Biome and consists of the Eastern Mixed Nama Karoo, the Upper Nama Karoo, the Central Lower Nama Karoo and the Great Nama Karoo vegetation types.

The vegetation is generally low throughout the region varying from dwalf shrubs, succulents, and *Acacia karroo* trees in dry riverbeds in the Central Lower Nama Karoo to dwalf shrubs and a few trees in the Great Nama Karoo to mainly shrubs and grasses in the Upper Nama Karoo. The Eastern Mixed Nama Karoo is the ecotone between the Nama Karoo and the Grassland Biome. It is a complete mix of grass and shrub dominated vegetation types with a few *Acacia karroo* trees in the dry riverbeds. (Low and Rebelo, 1996).

The region consist of irregular plains of the large flat basin formed between the escarpment in the north to a more undulating and diverse features such as the low mountains of the Karoo National Park.

Figure 5: Landscape types

TOUWS RIVER KAROO

MOORDENAARS KAROO

LANDSCAPE TYPES	Compiled for: Axis Landscape Architects Reference:GAM2012- LANDS TYPES-A4.cdr	AXIS LANDSCAPE ARCHITECTURE
GAMMA KAPPA 765kV LINE AND SUBSTATIONS UPGRADE	Date: 2013-03-31	

Figure 6: Landscape types

CENTRAL KAROO

LANDSCAPE TYPES GAMMA KAPPA 765kV LINE AND SUBSTATIONS UPGRADE	Compiled for: Axis Landscape Architects Reference:GAM2012- LANDS TYPES-A4.cdr Date: 2013-03-31	AXIS LANDSCAPE ARCHITECTURE

4.1.2. VISUAL CHARACTER

Visual character is based on human perception and the observer's response to the relationships between and composition of the landscape, the land uses and identifiable elements in the landscape. The description of the visual character includes an assessment of the scenic attractiveness regarding those landscape attributes that have aesthetic value and contribute significantly to the visual quality of the views, vistas and/or viewpoints of the study area.

4.1.2.1 Visual Quality

Visual quality is a qualitative evaluation of the composition of landscape components and their excellence in scenic attractiveness. Many factors contribute to the visual quality of the landscape and are grouped under the following main categories (Table 4) that are internationally accepted indicators of visual quality (FHWA, 1981):

Table 3: Criteria of Visual Quality (FHWA, 1981)

INDICATOR	CRITERIA
Vividness	The memorability of the visual impression received from contrasting landscape elements as they combine to form a striking and distinctive visual pattern.
Intactness	The integrity of visual order in the natural and man-built landscape, and the extent to which the landscape is free from visual encroachment.
Unity	The degree to which the visual resources of the landscape join together to form a coherent, harmonious visual pattern. Unity refers to the compositional harmony of inter-compatibility between landscape elements.

The landscape is allocated a rating from an evaluation scale of 1 to 7 and divided by 3 to get an average. The evaluation scale is as follows: Very Low =1; Low =2; Moderately Low =3; Moderate =4; Moderately High =5; High =6; Very High =7;

The regional landscape is assessed against each indicator separately. All three indicators should be *high* to obtain a *high* visual quality. The evaluation is summarised in Table 4.

Table 4: Visual Quality of the regional landscape

LANDSCAPE TYPE	VIVIDNESS	INTACTNESS	UNITY	VISUAL QUALITY
Touws River Karoo Region	4	4	4	Moderate
Moordenaars Karoo Region	6	5	6	Moderately High
Central Karoo Region	5	4	4	Moderate

The higher visual quality can be attributed to areas with less human intervention and with undisturbed natural features. The scattered agricultural practices and the informal settlements are impacting the regional visual quality.

4.1.2.2 Visual absorption capacity

Visual Absorption Capacity (VAC) signifies the ability of the landscape to accept additional human intervention without serious loss of character and visual quality or value. VAC is founded on the characteristics of the physical environment such as:

- Degree of visual screening:
  - A degree of visual screening is provided by landforms, vegetation cover and/or structures such as buildings. For example, a high degree of visual screening is present in an area that is mountainous and is covered with a forest compared to an undulating an mundane landscape covered in grass;
- Terrain variability:

- Terrain variability reflects the magnitude of topographic elevation and diversity in slope variation. A highly variable terrain will be recognised as one with great elevation differences and a diversity of slope variation creating talus slopes, cliffs and valleys. An undulating landscape with a monotonous and repetitive landform will be an example of a low terrain variability;

- Land cover:
  - Land cover refers to the perceivable surface of the landscape and the diversity of patterns, colours and textures that are presented by the particular land cover (i.e. urbanised, cultivated, forested, etc.);

A basic rating system is used to evaluate the three VAC parameters. The values are relative and relate to the type of project that is proposed and how it may be absorbed in the landscape (Table 5). A three value range is used; three (3) being the highest potential to absorb an element in the landscape and one (1) being the lowest potential. The values are counted together and categorised in a *high*, *medium* or *low* VAC rating.

Table 5: Regional Visual Absorption Capacity evaluation

LANDSCAPE TYPE	VISUAL SCREENING	TERRAIN VARIABILITY	LAND COVER	VAC
Touws River Karoo Region	2	2	1	moderate
Moordenaars Karoo Region	1	1	1	low
Central Karoo Region	1	1	1	low

The VAC of the study area is considered to be moderately low and provides some visual screening capacity for this project. The moderately low VAC relates to the topography and vegetation. The regular forms and associated vertical posture of the proposed alignment are unlike the undulating and horizontal appearance of the topography.

The less prominent project components such as access roads are expected to be visually absorbed to a greater degree in the landscape. The relative modest scale and extent of the project components are more readily accepted and will not create major alterations to the landscape character.

Figure 7: Landscape character of study area

STOCKFARMING

FARMSTEADS

LANDSCAPE CHARACTER GAMMA KAPPA 765kV LINE AND SUBSTATIONS UPGRADE	Compiled for: Axis Landscape Architects Reference:GAM2012- LANDS TYPES-A4.cdr Date: 2013-03-31	AXIS LANDSCAPE ARCHITECTURE

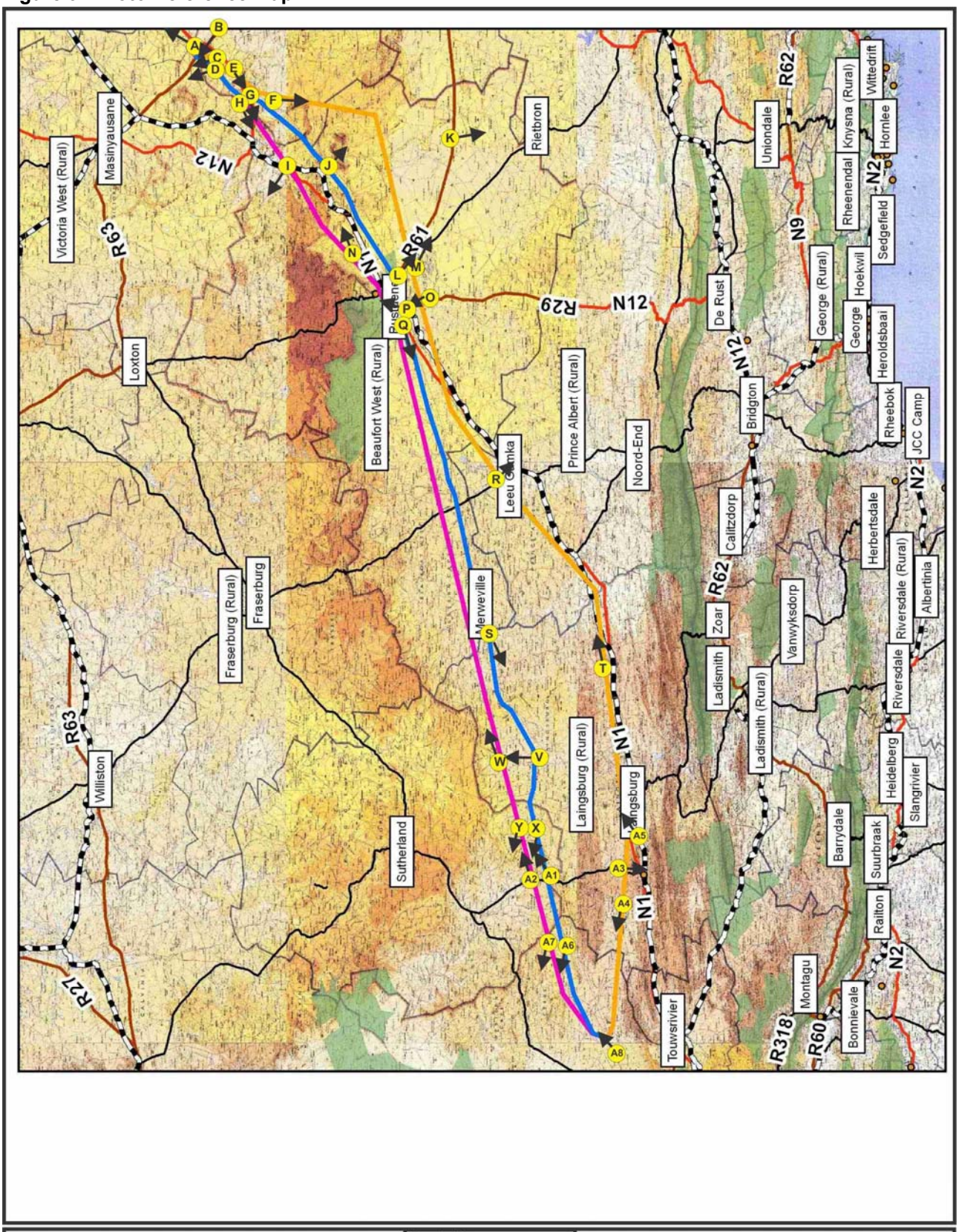
Figure 8: Landscape character of study area

KAROO NATIONAL PARK

FARMSTEADS

LANDSCAPE CHARACTER GAMMA KAPPA 765kV LINE AND SUBSTATIONS UPGRADE	Compiled for: Axis Landscape Architects Reference:GAM2012- LANDS TYPES-A4.cdr Date: 2013-03-31	AXIS LANDSCAPE ARCHITECTURE

Figure 9: Photo Reference Map



SITE CONTEXT PHOTO'S REFERENCE MAP GAMMA KAPPA 765kV LINE AND SUBSTATIONS UPGRADE	Compiled for: Axis Landscape Architects Reference:GAM2012- LANDS TYPES-A4.cdr Date: 2013-03-31	AXIS LANDSCAPE ARCHITECTURE

Figure 10: Photo plate 1

VIEW A: VIEW TOWARDS GAMMA SUBSTATION

VIEW B: VIEW FROM R63

SITE CONTEXT PHOTO'S GAMMA KAPPA 765kV LINE AND SUBSTATIONS UPGRADE	Compiled for: Axis Landscape Architects Reference:GAM2012- LANDS TYPES-A4.cdr Date: 2013-03-31	AXIS LANDSCAPE ARCHITECTURE

Figure 11: Photo plate 2

VIEW C: VIEW FROM A LOCAL ROAD TOWARDS ALTERNATIVE 1

VIEW D: VIEW FROM A LOCAL ROAD TOWARDS ALTERNATIVE 2

SITE CONTEXT PHOTO'S GAMMA KAPPA 765kV LINE AND SUBSTATIONS UPGRADE	Compiled for: Axis Landscape Architects Reference:GAM2012- LANDS TYPES-A4.cdr Date: 2013-03-31	AXIS LANDSCAPE ARCHITECTURE

Figure 12: Photo plate 3

VIEW E: VIEW FROM THE N1 TOWARDS ALTERNATIVE 1

VIEW F: VIEW FROM A LOCAL ROAD TOWARDS ALTERNATIVE 1

SITE CONTEXT PHOTO'S GAMMA KAPPA 765kV LINE AND SUBSTATIONS UPGRADE	Compiled for: Axis Landscape Architects Reference:GAM2012- LANDS TYPES-A4.cdr Date: 2013-03-31	AXIS LANDSCAPE ARCHITECTURE

Figure 13: Photo plate 4

VIEW G: VIEW FROM THE N1 TOWARDS ALTERNATIVE 2

VIEW H: VIEW FROM THE N1 TOWARDS ALTERNATIVE 3

SITE CONTEXT PHOTO'S GAMMA KAPPA 765kV LINE AND SUBSTATIONS UPGRADE	Compiled for: Axis Landscape Architects Reference:GAM2012- LANDS TYPES-A4.cdr Date: 2013-03-31	AXIS LANDSCAPE ARCHITECTURE

Figure 14: Photo plate 5

VIEW I: VIEW FROM THE N1 TOWARDS ALTERNATIVE 3

VIEW J: VIEW FROM A LOCAL ROAD TOWARDS ALTERNATIVE 2

SITE CONTEXT PHOTO'S GAMMA KAPPA 765kV LINE AND SUBSTATIONS UPGRADE	Compiled for: Axis Landscape Architects Reference:GAM2012- LANDS TYPES-A4.cdr Date: 2013-03-31	AXIS LANDSCAPE ARCHITECTURE

Figure 15: Photo plate 6

VIEW K: VIEW FROM A LOCAL ROAD TOWARDS ALTERNATIVE 1

VIEW L: VIEW FROM R61 TOWARDS ALTERNATIVE 2 CROSSING

SITE CONTEXT PHOTO'S GAMMA KAPPA 765kV LINE AND SUBSTATIONS UPGRADE	Compiled for: Axis Landscape Architects Reference:GAM2012- LANDS TYPES-A4.cdr Date: 2013-03-31	AXIS LANDSCAPE ARCHITECTURE

Figure 16: Photo plate 7

VIEW M: VIEW FROM THE R61 TOWARDS ALTERNATIVE 2

VIEW N: VIEW FROM A LOCAL ROAD TOWARDS ALTERNATIVE 3

SITE CONTEXT PHOTO'S GAMMA KAPPA 765kV LINE AND SUBSTATIONS UPGRADE	Compiled for: Axis Landscape Architects Reference:GAM2012- LANDS TYPES-A4.cdr Date: 2013-03-31	AXIS LANDSCAPE ARCHITECTURE

Figure 17: Photo plate 8

VIEW O: VIEW FROM THE N12 TOWARDS ALTERNATIVE 1

VIEW P: VIEW FROM THE N12 TOWARDS ALTERNATIVE 2 CROSSING

SITE CONTEXT PHOTO'S GAMMA KAPPA 765kV LINE AND SUBSTATIONS UPGRADE	Compiled for: Axis Landscape Architects Reference:GAM2012- LANDS TYPES-A4.cdr Date: 2013-03-31	AXIS LANDSCAPE ARCHITECTURE

Figure 18: Photo plate 9

VIEW Q: VIEW FROM THE N1 TOWARDS ALTERNATIVE 2

VIEW R: VIEW FROM THE R353 TOWARDS ALTERNATIVE 1

SITE CONTEXT PHOTO'S GAMMA KAPPA 765kV LINE AND SUBSTATIONS UPGRADE	Compiled for: Axis Landscape Architects Reference:GAM2012- LANDS TYPES-A4.cdr Date: 2013-03-31	AXIS LANDSCAPE ARCHITECTURE

Figure 19: Photo plate 10

VIEW S: VIEW FROM A LOCAL ROAD TOWARDS ALTERNATIVE 2

VIEW T: VIEW FROM A LOCAL ROAD TOWARDS ALTERNATIVE 1

SITE CONTEXT PHOTO'S GAMMA KAPPA 765kV LINE AND SUBSTATIONS UPGRADE	Compiled for: Axis Landscape Architects Reference:GAM2012- LANDS TYPES-A4.cdr Date: 2013-03-31	AXIS LANDSCAPE ARCHITECTURE

Figure 20: Photo plate 11

VIEW V: VIEW FROM A LOCAL ROAD TOWARDS ALTERNATIVE 2

VIEW W: VIEW FROM A LOCAL ROAD TOWARDS ALTERNATIVE 1

SITE CONTEXT PHOTO'S GAMMA KAPPA 765kV LINE AND SUBSTATIONS UPGRADE	Compiled for: Axis Landscape Architects Reference:GAM2012- LANDS TYPES-A4.cdr Date: 2013-03-31	AXIS LANDSCAPE ARCHITECTURE

Figure 21: Photo plate 12

VIEW X: VIEW FROM A LOCAL ROAD TOWARDS ALTERNATIVE 2

VIEW Y: VIEW FROM A LOCAL ROAD TOWARDS ALTERNATIVE 1

SITE CONTEXT PHOTO'S GAMMA KAPPA 765kV LINE AND SUBSTATIONS UPGRADE	Compiled for: Axis Landscape Architects Reference:GAM2012- LANDS TYPES-A4.cdr Date: 2013-03-31	AXIS LANDSCAPE ARCHITECTURE

Figure 22: Photo plate 13

VIEW A1: VIEW FROM THE R354 TOWARDS ALTERNATIVE 2

VIEW A2: VIEW FROM THE R354 TOWARDS ALTERNATIVE 3

SITE CONTEXT PHOTO'S GAMMA KAPPA 765kV LINE AND SUBSTATIONS UPGRADE	Compiled for: Axis Landscape Architects Reference:GAM2012- LANDS TYPES-A4.cdr Date: 2013-03-31	AXIS LANDSCAPE ARCHITECTURE

Figure 23: Photo plate 14

VIEW A3: VIEW FROM THE R354 TOWARDS ALTERNATIVE 1

VIEW A4: VIEW FROM A LOCAL ROAD TOWARDS ALTERNATIVE 1

SITE CONTEXT PHOTO'S GAMMA KAPPA 765kV LINE AND SUBSTATIONS UPGRADE	Compiled for: Axis Landscape Architects Reference:GAM2012- LANDS TYPES-A4.cdr Date: 2013-03-31	AXIS LANDSCAPE ARCHITECTURE

Figure 24: Photo plate 15

VIEW A5: VIEW FROM THE N1TOWARDS ALTERNATIVE 1

VIEW A6: VIEW FROM A LOCAL ROAD TOWARDS ALTERNATIVE A2

SITE CONTEXT PHOTO'S GAMMA KAPPA 765kV LINE AND SUBSTATIONS UPGRADE	Compiled for: Axis Landscape Architects Reference:GAM2012- LANDS TYPES-A4.cdr Date: 2013-03-31	AXIS LANDSCAPE ARCHITECTURE

Figure 25: Photo plate 16

VIEW A7: VIEW FROM A LOCAL ROAD TOWARDS ALTERNATIVE 3 CROSSING

VIEW A8: VIEW FROM A LOCAL ROAD TOWARDS THE KAPPA SUBSTATION

SITE CONTEXT PHOTO'S GAMMA KAPPA 765kV LINE AND SUBSTATIONS UPGRADE	Compiled for: Axis Landscape Architects Reference:GAM2012- LANDS TYPES-A4.cdr Date: 2013-03-31	AXIS LANDSCAPE ARCHITECTURE

5. IMPACT ASSESSMENT

The significance of impacts is a comparative function relating to the severity of the identified impacts on the respective receptors. The significance of an impact is considered *high* should a *highly* sensitive receptor be exposed to a *highly* severe impact (Table 6).

Table 6: Significance of impacts

RECEPTOR SENSITIVITY	IMPACT SEVERITY		
	LOW	MEDIUM	HIGH
LOW	No significance	Low	Low
MEDIUM	Low	Medium	Medium
HIGH	Low	Medium	High

5.1. SIGNIFICANCE OF LANDSCAPE IMPACT

5.1.1. LANDSCAPE CHARACTER SENSITIVITY

The sensitivity of the landscape character is an indication of " the degree to which a particular landscape can accommodate change from a particular development, without detrimental effects on its character" (GLVIA, 2002). A landscape with a *high* sensitivity would be one that is greatly valued for its aesthetic attractiveness and/or have ecological, cultural or social importance through which it contributes to the inherent character of the visual resource.

The assessment of the landscape is substantiated through professional judgement and informed reasoning which is based on the landscape character assessment in Section 4. A landscape sensitivity rating was adapted from GOSW (2006) (Table 7) and applied in the classification of the study area into different sensitivity zones.

Table 7: Landscape character sensitivity rating (Adapted from GOSW, 2006)

	DESCRIPTION
Low sensitivity	These landscapes are likely to: ◦ Have distinct and well-defined landforms; ◦ Have a strong sense of enclosure; ◦ Provide a high degree of screening; ◦ Have been affected by extensive development or man-made features; ◦ Have reduced tranquillity; ◦ Are likely to have little inter-visibility with adjacent landscapes; and ◦ Exhibit no or a low density of sensitive landscape features that bare visual value.
Moderately sensitivity	These landscapes are likely to: ◦ Have a moderately elevated topography with reasonably distinct landforms that provides some sense of enclosure; ◦ Have been affected by several man-made features; ◦ Have limited inter-visibility with adjacent landscapes; and ◦ Exhibit a moderate density of sensitive landscape features that bare visual value.
Highly sensitivity	These landscapes are likely to: ◦ Consist mainly of undulating plains and poorly defined landforms; ◦ Be open or exposed with a remote character and an absence of man-made features; ◦ Are often highly visible from adjacent landscapes; and ◦ Exhibit a high density of sensitive landscape features that bare visual value.

The majority of the study area is considered to have a moderately high landscape character sensitivity due to the undulating topography and undeveloped condition of the landscape, the generally high visual quality and the related tourism value that is placed on the visual resource. Low terrain variability mainly occurs through the study area where a moderately low VAC can be expected. Generally the vegetation cover is shrubland and scattered trees which will provide very little visual screening for the proposed transmission line.

The landscape character is considered moderately susceptible to change, whether it is a low intensity change over an extensive area or an acute change over a limited area. Generally, the vegetation occurring in the study area is rigid and recovers very slowly from surface disturbances.

Table 8: Landscape character sensitivity

LANDSCAPE TYPE (LT)	PREVAILING LANDSCAPE CHARACTER SENSITIVITY	AREA OF DISTURBANCE IN LT	LOCALISED REDUCTION OF SENSITIVITY
Touws River Karoo Region	Moderate	• Existing Power lines • Degraded areas around settlements	Low
Moordenaars Karoo Region	High	Degraded areas around settlements	Low
Central Karoo Region	Moderate	• The agricultural fields • Informal Settlements	Low

5.1.2. SEVERITY OF POTENTIAL LANDSCAPE IMPACTS

Landscape impacts are alterations to the fabric, character, visual quality and/or visual value which will either positively or negatively affect the landscape character. During the construction and operational phases, the project components are expected to impact on the landscape character of the landscape types. The magnitude/severity of this intrusion is measured against the scale of the project, the permanence of the intrusion and the loss in visual quality, -value and/or VAC.

Table 9: Landscape impact – Altering the landscape character

Activity	Nature of Impact	Extent of Impact	Duration of Impact	Severity of Impact	Probability of Impact	Significance without Mitigation	Significance with Mitigation	Level of Confidence
Construction phase								
Alternative 1	Negative – Impacting on the visual quality of the landscape due to the presence of foreign elements and a loss of vegetation cover.	Local	Permanent if not mitigated	Moderate	Definite	Moderate	Low	High
Alternative 2				Moderate	Definite	Moderate	Low	High
Alternative 3				Moderate	Definite	Moderate	Low	High
Operational phase								
Alternative 1	Negative – Impacting on the visual quality of the landscape due the presence of a power line.	Local	Permanent	Moderate	Definite	Moderate	Low	High
Alternative 2				Low	Definite	Low	Low	High
Alternative 3				Moderate	Definite	Moderate	Low	High

Construction phase

The activities that are expected to cause landscape impacts and that are associated with the construction phase, are the establishment of the construction camps, construction of access roads and the clearance of the site. These activities will create surface disturbances which will result in the removal of vegetation and the exposure of the underlying soil.

The extent of the disturbances will generally affect a relative large footprint area. Access roads to the towers are expected to be a two-track dirt road which will create the minimum disturbance. During construction, the area around the individual towers will be disturbed.

The construction camps and lay-down yards are anticipated to disturb a much larger area. The size and location of the construction camps will play a major role in the severity of the landscape impact. Due to a lack of technical information, two options are considered namely; the location of construction camps in remote, virgin land, or in/adjacent existing settlements. The initial presence of a construction camp in a undeveloped landscape will cause a temporary and localised alteration to the landscape character. A construction camp located in or adjacent to an existing town or settlement will be easily associated with the town and therefore the presence of the town, mitigates the impact. The mitigating result is most effective, the bigger the town or settlement is.

Servitudes will generally be cleared of higher growing and dense vegetation to reduce biomass that may cause a fire hazard if ignited. The complete removal of high growing vegetation and scrubs will result in disturbed areas of exposed soil and difference in texture.

The exposed soil and change in texture will contrast severely with the intact vegetation around the disturbance footprint and servitudes.

Considering the moderately low VAC throughout most of the study area, the undisturbed condition of parts of the landscape and the recovery rate of the endemic vegetation, the *severity of landscape impact* during the construction stage is expected to be low for Alternative 2 and moderate for Alternatives 1 and 3. The impact will extend over the entire length of the different alignments and may vary in degrees of severity along the linear length as it transects landscape types of varying VAC. Surface disturbances are also minimised through, for example, utilising existing roads.

Operational phase

Surface disturbances created during construction may remain for an extended period during the operational phase. These are seen as residual affects carried forward from the construction phase and can be completely or substantially mitigated if treated appropriately during the construction phase.

An additional impact will be caused as a result of the presence of the completed transmission line, i.e. that of the evenly spaced towers of the lines, buildings and structures. The industrial character and the near monumental vertical scale of the towers will contrast with the diverse landscape character that prevails through most of the study area.

5.2. SIGNIFICANCE OF VISUAL IMPACTS

5.2.1. VIEWER SENSITIVITY

Within the receiving environment, specific viewers (visual receptors) experience different views of the visual resource and value it differently. They will be affected because of alterations to their views due to the proposed project. The visual receptors are grouped according to their similarities. The visual receptors included in this study are:

- Residents;
- Tourists; and
- Motorists.

To determine visual receptor sensitivity a commonly used rating system is utilised. This is a generic classification of visual receptors and enables the visual impact specialist to establish a logical and consistent visual receptor sensitivity rating for viewers who are involved in different activities without engaging in extensive public surveys.

5.2.1.1 Residents

Residents of the affected environment are classified as visual receptors of *high* sensitivity owing to their sustained visual exposure to the proposed development as well as their attentive interest towards their living environment.

5.2.1.2 Tourists

Tourists are regarded as visual receptors of exceptional *high* sensitivity. Their attention is focused towards the landscape which they essentially utilise for enjoyment purposes and appreciation of the quality of the landscape.

5.2.1.3 Motorists

Motorists are generally classified as visual receptors of *low* sensitivity due to their momentary view and experience of the proposed development. As a motorist's speed increases, the sharpness of lateral vision declines and the motorist tends to focus on the line of travel (USDOT, 1981). This adds weight to the assumption that under normal conditions, motorists will show *low* levels of sensitivity as their attention is focused on the road and their exposure to roadside objects is brief.

Motorists on the scenic routes in the study area will present a higher sensitivity. Their reason for being in the landscape is similar to that of the tourists and they will therefore be categorised as part of the tourist viewer group.

5.2.2. SEVERITY OF POTENTIAL VISUAL IMPACTS

Severity of visual impact refers to the magnitude of change to specific visual receptor's views and/or experience of the landscape. Severity of visual impact is influenced by the following factors:

- The **viewer's exposure** to the project:
  - Distance of observers from the proposed project;
  - The visibility of the proposed project (ZVI);
  - Number of affected viewers; and
  - Duration of views to development experienced by affected viewers.
- Degree of **visual intrusion** created by the project.

Empirical research indicates that the visibility of a transmission tower and hence the severity of visual impact, decreases as the distance between the observer and the tower increases. The landscape type, through which the transmission line crosses, can mitigate the severity of visual impact through topographical or vegetative screening. Bishop *et al* (1988) noticed that in some cases the tower may dominate the view for example, silhouetted against the skyline, or in some cases be absorbed in the landscape. A complex landscape setting with a diverse land cover and topographical variation has the ability to decrease the severity of visual impact more than a mundane landscape (Bishop *et al*, 1985).

The Zone of Visual Influence (ZVI) is determined through a Geographical Information System (GIS). The result reflects a shaded pattern which identifies the areas that are expected to experience views of the proposed alignments. The ZVI is limited to 5 km from the proposed locations.

A visibility analysis has been completed for each of the three alternative alignments and deviation routes (APPENDIX 1). According to Bishop *et al* (1988), visual receptors within 1 km from the alignment are most likely to experience the highest degree of visual intrusion, hence contributing to the severity of the visual impact. This is considered as the zone of highest visibility after which the degree of visual intrusion decreases rapidly at distances further away.

In order to assess the extent and degree of visibility in the visual envelope, a Geographical Information System (GIS) was utilised. A visibility analysis was performed which provides the following information (Figure 26 - Figure 28):

- The areas within the visual envelope that may experience views of the proposed project; and
- The degree of visibility in terms of the percentage of the proposed project that will be visible from a specific location.

The GIS performs an analysis for a series of elevated observer points which represents the height of the entire power line in a digital elevation model (DEM). This results in a visibility map with the degree of visibility illustrated by a colour.

The visibility analyses consider worst-case scenarios, using line-of-sight, based on topography alone. The screening capability of vegetation is not captured in the base model of the DEM and is therefore not considered in these results.

5.2.2.1 Potential visual impacts on residents

Activity	Nature of Impact	Extent of Impact	Duration of Impact	Severity of Impact	Probability of Impact	Significance without Mitigation	Significance with Mitigation	Level of Confidence
Construction phase								
Alternative 1	Negative – Construction camp and lay-down yard may cause unsightly views.	Local	Temporary	Moderate	Definite	Low	Low	High
Alternative 2				Moderate	Definite	Low	Low	High
Alternative 3				Moderate	Definite	Low	Low	High
Operational phase								
Alternative 1	Negative – The presence of a power line intrudes on existing views and spoils the open panoramic views of the landscape.	Local	Permanent	Moderate	Definite	Low	Low	High
Alternative 2				Moderate	Definite	Low	Low	High
Alternative 3				Moderate	Definite	Low	Low	High

Generally, the study area is sparsely populated except around the human settlements, farms and towns. These communities are normally situated along main transportation routes, near agricultural areas or adjacent rivers or water resources

Residential areas and farm residents will experience an intrusion on their views due to the presence of the proposed Transmission Line. It is unpractical to discuss all, but they are recognised as the general population of the study area and are identified as affected visual receptors.

Considering the distribution of residents across the study area, it can be concluded that the entire study area has a low density of residents with the exception of higher concentrations of residents in the towns and human settlements.

Construction phase

During the construction phase, unsightly views may be created by the presence of construction camps and the lay-down yards. The duration of the potential visual impact will be temporary which will result in an anticipated *moderately low* significance of visual impact for all the alternatives. The visual exposure to the construction activity will initially be limited and only local residents will experience views of the site preparation activity. As the structures increase in scale and height, the ZVI increases, resulting in a greater number of affected viewers and a subsequent increase in visual exposure.

The cleared sites, construction camps and material lay-down yard will appear unsightly and out of character. Large scale construction elements such as cranes, will be highly visible and increase awareness of the construction activity over a considerable area. The visual intrusion caused during the construction stage will be moderate, but will be temporary in nature.

Operational phase

The residents of the residential areas and farming communities next to the power lines may experience a moderate degree of visual intrusion due to their proximity to all the Alternatives.

The presence of a transmission line in the visual field of the residents in this part of the study area will spoil the uncluttered panoramic views they currently experience. The silhouette of a transmission line on the horizon will be visible from a great distance and thus increase the ZVI considerably, potentially impacting on more residents.

5.2.2.2 Potential visual impacts on tourists

Activity	Nature of Impact	Extent of Impact	Duration of Impact	Severity of Impact	Probability of Impact	Significance without Mitigation	Significance with Mitigation	Level of Confidence
Construction phase								
Alternative 1	Negative – Construction camp and lay-down yard may cause unsightly views and spoil the undisturbed views over the landscape.	At a number of point locations	Temporary	Moderate	Definite	Moderate	Low	High
Alternative 2				Low	Definite	Low	Low	High
Alternative 3				High	Definite	Moderate	Low	High
Operational phase								
Alternative 1	Negative – The presence of a power line intrudes on existing views of the landscape	Local	Permanent	Moderate	Definite	Moderate	Low	High
Alternative 2				Low	Definite	Low	Low	High
Alternative 3				High	Definite	Moderate	Low	High

The study area is renowned for its karoo and mountainous landscapes especially in the Karoo National Park as well as the central and southern regions. These characteristics provide the basis for the tourism industry which plays a role in the economy of the Western and Northern Cape Provinces. The entire study area is considered to have a moderately high tourism potential.

The type of tourist that visits this area is expected to travel considerably through the study area by vehicle. This implies that they will experience a large part of the study area in a relative short time span.

Construction phase

The temporary duration of the construction phase is expected to cause high visual impacts, especially Alternative 3. The location and size of the construction camps and lay-down yards will be crucial in regulating the impact. Detailed information is not available and it is anticipated that the visual impact will occur localised and that a small number of tourists will be adversely affected by these project components during construction.

Their exposure to possible unsightly views of the construction camps and the associated activity will however be minimal and localised.

The potential visual impact on tourists during the construction phase of the proposed project can be mitigated with relative ease except for Alternatives 2 and 3. The greatest factor to consider is the location of the construction camps from potential views that may be experienced from scenic routes or tourist hotspots.

Operational phase

Considering the extent of the proposed alternatives, a number of tourists will be affected during their visit to the study area. Although it is difficult to pinpoint particular locations in the study area that are of specific tourist value, since the entire study area bares some value, the most obvious concentration of tourists can be expected in the northern central part of the study area. For these tourists, Alternatives 2 and 3 will create alterations to their views. The presence of a transmission line in this undeveloped landscape will spoil the views that are experiencing. It can be concluded that Alternative 3 will cause a high visual intrusion in the views expected by tourists travelling through the study area.

5.2.2.3 Potential visual impacts on motorists

Activity	Nature of Impact	Extent of Impact	Duration of Impact	Severity of Impact	Probability of Impact	Significance without Mitigation	Significance with Mitigation	Level of Confidence
Construction phase								
Alternative 1	Negative – Intruding on existing views of the landscape.	At a number of point locations	Short period	Moderate	Definite	Low	Low	High
Alternative 2				Moderate	Definite	Low	Low	High
Alternative 3				Moderate	Definite	Low	Low	High
Operational phase								
Alternative 1	Negative – Intruding on existing views of the landscape.	Local	Short period	Moderate	Definite	Low	Low	High
Alternative 2				Moderate	Definite	Low	Low	High
Alternative 3				High	Definite	Moderate	Low	High

The major routes in the study area are the N1, N12, R63, R61, R381, R353 and R354 connecting the towns and informal settlements. The secondary road network in the study area carries a much lower volume of motorists. Many of the roads are gravel roads which are mostly utilised by the local residents. Their duration of views will be temporary and it is expected that the visual intrusion that they will experience will be moderately low.

Construction phase

The potential visual impact that may be experienced by motorists during the construction phase is considered to be minimal. Limited information is available and the number, location and size of the construction camps and lay-down yards are essential for accurately assessing the visual impact. It is anticipated that views of the construction camps and lay-down yards of all the alternative routes will be visible from the major roads. The possibility that a construction camp will be established at this location is high and can be motivated from an accessibility point of view, due to the proximity to a major route.

The presence of the construction camp and lay-down yards may create unsightly views. Motorists' visual exposure to the impact will be brief and the severity of visual impact will be moderately low. The significance of potential visual impact is expected to be low.

Operational phase

The N1, R63, and N12 are the most prominent, carrying the highest volume of traffic. Alternative 1 will be the most visible from the N1 and N12. The severity and significance of visual impact for the proposed alternative 1 on motorists will be high and moderate for the other alternatives.

6. RECOMMENDED MITIGATION MEASURES

The aim of mitigation is to reduce or alleviate the intrusive contrast between the proposed project components and activities, and the receiving landscape to a point where it is acceptable to visual and landscape receptors.

6.1. GENERAL

- Proceed with construction of the substation during the off peak tourism season;
- Where areas are going to be disturbed through the destruction of vegetation, for example the establishment of the construction camp, the vegetation occurring in the area to be disturbed must be salvaged and kept in a controlled environment such as a nursery, for future re-planting in the disturbed areas as a measure of rehabilitation;

6.2. ACCESS ROUTES

- Make use of existing access roads where possible;
- Where new access roads are required, the disturbance area should be kept as small as possible. A two-track dirt road will be the most preferred option;
- Locate access routes so as to limit modification to the topography and to avoid the removal of established vegetation;
- Avoid crossing over or through ridges, rivers, pans or any natural features that have visual value. This also includes centres of floral endemism and areas where vegetation is not resilient and takes extended periods to recover;
- Maintain no or minimum cleared road verges;
- Access routes should be located on the perimeter of disturbed areas such as cultivated/fallow lands as not to fragment intact vegetated areas; and
- If it is necessary to clear vegetation for a road, avoid doing so in a continuous straight line. Alternatively, curve the road in order to reduce the visible extent of the cleared corridor.

6.3. TRANSMISSION TOWERS

- Avoid crossing over or through ridges, rivers, pans or any natural features that have visual value. This also includes centres of floral endemism and areas where vegetation is not resilient and takes extended periods to recover;
- The preferred type of tower is the compact cross-rope or the cross-rope suspension tower. These two tower types are the most visually permeable and create an extremely low degree of visual obstruction;
- Avoid changing the alignment's direction too often in order to minimise the use of the self-supporting strain tower. This tower type is the most visually intrusive as the steel lattice structure is more dense than the other two tower types, hence creating more visual obstruction;
- Plan the route so that the route crosses existing main routes as close to 90° as possible as this will reduce the time that the line is in the viewshed of the passing motorist / viewer;
- Where practically possible, provide a minimum of 1 km buffer area between the transmission line and sensitive visual receptors; and
- Rehabilitate disturbed areas around pylons as soon as practically possible after construction. This should be done to restrict extended periods of exposed soil.
- Align the route along the footslopes of hills, mountains and ridges. This is to maximise the backdrop screening effect of the topography that will reduce presenting the Transmission line in silhouette.
- Plan the route so that the route crosses existing main routes as close to 90° as possible as this will reduce the time that the line is in the viewshed of the passing motorist / viewer.

- Align the route through areas of existing visual clutter and disturbance such as alongside railway lines, existing Transmission lines, roads and other visible infrastructure, rather than through pristine or undisturbed areas where possible. However, the cumulative effect of adding to the visual clutter prior to the final placement should be evaluated
- Avoid areas where the current land uses, such as game farm, lodges, etc. often rely on the absence of human visual intrusion.
- The galvanising of the pylon should be allowed to weather to a matt grey finish rather than be painted silver, as is often the case. This allows the structures to blend in with the existing environmental colours more readily than the silver that is highly reflective especially early morning and late afternoon. Should it be necessary to paint, it is recommended that a neutral matt finish be used.

6.4. CLEARED SERVITUDES

- Locate the alignment and the associated cleared servitude so as to avoid the removal of established vegetation; and
- Avoid a continuous linear path of cleared vegetation that would strongly contrast with the surrounding landscape character. Feather the edges of the cleared corridor to avoid a clearly defined line through the landscape.

6.5. CONSTRUCTION CAMPS AND LAY DOWN YARDS

- If practically possible, locate construction camps in areas that are already disturbed or where it isn't necessary to remove established vegetation like for example, naturally bare areas;
- Utilise existing screening features such as dense vegetation stands or topographical features to place the construction camps and lay-down yards out of the view of sensitivity visual receptors;
- Keep the construction sites and camps neat, clean and organised in order to portray a tidy appearance; and
- Screen the construction camp and lay-down yards by enclosing the entire area with a dark green or black shade cloth of no less than 2 m height.

7. CONCLUSION

The three Alternatives have been evaluated against international accepted criteria to determine the impact they will have on the landscape character and the viewers that have been identified in the study area.

The alternatives are rated according to preference by using a three-point rating system in Table 10, three (3) being the least preferred, to one (1) being the most preferred. The preference rating is informed by the impact assessment discussions in Section 5 and the overall performance of each alternative with regards to the impact on the landscape character and the identified viewers.

Table 10: Evaluation of alternative alignments

ALTERNATIVES	PREFERENCE RATING
Alternative 1	2
Alternative 2	1
Alternative 3	3

Alternative 2 is regarded as the most preferred alternative. Its alignment along the existing transmission line and transmission servitude is considered to cause the least impact on the landscape character due to the reduced sensitivity of the landscape along the roads and servitudes.

The impact of Alternative 2 on visual receptors varies between residents, tourists and motorists. Alternative 2's great advantage lies in the less significant visual impact on tourists and residents as compared to the other alternatives. The public association with transmission lines and major public roads is a common perception which makes the co-existence of these two features more acceptable.

APPENDIX 1

Figure 26 - Figure 28 reflects the results of a visibility assessment, carried out using GIS software. The results provide a clear interpretation of the extent of the visual influence and also provide an indication of the land use that can be expected in the affected areas. Through the integration of different GIS datasets it is possible to identify areas along the alternative alignments that may cause higher impacts.

Figure 26: Alternative 1

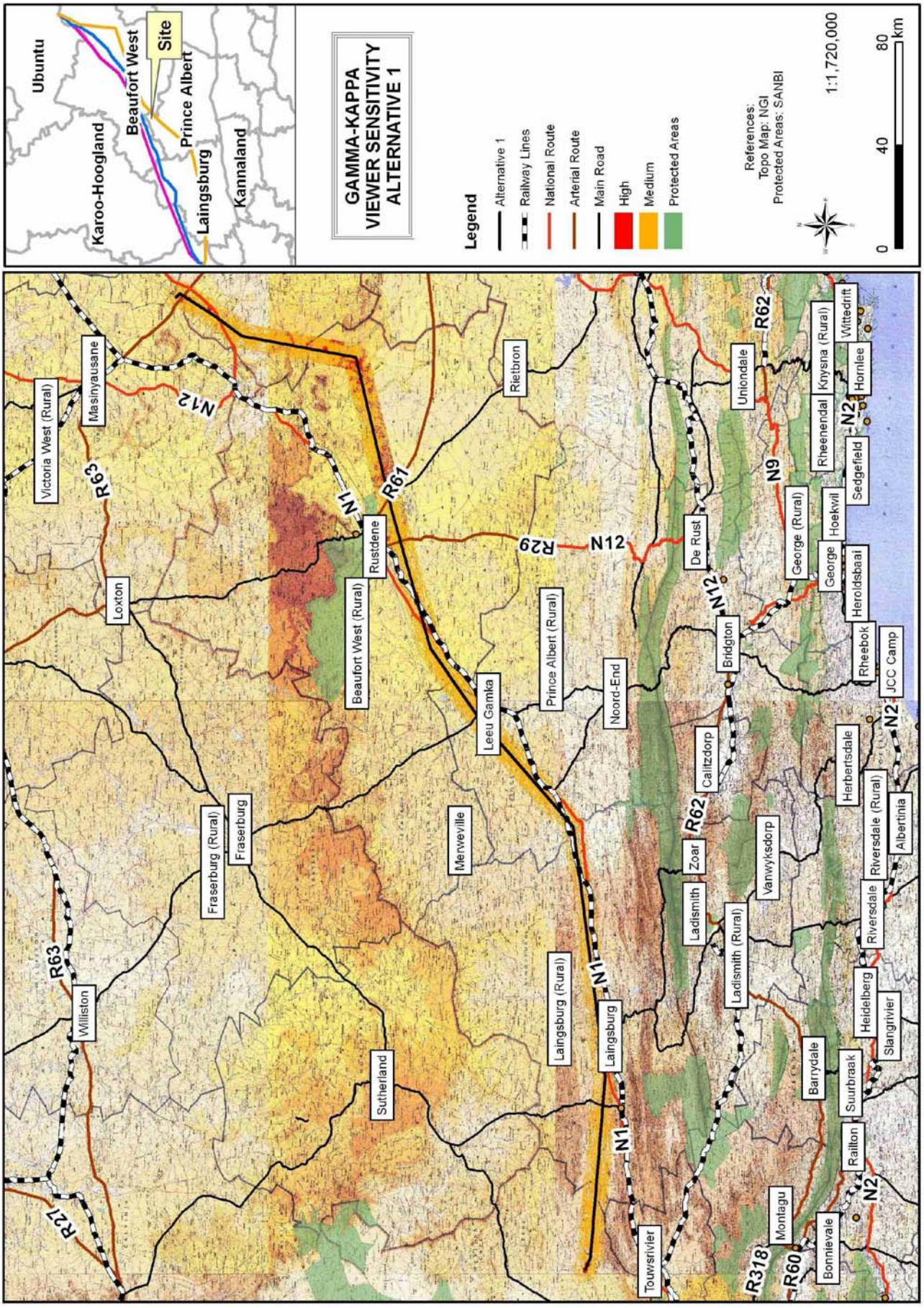


Figure 27: Alternative 2

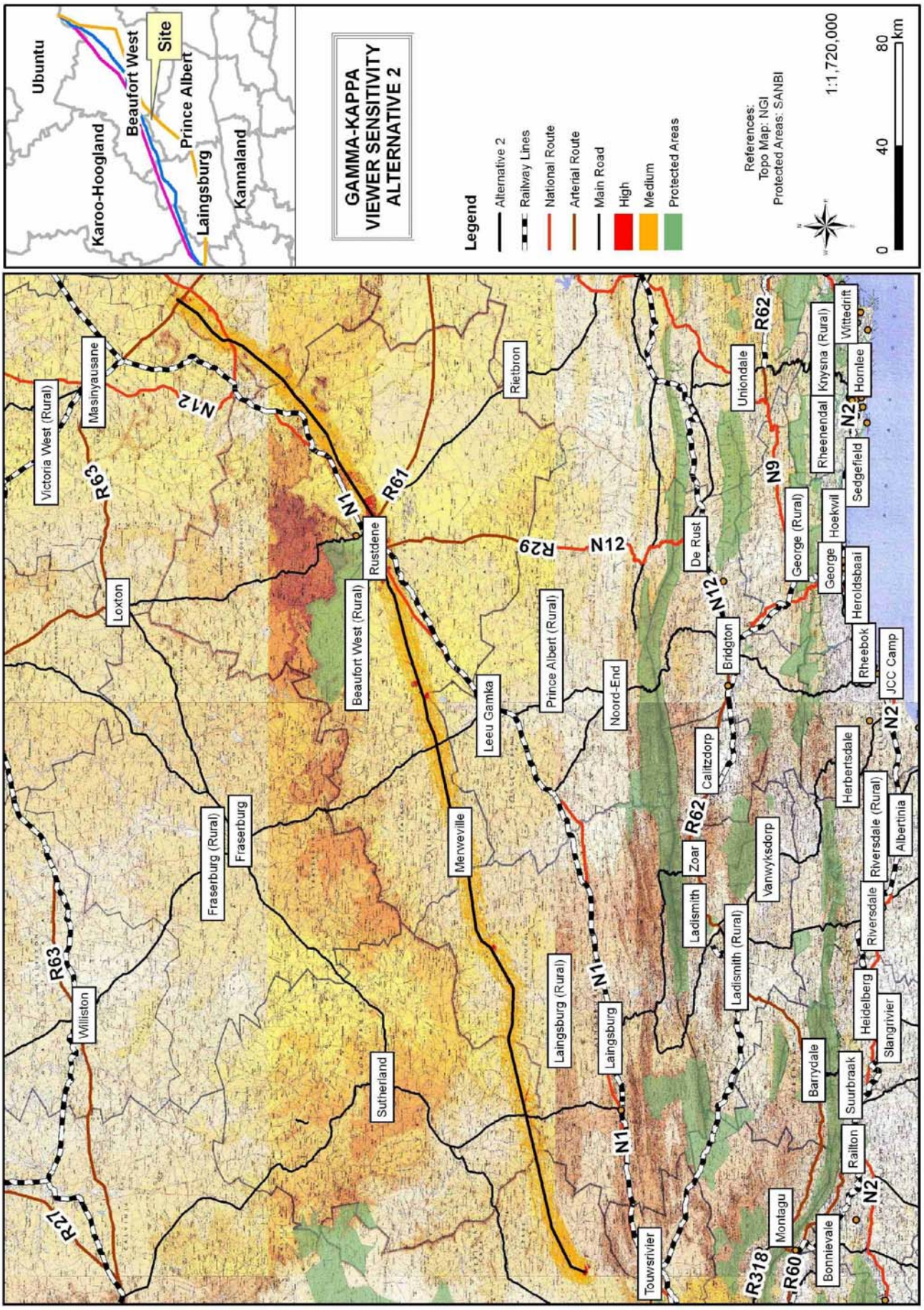
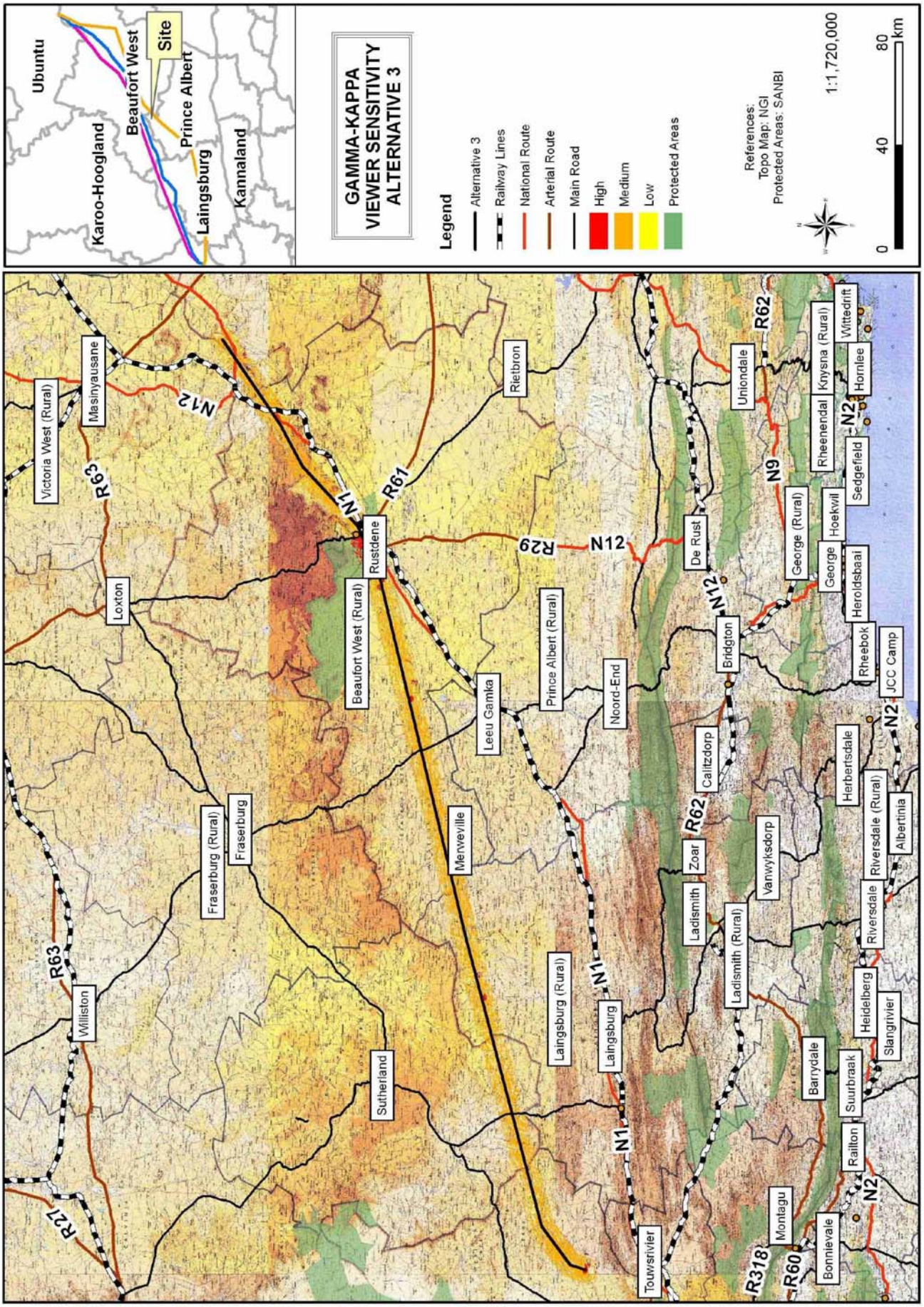


Figure 28: Alternative 3



GLOSSARY OF TERMS

Aesthetics	The science or philosophy concerned with the quality of sensory experience. (ULI, 1980)
Horizon contour	A line that encircles a development site and that follows ridgelines where the sky forms the backdrop and no landform is visible as a background. This is essentially the skyline that when followed through the full 360-degree arc as viewed from a representative point on the site defines the visual envelope of the development. This defines the boundary outside which the development would not be visible.
Landscape characterisation/ character	This covers the gathering of information during the desktop study and field survey work relating to the existing elements, features, and extent of the landscape (character). It includes the analysis and evaluation of the above and the supporting illustration and documentary evidence.
Landscape condition	Refers to the state of the landscape of the area making up the site and that of the study area in general. Factors affecting the condition of the landscape can include the level maintenance and management of individual landscape elements such as buildings, woodlands etc and the degree of disturbance of landscape elements by non-characteristics elements such as invasive tree species in a grassland or car wrecks in a field.
Landscape impact	Changes to the physical landscape resulting from the development that include; the removal of existing landscape elements and features, the addition of new elements associated with the development and altering of existing landscape elements or features in such as way as to have a detrimental affect on the value of the landscape.
Landscape unit	A landscape unit can be interpreted as an “outdoor room” which are enclosed by clearly defined landforms or vegetation. Views within a landscape unit are contained and face inward.
Sense of place	That distinctive quality that makes a particular place memorable to the visitor, which can be interpreted in terms of the visual character of the landscape. A more emotive sense of place is that of local identity and attachment for a place “*which begins as undifferentiated space* [and] *becomes place as we get to know it better and endow it with value*” (Tuan 1977)[1].
Viewer exposure	The extent to which viewers are exposed to views of the landscape in which the proposed development will be located. Viewer exposure considers the visibility of the site, the viewing conditions, the viewing distance, the number of viewers affected, the activity of the viewers (tourists or workers) and the duration of the views.
Viewer sensitivity	The assessment of the receptivity of viewer groups to the visible landscape elements and visual character and their perception of visual quality and value. The sensitivity of viewer groups depends on their activity and awareness within the affected landscape, their preferences, preconceptions and their opinions.
Visual absorption capacity (VAC)	The inherent ability of a landscape to accept change or modification to the landscape character and/or visual character without diminishment of the visual quality or value, or the loss of visual amenity. A high VAC rating implies a high ability to absorb visual impacts while a low VAC implies a low ability to absorb or conceal visual impacts.

[1] Cited in Climate Change and Our 'Sense of Place', http://www.ucsusa.org/greatlakes/glimpactplace.html

Visual amenity The notable features such as hills or mountains or distinctive vegetation cover such as forests and fields of colour that can be identified in the landscape and described. Also included are recognised views and viewpoints, vistas, areas of scenic beauty and areas that are protected in part for their visual value.

Visual character This addresses the viewer response to the landscape elements and the relationship between these elements that can be interpreted in terms of aesthetic characteristics such as pattern, scale, diversity, continuity and dominance.

Visual contour The outer perimeter of the visual envelope determined from the site of the development. The two dimensional representation on plan of the horizon contour.

Visual contrast The degree to which the physical characteristics of the proposed development differ from that of the landscape elements and the visual character. The characteristics affected typically include:

- Volumetric aspects such as size, form, outline and perceived density;
- Characteristics associated with balance and proportion such scale, diversity, dominance, continuity;
- Surface characteristics such as colour, texture, reflectivity; and
- Luminescence or lighting.

Visual envelope The approximate extent within which the development can be seen. The extent is often limited to a distance from the development within which views of the development are expected to be of concern.

Visual impact Changes to the visual character of available views resulting from the development that include: obstruction of existing views; removal of screening elements thereby exposing viewers to unsightly views; the introduction of new elements into the view shed experienced by visual receptors and intrusion of foreign elements into the view shed of landscape features thereby detracting from the visual amenity of the area.

Visual impact assessment A specialist study to determine the visual effects of a proposed development on the surrounding environment. The primary goal of this specialist study is to identify potential risk sources resulting from the project that may impact on the visual environment of the study area, and to assess their significance. These impacts include landscape impacts and visual impacts.

Visual quality An assessment of the aesthetic excellence of the visual resources of an area. This should not be confused with the value of these resources where an area of low visual quality may still be accorded a high value. Typical indicators used to assess visual quality are vividness, intactness and unity. For more descriptive assessments of visual quality attributes such as variety, coherence, uniqueness, harmony, and pattern can be referred to.

Visual receptors Includes viewer groups such as the local community, residents, workers, the broader public and visitors to the area, as well as public or community areas from which the development is visible. The existing visual amenity enjoyed by the viewers can be considered a visual receptor such that changes to the visual amenity would affect the viewers.

Zone of visual influence The extent of the area from which the most elevated structures of the proposed development could be seen and may be considered to be of interest (see visual envelope).

LEVEL OF CONFIDENCE

Table 11: Confidence level chart and description

CONFIDENCE LEVEL CHART				
	Information, knowledge and experience of the **project**			
Information, and knowledge of the **study area**		3b	2b	1b
	3a	9	6	3
	2a	6	4	2
	1a	3	2	1

3a – A *high* level of information is available of the **study area** in the form of recent aerial photographs, GIS data, documented background information and a thorough knowledge base could be established during site visits, surveys etc. The study area was readily accessible.

2a – A *moderate* level of information is available of the **study area** in the form of aerial photographs GIS data and documented background information and a moderate knowledge base could be established during site visits, surveys etc. Accessibility to the study area was acceptable for the level of assessment.

1a – *Limited* information is available of the **study area** and a poor knowledge base could be established during site visits and/or surveys, or no site visit and/or surveys were carried out.

3b – A *high* level of information and knowledge is available of the **project** in the form of up-to-date and detailed engineering/architectural drawings, site layout plans etc. and the visual impact assessor is well experienced in this type of project and level of assessment.

2b – A *moderate* level of information and knowledge is available of the **project** in the form of conceptual engineering/architectural drawings, site layout plans etc. and/or the visual impact assessor is moderately experienced in this type of project and level of assessment.

1b – *Limited* information and knowledge is available of the **project** in the form of conceptual engineering/architectural drawings, site layout plans etc. and/or the visual impact assessor has a low experience level in this type of project and level of assessment. (Adapted from Oberholzer. B, 2005)

VISUAL RECEPTOR SENSITIVITY

Table 12: Visual receptor sensitivity

VISUAL RECEPTOR SENSITIVITY	DEFINITION (BASED ON THE GLVIA 2ND ED PP90-91)
Exceptional	Views from major tourist or recreational attractions or viewpoints promoted for or related to appreciation of the landscape, or from important landscape features.
High	Users of all outdoor recreational facilities including public and local roads or tourist routes whose attention or interest may be focussed on the landscape; Communities where the development results in changes in the landscape setting or valued views enjoyed by the community; Residents with views affected by the development.
Moderate	People engaged in outdoor sport or recreation (other than appreciation of the landscape);
Low	People at their place of work or focussed on other work or activity; Views from urbanised areas, commercial buildings or industrial zones; People travelling through or passing the affected landscape on transport routes.
Negligible (Uncommon)	Views from heavily industrialised or blighted areas

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