KUDU INTEGRATION PROJECT FOR TRANSMISSION POWER-LINES AND SUBSTATIONS

VISUAL IMPACT ASSESSMENT

Eskom Transmission
PO Box 1091
Johannesburg
2157

Tel (011) 800-2465
Fax (011) 800-3917
E-mail: john.geeringh@eskom.co.za

Prepared by:

PD Naidoo & Associates
in association with
Strategic Environmental Focus (Pty) Ltd
P.O. Box 74785
LYNNWOOD RIDGE
0040
Tel. No.: (012) 349-1307
Fax. No.: (012) 349-1229
e-mail: sef@sefsa.co.za

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EXECUTIVE SUMMARY

Strategic Environmental Focus (Pty) Ltd in association with P.D. Naidoo & Associates (PDNA) was appointed by Eskom Transmission to follow the appropriate environmental process for the construction of a 400kV power line between the Oranjemond and Juno substations in the Northern and Western Cape.

A number of alternative alignments have been proposed to connect to the Western Grid of Eskom and supply electricity to the Western Cape. The transmission line will start in Namibia and cross the border east of Alexander Bay where it will join up with the Oranjemond substation. From here the proposed transmission line will be located adjacent the existing Oranjemond-Gromis-Nama 220kV line up to the Gromis substation. From the Gromis substation seven alternative alignments have been proposed to the Juno substation adjacent to Vredendal.

The study area contains the extent of all the alternative alignments (except Alternative D) and includes an approximate 10 km buffer area around the alternatives. Alternative D falls outside of the study area as it was not part of the initial scope of work. An accurate assessment can not be completed for alternative D and only a specialist opinion will be included in this document derived from a desktop study.

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; and
- Transmission line.

Of the three project components the towers of the transmission line are expected to cause the greatest impacts. A brief description of the tower characteristics, the seven alternatives and their individual routes are discussed in the following tables.

Types and typical characteristics of proposed towers			
Type	**Compact cross-rope tower**	**Self-supporting strain tower**	**Cross-rope tower**
Maximum Height	38 m	30 m	38 m
Concrete footings	2	4	2
Servitude width	55 m	47 m	80 m
Stays	2	None	4

DESCRIPTION OF ALTERNATIVE ALIGNMENTS	
ALTERNATIVES	**DESCRIPTION**
Alternative A	Alternative A is a relatively straight corridor from the Gromis substation to the Juno substation bisecting the Namaqualand National Park (NNP).
Alternative B	Alternative B will pass the NNP on the western side but will pass through the proposed western expansion of the park. From Hondeklipbaai the line will stay west on the coastal plateau until it joins up with the Nuwerus-Lutzville road. The line will follow the road to Juno substation.
Alternative C	Alternative C is proposed along the existing 220kV servitude between Gromis and Springbok. From Springbok the line will be constructed parallel to the N7 down to Juno substation.
Alternative D	Alternative D will follow the same existing servitude as Alternative C up to Springbok. From Springbok the line will continue south-east over the Kamiesberge and through the Boesmanland and Knersvlakte to Juno substation.
Alternative F	Alternative E is similar to Alternative B but will follow the route proposed by Alternative A from the Spoeg River to the Groot Goerap River, where after it will rejoin with Alternative B.
Alternative F	Alternative F will follow the same route as Alternative C but will branch off to the south at a certain point. The line will then cross the N7 and run east of the N7 beyond Kamieskroon, at which point the line would turn to the west and cross the N7 again between Kamieskroon and Garies. The line will follow a straight diagonal path to where it will meet up with Alternative B.
Alternative G	Alternative G will follow Alternative A, deviating from the route to the east before it enters the NNP. It will stay as close to the escarpment as possible. The line will follow the escarpment until it has passed through the park boundary, where after it will turn west to follow Alternative A again.

DESCRIPTION OF THE AFFECTED ENVIRONMENT

Broadly speaking, the study area is vacant and uninterrupted, covered with a uniformly textured vegetation layer. Extensive landscape disturbance originate from mining activities and is present in a narrow strip along the coast line. Isolated occurrences of cultivated fields are found between the coast and the Kamiesberg Range, which become more intense further south and around Vredendal. Human settlements are far apart and portray a remote country lifestyle.

The landscape character changes considerably 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 following broad scale landscape types have been identified in the study area:

- Orange River Valley;
- Strandveld Coast Line;
- Disturbed Strandveld Coast Line;
- Lowland Succulent Karoo plains;
- Kamiesberg Succulent Karoo;
- Vredendal Agricultural; and
- Olifants River Valley.

Probably the most famous phenomenon of the study area is the spectacular floral display in early spring. For ten months of the year the landscape of the Northern Cape is a dry and semi-arid desert landscape. This rapidly changes after the first rains when the landscape bursts into an array of colours during August and September. The Namaqualand National Park (NNP) is renowned for the spectacular floral displays and can be categorised as a tourist hotspot.

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 landscape character sensitivity of the different landscape types is categorised according to a rating system adapted from the England Government Office of the South-West (GOSW) (2006). A summary of the rating system can be found in the main report, Table 7.

The majority of the study area is considered to have a *high* landscape character sensitivity due to the relatively undeveloped and pristine 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 in the western part of the study area where a low to moderate Visula Absorption Capacity (VAC) can be expected. Generally the vegetation cover is limited to low shrubs and ground covers which will provide no visual screening for the proposed transmission line.

The landscape character of the different landscape types is considered highly 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 not resilient and recovers very slowly from surface disturbances. This often results in long periods of exposed soil and a reduction in visual quality.

Certain areas in the study area have previously been disturbed by human activities. These areas have undergone a loss in landscape character sensitivity and do not portray the same level of visual quality as the rest of the study area. The reduced sensitivities of the different landscape characters are localised and do not account for the entire landscape type. These areas and the reduced sensitivities are summarised in Table 8.

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 traverse.

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 A	Negative – Impacting on the visual quality of the landscape due to the presence of foreign elements and a loss of vegetation cover.	Localised impacts over an extensive area	Permanent if not mitigated	High	Definite	High	Low	High
Alternative B				High	Definite	High	Low	High
Alternative C				Moderate	Highly probable	Moderate	Low	High
Alternative D				Moderate	Probable	Moderate	Low	Low
Alternative E				High	Definite	High	Low	High
Alternative F				High	Definite	High	Low	High
Alternative G				High	Definite	High	Low	High
Operational phase								
Alternative A	Negative – Impacting on the visual quality of the landscape due the presence of a transmission line.	Regional	Permanent	High	Definite	High	High	High
Alternative B				High	Definite	High	High	High
Alternative C				Moderate	Highly probable	Moderate	Low	High
Alternative D				Moderate	Probable	Moderate	Moderate	Low
Alternative E				High	Definite	High	High	High
Alternative F				High	Definite	High	High	High
Alternative G				High	Definite	High	High	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 camp, construction of access roads and the clearance of the servitude. These activities will create surface disturbances which will result in the removal of vegetation and the exposure of the underlying soil.

The construction camps and lay-down yards are anticipated to disturb a relatively large area. 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 pristine 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.

Considering the low VAC throughout most of the study area, the pristine condition of great parts of the landscape and the slow recovery rate of the endemic vegetation, the *severity of landscape impact* during the construction stage is expected to be *high* for Alternatives A, B, E, F and G. 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.

Alternative C is aligned along the existing R355 route and the N7 between the Gromis and Juno substations. The presence of the roads has caused a localised reduction in the visual quality of the landscape types. Large areas along these routes are occupied by active or fallow cropland which further reduces the quality of the landscape. The VAC between Springbok and Bitterfontein is also considered high due to the varied topography of the Kamiesberg Mountain range. These factors limit the severity of landscape impact to a *moderate* degree.

Operational phase

Landscape impact will occur as a result of the presence of the completed transmission line, i.e. that of the evenly spaced towers. The industrial character and the near monumental vertical scale of the towers, will severely contrast with the simple and mundane landscape character that prevails through most of the study area.

The remoteness of the western part of the study area is considered as a landscape amenity that provides the study area with a unique and valued sense of place. This quality of the landscape will be adversely affected with the presence of a transmission line of this scale and extent. Proclaimed conservation areas such as the NNP and the proposed expansion of its jurisdiction, will experience major loss in visual quality which will impact on the landscape character.

Alternatives A, B, E, F and G traverse over the jurisdiction area of the NNP and also extend over the southern areas of the study area which are also considered as highly valued tourist areas. The significance of the landscape impact will be *high*.

Alternative C is aligned along the existing R355 and the N7 highway. The co-existence of transport routes and transmission lines is a common sight in South Africa and these land uses are considered compatible. The location of Alternative C parallel to the N7 is the most preferred alternative even though it traverses through a generally highly sensitive landscape, the Kamiesberg Succulent Karoo and Lowland Succulent Karoo plains. A localised reduction of landscape character sensitivity occurs along the R 355 and N7 routes which will result in a *moderate* significance of landscape impact.

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 A	Negative – Construction camp and lay-down yards may cause unsightly views.	Local	Temporary	Low	Probable	Low	Low	Low
Alternative B				Low	Probable	Low	Low	Low
Alternative C				Moderate	Probable	Moderate	Low	Low
Alternative D				Low	Probable	Low	Low	Low
Alternative E				Low	Probable	Low	Low	Low
Alternative F				Low	Probable	Low	Low	Low
Alternative G				Low	Probable	Low	Low	Low
Operational phase								
Alternative A	Negative – The presence of a transmission line intrudes on existing views and spoils the open panoramic views of the landscape.	Regional	Permanent	Moderate	Highly Probable	Moderate	Moderate	High
Alternative B				Moderate	Highly Probable	Moderate	Moderate	High
Alternative C				High	Highly Probable	High	High	High
Alternative D				Moderate	Probable	Moderate	Moderate	Low
Alternative E				Moderate	Highly Probable	Moderate	Moderate	High
Alternative F				Moderate	Highly Probable	Moderate	Moderate	High
Alternative G				Moderate	Highly Probable	Moderate	Moderate	High

The study area is sparsely populated with the exception of a few small towns and farming communities scattered along main transportation routes, near mining areas or adjacent rivers or water resources. The sparse distribution of residents across the study area results in a relatively low number of affected viewers.

Construction phase

During the construction phase, unsightly views may be created by the presence of the construction camp and the lay-down yards. The uncertainty pertaining to the number, location and size of the construction camps, relates to a low level of confidence in the assessment of the visual impact. The duration of the potential visual impact will be temporary, which will result in an anticipated *low* significance of visual impact for all but Alternative C.

Alternative C is located in close proximity to six recognised towns. A higher number of viewers will be affected and their visual exposure will be dependant on the placement of the construction camps and lay-down yards. At worst, the construction camps will be located in or adjacent to the exiting towns. This may cause a high visual intrusion for residents located adjacent the construction camps. A *moderate* significance of visual impact is anticipated.

Operational phase

The residents of the towns along the N7 may experience a high degree of visual intrusion due to their proximity to Alternative C & F. Alternative C will affect the largest number of residents compared to the other alternatives. Visual exposure is considered high due to the proximity of the alignment to the towns and the high level of visibility that can be expected.

The other alternatives mostly traverse through areas that are vacant and only intrude on views of remote settlements or farm residents. The number of affected viewers is relatively low. Any farm residents or small settlements within 5km of the proposed alignments may experience a high degree of visibility of the proposed transmission line and hence, experience a *highly* severe visual impact.

The VAC of the different landscape types does play a major role in the visibility of the proposed transmission line. A diverse land cover and topographically varied terrain does have the ability to decrease the severity of visual impact (Bishop *et al*, 1985) by creating a backdrop. The steel frame of the towers (especially the cross-rope suspension type) presents a high degree of visual permeability, and hence a low degree of visual obstruction. This characteristic of the towers allows it to readily blend with the background colours and patterns of the landscape. The mountainous terrain of the Kamiesberg Succulent Karoo and parts of the Lowland Succulent Karoo plains do provide sufficient topographic variability and diversity in surface cover to greatly reduce the severity of visual impact by absorbing the towers in the landscape setting. This results in a reduced Zone of Visual Influence (ZVI) because the visibility of the individual towers is limited to a smaller distance.

Inversely, a mundane landscape with a low degree of elevated topography often fails to create an effective backdrop. This would be the case for alternatives that cross through the Strandveld Coastline, Lowland Succulent Karoo plains, Vredendal Agricultural and Olifants River Valley landscape types.

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 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 A	Negative – Construction camp and lay-down yards may cause unsightly views and spoil the undisturbed views over the landscape.	At a number of point locations	Temporary	Moderate	Probable	Moderate	Low	Low
Alternative B				Moderate	Probable	Moderate	Low	Low
Alternative C				Low	Highly probable	Low	Low	Low
Alternative D				Moderate	Probable	Moderate	Low	Low
Alternative E				Moderate	Probable	Moderate	Low	Low
Alternative F				Moderate	Probable	Moderate	Low	Low
Alternative G				Moderate	Probable	Moderate	Low	Low
Operational phase								
Alternative A	Negative – The presence of a transmission line intrudes on existing views and spoils the open panoramic views of the landscape	Regional	Permanent	High	Definite	High	High	High
Alternative B				High	Definite	High	High	High
Alternative C				Moderate	Definite	Moderate	Moderate	High
Alternative D				Moderate	Highly probable	Moderate	Moderate	Low
Alternative E				High	Definite	High	High	High
Alternative F				High	Definite	High	High	High
Alternative G				High	Definite	High	High	High

The study area is renowned for its exceptional biodiversity and pristine desert-like landscapes. Tourists flock to Namaqualand during the early spring period when the spectacular floral display is at its peak. During these periods, tourists infiltrate every small gravel road and town, in search of secluded locations where they can experience the true remoteness and undisturbed beauty of the landscape.

Construction phase

The temporary duration of the construction phase is not expected to cause major visual impacts. The location, number and size of the construction camps and lay-down yards will be crucial in regulating the impact. Detail 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.

The construction camps may however cause a higher visual intrusion on tourists visiting the mostly vacant, western areas of the study area where the possibility of integrating it with existing settlements/towns is low. This could potentially be the case during the construction of alternative A, B, E, F & G. It is highly probable that a number of construction camps will have to be established in pristine landscapes, which may temporarily interfere with the undisturbed views that will be experienced by tourists at that time. 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. The greatest factor to consider is the location of the construction camp out of potential views that may be experienced from scenic routes or tourist hotspots.

Operational phase

Considering the extent of the proposed alternatives, a great number of tourists will be affected during their visit to the Namaqualand and the rest of the study area. Tourists visiting the NNP will experience views of alternatives A, B, E, F & G. The presence of a transmission line in this pristine landscape will severely spoil the picturesque views that are experienced over the undulating hills.

The same argument accounts for the rest of the study area that is classified as vacant and is anticipated to bare similar qualities as the NNP. Although not part of a formal conservation area, the tourist potential of these areas is considered extremely high and is often visited by the more dedicated tourist.

It can be concluded that alternatives A, B, E, F & G will cause major visual intrusion for tourists travelling through the study area. The western part of the study area generally has a low VAC which will cause a greater ZVI. The severity of the visual impact will be *highly* severe, causing a *highly* significant visual impact.

Alternative C will be constructed along the N7. Considering the high VAC of the Kamiesberg Succulent Karoo landscape type and the common association with infrastructure along major transport routes, the severity of potential visual impact will be *moderate*. The backdrop created by the mountains has a further mitigating effect which will firstly limit the visibility of the individual towers and secondly reduce the ZVI. The significance of visual impact will be *moderate*.

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 A	Negative – Intruding on existing views of the landscape.	At a number of point locations	Short period	Low	Highly Probable	Low	Low	Moderate
Alternative B				Low	Highly Probable	Low	Low	Moderate
Alternative C				Low	Highly probable	Low	Low	Moderate
Alternative D				Low	Probable	Low	Low	Low
Alternative E				Low	Highly Probable	Low	Low	Moderate
Alternative F				Low	Highly Probable	Low	Low	Moderate
Alternative G				Low	Highly Probable	Low	Low	Moderate
Operational phase								
Alternative A	Negative – Intruding on existing views of the landscape.	Local	Short period	Low	Definite	Low	Low	High
Alternative B			Short period	Low	Definite	Low	Low	High
Alternative C			Intermittent	Low	Definite	Low	Low	High
Alternative D			Short period	Low	Highly Probable	Low	Low	Low
Alternative E			Short period	Low	Definite	Low	Low	High
Alternative F			Short period	Low	Definite	Low	Low	High
Alternative G			Short period	Low	Definite	Low	Low	High

The major routes in the study area are the N7 connecting the towns of Bitterfontein and Springbok, the R355 between Springbok and Kleinzee and the R382 connecting Steinkopf, Port Nolloth and Alexander Bay. Secondary and tertiary routes form a loose network of gravel roads in the remote areas, linking smaller settlements. This assessment will be limited to motorists utilising the main routes, as the countless smaller roads are considered as scenic routes, mostly utilised by tourists.

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 Alternative C may be visible from the N7. The other alternatives cross the R355 at one location. The likeliness of a construction camp 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 *low*. The VAC of the Lowland Succulent Karoo plains and the Kamiesberg Succulent Karoo landscape types are considered sufficient to screen or absorb these project components relatively effectively if siteing of the construction camp is done with consideration to the views experienced by motorists. The significance of potential visual impact is expected to be *low*.

Operational phase

Of these routes, the N7 is the most prominent, carrying the highest volume of traffic. The elevated terrain of the Kamiesberg Succulent Karoo will visually screen much of the transmission line proposed by Alternative C & F. The partial screening effect will considerably reduce visual exposure to the transmission line and intermittent views may be experienced. The speed at which motorists travel also has a moderating effect on the severity of the visual impact and further reduces visual exposure.

The R355 & R382 cross through landscape types which have a moderate to low VAC. The motorists' visual exposure to the proposed transmission lines will be prolonged due to the minimal visual screening created by the landscape. These routes are less travelled than the N7, which implies a reduced number of affected motorists.

Alternatives A, B, E, F & G cross the R355 at one location. The severity of visual impact at this point of crossing will be increased, but the high degree of visual exposure is limited to a very short period.

The severity of visual impact for all the proposed alternatives on motorists will be *low*. The speed at which they travel reduces their sensitivity and also contributes to short periods of visual exposure which results in a *low* significance of visual impact.

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 siteing 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.

The completed transmission line can be mitigated less effectively. Alternatives A, B, E, F & G traverse landscapes with a low VAC. Little or no screening will be provided by the landscape types through which the above mentioned alternatives cross. The Kamiesberg Succulent Karoo and Lowland Succulent Karoo plains express high terrain variability and slight re-alignment of the transmission line can reduce the impacts considerably. The screening capacity of the topography will be able to screen the transmission line from sensitive visual receptors, but have to be delineated on site.

CONCLUSION

The seven alternative alignments 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, three (3) being the most preferred, to one (1) being the least preferred.

ALTERNATIVES	PREFERENCE RATING
Alternative A	1
Alternative B	1
Alternative C	3
Alternative D	2
Alternative E	1
Alternative F	1
Alternative G	1

Alternative C is regarded as the most preferred alternative. Its alignment along the R355 & N7 is considered to cause the least impact on the landscape character due to the reduced sensitivity of the landscape along the roads. A large section of the alignment traverses the Kamiesberg Succulent Karoo mountain range which has the highest VAC. The backdrop that will be created by the mountains and the mottled texture of the vegetation will partially absorb the visual impact of the transmission pylons in the landscape.

The impact of Alternative C on visual receptors varies between residents, tourists and motorists. Alternative C's great advantage lies in the less significant visual impact on tourists as compared to the other alternatives. The high VAC of the Kamiesberg Succulent Karoo mountain range through which a large section of the alignment pass, will cause a major reduction in the visibility of the transmission line. Alternative C stays clear of major tourist attractions such as the NNP. The public is familiar with the combination of transmission lines and major public roads, which makes the co-existence of these two features more acceptable.

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LIST OF ABBREVIATIONS

CCGT	Combined Cycle Gas Turbine
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.
GOSW	Government Office of the South West
LCA	Landscape Character Assessment.
LT	Landscape Type
NNP	Namaqualand National Park
VAC	Visual Absorption Capacity
VIA	Visual Impact Assessment.
ULI	Urban Land Institute
ZVI	Zone of Visual Influence.

1. INTRODUCTION

Strategic Environmental Focus (Pty) Ltd in association with P.D. Naidoo & Associates (PDNA) was appointed by Eskom Transmission to follow the appropriate Environmental Impact Assessment (EIA) process for the construction of a 400kV transmission line. The proposed 400kV transmission line is planned to supply bulk power from the Kudu Combined Cycle Gas Turbine (CCGT) power station in Namibia to the Juno substation near Vredendal, Western Cape.

A number of alternative alignments have been proposed to connect to the Western Grid of Eskom and supply electricity to the Western Cape. The transmission line will start in Namibia and cross the border east of Alexander Bay where it will join up with the Oranjemond substation. From here the proposed transmission line will be constructed parallel to the existing Oranjemond-Gromis-Nama 220kV line up to the Gromis substation. From the Gromis substation, seven alternative alignments have been proposed to the Juno substation adjacent to Vredendal.

This Visual Impact Assessment (VIA) is a specialist study to determine and compare the visual affects of the seven proposed alignments on the receiving environment.

1.1. BACKGROUND AND BRIEF

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

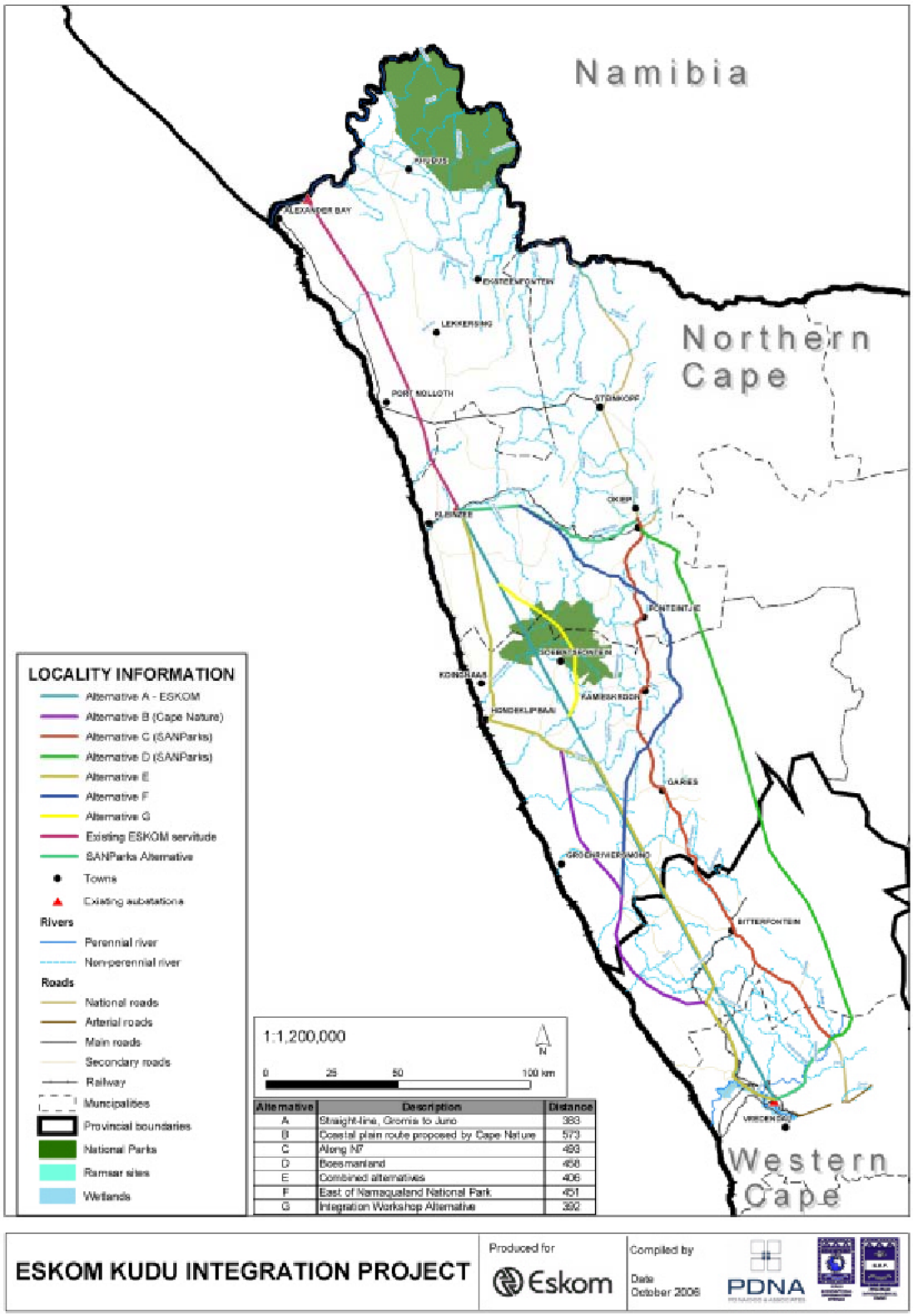
- Determination of the extent of the study area;
- Description of the proposed project and the receiving environment;
- Identification and description of the landscape character of the study area;
- Identification of the elements of particular visual value and -quality that could be affected by the proposed 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; and
- A photographic simulation of the proposed transmission line in one of the landscape types.

1.2. STUDY AREA

The study area includes the entire area covered by the alternative alignments. It stretches from the Oranjemond substation in the north to the Juno substation near Vredendal and from the west coast to the N7 national road including a 10 km offset to the east of the N7 (Figure 1).

Alternative D falls outside of the study area as it was not part of the initial scope of work. An accurate assessment can not be completed for alternative D and only a specialist opinion will be included in this document derived from a desktop study.

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 SEFGIS (2006) 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 public participation is complete and approval is received from the relevant authorities;
- The exact location, size and number 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 along the preferred alignment. The construction camps will consist of temporary structures such as tents or temporary buildings. Ablution facilities will also be associated with the construction camps and are expected to be portable toilets and temporary shower facilities;
- The exact alignment of the proposed transmission lines and position of the pylons are not yet determined and the alternatives only specify proposed corridors. The visibility results have been generated from the anticipated alignment and may deviate from the route for the final approved alignment. The differences are considered omissible;
- The site visit was conducted during January and the photographs used in this report illustrate the character of the landscape outside the rainy season (i.e. a dry time of the year);
- The study area is an exceptional large area and an in depth site investigation is unfeasible, considering the timeframes and budget allocated for the assessment. The assessment is based on information gathered from a desktop study and confirmed during the site investigation. The route of travel was considered to be representative of the majority of the study area and provided enough detail to complete the assessment with reasonable accuracy;
- Alternative D was added as an additional alignment after commencement of the report and was not included in the initial scope of work. Evidently, this alternative was not assessed during the site visit and the impacts relating to Alternative D are purely based on a desktop study and provide a mere visual opinion; and
- This level of assessment excludes surveys to establish viewer preference and thereby their sensitivity. Viewer sensitivity is determined by means of a commonly used rating system (Table 12).

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 Figure 1;
- 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 400 kV transmission line from the Oranjemond substation on the border between South Africa and Namibia, to the Juno substation near Vredendal in the Western Cape. The direct linear distance between the origin and the end of the line is approximately 400 km (For exact distances, refer to Figure 1).

3.2. ALTERNATIVE ALIGNMENTS

Table 1: Description of alternative alignments

ALTERNATIVES	DESCRIPTION (Refer to Figure 1)
Alternative A	Alternative A is a relatively straight corridor from the Gromis substation to the Juno substation bisecting the Namaqualand National Park (NNP).
Alternative B	Alternative B will pass the NNP on the western side but will pass through the proposed western expansion of the park. From Hondeklipbaai the line will stay west on the coastal plateau until it joins up with the Nuwerus-Lutzville road. The line will follow the road to Juno substation.
Alternative C	Alternative C is proposed along the existing 220kV servitude between Gromis and Springbok. From Springbok the line will be constructed parallel to the N7 down to Juno substation.
Alternative D	Alternative D will follow the same existing servitude as Alternative C up to Springbok. From Springbok the line will continue south-east over the Kamiesberge and through the Boesmanland and Knersvlakte to Juno substation.
Alternative E	Alternative E is similar to Alternative B but will follow the route proposed by Alternative A from the Spoeg River to the Groot Goerap River, where after it will rejoin with Alternative B.
Alternative F	Alternative F will follow the same route as Alternative C but will branch off to the south at a certain point. The line will then cross the N7 and run east of the N7 beyond Kamieskroon, at which point the line would turn to the west and cross the N7 again between Kamieskroon and Garies. The line will follow a straight diagonal path to where it will meet up with Alternative B.
Alternative G	Alternative G will follow Alternative A, deviating from the route to the east before it enters the NNP. It will stay as close to the escarpment as possible. The line will follow the escarpment until it has passed through the park boundary, where after it will turn west to follow Alternative A again.

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. CONSTRUCTION CAMPS AND LAY-DOWN YARDS

The construction phase is expected to continue for 15 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 along the alignment where practical. The material lay-down yards are 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 construction phase in conjunction with between 10 and 40 labourers. In extreme cases, a helicopter may be used where the transmission line transect inaccessible terrain (Figure 3).

3.3.2. 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 through dense thickets. It is expected that roads will be rehabilitated after the construction phase or maintained to facilitate access during periodic maintenance visits (Figure 2).

3.3.3. TRANSMISSION LINE

The completed transmission line will connect the Oranjemond substation to the Juno substation via the Gromis substation. The direct linear distance between the Oranjemond and Juno substations is approximately 400 km (Figure 1).

Three tower types will be used depending on the terrain being transect (Table 2). The towers will consist of a lattice steel framework reaching a maximum height of 38 m with electrical cables suspended between them. The average spacing between the towers will be approximately 450 m (Figure 4). The self-supporting strain tower will only be used where the alignment changes direction.

Table 2: Types and typical characteristics of proposed towers

Type	Compact cross-rope tower	Self-supporting strain tower	Cross-rope tower
Maximum Height	38 m	30 m	38 m
Concrete footings	2	4	2
Servitude width	55 m	47 m	80 m
Stays	2	None	4

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 elegant industrial character enforced by the slender steel lattice framework and the electrical cables between the towers. It has a near monumental scale if compared to the predominantly mundane landscape along the coast and the low growing vegetation which occurs across the entire study area. 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 1 km.

Figure 2: Example of construction camps

Typical example of site offices

Typical example of bush clearing of access routes through thickets

Typical example of construction camps and accommodation facilities

EXAMPLES OF CONSTRUCTION CAMPS **ESKOM KUDU INTEGRATION PROJECT**	Compiled for: ESKOM TRANSMISSION Reference: 6041_G-VIA_01_A4.cdr Date: 13 - 11 - 2006		S.E.F. LANDSCAPE ARCHITECTURE

Figure 3: Typical construction equipment

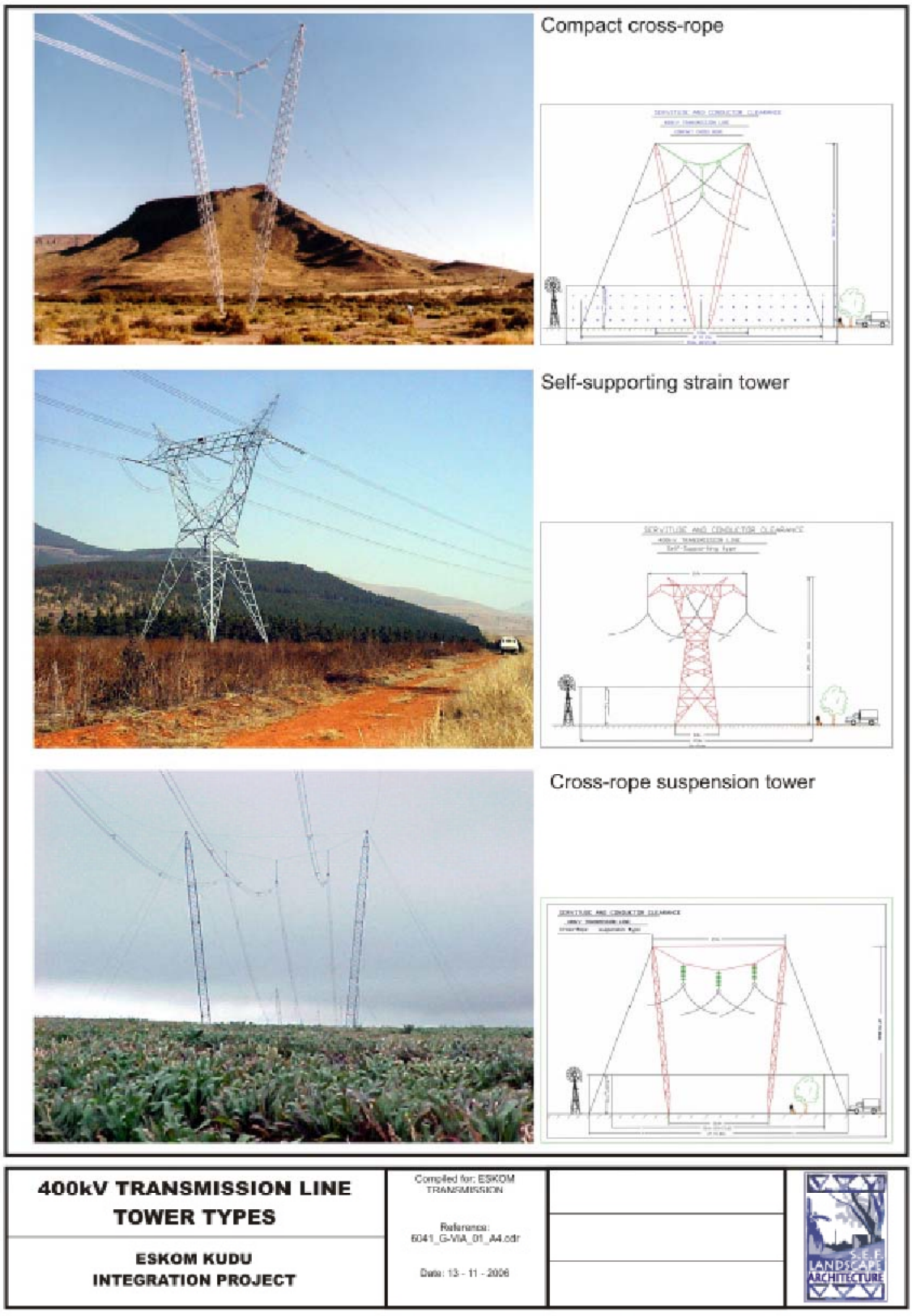
CRANE

HELICOPTER

TENSIONER STATION

TYPICAL CONSTRUCTION EQUIPMENT **ESKOM KUDU INTEGRATION PROJECT**	Compiled for: ESKOM TRANSMISSION Reference: 6041_G-VIA_01_A4.cdr Date: 13 - 11 - 2006		S.E.F. LANDSCAPE ARCHITECTURE

Figure 4: 400 kV transmission line tower types



4. DESCRIPTION OF THE AFFECTED ENVIRONMENT

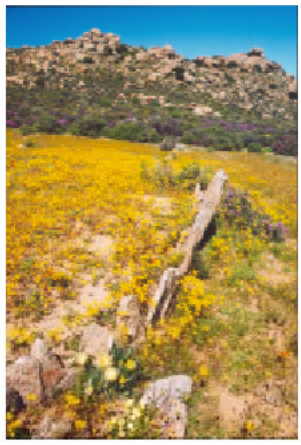
Landscape and visual impacts may result from changes to the landscape. A distinction should be made between impacts on the visual resource (landscape) and on the viewers. The former are impacts on the physical landscape that may result in changes to landscape character while the latter are impacts on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

Generally, the study area is vacant and uninterrupted, covered with a uniformly textured vegetation layer. Extensive mining activity is present in a narrow strip along the coast line. Isolated occurrences of cultivated fields are found between the coast and the Kamiesberg Range which become more intense further south and around Vredendal. Human settlements are far apart and portray a remote country lifestyle.



For ten months of the year the landscape of the Northern Cape is a dry and semi-arid desert landscape. This rapidly changes after the first rains when the landscape bursts into an array of rainbow colours during August and September. The Namaqualand is renowned for its abundant flower display in spring (see photo on right). The vegetation diversity in the study area is exceptionally unique. For a few months each year the area in and around the NNP is a hotspot for tourists experiencing the floral marvel.

The landscape character changes considerably 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 (Refer to Figure 7).

The following broad scale landscape types have been delineated in the study area (Figure 7). 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);

- Orange River Valley;
- Strandveld Coast Line;
- Disturbed Strandveld Coast Line;
- Lowland Succulent Karoo plains;
- Kamiesberg Succulent Karoo;
- Vredendal Agricultural; and
- Olifants River Valley.

Orange River Valley

The Orange River meets the ocean at Alexander Bay and forms a natural border between South Africa and Namibia. Its wide flood plain and curving movement carves a sinuous path through an arid, desert-like landscape. A striking contrast is created between the white desert sand dunes and the sinuous green corridors flanking the often brown water of the Orange River (Figure 8 - 2).

Stunted succulents growing in the whitish sand create a distinct mottled texture on the undulating sand dunes. Rocky outcrops are visible on the steeper slopes and create shelter for slightly higher growing succulent plants.

The smooth rounded shapes of the sand dunes dictate the flow of the river through a barren landscape. The interactive motion of these two natural features is harmonised and evokes the impression of an aged and mature landscape.

The Orange River Valley is generally free from human intervention. A border post outside Alexander Bay provides a bridge over the river. A few kilometres east, a transmission line crosses the river from the Namibian side to meet with the Oranjemond Substation situated among the sand dunes (Figure 8-1).

Strandveld Coast Line and Disturbed Strandveld Coast Line

The Strandveld Coast Line is a low lying coastal plain parallel to the cold and windy Atlantic Ocean. Sandy beaches create a white edge along the grey-blue ocean. The sand dunes extend into the landscape, creating a rolling topography fading out into the Lowland Succulent Karoo plains. Low growing vegetation creates a homogenous dappled texture on the dunes which is for most parts of the year dark brown to grey.

Large parts of the coast line are highly disturbed by mining activities. Remnants of the mining activities can be seen from Alexander Bay to Kleinzee and again near Koingnaas and Hondeklipbaai. The mining created scars in the landscape as it is devoid of vegetation and exposes the pure white sand that lies beneath. The mining activity is declining and it is expected that rehabilitation will follow. Rehabilitation of the disturbed areas may take several years, as the local vegetation takes an exceptional long time to re-establish.

The hostile weather conditions and limited freshwater supplies are responsible for a mostly vacant coastline. Large parts of the coast line have mining rights and public access to the seashore is restricted. The R382 is the only tar road that connects Alexander Bay and Port Nolloth from where it turns east to Steinkopf and joins up with the N7 national highway. Isolated towns are widely spaced along the coast line and are usually found next to river mouths or at the convergence of main roads. The towns are small and a strong fisherman influence usually dictates the architecture. White, lime painted buildings accommodate the simple subsistence lifestyles of the inhabitants and can be described as elementary but typical of the Western and Northern Cape coast.

The proposed expansion of the NNP extents south of Hondeklipbaai to Groenriviersmond further south. This will include an estimated 50 km stretch of the Strandveld Coast line in the parks' management boundaries (Figure 6). This part of the coast line is relatively unspoilt and is classified as a protected area, hence the proposed NNP expansion.