

Professional Opinion:  
Visual Impact Assessment  
Final Report

# Visual Impact Assessment for the Proposed Solar Photovoltaic installation at the Grootvlei Power Station, Mpumalanga Province

Yonanda Martin (Pri Sci Nat)

Newtown Landscape Architects



**PROPOSED SOLAR PHOTOVOLTAIC INSTALLATION AT THE GROOTVLEI POWER  
STATION**

**GROOTVLEI**

**MPUMALANGA PROVINCE**

Submitted to:

**Environmental Impact Management Services (Pty) Ltd**

**EIMS**

Block 5 Fernridge Office Park

5 Hunter Avenue

Ferndale

Randburg



Prepared by:

**Newtown Landscape Architects cc**

PO Box 36

Fourways

2055

yonanda@newla.co.za

[www.newla.co.za](http://www.newla.co.za)

NLA Project No: 1600/V12MP

Report Revision No: Final VIA Professional Opinion Report

Date Issued: October 2012

Prepared By: Yonanda Martin (Pri. Sci. Nat.)

Reference: Solar Photovoltaic installation at the Grootvlei Power Station

## EXPERTISE OF SPECIALISTS

<b>Name:</b>	Yonanda Martin
<b>Qualification:</b>	MSc. (Env.)
<b>Professional Registration:</b>	Pri. Sci. Nat.
<b>Experience in Years:</b>	4 years
<b>Experience</b>	<p>Yonanda Martin has been doing visual impact assessments for Newtown Landscape Architects since 2006. She has experience in a wide range of visual impact assessments which include visual impacts for game lodges, transmission lines, roads, mines and telecommunication masts. Projects that she worked on include:</p> <ul style="list-style-type: none"> <li>• <b>Eskom Ngwedi Substation</b> (PBAI), North West Province</li> <li>• <b>NBC Belfast Project</b> (Exxaro), Mpumalanga</li> <li>• <b>Tamboiti Platinum Mine</b> (Metago), Limpopo</li> <li>• <b>De Wittekrans</b> (GCS), Mpumalanga</li> <li>• <b>Dorsfontein West Expansion</b> (GCS (Pty) Ltd), Kriel</li> <li>• <b>Ferreira Coal Mining</b> (GCS (Pty) Ltd), Ermelo</li> <li>• <b>Eskom Honingklip</b> (Kv3 Engineers), Muldersdrift</li> <li>• <b>SANRAL PWV3</b> (Jeffares &amp; Green), Hartbeespoort</li> </ul>

<b>Name:</b>	Graham A Young
<b>Qualification:</b>	Pr LArch
<b>Professional Registration:</b>	South African Council for the Landscape Architectural Profession (SACLAP) Institute of Landscape Architects of South Africa (ILASA)
<b>Experience in Years:</b>	30 years
<b>Experience</b>	<p>Graham is a landscape architect with thirty years' experience. He has worked in Southern Africa and Canada and has valuable expertise in the practice of landscape architecture, urban design and environmental planning. He is also a senior lecturer, teaching urban design and landscape architecture at post and under graduate levels at the University of Pretoria. He specializes in Visual Impact Assessments and has won an Institute of Landscape Architects Merit Award for his</p>

	VIA work.
--	-----------

## **ACRONYMS**

CSIR	Council for Scientific and Industrial Research
EIA	Environmental Impact Assessment
EIMS	Environmental Impact Management Services (Pty) Ltd
IFC	International Finance Corporation
MW	Megawatt
NLA	Newtown Landscape Architects
SACLAP	South African Council for the Landscape Architectural Profession
VIA	Visual Impact Assessment

## **GLOSSARY OF TERMS**

### **Aesthetic Value**

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

### **Aesthetically significant place**

A formally designated place visited by recreationists and others for the express purpose of enjoying its beauty. For example, tens of thousands of people visit Table Mountain on an annual basis. They come from around the country and even from around the world. By these measurements, one can make the case that Table Mountain (a designated National Park) is an aesthetic resource of national significance. Similarly, a resource that is visited by large numbers who come from across the region probably has regional significance. A place visited primarily by people whose place of origin is local is generally of local significance. Unvisited places either have no aesthetic significance or are "no trespass" places. (after New York, Department of Environment 2000).

### **Aesthetic impact**

Aesthetic impact occurs when there is a detrimental effect on the perceived beauty of a place or structure. Mere visibility, even startling visibility of a project proposal, should not be a threshold for decision making. Instead a project, by virtue of its visibility, must clearly interfere with or reduce (i.e. visual impact) the public's enjoyment and/or appreciation of the appearance of a valued resource e.g. cooling tower blocks a view from a National Park overlook (after New York, Department of Environment 2000).

### **Cumulative Effects**

The summation of effects that result from changes caused by a development in conjunction with the other past, present or reasonably foreseeable actions.

### **Landscape Character**

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

### **Landscape Impact**

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

### **Study Area**

For the purposes of this report the Grootvlei Power Station Solar Photovoltaic Project study area refers to the proposed project footprint / project site as well as the 'zone of potential influence' (the area defined as the radius about the centre point of the project beyond which the visual impact of the most visible features will be insignificant) which is a 5km radius surrounding the proposed project footprint / site.

### **Project Footprint / Site**

For the purposes of this report the Grootvlei Power Station Solar Photovoltaic Project *site / footprint* refers to the actual layout of the project.

### **Sense of Place (*genius loci*)**

Sense of place is the unique value that is allocated to a specific place or area through the cognitive experience of the user or viewer. *Genius loci* literally means 'spirit of the place'.

### **Sensitive Receptors**

Sensitivity of visual receptors (viewers) to a proposed development.

### **Viewshed analysis**

The two dimensional spatial pattern created by an analysis that defines areas, which contain all possible observation sites from which an object would be visible. The basic assumption for preparing a viewshed analysis is that the observer eye height is 1,8m above ground level.

### **Visibility**

The area from which project components would potentially be visible. Visibility depends upon general topography, aspect, tree cover or other visual obstruction, elevation and distance.

### **Visual Exposure**

Visibility and visual intrusion qualified with a distance rating to indicate the degree of intrusion and visual acuity, which is also influenced by weather and light conditions.

**Visual Impact**

Visual effects relate to the changes that arise in the composition of available views as a result of changes to the landscape, to people's responses to the changes, and to the overall effects with respect to visual amenity.

**Visual Intrusion**

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

**Worst-case Scenario**

Principle applied where the environmental effects may vary, for example, seasonally to ensure the most severe potential effect is assessed.

**Zone of Potential Visual Influence**

By determining the zone of potential visual influence it is possible to identify the extent of potential visibility and views which could be affected by the proposed development. Its maximum extent is the radius around an object beyond which the visual impact of its most visible features will be insignificant primarily due to distance.

## TABLE OF CONTENTS

<b>1</b>	<b>EXECUTIVE SUMMARY</b>	<b>12</b>
1.1	Introduction	12
1.2	Aim and Objectives	12
1.3	Visual Resource	12
1.4	Sensitive Viewers	13
1.5	Predicted Impact	13
<b>2</b>	<b>INTRODUCTION</b>	<b>3</b>
2.1	Project Overview	3
2.2	Proposed Study area	3
2.3	Terms of Reference	3
2.4	Assumption and Limitations	3
<b>3</b>	<b>LEGAL REQUIREMENTS</b>	<b>4</b>
3.1	National Guidelines	4
3.2	International Guidelines	4
<b>4</b>	<b>APPROACH AND METHODOLOGY</b>	<b>6</b>
4.1	Approach	6
4.1.1	The Visual Resource	6
4.1.2	Sensitivity of Visual Resource	7
4.1.3	Sense of Place	7
4.1.4	Sensitive Viewer Locations	8
4.1.5	Landscape Impact	9
4.1.6	Visual Impact	9
4.2	Methodology	10
<b>5</b>	<b>DESCRIPTION OF THE PROJECT</b>	<b>11</b>
<b>6</b>	<b>THE ENVIRONMENTAL SETTING</b>	<b>12</b>
6.1	The Study Area	12
6.2	Surrounding Land Use	12
6.2.1	Residential	12
6.2.2	Tourism	12
6.2.3	Infrastructure, Industrial, Mining and Commercial	12
6.2.4	Transportation systems	13
6.3	Landscape Character	13
<b>7</b>	<b>VISUAL RESOURCE</b>	<b>14</b>
7.1	Visual Resource Value / Scenic Quality	14

<b>7.2</b>	<b>Sense of Place</b>	<b>15</b>
<b>8</b>	<b>VISUAL RECEPTORS</b>	<b>16</b>
<b>8.1</b>	<b>Views</b>	<b>16</b>
8.1.1	Sensitive Viewer Locations	16
<b>9</b>	<b>VISUAL ISSUES</b>	<b>18</b>
<b>9.1</b>	<b>The Visual Condition of existing landscape</b>	<b>18</b>
<b>9.2</b>	<b>The Visual Impact of the proposed project</b>	<b>18</b>
<b>9.3</b>	<b>The Severity of the Visual Impact</b>	<b>21</b>
<b>10</b>	<b>MITIGATING MEASURES</b>	<b>23</b>
<b>10.1</b>	<b>Earthworks</b>	<b>23</b>
<b>10.2</b>	<b>Landscaping</b>	<b>23</b>
<b>10.3</b>	<b>Access Roads</b>	<b>24</b>
<b>10.4</b>	<b>Lighting</b>	<b>24</b>
<b>11</b>	<b>CONCLUSION</b>	<b>25</b>
<b>12</b>	<b>REFERENCES</b>	<b>26</b>
	<b>APPENDIX A: LIST OF FIGURES</b>	<b>27</b>
	<b>APPENDIX B: DETERMINING A LANDSCAPE AND THE VALUE OF THE VISUAL RESOURCE</b>	<b>28</b>
	<b>APPENDIX C: METHOD FOR DETERMINING THE MAGNITUDE (SEVERITY / INTENSITY) OF LANDSCAPE AND VISUAL IMPACT</b>	<b>33</b>
	<b>APPENDIX D: CRITERIA FOR PHOTO / COMPUTER SIMULATION</b>	<b>42</b>

## LIST OF FIGURES

Figure 1	Locality and Views
Figure 2	Visual Resource
Figure 3	Proposed Layout of Alternative Sites
Figure 4	Lighting Examples
Figure 5	Landscape Character
Figure 6	Landscape Character
Figure 7	Landscape Character
Figure 8	Landscape Character
Figure 9	Landscape Character
Figure 10	Landscape Character
Figure 11	Simulation – View 10
Figure 12	Simulation – View 12
Figure 13	Simulation – View 14
Figure 14	Simulation – View 14

## LIST OF TABLES

Table 1	Visual Resource
Table 2:	Potential Sensitivity of Visual Receptors
Table 3:	Visual Impact of the Proposed Project
Table 4:	<i>Severity (Intensity)</i> of Visual Impact of the Proposed Project

## **1 EXECUTIVE SUMMARY**

### **1.1 Introduction**

Newtown Landscape Architects (NLA) were commissioned by Environmental Impact Management Services (Pty) Ltd (EIMS) to carry out a Visual Impact Assessment (VIA): Professional Opinion for the proposed installation of a Solar Photovoltaic Plant at the Grootvlei Power Station, Mpumalanga Province. This specialist report forms part of the *Basic Assessment* for the proposed project.

Landscape character, landscape quality and “sense of place” determined that the visual resource (scenic beauty of the study area) is of *moderate* quality for the proposed study area. The visibility of the project was established and then qualified in terms of its visual intrusion. Photographic panoramas were taken from representative viewpoints and altered through a computer simulation technique to characterize the nature of the visual intrusion of the proposed project components on the landscape. The visual concerns / issues regarding the proposed project were discussed.

### **1.2 Aim and Objectives**

The main aim of the study is to ensure that the visual consequences of the proposed Grootvlei Power Station Solar Photovoltaic Project are understood and adequately considered in the environmental impact assessment process. The main objectives of the study are to:

- Describe the baseline environment;
- To define the visual resource and sense of place of the study area;
- To identify the sensitive receptors / lines of site;
- To determine the visual intrusion by simulating the proposed components;
- Consider the visual impacts and;
- To recommend possible mitigation measures.

### **1.3 Visual Resource**

The sense of place of the study area can be described as being a combination between tranquil / rural and a more urban / industrial sense of place. The study area is characterized by open grassland, distant hills, Grootvlei Dam and the Molspruit located to the east of the site as well as the Grootvlei Power Station and Mining Village. The land use within the study area varies from agricultural fields, farmsteads and villages to more commercial and industrial activities.

#### **1.4 Sensitive Viewers**

Sensitive viewing locations within the study area include views from the Grootvlei Village, Grootvlei Town, farmsteads and local roads.

#### **1.5 Predicted Impact**

It is predicted that negative visual impacts would result from the construction, operation and decommissioning phases of the proposed Project. The significance of the visual impact is rated as **low**. Mitigation measures are possible and if implemented correctly the significance will remain **low** for viewers such as motorists, views from the farmsteads and views from Grootvlei Village. For the Grootvlei Village, which is located immediately adjacent to the solar photovoltaic plants the visual impact can be **moderate to high** if not mitigated correctly.

## **2 INTRODUCTION**

### **2.1 Project Overview**

Newtown Landscape Architects (NLA) were commissioned by Environmental Impact Management Services (Pty) Ltd (EIMS) to carry out a Visual Impact Assessment (VIA) for the proposed installation of a Solar Photovoltaic Plant at the Grootvlei Power Station, Mpumalanga Province, here after referred to as the “proposed Project”. The proposed Project includes four (4) alternatives sites for the proposed photovoltaic plant.

### **2.2 Proposed Study area**

The proposed Project is located within the boundaries of the Grootvlei Power Station. The Grootvlei Power Station is located approximately 1km north of the town of Grootvlei and approximately 12km south-west of Balfour in Mpumalanga Province. On the north-western corner of the Grootvlei Power Station is the Grootvlei Village. The R51 is located to the east of the Grootvlei Power Station and to the east of that are the Grootvlei Wetland and Dam. Other towns in the area include Villiers, located approximately 27km south, and Heidelberg which is located approximately 37km to the north-west. The surrounding area consists mostly of agricultural fields with one or two small stream crossings. Refer to Figure 1: Locality & Views for the location of the project.

### **2.3 Terms of Reference**

A specialist study is required to assess the visual impacts arising from the proposed Project. Based on the general requirements for a comprehensive VIA, the following terms of reference were established:

- Define the visual resource and sense of place of the area;
- Identify the sensitive viewers;
- Illustrate the visual impact by simulating the key components of the project;
- Discuss potential visual concerns;
- Recommend visual mitigation measures;
- Comply with the IFC (International Finance Corporation) Standards.

### **2.4 Assumption and Limitations**

In determining the significance of the visual impact of the proposed Project, with mitigation, it is assumed that mitigation measures proposed in the report are effectively implemented and managed throughout the life of the project.

### **3 LEGAL REQUIREMENTS**

#### **3.1 National Guidelines**

##### National Environmental Management Act (Act 107 of 1998) EIA Regulations

The specialist report is in accordance to the specification on conducting specialist studies as per Government Gazette (GN) R 543 of the National Environmental Management Act (NEMA) Act 107 of 1998. The mitigation measures as stipulated in the specialist report can be used as part of the Environmental Management Plan (EMP) and will be in support of the Environmental Impact Assessment (EIA).

##### The NEMA Protected Areas Act (57 of 2003)

The main aim of the Act is to protect natural landscapes.

##### The National Heritage Resources Act (25 of 1999)

The Act is applicable to the protection of heritage resources and includes visual resources such as cultural landscapes, nature reserves, proclaimed scenic routes and urban conservation areas.

##### Western Cape Department of Environmental Affairs & Development Planning: Guideline for Involving Visual and Aesthetic Specialists in EIA Processes Edition 1 (CSIR, 2005)

Although the guidelines were specifically compiled for the Western Cape it provides guidance that will be appropriate for any EIA process and to understand when a visual specialist should get involved in the EIA process.

#### **3.2 International Guidelines**

##### World Bank's IFC Standards

The World Bank's IFC Standards: Environmental, Health and Safety Guidelines for Mining refers to Visual Impact Assessments by stating that:

*“Mining operations, and in particular surface mining activities, may result in negative visual impacts to resources associated with other landscape uses such as recreation or tourism. Potential contributors to visual impacts include high walls, erosion, discoloured water, haul roads, waste dumps, slurry ponds, abandoned mining equipment and structures, garbage and refuse dumps, open pits, and deforestation. Mining operations should prevent and minimize negative visual impacts through consultation with local communities about potential post-closure land use, incorporating visual impact assessment into the mine reclamation process. Reclaimed lands should, to the extent feasible, conform to the visual aspects of the surrounding landscape. The reclamation design and procedures should take into consideration the proximity to public viewpoints and the visual impact within the context of the viewing distance. Mitigation measures may include strategic placement of screening*

*materials including trees and use of appropriate plant species in the reclamation phase as well as modification in the placement of ancillary facilities and access roads.”*

Although the proposed project is not a mine, there are numerous landscape features on the Grootvlei site synonymous with mining activities. The specialists study is still in accordance to the IFC Performance Standards (Performance Standard 1: Social and Environmental Assessment and Management Systems) for the undertaking of Environmental Assessments and contributes to the EIA for the proposed Project.

## **4 APPROACH AND METHODOLOGY**

### **4.1 Approach**

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

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

#### **4.1.1 The Visual Resource**

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

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

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

- Topographic ruggedness and relative relief increase;
- Water forms are present;
- Diverse patterns of grassland and trees occur;
- Natural landscape increases and man-made landscape decreases;

- Where land use compatibility increases (Crawford, 1994).

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

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

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

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

In determining the quality of the visual resource, both the objective and the subjective or aesthetic factors associated with the landscape are considered. Many landscapes can be said to have a strong sense of place, regardless of whether they are considered to be scenically beautiful but where landscape quality, aesthetic value and a strong sense of place coincide - the visual resource or perceived value of the landscape is considered to be very high. The criteria given in Appendix B are used to assess landscape quality, sense of place and ultimately to determine the aesthetic value of the study area.

#### **4.1.2 Sensitivity of Visual Resource**

The sensitivity of a landscape or visual resource is the degree to which a particular landscape type or area can accommodate change arising from a particular development, without detrimental effects on its character. Its determination is based upon an evaluation of each key element or characteristic of the landscape likely to be affected. The evaluation will reflect such factors such as its quality, value, contribution to landscape character, and the degree to which the particular element or characteristic can be replaced or substituted (Institute of Environmental Assessment & The Landscape Institute, 1996:87).

#### **4.1.3 Sense of Place**

Central to the concept of sense of place is that the landscape requires uniqueness and

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

Because the sense of place of the study area is derived from the emotional, aesthetic and visual response to the environment, it cannot be experienced in isolation. The landscape context must be considered. With this in mind, the combination of the natural landscape (mountains, streams and the vegetation) together with the manmade structures (residential areas, roads, mining activities and power lines) contribute to the sense of place for the study area. It is these land-uses, which define the area and establish its identity.

#### **4.1.4 Sensitive Viewer Locations**

The sensitivity of visual receptors and views are dependent on the location and context of the viewpoint, the expectations and occupation or activity of the receptor or the importance of the view. This may be determined with respect to its popularity or numbers of people affected, its appearance in guidebooks, on tourist maps, and in the facilities provided for its enjoyment and references to it in literature or art.

The most sensitive receptors may include:

- Users of all outdoor recreational facilities including public rights of way, whose intention or interest may be focused on the landscape;
- Communities where development results in changes in the landscape setting or valued views enjoyed by the community;
- Occupiers of residential properties with views affected by the development.

Other receptors include:

- People engaged in outdoor sport or recreation (other than appreciation of the landscape, as in landscapes of acknowledged importance or value);
- People traveling through or past the affected landscape in cars or other transport modes;
- People at their place of work.

Views from residences and tourist facilities / routes are typically more sensitive, since views from these are considered to be frequent and of long duration.

#### **4.1.5 Landscape Impact**

The landscape impact of a proposed development is measured as the change to the fabric, character and quality of the landscape caused by the physical presence of the proposed development. Identifying and describing the nature and intensity (severity) of change in the landscape brought about by the proposed new development is based on the professional opinion of the author supported by photographic simulations. It is imperative to depict the change to the landscape in as realistic a manner as possible (Van Dortmont in Lange, 1994). In order to do this, photographic panoramas were taken from key viewpoints and altered using computer simulation techniques to illustrate the physical nature of the proposed project in its final form within the context of the landscape setting. The resultant change to the landscape is then observable and an assessment of the anticipated visual intrusion can be made.

#### **4.1.6 Visual Impact**

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

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

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

## 4.2 Methodology

The following method was used:

- Site visit: A field survey was undertaken and the study area scrutinized to the extent that the receiving environment could be documented and adequately described;
- Project components: The physical characteristics of the project components were described and illustrated;
- General landscape characterization: The visual resource (i.e. receiving environment) was mapped using field survey and GIS mapping technology. The description of the landscape focused on the nature of the land rather than the response of a viewer (refer to Appendix B);
- The **landscape character** of the study area was described. The description of the landscape focused on the nature and character of the landscape rather than the response of a viewer;
- The **quality of the landscape** was described. Aesthetic appeal was described using recognized contemporary research in perceptual psychology as the basis;
- The **sense of place** of the study area was described as to the uniqueness and distinctiveness of the landscape. The primary informant of these qualities was the spatial form and character of the natural landscape together with the cultural transformations associated with the historic / current use of the land;
- Illustrations, in very basic **simulations**, of the proposed project were overlaid onto panoramas of the landscape, as seen from nearby sensitive viewing points to give the reviewer an idea of the scale and location of the proposed project within their landscape context;
- **Visual intrusion** (contrast) of the proposed project was determined by simulating its physical appearance from sensitive viewing areas;
- **Visual issues** - based on the work as described in this report visual issues were identified and their impact assessed, and
- Measures that could mitigate the negative impacts of the proposed project were recommended.

## **5 DESCRIPTION OF THE PROJECT**

The proposed solar photovoltaic plant installation is intended to produce 8 Megawatt (MW). Eskom is currently considering two technology designs:

- Static panels, with an approximate height of 1.3m
- Tracking arrays, with a maximum height of 4m

There are currently four (4) alternative sites available:

- Alternative Site 1 – located in the south-eastern corner;
- Alternative Site 2 – located in the south-western corner;
- Alternative Site 3 – located along the eastern boundary; and
- Alternative Site 4 – located in the north-western corner.

Refer to Figure 4: Layout Alternatives for the location of the proposed alternative sites.

## **6 THE ENVIRONMENTAL SETTING**

### **6.1 The Study Area**

As mentioned above the proposed Project site will be located within the boundaries of the Grootvlei Power Station, Mpumalanga Province. The project area consists of a mixture of land uses. Bordering the north-western corner of the site is the Grootvlei Village and to the south of the site is the small town of Grootvlei. The surrounding land use is agricultural activities which vary between cattle and intensive crop farming. Refer to Figure 1: Locality and Views as well as Figure 2: Visual Resource for the location of the proposed project as well as the surrounding land use.

### **6.2 Surrounding Land Use**

#### **6.2.1 Residential**

The proposed project's Alternative Site 4 is located on the northern boundary of the Grootvlei Power Station and borders the Grootvlei Village. The Grootvlei Informal Settlement as well as the town of Grootvlei is located to the south of the project site. Other residential uses include the farmsteads that are scattered throughout the study area.

The closest towns are Balfour, which is located approximately 12km to the north-east, Greylingstad which is located 25km to the east, Villiers, located approximately 27km south, and Heidelberg which is located approximately 37km to the north-west of the proposed project site.

#### **6.2.2 Tourism**

No major tourism exists in the study area. During the site visit accommodation facilities were however noted but most of these facilities are located within the Grootvlei Village and it is assumed that they are catering for guest that visits the Grootvlei Power Station. Other accommodation facilities that are located within the study area include the Henta Guest House, 'Merino Hotel' and 'Die Ou-Poot', which is located along the R51. The Olive Grove Restaurant and Lodge is located on the road between Grootvlei and the Grootvlei Power Station.

#### **6.2.3 Infrastructure, Industrial, Mining and Commercial**

Apart from the Grootvlei Power Station, which is the main industrial activity in the area, there is an Eskom substation (Klipspringer Substation) located to the south of the study site and an industrial zone within the Grootvlei Town. Eskom transmission lines enter and exit the Grootvlei Power Station and cross over Alternative Site 4.

A few commercial activities are located to the south of the proposed site along the R51 including a small shop / cafe, the Red Bull Farming Group and the Auction House, which is involved in stock auctions. There are also commercial activities located to the south-west of the site which includes a small café as well as the Dasville Towing Services.

#### **6.2.4 Transportation systems**

The main access route to the proposed sites is the Grootvlei Power Station road from the N3 towards the power station. Other access routes are the road between Grootvlei and the power station as well as the R51 between Balfour and Villiers. The N3 is located approximately 4.5km to the west of the proposed site. Other roads include the main road through Grootvlei and smaller roads that connect the different residential areas. A disused Transnet railway line runs more or less parallel to the R51 through Grootvlei to Grootvlei Power Station.

#### **6.3 Landscape Character**

Landscape character types are landscape units refined from the regional physiographic and cultural data derived from 1:50 000 topographical maps, aerial photographs and information gathered on the site visit. Dominant landform and land use features such as hills, rolling plains, valleys and urban areas of similar physiographic and visual characteristics typically define landscape character types. Refer to the views in Figures 4 – 10, which illustrate the nature and character of the study area. The viewpoint locations are indicated in Figure 1: Location and Views.

The study area has a rolling topography with the Vaalrand hills area to the north of the Grootvlei Power Station and the Grootvlei Dam, wetland and the Molspruit to the east of the proposed site (refer to View 3 Figure 5 and View 17 Figure 10). The existing vegetation in the area is a mosaic of remnant grassland patches, together with areas of gum trees, particularly along the local roads and the boundary of the Grootvlei Power Station. The terrain is characterised by gentle to moderately undulating landscape.

The proposed surrounding landscape is characterised by open grassland and rural farmland, especially the area located to the east of the R51. The Molspruit runs through this area to the east of the site, creating an undulating landscape with wetlands and the Grootvlei Dam. To the north of the proposed site there are patches of grassland mixed with arable agriculture. Although the landscape is characterised by pastoral activities it is dominated by the Grootvlei Power Station.

Figure 2: Visual Resource, illustrates the spatial distribution of the various landscape character types and the section below will rate the relative value of these types.

## 7 VISUAL RESOURCE

### 7.1 Visual Resource Value / Scenic Quality

The spatial distribution of the landscape types discussed in Section 6 is illustrated in Figure 2: Visual Resource. The figure also rates the relative scenic quality of each type and its landscape sensitivity.

Scenic quality ratings (using the scenic quality rating criteria described in Appendix C) were assigned to each of the landscape types defined in Figure 2: Visual Resource. The *highest* value is assigned to the Vaalrand hills which are located to the north of the project area. Grootvlei Dam, wetlands and the Molspruit are also regarded as having a high visual resource value. The agricultural activities (crops), grazing fields and farmsteads are rated as having *moderate* resource value.

The landscape type with the *lowest* scenic quality rating is assigned to the Grootvlei Village, the town and associated infrastructure which includes the roads, railway and power lines, Grootvlei Industrial Area as well as the Grootvlei Power Station, Eskom substation and transmission lines.

The study area as a whole has a *moderate* visual resource value with sections, such as the hills and water bodies, displaying a high visual resource value. The proposed project sites are however located within the boundaries of the Grootvlei Power Station and therefore has a *low* visual resource value.

A summary of the visual resource values is tabulated in Table 1 below.

**Table 1: Value of the Visual Resource**

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

High	Moderate	Low
Vaalrand hills, Grootvlei Dam, Molspruit and wetlands	Farmsteads, Agricultural Activities and Grazing fields. Residential areas.	Grootvlei Power Station, Eskom substation, transport infrastructure and power / transmission lines, industrial and commercial activities
<p><b>This landscape type is considered to have a <i>high</i> value because it is a:</b></p> <p><b>Distinct landscape that exhibits a very positive character with valued</b></p>	<p><b>This landscape type is considered to have a <i>moderate</i> value because it is a:</b></p> <p><b>Common landscape that exhibits some positive</b></p>	<p><b>This landscape type is considered to have a <i>low</i> value because it is a:</b></p> <p><b>Minimal landscape generally negative in character with few, if any, valued features.</b></p>

**features that combine to give the experience of unity, richness and harmony. It is a landscape that may be considered to be of particular importance to conserve and which has a strong sense of place.**

**character but which has evidence of alteration / degradation / erosion of features resulting in areas of more mixed character.**

**Regional Resource**

**Sensitivity:**

**It is sensitive to change in general and will be detrimentally affected if change is inappropriately dealt with.**

**Regional Resource**

**Sensitivity:**

**It is potentially sensitive to change in general and change may be detrimental if inappropriately dealt with**

**7.2 Sense of Place**

The sense of place in the study area derives from the combination of all landscape types and their impact on the senses. The sense of place for the proposed project study area is a combination of a pastoral and calm sense of place which is created by the outstretched grassland and agricultural activities and a more active and urban sense of place which is created by the Grootvlei Power Station, Grootvlei town and residential areas.

For viewers located to the north of the site, beyond the Vaalrand Hills, as well as viewers located to the south of Grootvlei Town the sense of place will be more pastoral and calm as these viewers are not always exposed to the activities associated with the Grootvlei Power Station. Viewers located closer to the town and the power station experience a more active or industrial sense of place.

## 8 VISUAL RECEPTORS

### 8.1 Views

The main views of the proposed project will be from the within the power station, local roads, especially the roads that run along, or close to, the proposed project sites, and views from residential areas and farmsteads.

#### 8.1.1 Sensitive Viewer Locations

Sensitive viewers typically include views from residential areas, tourist facilities and recreational facilities.

In the case of the proposed project, sensitive viewers include:

- Residents in the Grootvlei Village. Although the proposed village is associated with the Grootvlei Power Station all residents staying in the village might not work at the power station and are therefore considered to be sensitive viewers;
- Residents from the neighboring farms;
- Road users on the R51; and
- Link roads between Grootvlei Town, N3 and the Grootvlei Power Station.

**Table 2: Potential Sensitivity of Visual Receptors**

High	Moderate	Low
<p>Visitors of Game Farms / Lodges and travelling along local routes, whose intention or interest may be focused on the landscape;</p> <p><b>Communities where the development results in changes in the landscape setting or valued views enjoyed by the community such as the Grootvlei Village, Town and neighbouring farms.</b></p> <p><b>Occupiers of residential properties with views affected by the development such as the Grootvlei Village, Town and neighbouring</b></p>	<p><b>People engaged in outdoor sport or recreation (other than appreciation of the landscape, as in landscapes of acknowledged importance or value). This will include recreational users of the Grootvlei Dam.</b></p> <p><b>People travelling through or past the proposed Project on the R51 and the Grootvlei link roads.</b></p>	<p><b>Visitors and people working in and travelling along local roads whose activities are job-related and who therefore are potentially less susceptible to changes in the view. This will typically include people travelling to and from and working in the Grootvlei Power Station.</b></p>

**farms.**

Highlighted sections are applicable to the proposed project alternatives.

---

## 9 VISUAL ISSUES

### 9.1 The Visual Condition of existing landscape

The *landscape impact* (i.e. the change to the fabric and character of the landscape caused by the physical presence of a development) of the proposed project will be **moderate** as the physical impact of the construction, operation and closure of the project will disturb a reasonable percentage of the proposed project site.

To evaluate the visual impact of the proposed project, the visual resource of the existing landscape which would be affected by the proposed project has been described and rated as being **moderate** within the context of the sub-region.

### 9.2 The Visual Impact of the proposed project

As previously mentioned, although agricultural activities (grazing fields and crops) are the dominant land use in the area the prominent activity is the Eskom Grootvlei Power Station. The proposed solar photovoltaic plant will be located within the boundaries of the power station and will therefore be seen as one unit. The solar photovoltaic plant will contribute to the cumulative impact within the study area. Although there are no similar projects located within the study area, the proposed site will not be intrusive to the study area. The main reason for this is the fact that the proposed project will form part of the existing power plant.

It should be noted that the tracking arrays will be more visible than the static panels due to the difference in height. The landscape of the study area is characterised by a rolling topography and therefore the tracking arrays (4m) will be more visible whereas the static panels (1,5m) might be screened by the rolling topography.

There are currently four (4) alternative sites available for the proposed solar photovoltaic plant.

#### Alternative Site 1:

This proposed site is located in the south-eastern corner of the power station site. Alternative Site 1 is approximately 0.9km west of the R51 and views from the road will be clear towards the solar photovoltaic plant. As explained above, due to the height of the tracking arrays it will be more visible than the static arrays. Other views will include views from the farmsteads located directly east of the site, Grootvlei Informal Settlement as well as views from the road between Grootvlei and the substation. Farmers located within the study area, especially east of the site will also have a view towards the solar photovoltaic plant. Views towards the solar photovoltaic plant will however have the power station in the backdrop and the plant will therefore melt in with the existing land use of the area.

---

The proposed solar photovoltaic plant on Alternative Site 1 will be shielded from views from residents located to the north and the west of the proposed site by the existing power station.

#### Alternative Site 2:

The proposed site is located in the south-western corner of the power station site. Alternative Site 2 is located closer to the local roads that link Grootvlei Town, Grootvlei Power Station and the N3. Motorists travelling along these roads will have views towards the photovoltaic plant. Due to the slightly rolling topography of the area the tracking arrays (4m) will be more visible than the static panels (1,5m).

Views from the north, north-east and the north-west will be blocked by the existing power station. Motorist travelling along the R51 will not have a view or will have a partial view of the proposed project site. Residents from the Grootvlei Village will have a partial view or no view at all as the views are screened by the rows of trees planted along the southern boundary of the residential area.

#### Alternative Site 3:

The proposed site is located along the eastern side of the power station site. According to the layout plan the proposed site is located on top of an existing ashdam and it is unclear whether the solar photovoltaic plant will be constructed on top of the ashdam and whether it will be reworked before the solar photovoltaic is constructed. Should the ashdam be reworked and the solar photovoltaic plant constructed on ground level the solar photovoltaic plant will be surrounded by activities associated with the power station and will therefore be either fully or partially screened from visual receptors. Possible views towards the solar photovoltaic plant will be from the R51, farmsteads located to the east of the power station and views from the link road between Grootvlei Town and the power station.

If the solar photovoltaic plant is however constructed on top of the ashdam it will be exposed and therefore visible from longer distances. It will also be difficult to mitigate as you will not be able to plant a vegetation screen along the boundaries of the solar photovoltaic plant. The solar photovoltaic plant will be visible from the R51 and local roads, the Grootvlei Town and informal settlement, as well as the surrounding farmsteads.

#### Alternative Site 4:

The proposed site is located in the north-western corner of the power station site. The site is bordering the Grootvlei Village and unfortunately it will be located between the residents (houses) and the row of trees that surround the Grootvlei Village. For this reason the residents (at least the first row of houses) will be fully exposed to the solar photovoltaic panels. The solar photovoltaic panels will not just have an impact on residents staying in the first row of houses but will also have an impact on the residents visiting the park / open space which borders the solar photovoltaic plant. For the viewers, as mentioned above,

---

the impact will be the same whether static panels or tracking arrays are used.

The proposed site will be screened from visual receptors located to the east and the south of the site. Residents located to the west (extension of Grootvlei Village) will only have partial views or no view at all due to the tree screen that runs along the boundary of the residential area. For viewers (farmsteads) located to the north of the site the solar photovoltaic plant will be partially visible or not visible at all.

Although the above is true it should also be noted that most of the viewers / visual receptors, as mentioned above, are exposed to the Grootvlei Power Station and will have the power station in the backdrop of their views. For this reason it can be said that the sensitivity of the visual receptors are **moderate** and in some circumstances even **low**.

Taking the above into consideration it can therefore be concluded that the visual impact of the proposed project is **low** for the proposed Alternative Sites 1 - 3. It should however be noted that if the mitigation measure are not implemented correctly the visual impact for Alternative Site 4 can be **moderate**.

**Table 3: Visual Impact of the Proposed Project**

<b>High</b>	<b>Moderate</b> <b>Alternative Site 4</b> <b>Alternative Site 3 – if</b> <b>constructed on top of</b> <b>the ashdam</b>	<b>Low</b> <b>Alternative Site 1 &amp; 2</b> <b>Alternative Site 3 – if</b> <b>constructed on ground</b> <b>level</b>	<b>Positive</b>
Because the proposed development: - Has a substantial negative effect on the visual quality of the landscape;  - Contrasts dramatically with the patterns or elements that define the structure of the landscape;	<b>Because the proposed development:</b> <b>- Has a moderate negative effect on the visual quality of the landscape;</b>  <b>- Contrasts with the patterns or elements that define the structure of the landscape;</b>	<b>Because the proposed development:</b> <b>- Has a low negative effect on the visual quality of the landscape;</b>  <b>- Contrasts minimally with the patterns or elements that define the structure of the landscape;</b>	The proposed development: - Has a beneficial effect on the visual quality of the landscape;  - Enhances the patterns or elements that define the structure of the landscape;

- Contrasts with land use, settlement or enclosure patterns;	- Is partially compatible with land use (utilities) patterns of the general area.	- <b>Is mostly compatible with land use, (utility) patterns.</b>	- Is compatible with land use, settlement or enclosure patterns.
- Cannot be 'absorbed' into the landscape from key viewing areas	- <b>Is partially 'absorbed' into the landscape from key viewing areas (by distance)</b>	- <b>Is 'absorbed' into the landscape from key viewing areas (due to the existing power station)</b>	
<i>Result</i>	<i>Result</i>	<i>Result</i>	<i>Result</i>
Notable change in landscape characteristics over an extensive area and / or intensive change over a localized area resulting in major changes in key views.	<b>Moderate change in landscape characteristics over an extensive area, resulting in a moderate change to key views.</b>	<b>Low change in landscape characteristics over an extensive area resulting in a minor change to a few key views.</b>	Positive change in key views.

### 9.3 The Severity of the Visual Impact

Table 4 below is the rating of the *severity (intensity)* of the visual impact by the proposed project with NO MITIGATION MEASURES applied.

**Table 4: Severity (intensity) of Visual Impact of the proposed project**

High	Moderate	Low	Negligible
Total loss of or major alteration to key elements, features, characteristics of the baseline environment.	Partial loss of or alteration to key elements, features, characteristics of the baseline environment.	<b>Minor loss of or alteration to key elements, features, characteristics of the baseline environment.</b>	Very minor loss or alteration to key elements, features, characteristics of the baseline environment.
i.e. Introduction of elements considered to be totally	Introduction of elements that may be prominent but may not necessarily be	<b>Introduction of elements that may not be uncharacteristic when</b>	Introduction of elements that are not uncharacteristic with the

uncharacteristic when set within the attributes of the receiving landscape.	considered to be substantially uncharacteristic when set within the attributes of the receiving landscape.	<b>set within the attributes of the receiving landscape.</b>	surrounding landscape – approximating the ‘no change’ situation.
<i>Result:</i> High scenic quality impacts and major loss of attributes of pre-development views.	<i>Result:</i> Moderate scenic quality impacts and moderate loss of attributes of pre-development views.	<i>Result:</i> <b>Low scenic quality impacts and minor loss of attributes of pre-development views.</b>	<i>Result:</i> Negligible scenic quality impacts and loss of attributes of pre-development views.

From the summary in Table 4 the severity of the visual impact of the proposed project would be **low** for site alternatives 1 - 3 resulting in minor loss of key characteristics of the baseline environment. The solar photovoltaic plant (alternatives 1 - 3) will not be uncharacteristic and it will blend in with the existing power plant which will lower the visual intrusion. The severity of the visual impact for site alternative 4 could however be **moderate** if not mitigated.

## 10 MITIGATING MEASURES

In considering mitigating measures there are three rules that were considered - the measures should be feasible (economically), effective (how long will it take to implement and what provision is made for management / maintenance) and acceptable (within the framework of the existing landscape and land use policies for the area). To address these, the following principles have been considered:

- Mitigation measures should be designed to suit the existing landscape character and needs of the locality. They should respect and build upon landscape distinctiveness.
- It should be recognized that many mitigation measures, especially the establishment of planted screens and rehabilitation, are not immediately effective.

If the mitigation measures, as suggested below, are successfully implemented and maintained the overall visual impact of the proposed project can be reduced. The following mitigation measures are proposed:

### 10.1 Earthworks

- Dust suppression techniques must be in place at all times during the construction, operational and the decommissioning phases.

### 10.2 Landscaping

- If feasible vegetation screens (a combination of indigenous trees and shrubs such as *Rhus pyroides* and *Buddleja salviifolia*) should be planted along the boundaries of the proposed project to screen sensitive viewing areas, such as the Grootvlei Village, from views of the project. The vegetation screens are specific to the alternative sites as it is not feasible to use a tree screen at all the sites. The following vegetation screens are suggested for the different sites:
  - Alternative Site 1: a vegetation screen comprising of trees and shrubs could be planted along the southern boundary as well as along sections of the western and eastern boundary of the Grootvlei Power Station. Should the solar panels be located on top of the ashdam it will be difficult to mitigate the impact. Screening trees would not be effective due to the height and slope of the ashdam and therefore it is suggested that if feasible, a vegetation screen of grass should be planted. This will soften the view but will not screen it completely. It is recommended that grasses that are found in the surrounding area must be used for the vegetation screen.

- Alternative Site 2: a vegetation screen comprising of trees and shrubs could be planted along the southern boundary as well as along sections of the western and eastern boundary of the Grootvlei Power Station.
- Alternative Site 3: due to the fact that this site is located more towards the middle of the power station it is screened from viewers located to the west of the site by the power plant. It is however not screened from the east and it is therefore recommended that a screen be planted along a section of the eastern boundary of the power station.
- Alternative Site 4: trees along the northern boundary must be kept. A vegetation screen must be planted along the south-western boundary where the site borders the Grootvlei Village.
- An ecologist, preferable the ecologist that did the flora assessment, must be appointed to assist with the final design and plant selection for the proposed vegetation screen.
- The vegetation screen must be maintained in order to ensure that the plants remain as an effective screen and buffer for the life of the project.

### **10.3 Access Roads**

During construction and decommissioning of the Project, access roads will require an effective dust suppression management programme, such as the use of non-polluting chemicals that will retain moisture in the perimeter road surface.

### **10.4 Lighting**

Light pollution should be kept to a minimum wherever possible as light at night travels great distances. If security lighting is used at the solar park it should only be used where absolutely necessary and carefully directed.

The negative impact of night lighting, glare and spotlight effects, can be mitigated using the following methods:

- Install light fixtures that provide precisely directed illumination to reduce light “spillage” beyond the immediate surrounds of the Project (Figure 5).
  - Avoid high pole top security lighting along the periphery of the Project site and if possible only use lights that are activated on movement at illegal entry to the site.
  - i.e. the lights will therefore be off for most of the time and would alert security personnel should the lights suddenly come on at night OR
  - In preference, utilize closed circuit TV security systems with infrared capability, which will minimize the need for security lighting
-

## 11 CONCLUSION

It can be concluded that negative visual impacts would result from the construction, operational and decommissioning phases of the proposed Grootvlei Power Station Photovoltaic Plant.

The proposed study area has a rolling topography with a combination of the open grassland, agricultural activities, Vaalrand Hills, water bodies the Grootvlei Village, Town and the Grootvlei Power Plant. The visual resource value of the area is rated as being moderate and the sense of place is a combination of both rural and more industrial or urban sense of place.

Sensitive viewers will typically include views from residential areas, such as the farmsteads, Grootvlei Village and Town. Other views will be from the R51 as well as link roads between the Grootvlei Power Station, the village, town and the N3. Although there are guest houses located within the area it is assumed that most of these are used for people visiting the Eskom Grootvlei Power Station as the propose study area is not a tourist destination.

Due to the rolling topography of the area the static panels will be less visible and easier to screen than the tracking arrays. Effective mitigation can however be achieved by means of vegetation screening along the perimeters of the solar photovoltaic plants, using selected indigenous trees and shrubs.

The proposed Site Alternative 4 is located right next to the Grootvlei Village and residents staying along the northern boundary or people using the ark / open space will be fully exposed to the solar photovoltaic plant. Most of the views towards the proposed Alternative Sites 1 – 3 will be from motorist using the R51 or local roads. Other views will be from farmsteads bordering the proposed sites.

The visual impact of the proposed project (site alternatives 1 – 3) will be low as the proposed project will not be uncharacteristic to the land use of the area, will form part of the power station and will therefore blend into the surrounding environment. Most of the visual receptors within the study area are already exposed to the power station and views towards the solar photovoltaic plant will include the power station as a backdrop.

It should however be noted that if the visual impact is not mitigated correctly the impact could be **moderate** and even **high** for residents located next to Site Alternative 4

---

## 12 REFERENCES

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

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

Institute of Environmental Assessment & The Landscape Institute, 1996. *Guidelines for Landscape and Visual Impact Assessment*, E & FN Spon, London (117)

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

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

Lynch, K., 1992. *Good City Form*, The MIT Press, London. (131)

Mucina, L. & Rutherford, M.C. (eds) 2006. The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia 19*. South African National Biodiversity Institute, Pretoria.

Oberholzer, B., 2005. Guideline for involving visual & aesthetic specialists in EIA processes: Edition 1. CSIR Report No ENV-S-C 2005 053 F. Republic of South Africa, Provincial Government of the Western Cape, Department of Environmental Affairs & Development Planning, Cape Town

Warnock, S. & Brown, N., 1998. Putting Landscape First. *Landscape Design*. 268: 44-46.

---

## APPENDIX A: LIST OF FIGURES

Figure 1	Locality and Views
Figure 2	Visual Resource
Figure 3	Proposed Layout of Alternative Sites
Figure 4	Lighting Examples
Figure 5	Landscape Character
Figure 6	Landscape Character
Figure 7	Landscape Character
Figure 8	Landscape Character
Figure 9	Landscape Character
Figure 10	Landscape Character
Figure 11	Simulation – View 10
Figure 12	Simulation – View 12
Figure 13	Simulation – View 14
Figure 14	Simulation – View 14

---

## **APPENDIX B: DETERMINING A LANDSCAPE AND THE VALUE OF THE VISUAL RESOURCE**

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

### **Landscape Elements and Character**

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

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

### **Landscape Value – all encompassing (Aesthetic Value)**

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

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

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

## **Sense of Place**

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

## **Scenic Quality**

Assigning values to visual resources is a subjective process. The phrase, "beauty is in the eye of the beholder," is often quoted to emphasize the subjectivity in determining scenic values. Yet, researchers have found consistent levels of agreement among individuals asked to evaluate visual quality.

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

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

### **Scenic Quality - Explanation of Rating Criteria:**

(After The Visual Resource Management System, Department of the Interior of the USA Government, Bureau of Land Management)

**Landform:** Topography becomes more interesting as it gets steeper or more massive, or more severely or universally sculptured. Outstanding landforms may be monumental, as the Fish River or Blyde River

---

Canyon, the Drakensberg or other mountain ranges, or they may be exceedingly artistic and subtle as certain badlands, pinnacles, arches, and other extraordinary formations.

**Vegetation:** (Plant communities) Give primary consideration to the variety of patterns, forms, and textures created by plant life. Consider short-lived displays when they are known to be recurring or spectacular (wildflower displays in the Karoo regions). Consider also smaller scale vegetational features, which add striking and intriguing detail elements to the landscape (e.g., gnarled or wind beaten trees, and baobab trees).

**Water:** That ingredient which adds movement or serenity to a scene. The degree to which water dominates the scene is the primary consideration in selecting the rating score.

**Colour:** Consider the overall colour(s) of the basic components of the landscape (e.g., soil, rock, vegetation, etc.) as they appear during seasons or periods of high use. Key factors to use when rating "colour" are variety, contrast, and harmony.

**Adjacent Scenery:** Degree to which scenery outside the scenery unit being rated enhances the overall impression of the scenery within the rating unit. The distance which adjacent scenery will influence scenery within the rating unit will normally range from 0-8 kilometres, depending upon the characteristics of the topography, the vegetative cover, and other such factors. This factor is generally applied to units which would normally rate very low in score, but the influence of the adjacent unit would enhance the visual quality and raise the score.

**Scarcity:** This factor provides an opportunity to give added importance to one or all of the scenic features that appear to be relatively unique or rare within one physiographic region. There may also be cases where a separate evaluation of each of the key factors does not give a true picture of the overall scenic quality of an area. Often it is a number of not so spectacular elements in the proper combination that produces the most pleasing and memorable scenery - the scarcity factor can be used to recognize this type of area and give it the added emphasis it needs.

**Cultural Modifications:** Cultural modifications in the landform / water, vegetation, and addition of structures should be considered and may detract from the scenery in the form of a negative intrusion or complement or improve the scenic quality of a unit.

### **Scenic Quality Inventory and Evaluation Chart**

(After The Visual Resource Management System, Department of the Interior of the USA Government, Bureau of Land Management)

---

Key factors	Rating Criteria and Score	.	.
Landform	High vertical relief as expressed in prominent cliffs, spires, or massive rock outcrops, or severe surface variation or highly eroded formations including major badlands or dune systems; or detail features dominant and exceptionally striking and intriguing such as glaciers.  <b>5</b>	Steep canyons, mesas, buttes, cinder cones, and drumlins; or interesting erosional patterns or variety in size and shape of landforms; or detail features which are interesting though not dominant or exceptional.  <b>3</b>	Low rolling hills, foothills, or flat valley bottoms; or few or no interesting landscape features.  <b>1</b>
Vegetation and landcover	A variety of vegetative types as expressed in interesting forms, textures, and patterns.  <b>5</b>	Some variety of vegetation, but only one or two major types.  <b>3</b>	Little or no variety or contrast in vegetation.  <b>1</b>
Water	Clear and clean appearing, still, or cascading white water, any of which are a dominant factor in the landscape.  <b>5</b>	Flowing, or still, but not dominant in the landscape.  <b>3</b>	Absent, or present, but not noticeable.  <b>0</b>
Colour	Rich colour combinations, variety or vivid colour; or pleasing contrasts in the soil, rock, vegetation, water or snow fields.  <b>5</b>	Some intensity or variety in colours and contrast of the soil, rock and vegetation, but not a dominant scenic element.  <b>3</b>	Subtle colour variations, contrast, or interest; generally mute tones.  <b>1</b>
Influence of adjacent scenery	Adjacent scenery greatly enhances visual quality.  <b>5</b>	Adjacent scenery moderately enhances overall visual quality.  <b>3</b>	Adjacent scenery has little or no influence on overall visual quality.  <b>0</b>
Scarcity	One of a kind; or unusually memorable, or very rare within region. Consistent chance for exceptional wildlife or wildflower viewing, etc. National and provincial parks and conservation areas  <b>* 5+</b>	Distinctive, though somewhat similar to others within the region.	Interesting within its setting, but fairly common within the region.

		<b>3</b>	<b>1</b>
Cultural modifications	Modifications add favourably to visual variety while promoting visual harmony.	Modifications add little or no visual variety to the area, and introduce no discordant elements.	Modifications add variety but are very discordant and promote strong disharmony.
	<b>2</b>	<b>0</b>	<b>-4</b>

**Scenic Quality (i.e. value of the visual resource)**

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

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

**Value of Visual Resource – expressed as Scenic Quality**

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

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

## **APPENDIX C: METHOD FOR DETERMINING THE MAGNITUDE (SEVERITY / INTENSITY) OF LANDSCAPE AND VISUAL IMPACT**

A visual impact study analysis addresses the importance of the inherent aesthetics of the landscape, the public value of viewing the natural landscape, and the contrast or change in the landscape from the project.

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

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

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

### **Landscape Impact**

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

---

Landscape Institute, 2002).

### **Visual Impact**

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

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

#### **Visual Intrusion:**

The nature of intrusion or contrast (physical characteristics) of a project component on the visual quality of the surrounding environment and its compatibility / discord with the landscape and surrounding land use.

#### **Visibility:**

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

#### **Visual exposure:**

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

#### **Sensitivity:**

Sensitivity of visual receptors to the proposed development.

### **Visual Intrusion / contrast**

Visual intrusion deals with the notion of contextualism i.e. how well does a project component fit into the ecological and cultural aesthetic of the landscape as a whole. Or conversely what is its contrast with the receiving environment. Combining landform / vegetation contrast with structure contrast derives overall visual intrusion / contrast levels of high, moderate, and low.

Landform / vegetation contrast is the change in vegetation cover and patterns that would result from construction activities. Landform contrast is the change in landforms, exposure of soils, potential for erosion scars, slumping, and other physical disturbances that would be noticed as uncharacteristic in the natural landscape. Structure contrast examines the compatibility of the proposed development with other structures in the landscape and the existing natural landscape. Structure contrast is typically strongest where there are no other structures (e.g., buildings, existing utilities) in the landscape setting.

Photographic panoramas from key viewpoints before and after development are presented to illustrate

---

the nature and change (contrast) to the landscape created by the proposed development. A computer simulation technique is employed to superimpose a graphic of the development onto the panorama. The extent to which the component fits or contrasts with the landscape setting can then be assessed using the following criteria.

Does the physical development concept have a negative, positive or neutral effect on the quality of the landscape?

Does the development enhance or contrast with the patterns or elements that define the structure of the landscape?

Does the design of the project enhance and promote cultural continuity or does it disrupt it?

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

**Visual Intrusion**

<b>High</b>	<b>Moderate</b>	<b>Low</b>	<b>Positive</b>
<p>If the project:</p> <ul style="list-style-type: none"> <li>- Has a substantial negative effect on the visual quality of the landscape;</li> <li>- Contrasts dramatically with the patterns or elements that define the structure of the landscape;</li> <li>- Contrasts dramatically with land use, settlement or enclosure patterns;</li> <li>- Is unable to be 'absorbed' into the landscape.</li> </ul>	<p>If the project:</p> <ul style="list-style-type: none"> <li>- Has a moderate negative effect on the visual quality of the landscape;</li> <li>- Contrasts moderately with the patterns or elements that define the structure of the landscape;</li> <li>- Is partially compatible with land use, settlement or enclosure patterns.</li> <li>- Is partially 'absorbed' into the landscape.</li> </ul>	<p>If the project:</p> <ul style="list-style-type: none"> <li>- Has a minimal effect on the visual quality of the landscape;</li> <li>- Contrasts minimally with the patterns or elements that define the structure of the landscape;</li> <li>- Is mostly compatible with land use, settlement or enclosure patterns.</li> <li>- Is 'absorbed' into the landscape.</li> </ul>	<p>If the project:</p> <ul style="list-style-type: none"> <li>- Has a beneficial effect on the visual quality of the landscape;</li> <li>- Enhances the patterns or elements that define the structure of the landscape;</li> <li>- Is compatible with land use, settlement or enclosure patterns.</li> </ul>

<i>Result</i> Notable change in landscape characteristics over an extensive area and / or intensive change over a localized area resulting in major changes in key views.	<i>Result</i> Moderate change in landscape characteristics over localized area resulting in a moderate change to key views.	<i>Result</i> Imperceptible change resulting in a minor change to key views.	<i>Result</i> Positive change in key views.
--	--	---	--

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

### Visibility

A viewshed analysis was carried out to define areas, which contain all possible observation sites from which the development would be visible. The basic assumption for preparing a viewshed analysis is that the observer eye height is 1.8m above ground level. Topographic data was captured for the site and its environs at 10m contour intervals to create the Digital Terrain Model (DTM). The DTM includes features such as vegetation, rivers, roads and nearby urban areas. These features were 'draped' over the topographic data to complete the model used to generate the viewshed analysis. It should be noted that viewshed analyses are not absolute indicators of the level of significance (magnitude) of the impact in the view, but merely a statement of the fact of potential visibility. The visibility of a development and its contribution to visual impact is predicted using the criteria listed below:

### Visibility

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

## **Visual Exposure**

Visual exposure relates directly to the distance of the view. It is a criterion used to account for the limiting effect of increased distance on visual impact. The impact of an object in the foreground (0 – 800m) is greater than the impact of that same object in the middle ground (800m – 5.0km) which, in turn is greater than the impact of the object in the background (greater than 5.0km) of a particular scene.

Distance from a viewer to a viewed object or area of the landscape influences how visual changes are perceived in the landscape. Generally, changes in form, line, colour, and texture in the landscape become less perceptible with increasing distance.

Areas seen from 0 to 800m are considered foreground; foliage and fine textural details of vegetation are normally perceptible within this zone.

Areas seen from 800m to 5.0km are considered middle ground; vegetation appears as outlines or patterns. Depending on topography and vegetation, middle ground is sometimes considered to be up to 8.0km.

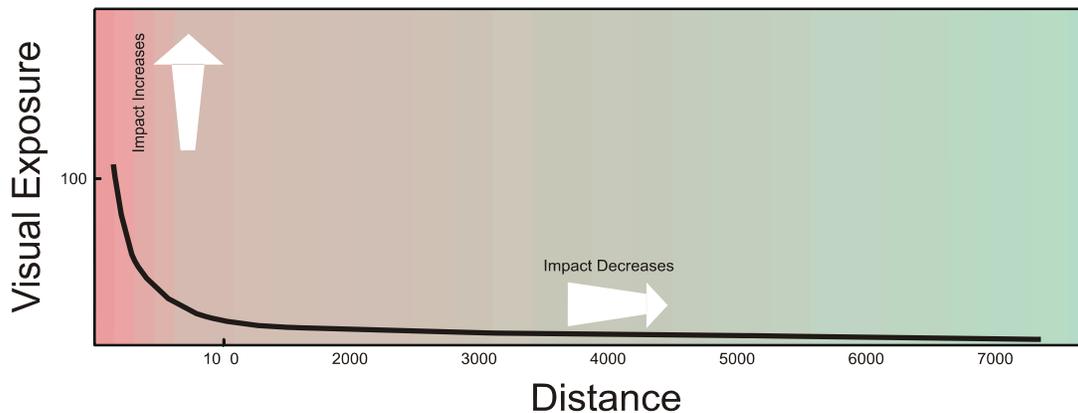
Areas seen from 5.0km to 8.0km and sometimes up to 16km and beyond are considered background. Landforms become the most dominant element at these distances.

Seldom seen areas are those portions of the landscape that, due to topographic relief or vegetation, are screened from the viewpoint or are beyond 16km from the viewpoint. Landforms become the most dominant element at these distances.

The impact of an object diminishes at an exponential rate as the distance between the observer and the object increases. Thus, the visual impact at 1000m would be 25% of the impact as viewed from 500m. At 2000 m it would be 10% of the impact at 500m. The inverse relationship of distance and visual impact is well recognised in visual analysis literature (e.g. Hull and Bishop (1988)) and is used as important criteria for the study. This principle is illustrated in the figure below.

---

## Effect of Distance on Visual Exposure



### Sensitivity of Visual Receptors

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

The sensitivity of visual receptors and views will be depended on:

The location and context of the viewpoint;

The expectations and occupation or activity of the receptor;

The importance of the view (which may be determined with respect to its popularity or numbers of people affected, its appearance in guidebooks, on tourist maps, and in the facilities provided for its enjoyment and references to it in literature or art).

The most sensitive receptors may include:

Users of all outdoor recreational facilities including public rights of way, whose intention or interest may be focused on the landscape;

Communities where the development results in changes in the landscape setting or valued views enjoyed by the community;

Occupiers of residential properties with views affected by the development.

These would all be high (5)

Other receptors include:

People engaged in outdoor sport or recreation (other than appreciation of the landscape, as in landscapes of acknowledged importance or value); (3)

People travelling through or past the affected landscape in cars, on trains or using other transport modes;

(0)

People at their place of work. (0)

The least sensitive receptors are likely to be people at their place of work, or engaged in similar activities, whose attention may be focused on their work or activity and who therefore may be potentially less susceptible to changes in the view.

In this process more weight is usually given to changes in the view or visual amenity which are greater in scale and visible over a wide area. In assessing the effect on views, consideration should be given to the effectiveness of mitigation measures, particularly where planting is proposed for screening purposes (Institute of Environmental Assessment & The Landscape Institute (1996).

#### Sensitivity of Visual Receptors

High (5)	Moderate (3)	Low (0)
Users of all outdoor recreational facilities including public rights of way, whose intention or interest may be focused on the landscape;  Communities where the development results in changes in the landscape setting or valued views enjoyed by the community;  Occupiers of residential properties with views affected by the development.	People engaged in outdoor sport or recreation (other than appreciation of the landscape, as in landscapes of acknowledged importance or value);  People travelling through or past the affected landscape in cars, on trains or other transport routes;	The least sensitive receptors are likely to be people at their place of work, or engaged in similar activities, whose attention may be focused on their work or activity and who therefore may be potentially less susceptible to changes in the view (i.e. office and industrial areas).  Roads going through urban and industrial areas

#### Magnitude (Severity / Intensity) of the Visual Impact

Potential visual impacts are determined by analysing how the physical change in the landscape, resulting from the introduction of a project, are viewed and perceived from sensitive viewpoints. Impacts to views are the highest when viewers are identified as being sensitive to change in the landscape, and their views are focused on and dominated by the change. Visual impacts occur when changes in the landscape are noticeable to viewers looking at the landscape from their homes or from parks, and conservation areas, highways and travel routes, and important cultural features and historic sites, especially in foreground

views.

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

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

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

**Magnitude (Severity / Intensity) of Visual Impact**

<b>High</b>	<b>Moderate</b>	<b>Low</b>	<b>Negligible</b>
Total loss of or major alteration to key elements / features / characteristics of the baseline.	Partial loss of or alteration to key elements / features / characteristics of the baseline.	Minor loss of or alteration to key elements / features / characteristics of the baseline.	Very minor loss or alteration to key elements / features / characteristics of the baseline.
I.e. Pre-development landscape or view and / or introduction of elements considered to be totally uncharacteristic when set within the attributes of the receiving landscape.	I.e. Pre-development landscape or view and / or introduction of elements that may be prominent but may not necessarily be considered to be substantially uncharacteristic when set within the attributes of the receiving landscape.	I.e. Pre-development landscape or view and / or introduction of elements that may not be uncharacteristic when set within the attributes of the receiving landscape.	I.e. Pre-development landscape or view and / or introduction of elements that are not uncharacteristic with the surrounding landscape – approximating the 'no change' situation.
High scenic quality impacts would result.	Moderate scenic quality impacts would result	Low scenic quality impacts would result.	Negligible scenic quality

			impacts would result.
--	--	--	-----------------------

**Cumulative effects**

Cumulative landscape and visual effects (impacts) result from additional changes to the landscape or visual amenity caused by the proposed development in conjunction with other developments (associated with or separate to it), or actions that occurred in the past, present or are likely to occur in the foreseeable future. They may also affect the way in which the landscape is experienced. Cumulative effects may be positive or negative. Where they comprise a range of benefits, they may be considered to form part of the mitigation measures.

Cumulative effects can also arise from the intervisibility (visibility) of a range of developments and / or the combined effects of individual components of the proposed development occurring in different locations or over a period of time. The separate effects of such individual components or developments may not be significant, but together they may create an unacceptable degree of adverse effect on visual receptors within their combined visual envelopes. Intervisibility depends upon general topography, aspect, tree cover or other visual obstruction, elevation and distance, as this affects visual acuity, which is also influenced by weather and light conditions. (Institute of Environmental Assessment and The Landscape Institute, 1996).

## APPENDIX D: CRITERIA FOR PHOTO / COMPUTER SIMULATION

To characterize the nature and magnitude of visual intrusion of the proposed project, a photographic simulation technique was used. This method was used according to Sheppard (in Lange 1994), where a visual simulation is good quality when the following five criteria are met.

Representativeness:	A simulation should represent important and typical views of a project.
Accuracy:	The similarity between a simulation and the reality after the project has been realized.
Visual clarity:	Detail, parts and overall contents have to be clearly recognizable.
Interest:	A simulation should hold the attention of the viewer.
Legitimacy:	A simulation is defensible if it can be shown how it was produced and to what degree it is accurate.

To comply with this standard it was decided to produce a stationary or static simulation (Van Dortmont in Lange, 1994), which shows the proposed development from a typical static observation points (Critical View Points).

Photographs are taken on site during a site visit with a manual focus, 50mm focal depth digital camera. All camera settings are recorded and the position of each panoramic view is recorded by means of a GPS. These positions, coordinates are then placed on the virtual landscape (see below).

A scale model of the proposal is built in virtual space, scale 1:1, based on CAD (vector) information as supplied by the architect / designers. This model is then placed on a virtual landscape, scale 1:1, as produced by means of GIS software. The accuracy of this depends on the contour intervals.

The camera views are placed on the points as recorded on the virtual landscape. The respective photographs are overlaid onto the camera views, and the orientation of the cameras adjusted accordingly. The light source is adjusted to suit the view. Each view is then rendered as per the process above.

---