Visual Impact Assessment Report

Medupi Flue Gas Desulphurisation and ADF changes, Lephalele, Limpopo Province

Yonanda Martin

Newtown Landscape Architects

PROPOSED MEDUPI FLUE GAS DESULPHURISATION (FGD)

LEPHALELE, LIMPOPO PROVINCE

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Reference:	Medupi FGD

Declaration of Independence

I, Yonanda Martin, declare that –

- I am contracted as Visual Assessment Practitioner for the Medupi FGD Project.
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the National Environmental Management Act (Act 107 of 1998), Environmental Impact Assessment Regulations 2010 and 2014, and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I will take into account, to the extent possible, the matters listed in Regulation 8;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing – any decision to be taken with respect to the application by the competent authority; and – the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of section 24F of the Act.

Yonanda Martin

SACNASP Professional Reg No: 400204/09

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Expertise of Specialist

Name:	Graham A Young
Qualification:	Pr LArch
Professional Registration:	South African Council for the Landscape Architectural Profession (SACLAP) Institute of Landscape Architects of South Africa (ILASA)
Experience in Years:	30 years
Experience	Graham is a landscape architect with thirty over 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 VIA work.

Name:	Yonanda Martin
Qualification:	MSc. (Env.)
Professional Registration:	Pri. Sci. Nat.
Experience in Years:	11 years
Experience	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: • **Eskom Ngwedi Substation** (PBAI), North West Province • **NBC Belfast Project** (Exxaro), Mpumalanga • **Tamboti Platinum Mine** (Metago), Limpopo • **De Wittekrans** (GCS), Mpumalanga • **Dorsfontein West Expansion** (GCS (Pty) Ltd), Kriel • **Eskom Honingklip** (Kv3 Engineers), Muldersdrift • **SANRAL PWV3** (Jeffares & Green), Hartbeespoort

Acronyms, Abbreviations & Glossary

Acronyms & Abbreviations:

ADF	Ash Disposal Facility
CAD	Computer-aided design
CSIR	Council for Scientific and Industrial Research
DTM	Digital Terrain Model
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
Eskom	Electricity Supply Commission
FGD	Flue Gas Desulphurisation
GIS	Geographic Information System
IFC	International Finance Corporation
ILASA	Institute for Landscape Architecture in South Africa
NEMA	National Environmental Management Act
NLA	Newtown Landscape Architects
SACLAP	South African Council for the Landscape Architectural Profession
VIA	Visual Impact Assessment

Glossary:

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 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 Medupi FGD 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 12km radius surrounding the proposed project footprint / site.
Project Footprint / Site	For the purposes of this report the Medupi FGD 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.

Executive Summary

Newtown Landscape Architects (NLA) was commissioned by Zitholele Consulting (Pty) Ltd to carry out a Visual Impact Assessment (VIA) for the proposed Medupi Flue Gas Desulphurisation (FGD) Project (the Project) located within Lephalale Municipality, Limpopo Province.

During the Scoping / Baseline Assessment Site Alternative 13 was considered to be the most appropriate site for the ash disposal facility (ADF) and therefore only this alternative was assessed for the proposed project together with the FGD system, gypsum & limestone handling area and the railway yard.

The study area is a combination of natural environments such as the dense bushveld, koppies and mountains and the industrial / urbanized areas such as the Grootgeluk Mine, Medupi and Matimba Power Stations. The visual resource value was assessed as being moderate within the context of the sub-region.

The study area's sense of place comprises a peaceful savannah landscape experienced by people visiting tourist accommodation facilities located in the south and west of the study area and an urbanized character that people experience when travelling along the D1675 towards Lephalale.

Potential sensitive viewers / receptors are mostly concentrated along the D1925 which is located immediately south of the proposed ADF site. Sensitive viewers are located along the D1675, which runs along the northern boundary of the project site. Motorists travelling along the D1925 and the D2649 have minimal visual exposure to mining activities, the ash disposal facilities and the power stations, whereas motorist travelling along the D1675 are exposed to these activities.

Although there are other mining activities located to the north and east of the proposed project site, the new ash disposal facility will be intrusive to sensitive viewing sites within the study area as it is proposed to be located in an area that falls within the viewshed of residential units and tourist lodges. In the early stages of its development, the new ash disposal facility will be screened from viewers travelling along the D1675 and viewers located to the south of the project site, due to the dense vegetation cover, but will become visible once it rises above the tree line. The project, from its inception, will however be visible from elevated sites such as the Lephalale Game Traders lodge.

Using Zitholele's impact assessment criteria, the significance of the ADF impact during construction and decommissioning was rated as *moderate*. During the operational phase the significance will remain *moderate* even when mitigation measures are implemented because the ash facility will become more visible once it rises above the tree line. The receptors that will mostly be affected by these activities are viewers travelling along the D1675 and D1925 as well as viewers staying at or visiting the Komunati Lodge, Landelani Game Farms, Lephalale Game Farm / Lodge and Hooi Kraal.

During the closure phase the significance could be reduced to *low* but only if the ash disposal facility is removed, should the facility remain on site the significance will remain *moderate*.

The unmitigated impact of the FGD system, gypsum & limestone handling area and the railway yard will be very low during the construction phase. During this phase there will be more activity on site which will be visible for motorist travelling along the boundary of the Medupi Power Station. During the operational, decommissioning and closure phase the components will be absorbed by the existing structures and will therefore be seen as a whole. It will contribute as a cumulative impact to the overall impact of the Medupi Power Station.

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1. INTRODUCTION

1.1 Project Overview and Background

Newtown Landscape Architects (NLA) was commissioned by Zitholele Consulting (Pty) Ltd to carry out a Visual Impact Assessment (VIA) for the proposed Medupi Flue Gas Desulphurisation (FGD) Project (the Project) located within Lephalale Municipality, Limpopo Province.

The project entails the establishment of a waste disposal facility, here after referred to as the Ash Disposal Facility (ADF), for the three by-products (gypsum, chemical sludge and salts) produced during the Flue Gas Desulphurisation process, the construction of the FGD system, the gypsum and limestone handling area and the railway yard.

1.2 Study Area

The Project site is situated approximately 15km to the east of the town of Lephalale and approximately 9km east of Onverwacht, refer to Figure 1: Locality Map. During the Scoping Phase three alternative sites were considered for the proposed ADF, but only one site was chosen for the Impact Assessment Phase, refer to Figure 2: Project Site for the locality of the ADF site. The FGD system, the gypsum and limestone handling area and the railway yard will form part of the existing Medupi Power Station.

1.3 Objective of the Specialist Study

The main aim of the visual impact specialist study is to ensure that the visual / aesthetic consequences of the proposed project are understood and adequately considered in the environmental planning process. This report is the Impact Assessment Report and therefore includes a detailed assessment of the project and mitigation measures that could be implemented to reduce the predicted visual impact.

1.4 Terms and Reference

Based on the general requirements for a VIA report, the following terms of reference were established for the project.

- Define the visual resource and sense of place of the area;
- Identify the sensitive viewers;
- Determine visual intrusion (contrast) of the proposed project;
- Determine the visibility of the proposed project;
- Rate the impact on the visual environment of the proposed Project based on the impact assessment criteria provided by Zitholele.
- Suggest management measures that could mitigate the negative impacts of the Project.

1.5 Assumption, Uncertainties and Limitations

The following assumptions and limitations have been made in the study:

- The extent of the study area is determined by the zone of potential influence, which in this study relates to a radius about the project site of 12km. At 12km and beyond the Project would recede into background views.
- In determining the significance of the visual impact of the Project with mitigation, it is assumed that

mitigation measures proposed in the report are correctly and effectively implemented and managed throughout the life of the project.

- The site visit was undertaken on 9 and 10 September 2015 and it is assumed that the area has stayed the same over the last two years. The assessment is therefore based on the conditions that prevailed as the time of the site visit and recent Google Earth aerial photographs.

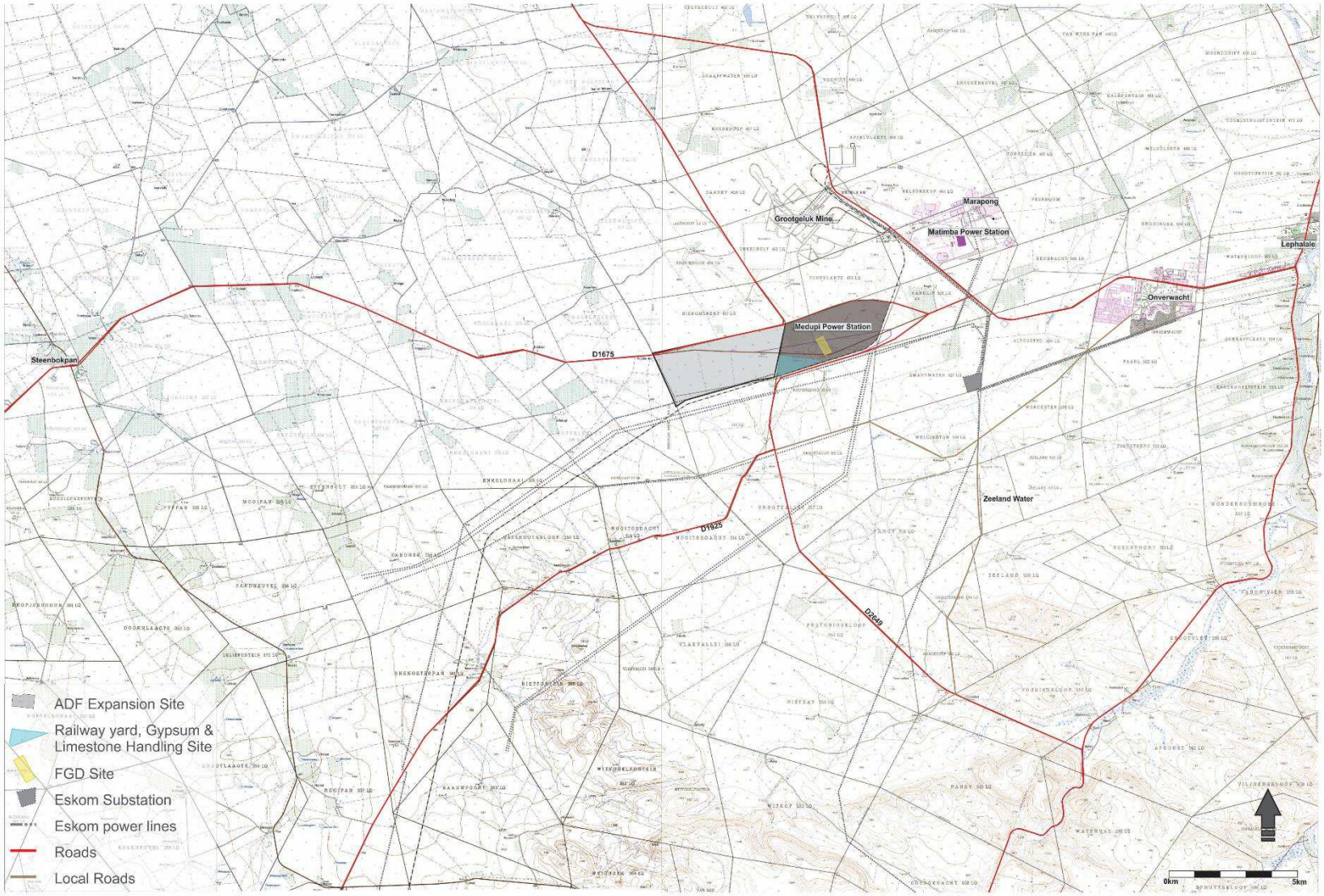

Figure 1: **LOCALITY MAP** - Medupi FGD Project

January 2018

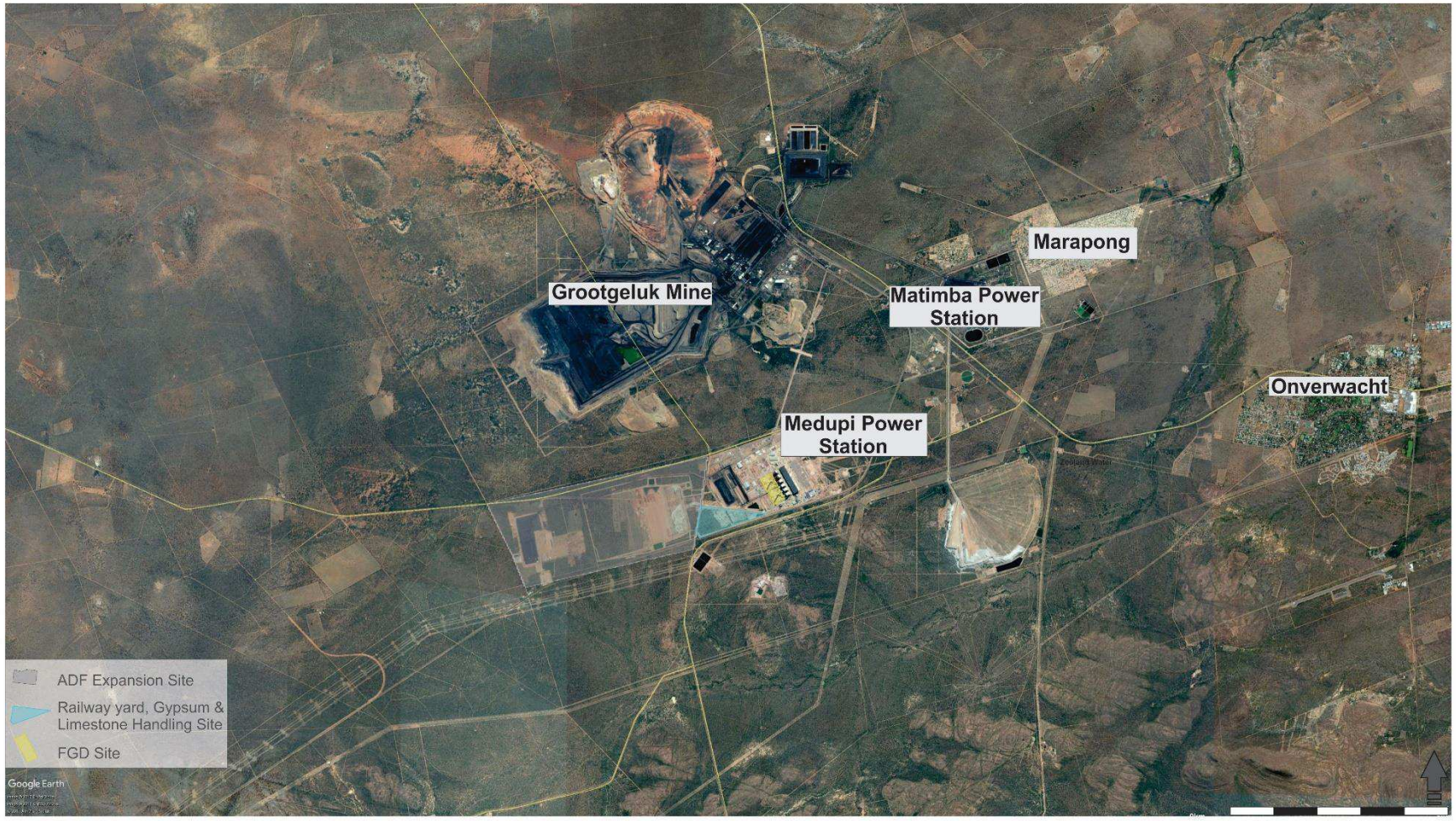

Figure 2: **PROJECT SITE** - Medupi FGD Project

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2. LEGAL REQUIREMENTS AND GUIDELINES

2.1 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 326 of the National Environmental Management Act (NEMA) Act 107 of 1998, as amended in April 2017. 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 National Heritage Resources Act (25 of 1999)

The Act is applicable to the protection of heritage resources and includes the 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 Province of the Western Cape it provides guidance that will be appropriate for any EIA process. The Guideline document also seeks to clarify instances when a visual specialist should get involved in the EIA process.

2.2 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."

The specialists study is 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.

The World Bank's IFC Standards are very specific regarding the Visual Impact Assessment for mining and

mining related activities and doesn't really mention other types of projects. The Standards can however be used as a guideline for various types of projects and therefore the Visual Impact Assessment report also include these Standards as part of the base / structure of the assessment.

3. APPROACH AND METHODOLOGY

3.1 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 impact, the worst-case scenario is taken into account. Landscape and visual assessments are separate, although linked, procedures.

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

3.1.1 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.

3.1.2 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).

3.1.3 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.

3.1.4 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.

3.1.5 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 waste disposal facility 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.

3.1.6 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).

3.1.7 Severity of Visual Impact

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

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

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

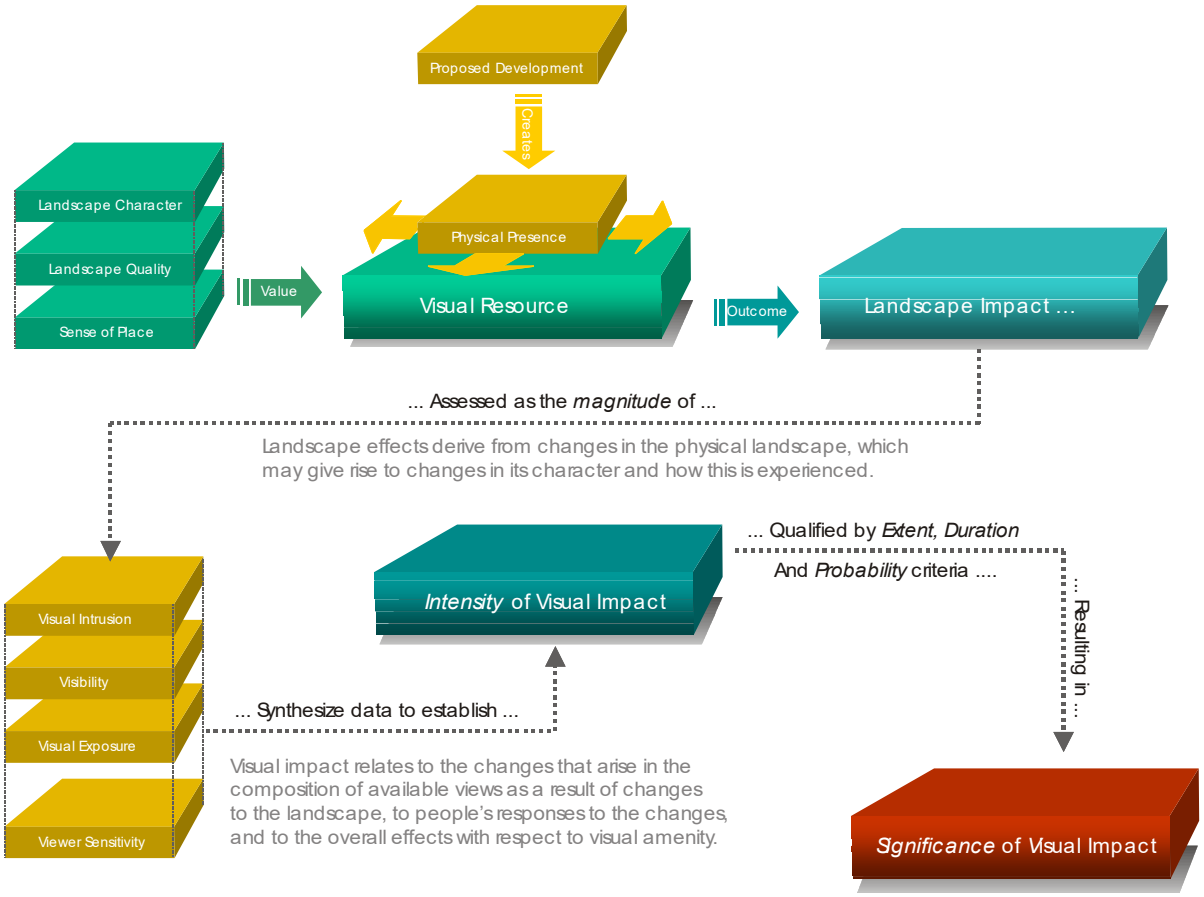


Image 1: Visual Impact Process

3.1.8 Significance of Visual Impact

The significance of impact was determined based on the method of determination of the significance of impacts provided by Zitholele Consulting, refer to Appendix B for the detailed description.

3.2 Methodology

The following method was used to conduct the Scoping / Baseline Phase of the Visual Impact Assessment:

- **Site visit:** a field survey was undertaken and the study area scrutinized to the extent that the receiving environment can be documented and adequately described.
    - the site visit took place on 9 and 10 September 2015 from 08:00 to 17:00.
    - the site visit was undertaken by Yonanda Martin (NLA) and Erika van Den Heever (NLA).
    - Photographs were taken from various viewpoints surrounding the site. These viewpoints were taken from public roads and represent typical public views that will be experienced by people located in or travelling through the study area.
    - GPS co-ordinates were taken for each of the viewpoints and were mapped in Google Earth Professional to accurate locate these on the various figures (refer to Figure 4: Locality & Viewpoints).
    - The site visit was carried out shortly after winter. Vegetation growth (leaves on trees and shrubs) is sparse, and the visibility of project components will therefore be higher than in the summer months or when vegetation is dense.
- **Project components:** The physical characteristics of project components were described and illustrated.
- **Landscape character description:** the landscape character was determined and mapped based on the field survey findings and aerial photographic interpretation (Google Earth). The description of the landscape focused on the nature of the land rather than the response of a viewer.
- **Landscape quality description:** the quality of the landscape was assessed and mapped as a measurement of the union of ecological integrity (overall health of the landscape) and aesthetic appeal. Aesthetic appeal was described using contemporary research in perceptual psychology and the opinion of the specialist as the basis for determining its value.
- **Sense of place description:** sense of place of the study area was evaluated and mapped as to the uniqueness and distinctiveness of the landscape. The primary informant of these qualities is spatial form, character and the natural landscape together with the cultural transformations and traditions associated with historic and current use of the land.
- **Visual resource description:** landscape character, landscape quality and sense of place were used to determine the visual resource. These measures are intrinsic to the landscape

and thus enable a value to be placed on the landscape that is independent of the person doing the viewing.

- **Illustrate**, with basic simulations, the proposed project overlaid onto panoramas of the landscape, as seen from sensitive land based viewing points, as well as an aerial view, to give the reviewer an idea of the scale and location of the Project within its landscape context.
- **Determine visual intrusion** (contrast) of the proposed project using the simulations.
- **Determine the visibility** of the proposed project by conducting a series of detailed viewshed analyses.
- **Rate the impact** on the visual environment of the proposed Project based on the impact assessment criteria provided by Zitholele.
- Suggest **management measures** that could mitigate the negative impacts of the Project.

4. DESCRIPTION OF THE PROJECT

The Medupi Power Station Flue Gas Desulfurization (FGD) Retrofit Project entails the following:

- Construction and operation of a rail yard/siding to transport Limestone from a source defined point via the existing rail network to the Medupi Power Station and proposed rail yard / siding. The rail yard infrastructure will include storage of fuel (diesel) in above ground tanks and 15m deep excavation for tippler building infrastructure;
- Construction and operation of limestone storage area, preparation area, handling and transport via truck and conveyor to the FGD system located near the generation units of the Medupi Power Station;
- The construction and operation of the wet FGD system that will reduce the SO_2 content in the flue gas emitted;
- Construction and operation of associated infrastructure required for operation of the FGD system and required services to ensure optimal functioning of the wet FGD system. The associated FGD infrastructure include a facility for storage of fuel (diesel), installation of stormwater infrastructure and conservancy tanks for sewage;
- The handling, treatment and conveyance of gypsum and effluent from the gypsum dewatering plant. Disposal of gypsum on the existing ADF is not included in the current EIA application and will be addressed in the ADF WML amendment application.
- Pipeline for the transportation of waste water from the gypsum dewatering plant and its treatment at the WWTP that will be located close to the FGD infrastructure within the Medupi Power Station;
- Construction and operation of the WWTP;
- Management, handling, transport and storage of salts and sludge generated through the waste water treatment process at a temporary waste storage facility. In terms of the EIA process impacts related to the management of salts and sludge will be considered in the EIR. However, licencing of the storage activity and requirements relating to the waste storage facility will be assessed in the WML registration application process.
- The transportation of salts and sludge via trucks from the temporary waste storage facility to a final Waste Disposal Facility to be contracted by Eskom for the first 5 years of operation of the FGD system. Long term disposal of salts and sludge will be addressed though a separate independent EIA process to be commissioned by Eskom in future.
- Disposal of gypsum together with ash on the existing licenced ash disposal facility (ADF), with resulting increase in height of the ADF from 60m to 72m.

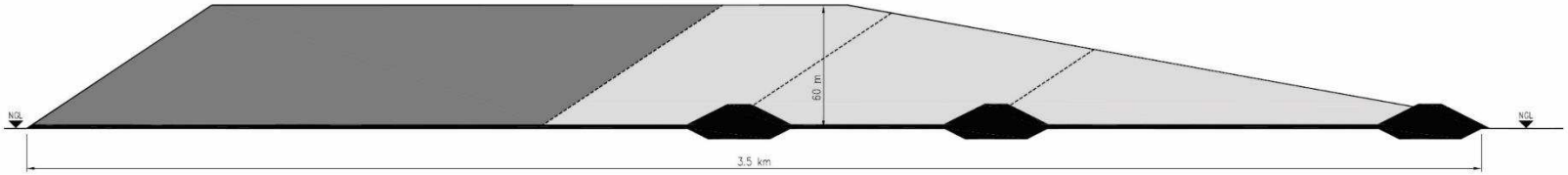
The visual impact assessment assesses the raising of the height of the existing ash disposal facility and the following measures were used for the proposed facility:

Maximum Height
72m

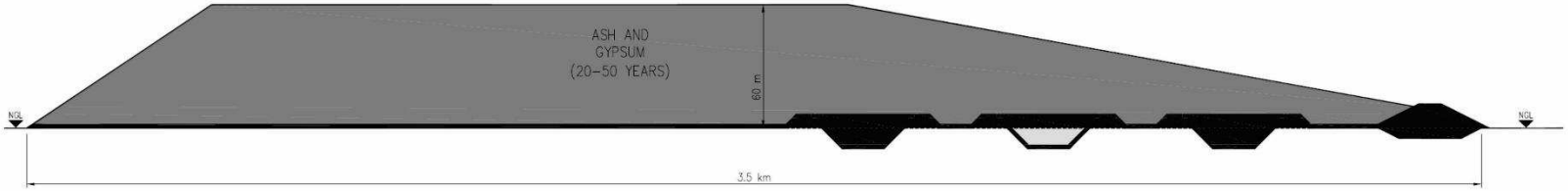
Refer to Figure 2: Project Site for the exact location of the proposed ADF site and to Figure 3: Cross Section for a typical cross section of a waste/ash disposal facility.

The Cross Section (Figure 3) refers to a height of 60m for the ash disposal facility, this is only an illustration of what the facility will look like and not the exact measurements. For the purpose of the impact assessment the measurements as provided above were used.

Image Reference: Google Earth 15 November 2017



TYPICAL SECTION OF MEDUPI NORTH DISPOSAL FACILITY
N.T.S.



TYPICAL SECTION OF MEDUPI SOUTH DISPOSAL FACILITY
N.T.S.

Image Reference: Zitholele Consulting, 21 October 2015

Figure 3: **CROSS SECTION** - Medupi FDG Project

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5. THE ENVIRONMENTAL SETTING

5.1 The Study Area

A description of the receiving environment for the proposed Medupi FGD Project was produced from desktop studies, aerial photographs, 1:50 000 topographical maps and the observations of the specialist during the site visit. Figures 6 - 14 at the end of this section illustrate the landscape character of the study area.

The area is mostly known for its game farms but also for the renowned Eskom Power Stations, Matimba and Medupi. According to Mucina & Rutherford (2006) the vegetation type of the study area is predominantly classified as Limpopo Sweet Bushveld with a small section of the study area (mostly south and south – western corner) covered with Western Sandy Bushveld. The Limpopo Sweet Bushveld is characterised by undulating or irregular plains traversed by several tributaries of the Limpopo River, which is characteristic of the western part of the study area. The vegetation is short open woodland but in disturbed areas the vegetation is characterised by thickets of *Acacia erubescens*, *Acacia mellifera* and *Dichrostachys cinerea* which is almost impenetrable. This can clearly be seen in the panoramic views of the study area.

5.2 Surrounding Land Use

5.2.1 Residential

The residential component of the study area is a combination of farmsteads (both game farms and cattle farms), towns such as Lephalale (previously known as Ellisras) and Onverwacht as well as more informal residential areas such as Marapong.

Lephalale is located along the Mokolo River and is approximately 21 km to the east of the proposed project site and therefore falls outside the Zone of Potential Influence (i.e. outside the study area). Onverwacht is located approximately 13km to the east of the proposed project site; refer to Figure 9 View 7 and 8 for typical views from Onverwacht. The residential area of Marapong is located to the east of Grootgeluk Mine and approximately 8.5km to the north east of the proposed project site. The farmsteads are spread throughout the study site and occur mostly f to the south and the west of the project site; refer to Figure 12 View 14 for their locations.

5.2.2 Agriculture

Agricultural activities that occur in the study area are limited to cattle farming and are mostly located to the south and west of the project site. There are, however, cultivated fields located along the Mokolo River but these fall outside the Project's study area.

5.2.3 Tourism

Lephalale is located on the western side of the Waterberg Biosphere and is an ideal environment for tourism activities. One of the major attractions in the area is the game farms which include activities such as game viewing and trophy hunting. The Waterberg and Mokolo Rivers offer great opportunities for camping, horse riding, hiking and other eco-tourism activities as is evident by the amount of advertisements placed by the tourist destinations. In the study area, most game farms and tourist accommodation facilities are located along the D1925, east of Project site and the D1675, west of the site.

5.2.4 Infrastructure, Industries and Mining

Lephalale is also home to two Eskom Power Stations, Medupi and Matimba as well as the Grootgeluk Mine and other infrastructure associated with the power stations and coal mines that support them. Figure 10 View 9 and 10 and to Figure 6 View 2 illustrate the Power Stations and the Grootgeluk Mine from public viewing points. Other infrastructure includes the associated ash dump facilities, substations and the power lines; refer to Figure 8 View 6, Figure 11 View 11 and Figure 13 View 17, which illustrate these facilities.

5.2.5 Transportation Routes

Transportation systems include the main access roads between Lephalale, Grootgeluk Mine and the Power Stations (D1675), refer to Figure 13 and Figure 14, the roads that link Lephalale with the surrounding farms (D1925 and D2649) refer to Figure 8 and Figure 11, and smaller farms roads (dirt roads). Other transportation includes a railway link, which is used by the FGD operation or disposal facility operation and the Grootgeluk Mine.

5.3 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 during the site visit. Dominant landform and land use features (e.g., hills, rolling plains, valleys and urban areas) of similar physiographic and visual characteristics, typically define landscape character types. Refer to the views in Figures 6 – 14, which illustrate the nature and character of the study area. The viewpoint locations are indicated in Figure 5.

Figure 14 illustrates the spatial distribution of the various landscape character types and rates their respective visual resource value. The section below discusses the relative value of these types.

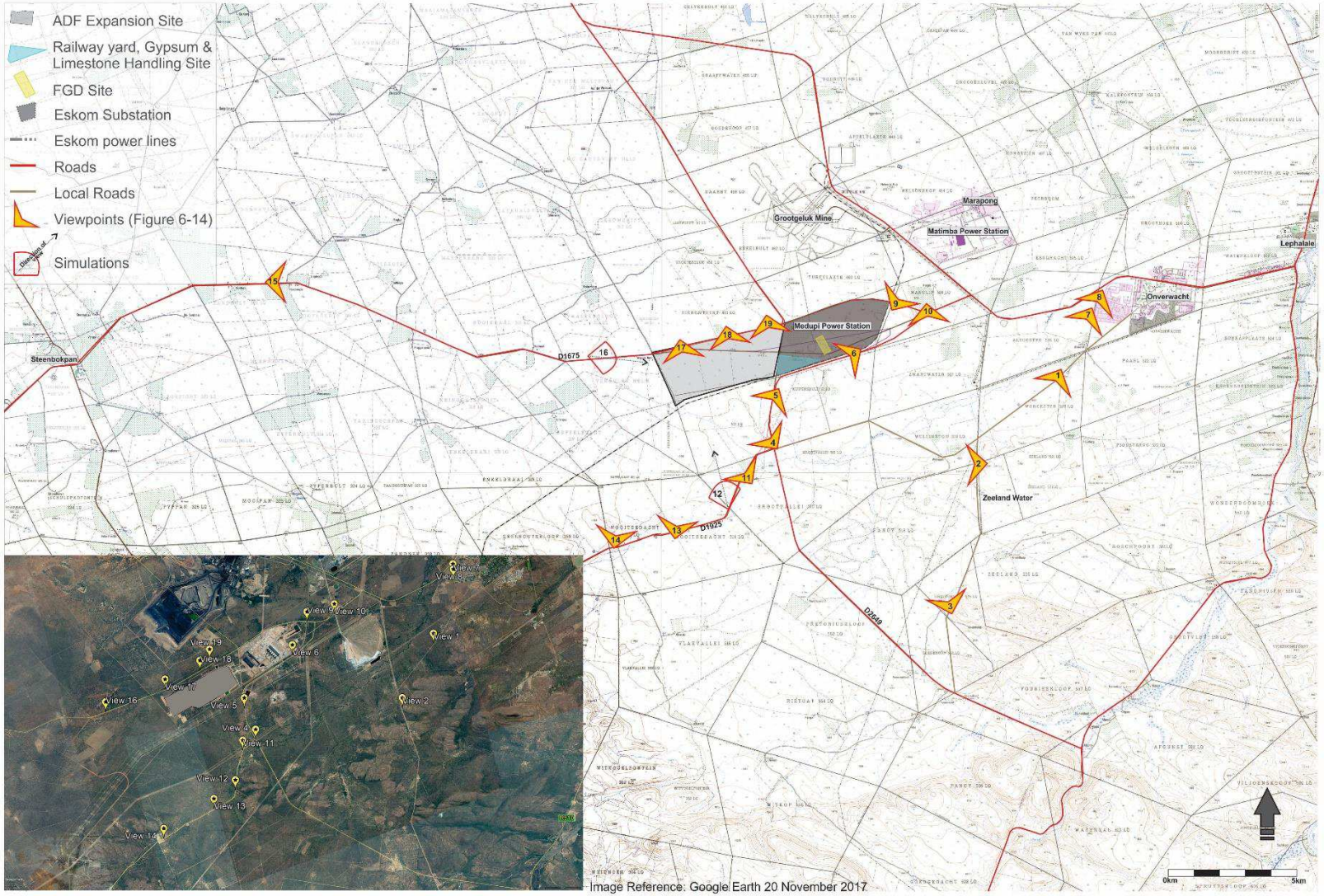

Figure 4: **VIEWPOINTS** - Medupi FGD Project

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View 1: View from Palala Road with the Matimba Power Station in the background
Approximately 10,7km east of the site

View 2: View from the service road with the Matimba Power Station in the background
Approximately 8,2km east of the site

Refer to Figure 4 for the location of the viewpoints

Figure 5: **LANDSCAPE CHARACTER** - Medupi FGD Project

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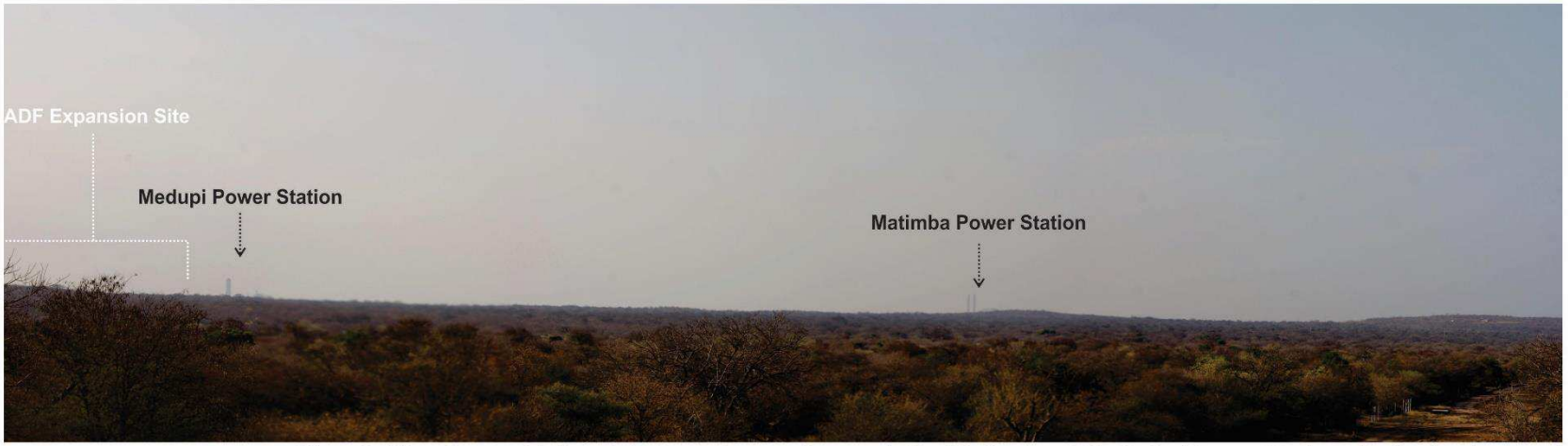

View 3: View from a high point along the service road, the Medupi and Matimba Power Stations in the background Approximately 11km south-eat of the site

View 4: View from the intersection of D2649 and D1925, proposed site will be in the middle-ground view

Refer to Figure 4 for the location of the viewpoints

Figure 6: **LANDSCAPE CHARACTER** - Medupi FGD Project

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View 5: View along the D2649 road

View 6: View along the D2649 road with the proposed ADF site in the middle to background view Approximately 3km east of the site

Refer to Figure 4 for the location of the viewpoints

Figure 7: **LANDSCAPE CHARACTER** - Medupi FGD Project

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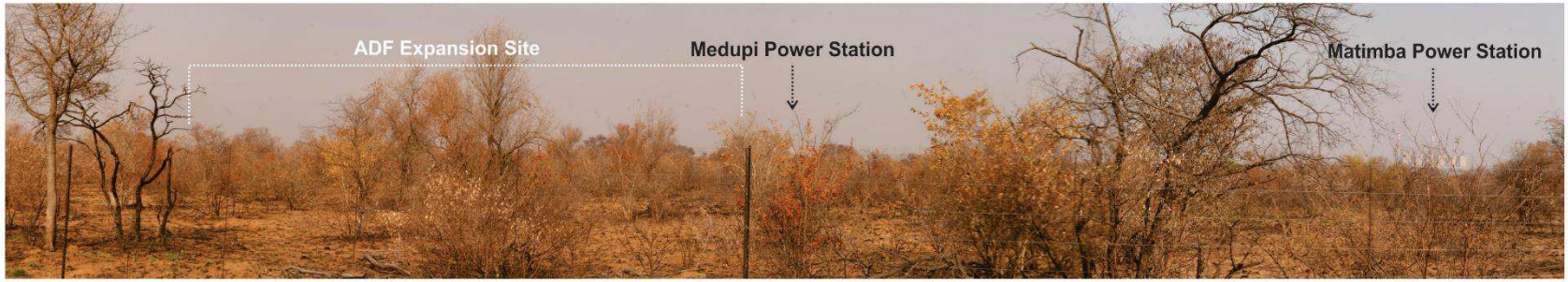
View 7: View from Onverwacht with the proposed ADF site in the background view. Views from Onverwacht are screened either by vegetation or buildings. Approximately 12,5km east of the site



View 8: View from Onverwacht with the proposed ADF site in the background view. Views from Onverwacht are screened either by vegetation or buildings. Approximately 12,5km east of the site

Refer to Figure 4 for the location of the viewpoints

Figure 8: **LANDSCAPE CHARACTER** - Medupi FGD Project

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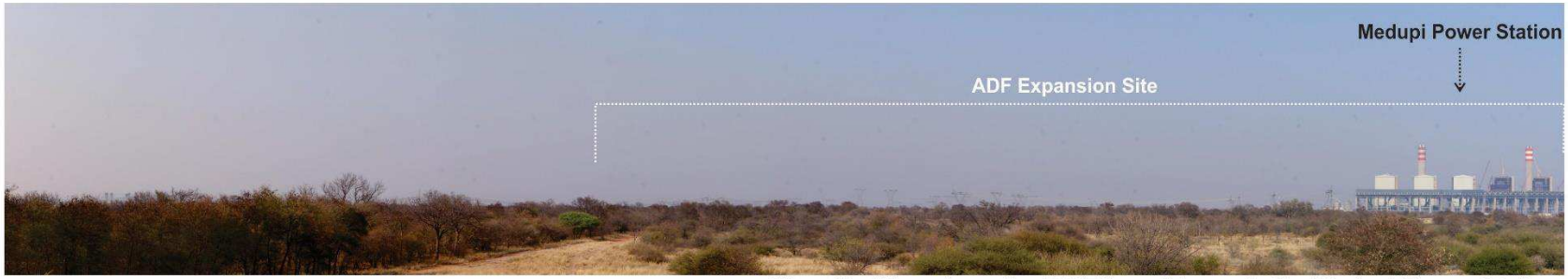
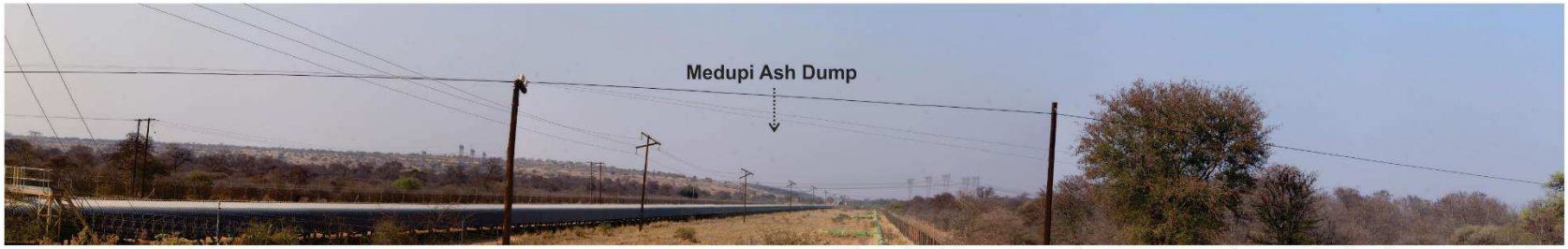
View 9a: View along the D1675 road towards the Grootgeluk Mine



View 9b: View along the D1675 road towards the Medupi Power Station,
The proposed ADF extension sit will be in the middle to background view



View 10: View along the D1675 road towards the Grootgeluk Mine
Refer to Figure 4 for the location of the viewpoints

Figure 9: **LANDSCAPE CHARACTER** - Medupi FGD Project

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View 11: View along the D1925 road towards the proposed ADF Expansion site which will be in the middle-ground of viewers travelling along the road

View 12a and b: View along the D1925 road (Komunati Lodge) towards the proposed ADF Expansion site which will be in the middle-ground of viewers travelling along the road

Refer to Figure 4 for the location of the viewpoints

Figure 10: **LANDSCAPE CHARACTER** - Medupi FGD Project

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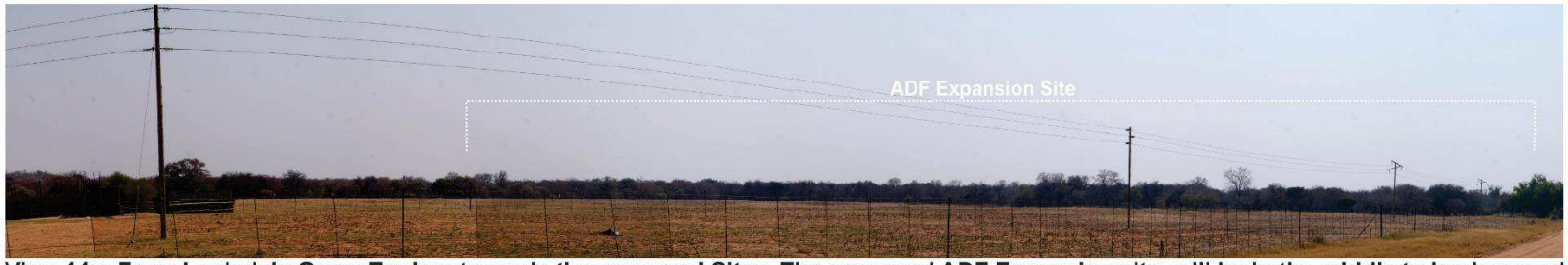
View 13: View from D1925 road towards proposed ADF Expansion site
The proposed site will be in the middle-ground view. View located approximately 4.5km south of the site



View 14a: From Lephalale Game Traders towards the proposed Sites. The proposed ADF Expansion site will be in the middle to background view, located approximately 5km north-east of Lephalale Game Traders

View 14b: View from the accommodation facilities at Lephalale Game Traders towards the proposed site
The proposed ADF expansion site will be in the middle to background view, located approximately 5km north-east of Lephalale Game Traders

Refer to Figure 4 for the location of the viewpoints

Figure 11: **LANDSCAPE CHARACTER** - Medupi FGD Project

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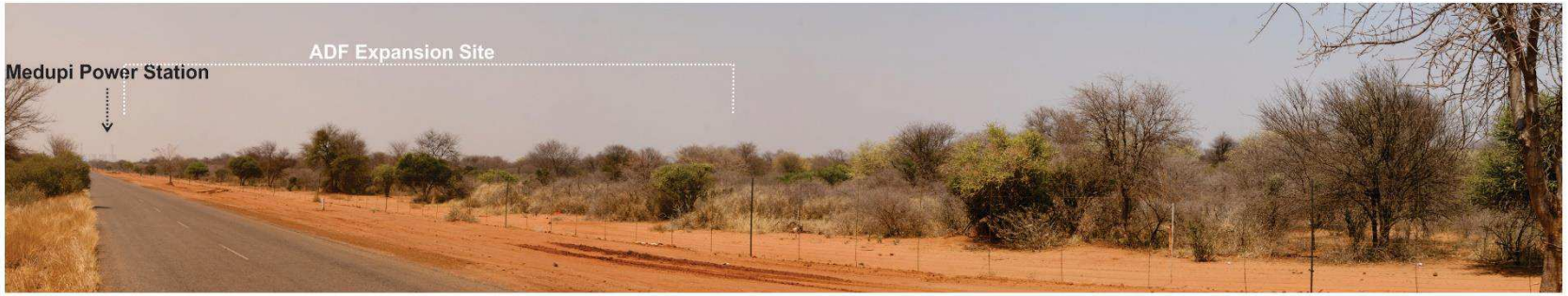
View 15: View from D1675 road towards the proposed ADF expansion site. The site will be in the background view
View located approximately 15km north-west of the site



View 16: View from D1675 road towards the proposed ADF expansion site. The site will be in the foreground view
View located approximately 2.5km west of the site

Refer to Figure 4 for the location of the viewpoints

Figure 12: **LANDSCAPE CHARACTER** - Medupi FGD Project

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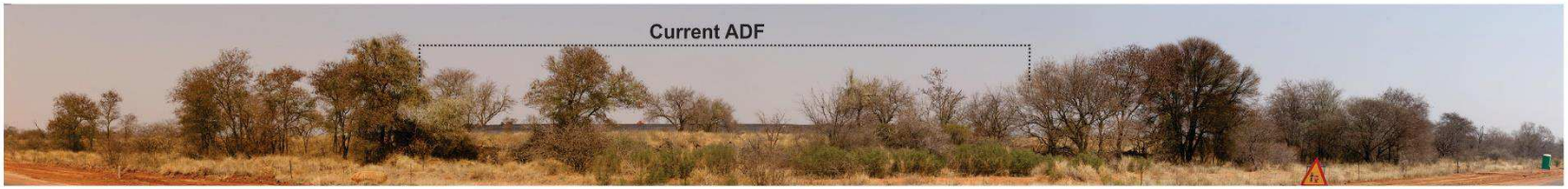

View 17: View from D1675 road towards the proposed ADF expansion site. The site will be in the foreground view, as can be seen from the existing ash dump facility

View 18: View from D1675 road towards the proposed ADF expansion site. The site will be in the foreground view

View 19: View from D1675 road towards the proposed ADF expansion site. the site will be in the foreground view, as can be seen from the existing ash dump facility

Refer to Figure 4 for the location of the viewpoints

Figure 13: **LANDSCAPE CHARACTER** - Medupi FGD Project

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6. VISUAL RESOURCE

6.1 Visual Resource Value / Scenic Quality

Scenic quality ratings as described in Appendix C, were assigned to each of the landscape types. The *highest* value is assigned to the koppies, mountains, bushveld and the Mokolo River because it gives the area a unique character that contributes positively to the overall sense of place of the area. The game farms, farmsteads and residential areas were considered to have a moderate scenic quality as it shows signs of alteration but still exhibits some positive character. The mining activities (Grootgeluk Mine), power stations (Matimba and Medupi) and other infrastructure (substations, power lines, and ash disposal facilities) were considered to have the lowest scenic quality.

The combination of the study area's natural environment (bushveld, koppies and mountains) along with the industrial nature of the mining, power station and infrastructure activities) results in a ***moderate*** visual resource value for the study area, within the context of the sub-region. This rating is given as the character of the study area is regarded to be moderately sensitive to change to the landscape. However, the value of the project site, is low due to its relative position to the ash disposal facility and the Medupi Power Station. A summary of the visual resource values of the various landscape types 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 Mountains & Koppies Mokolo River Bushveld	**Moderate** Farmsteads Residential	**Low** Grootgeluk Mine Medupi & Matimba Power Stations Substations and power lines Ash Dump Facility
This landscape type is considered to have a *high* value because it is a: Distinct landscape that exhibits a positive character with valued features that combine to give the experience of unity, richness and harmony. It is a landscape that may be considered to be of particular importance to conserve and which has a strong sense of place. Sensitivity: It is sensitive to change in general and will be detrimentally affected if change is inappropriately dealt with.	This landscape type is considered to have a *moderate* value because it is a: Common landscape that exhibits some positive character but which has evidence of alteration /degradation/erosion of features resulting in areas of more mixed character. Sensitivity: It is potentially sensitive to change in general and change may be detrimental if inappropriately dealt with	This landscape type is considered to have a *low* value because it is a: Minimal landscape generally negative in character with few, if any, valued features.

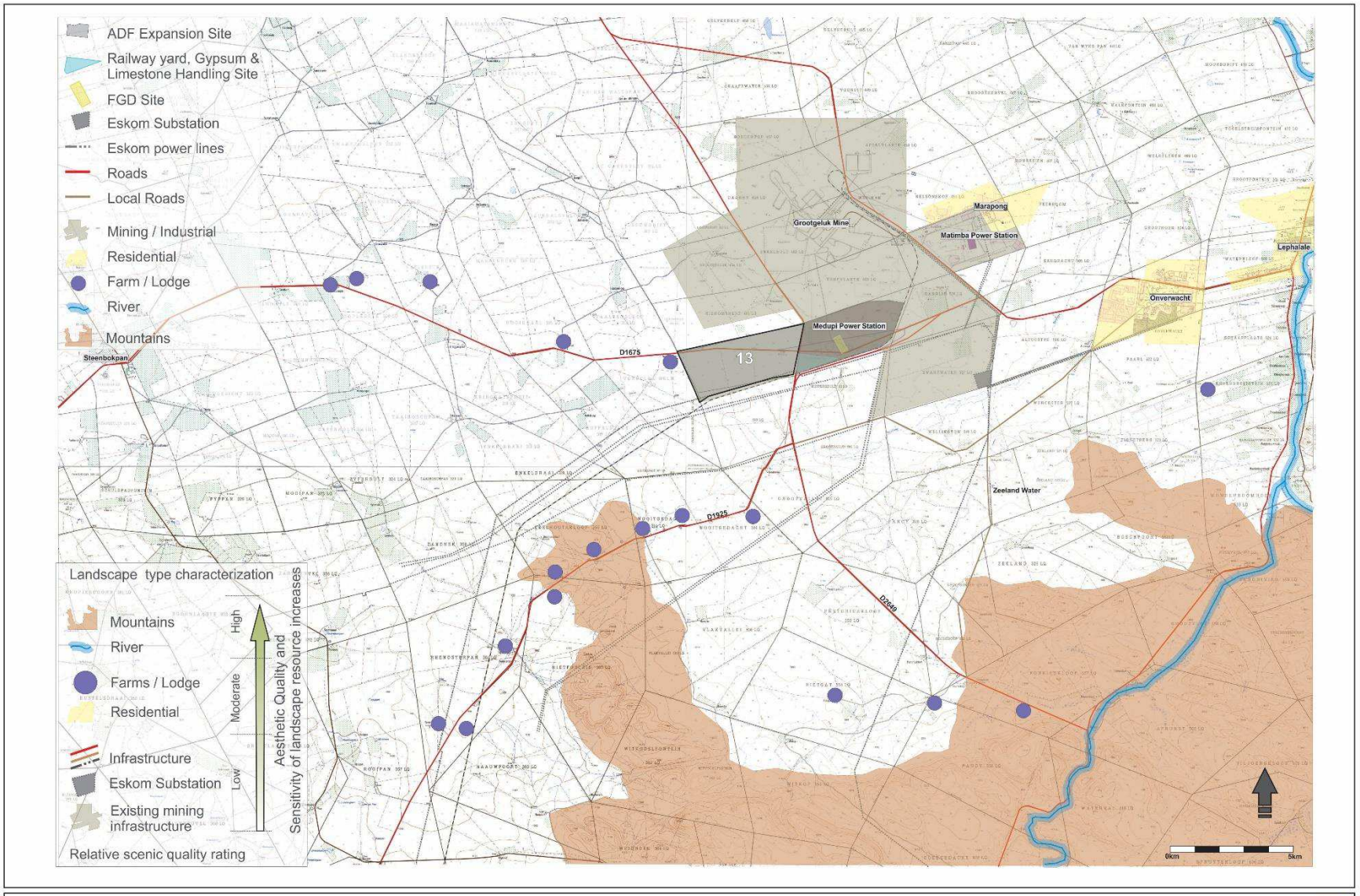

Figure 14: **VISUAL RESOURCE** - Medupi FGD Project

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6.2 Sense of Place

The sense of place for the proposed study area derives from the combination of all landscape types and their impact on the senses. The southern, western and south-eastern section of the study area is characterised by a combination of natural and cultural features which comprise of koppies / mountains, bushveld, farms (cattle and game) and tourist accommodation. This combination results in a natural and tranquil environment where people visiting and living in the area can experience a natural and relaxed sense of place. The north eastern portion of the study is however quite different as they are dominated by human / industrial activities which impact negatively on this sense of place.

7. VISUAL RECEPTORS

7.1 Views

Typical visual receptors within the study area will include:

- residents of the towns (Marapong and Onverwacht) and farmsteads;
- game farms and other tourist destinations;
- local and tourist travelers within and through the study area, as well as
- mines, industries and businesses.

7.1.1 Potential Sensitive Viewers and Locations

With reference to Table 2 below, viewers with a potentially *high* sensitivity would include people living in the town of Onverwacht, farmsteads, game farms and tourist attractions. Although the small town of Marapong is also located within the study area it is not considered as sensitive since it is surrounded by mining infrastructure and the power stations, however the cumulative effect of the proposed Project could impact on these receptors.

Refer to Table 2 below, which summarized viewers sensitivity by spatial distribution and Figure 15, which gives the location of the viewers.

Table 2: Potential Sensitivity of Visual Receptors – the Project

High Onverwacht Farmsteads Game Farms and other Tourist destinations: Komunati Lodge, Landelani Game Farms, Lephalale Game Farm / Lodge, Geelhoutskloof, Rietfontein, Rhenosterpan, Kalamahala Lodge, Pretorius Kloof, Hooi Kraal	**Moderate** Marapong Travelers using route D1675, D1925 an D2649	**Low** Matibma and Medupi Power Station Grootgeluk Mine Industries / business along route D1675
Visitors of tourist attractions and people travelling along local routes, whose intention or interest may be focused on the landscape such as the lodges and tourist accommodation facilities; Communities where the development results in changes in the landscape setting or valued views enjoyed by the community such as the farmers located along the D1925. Occupiers of residential properties with views affected	People travelling through or past the affected landscape in cars such as motorist visiting the study area or farmers staying in the study area and using the D1675, D1925 and the D2649 roads.	Visitors and people working in mining / prospecting activities and travelling along local mining roads whose attention may be focused on their work or activity and who therefore may be potentially less susceptible to changes in the view.

by the development such as the Lephalale Game Farm.		

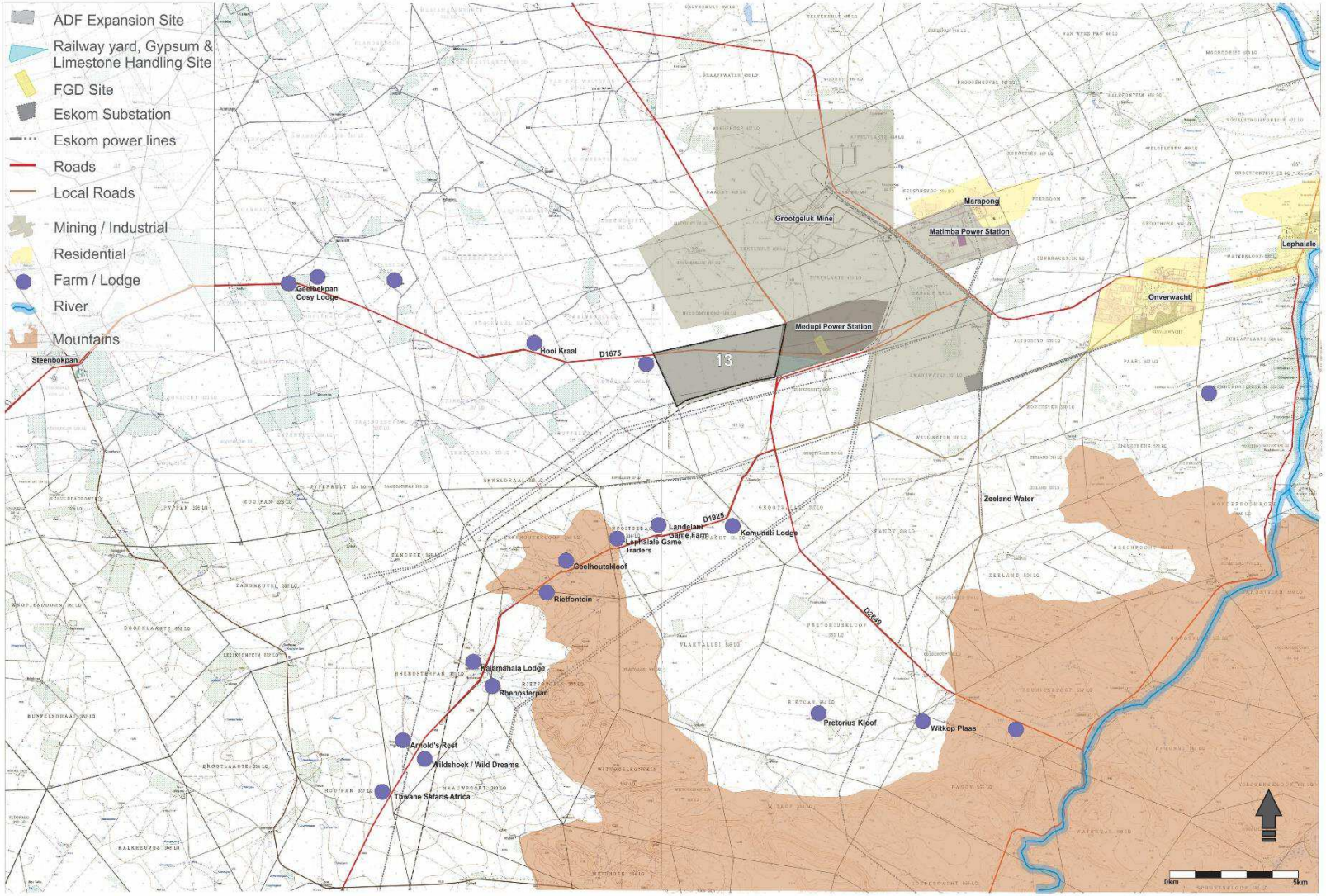

Figure 15: **POTENTIAL SENSITIVE VIEWING AREAS** - Medupi FGD Project

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8. LANDSCAPE IMPACT

The *landscape impact* (i.e. the change to the fabric and character of the landscape caused by the physical presence of the intervention) of the project is predicted to be *moderate* (due to effect of the project's activities as described in Section 4 on the immediate site). The proposed Project will be seen within the context of mining and industrial activities which, have already impacted negatively on the original landscape. The contrast between the existing activities and the proposed Project activities will not be dramatic but the Project will contribute to the negative cumulative impact on the study area.

The physical change to the landscape (landscape impact) must be understood in terms of the Project's visibility (by sensitive viewers) and its effect on the visual aesthetics of the study area (intensity or contrast with baseline visual resource). The following sections discuss the effect that the project could have on the visual and aesthetic environment.

9. VISUAL IMPACT

Visual impacts will be caused by the proposed Project during all the phases i.e. construction, operational, decommissioning and closure. Activities associated with the Project, will be visible during the day, especially by people driving along the D1675, and during the night (lights) from many areas about the Project site. During start up and the operational phase, the project's visibility will be influenced by earth moving activities, removal of vegetation, the creation of dust associated with these activities and trucks moving about the site. During the decommissioning / closure phases the impact should reduce but will be determined by the success and effectiveness of rehabilitation measures.

The *severity* (intensity) of visual impact is determined using visibility, visual intrusion, visual exposure and viewer sensitivity criteria. When the severity of impact is qualified with spatial, duration and probability criteria the significance of the impact can be predicted. *Consequence* is a function of severity, spatial extent and duration and *significance* is the function of consequence and probability. Refer also to Appendix C (Zitholele's Impact Assessment Criteria) and Figure A (Section 3).

9.1 Visual Receptors

The most sensitive viewer sites are located south of the Project site along the D1925 (Komunati Lodge, Landelani Game Farms, Lephalale Game Farm / Lodge, Geelhoutskloof, Rietfontein, Rhenosterpan, Kalamahala Lodge and Pretorius Kloof) and east of the Project site along the D1675 (Hooi Kraal) – refer to Figure 4 for these. The panoramic views illustrated in Figures 11 to 13 are taken from these roads and are typical of views that people living in and travelling through the area would experience. View 14b, Figure 11 is a typical view from the accommodation facility at Lephahale Game Farms (Traders) and Figure 10 and 11 illustrate views from the game farms.

9.2 Visibility, Visual Exposure and Visual Intrusion

Over 12km (the extent of the study area) from the project site, the impact of the Project and its associated activities would have reduced due to the diminishing effect of distance and atmospheric conditions (haze – particularly in the winter months) on visibility. Also, at this distance Project activities and the physical present of its components, would recede into the background of views that already contain mining activities, thus being 'absorbed' into the landscape setting.

9.2.1 Visibility

In determining the visibility of Project components, an off-set of 70m above existing ground level was used for the waste/ash disposal facility (ADF) to generate the viewshed analyses. It can be seen from the patterns generated by the viewsheds in Figure 16 that the expansion of the ADF is potentially highly visible and sensitive viewing areas, as illustrated in Figure 14 and 15, would be impacted. However, it must be emphasized that the viewshed represents *potential* viewing sites and illustrates the worst-case scenario i.e. the landscape without vegetation. It is therefore imperative that the visibility of the ADF be interpreted along

with the findings modelled in the simulations presented in Figures 17 and 18 (View 12 and 16). Whilst visibility is potential very high (Table 3 below), the flat nature of the terrain along with the bushveld cover (on average 2 - 4m above ground level), would effectively block many views to the ADF site with only the top of the waste disposal facility being visible above the tree line, refer to Figure 17, View 12. Therefore, visibility of the project will remain relatively low for the first number of years of operation, until the facility has reached a general height of 72m. The Project will however be *highly* visible from elevated areas such as at the Lephalale Game Traders lodge.

Table 3: Visibility of the ADF due to height increase

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

The visibility of the FGD system will be low since the FGD system will be constructed between the existing Medupi Power Station structures and infrastructure. It will therefore only be visible for people working at the Medupi Power Station and for a motorist travelling along the D2649.
The visibility of the gypsum & limestone handling area and the railway yard will only be visible for motorist travelling along the D2649 and therefore the visibility was considered to be low.

Table 4: Visibility of the proposed FGD, Gypsum & Limestone handling area and Railway Yard

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

9.2.2 Visual Exposure

Visual exposure is determined by qualifying the view with a distance rating to indicate the degree of potential intrusion and visual acuity. 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 as indicated in the graph in Appendix B.

Using these criteria and those contained in Appendix B, Table 5 rates visual exposure on the identified sensitive viewing areas described in Section 7. Again, it must be realized that although the exposure ratings given below would contribute to the severity of impact, the effect of a relatively flat topography and dense

bushveld cover would partially block most views to the ADF expansion site and render visual exposure a moot point. Visual exposure is considered high when Project activities are visible in foreground views (i.e. up to 2km from the site - illustrated with the red circle in the viewsheds in Figures 16) and would greatly contribute to the intensity of visual impact. There are only two sensitive viewing locations that would experience foreground views of the proposed ADF, i.e. the farmstead located (0.8km) west of the site and viewers travelling along the D1675 that come within 2km or closer to the site.

Farmsteads and lodges that would experience *moderate* exposure (between 2km and 5km from the project site – the orange circle in Figures 16) are: Hooi Kraal, Landelani Game Farm and Komunati Lodge (refer also to the simulations Figures 17 and 18).

Sensitive areas where the project would occur in background views (beyond 5km from the project site - low visual exposure) are: Lephalale Game Traders, Geelhoutskloof and Rietfontein. Even though Lephalale Game Traders are located outside the 5km zone it must be noted that the tourist accommodation is located on top of the koppie and therefore the project will be clearly visible from that property.

Table 5: Visual Exposure of the ADF

	Foreground view i.e. 0 – 2km from Project Site	Middle-ground view i.e. 2km - 5km from Project Site	Background view i.e. 5km and beyond
Public roads	D1675 D1925	D1675 D1925 D2649	D1675 D1925 D2649
Residential areas	The farmstead directly west of the study site (0.8km from site)	Farmstead such as Hooi Kraal	Marapong
Lodges / Game Farms	None	Landelani Game Farms Komunati Lodge	Lephalale Game Traders Geelhoutskloof Rietfontein

The visual exposure for the FGD system, gypsum & limestone handling site as well as the railway yard will mostly be experienced as a cumulative effect since it will be seen as part of the Medupi Power Station. It will mostly be seen by motorist travelling along the boundary of the Medupi Power Station (driving along the D2649) since it will be in the fore-ground view of these viewers.

9.2.3 Visual Intrusion

Visual intrusion deals with the notion of contextualism i.e. how well does a project component fit with / enhance or disrupt the ecological and cultural aesthetic of the landscape as a whole?

The simulations (of the ash disposal facility at its highest elevation) in Figures 17 - 18 illustrate the visual effect of the ADF on views from these sensitive viewing locations i.e. from public access points along the D1675 (Figure 18) and the D1925 (Figure 17). These represent the worst-case scenario. It is evident, when

one considers the “before” (current situation) and “after” scenarios, that the ADF will have a varying effect on sensitive viewing areas. The greatest intrusion would be on viewers driving along the public roads, especially along the D1675, as illustrated in Figures 18. The ash disposal facility is located close to the road and would be visible between the trees and above the tree line. The intrusive nature on these views is therefore considered *moderate* because the ADF is partially compatible with the land use along the D1675 road and would therefore result in moderated changes to the landscape.

Visual intrusion on viewers living or visiting the farmsteads and lodges to the south of the site (Landelani Game Farms, Komunati Lodge and Lephalale Game Traders) would be *low* as only the upper portions of the ash disposal facility would appear above the tree line and in the background of views as illustrated in Figures 17. It should however be noted that the accommodation facilities for the Lephalale Game Traders lodge are located on a small koppie and visitors to the farm will have a clear view towards the proposed site – the impact of this relationship will be highest at night, when lights from the Project would be clearly visible from the lodge and disrupt the sense of place as it currently exists. The ash disposal facility will occur in the middle to background of the views and will result in a *high* visual intrusion. Geelhoutskloof and Rietfontein are located behind small koppies and therefore the views towards the ash disposal facility will be blocked resulting in a *negligible* visual intrusion when viewed from the homestead but a *low* visual intrusion when viewed from the roads leading to the homestead.

Table 6 below summarizes the visual intrusion of the ADF based on the worst-case scenario.

Table 6: Visual Intrusion of the ADF

High	Moderate	Low
The proposed project would have a substantial negative effect on the visual quality of the landscape relative to the baseline landscape because it would: - Contrast with the patterns or elements that define the structure of the landscape specifically referring to the Lephalale Game Lodge / Traders and especially during the evenings when viewed from the koppie.	The proposed project would have a: - Moderate negative effect on the visual quality (sense of place) of the landscape; - Contrast moderately with the current patterns or elements that define the structure of the landscape; - Be partially compatible with land use (mining), settlement or enclosure patterns of the general area;	The proposed expansion project would have a minimal effect on the visual quality (sense of place) of the landscape; - Contrasts minimally with the patterns or cultural elements that define the structure of the landscape; - Is mostly compatible with land use, settlement or enclosure patterns;
RESULT: **Notable change in landscape characteristics over an extensive area and an intensive change over a localized area resulting in**	***RESULT:*** **Moderate change in landscape characteristics over localized area resulting in a moderate change to key views (sensitive viewing areas would include**	***RESULT:*** **Imperceptible change resulting in a minor change to key views such as Geelhoutskloof and Rietfontein.**

major changes in key views such as Lephalale Game Lodge / Traders.	**the D1925, Komunati Lodge, Landelani Game Farms and Hooi Kraal.**	

The visual intrusion of the proposed FGD, gypsum & limestone handling area and railway yard was regarded as being low. The project components, as listed above, will be absorbed by the existing Medupi Power Station and will therefore not be uncharacteristic of the area. Sensitive viewers will mostly be people travelling along the D2649 who will be exposed to the project components for a very short period of time and who might not even notice the new components being added to the existing facility since they observe or experience the Medupi Power Station as whole and not as different components.

Table 7 below summarizes the visual intrusion of the proposed FGD, gypsum & limestone handling area and railway yard based on the worst-case scenario.

Table 7: Visual Intrusion of the proposed FGD, Gypsum & Limestone handling area and Railway Yard

High	Moderate	Low
The proposed project would have a substantial negative effect on the visual quality of the landscape relative to the baseline landscape because it would: - Contrast with the patterns or elements that define the structure of the landscape specifically referring to the Lephalale Game Lodge / Traders and especially during the evenings when viewed from the koppie.	The proposed project would have a: - Moderate negative effect on the visual quality (sense of place) of the landscape; - Contrast moderately with the current patterns or elements that define the structure of the landscape; - Be partially compatible with land use (mining), settlement or enclosure patterns of the general area;	The proposed expansion project would have a minimal effect on the visual quality (sense of place) of the landscape; - Contrasts minimally with the patterns or cultural elements that define the structure of the landscape; - Is mostly compatible with land use, settlement or enclosure patterns;
RESULT: Notable change in landscape characteristics over an extensive area and an intensive change over a localized area resulting in major changes in key views.	*RESULT:* Moderate change in landscape characteristics over localized area resulting in a moderate change to key views.	***RESULT:*** **Imperceptible change resulting in a minor change to key views such as the D2649.**

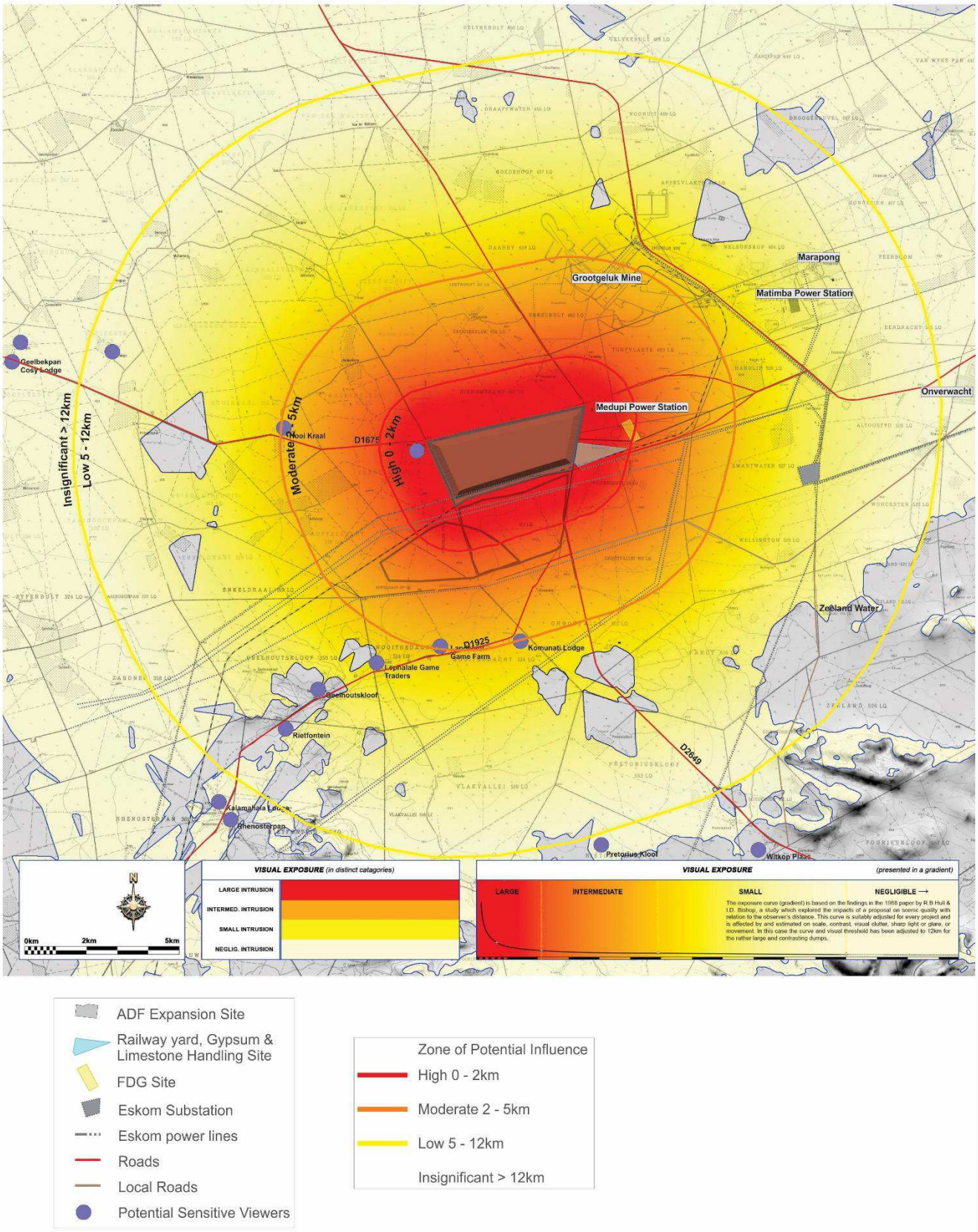


Figure 16: **VIEWSHED ANALYSIS** - Medupi FGD Project

January 2018

BEFORE

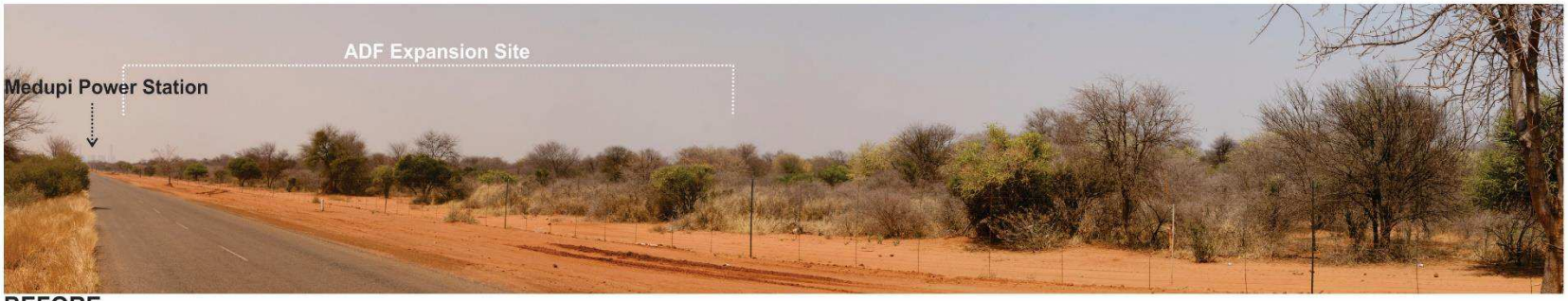
AFTER

View 12: View along the D1925 road (Komunati Lodge) towards the proposed ADF expansion site which will be in the middle-ground of viewers travelling along the road

Refer to Figure 4 for the location of the viewpoints

Figure 17: **SIMULATION** - Medupi FGD Project

January 2018



BEFORE

AFTER

View 16: View from D1675 road towards the proposed ADF expansion site. the site will be in the foreground view
View located approximately 2.5km west of the site

Refer to Figure 4 for the location of the viewpoints

Figure 18: **SIMULATIONS** - Medupi FGD Project

January 2018

9.2.4 Severity of Visual Impact

Referring to discussions in Section 9 above and using the sensitivity criteria listed in Table 2, the *severity* of visual impact of the Project is rated in Table 8 below. To assess the severity 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

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

The *severity* of visual impact is based on the worst-case scenario as discussed above i.e. assuming no vegetation cover and maximum height of the ADF of approximately 72m. Refer also the sensitivity rating system in the table in Appendix C at the back of the report.

Table 8: Severity of Visual Impact of the Project

High	**Moderate** **ADF**	Low	**Negligible** **FGD system, Gypsum & Limestone handling area and Railway Yard**
The Project will cause a major alteration to key elements/features/ characteristics of the baseline through the introduction of elements considered to be uncharacteristic when set within the attributes of aspects of the current and future receiving landscape.	The Project will cause a partial loss of or alteration to key elements / features / characteristics of the visual and landscape baseline. I.e. The introduction of project elements that may be prominent but may not necessarily be substantially uncharacteristic when set within the attributes of the receiving	Minor loss of or alteration to key elements / features / characteristics of the baseline. 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.	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 that are not uncharacteristic with the surrounding landscape – approximating the 'no

Result: High scenic quality impacts would result as well as impacts on sensitive viewing areas.	landscape. **Result:** **Moderate scenic quality and impacts on key views would result.**	Result: Low scenic quality impacts would result.	change' situation. Result: **Negligible scenic quality impacts would result.**

The *severity* of impact for the construction and operating phases is predicted to be *moderate* as the ADF will:

- Have a moderate negative effect on the visual quality of the landscape. The ADF is partially compatible with the patterns (other mining infrastructure in the general area) that generally define the character of the study area's landscape - *the study area's visual resource is rated high (koppies / rivers) to low (mining infrastructure) and the project site is in a landscape considered to be of moderate aesthetic appeal within the context of the sub-region. The visual quality of the study area has already been compromised by other mining developments east and north of the site and the presence of the proposed Project will have an increasing effect and further compromise the scenic and aesthetic value of study area.*
- Have a moderate negative effect on key views – *From the residential areas and lodges south (*Komunati Lodge, Landelani Game Farms, Lephalale Game Farm / Lodge, Geelhoutskloof, Rietfontein, Rhenosterpan, Kalamahala Lodge*) and west (Hooi Kraal) of the project site.*

At decommission and closure the severity of impact would reduce from moderate to *low* assuming mitigating measures are effectively implemented.

The *severity* of impact for the construction and operating phases is predicted to be *moderate* as the FGD, gypsum & limestone handling area and railway yard will:

- Have a negligible effect on the visual quality of the landscape. The Project components is compatible with the patterns (Medupi Power Station) that generally define the character of the study site.

During decommission and closure the severity of impact would depend on how the Medupi Power Station will be decommissioned and/or closed. At that stage the project components will be regarded as part of the Medupi Power Station and not necessarily as individual components. It will therefore contribute to the cumulative impact the different components of the Medupi Power Station will have on the study area.

10. MITIGATION 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.

The following mitigation measures are suggested and should be included as part of the Environmental Management Programme (EMPr).

10.1 Project Area Development

- It is proposed that as little vegetation as possible be removed during the start-up and operational phases. Especially the vegetation along the D1675 since the vegetation along this road will form a visual buffer.
- Ensure, wherever possible, all existing natural vegetation is retained and incorporated into the project site rehabilitation.

10.2 Earthworks

- Dust suppression techniques should be in place always during all phases of the project.
- Only the footprint and a small ‘construction buffer zone’ around the proposed mining and associated infrastructure areas should be exposed. In all other areas, the natural vegetation should be retained.
- Topsoil should be applied to all exposed slopes.

10.3 Rehabilitation

- It is imperative that the affected areas be rehabilitated back to the natural vegetation associated with the Limpopo Sweet Bushveld vegetation unit.
- It is recommended that additional trees and shrubs be planted along the northern boundary of the project site in order to screen views from the D1675 road.
- A registered Professional Landscape Architect, working alongside the project ecologist should be appointed to assist with the rehabilitation plan for the project.
- Rehabilitate / restore exposed areas as soon as possible after construction and other operational activities are complete.
- Only indigenous vegetation should be used for rehabilitation / landscaping purposes.
- The WDF side slopes should be hydro-seeded to avoid erosion during the rehabilitation period.

- Where slopes compatible with the surrounding landscape can be achieved, an attempt should be made to visually soften steeper slopes by avoiding strait engineered ridges and sharp changes of angle;
- Grass seeding of the slopes should be undertaken to emulate the groupings of natural vegetation in nearby hills.

10.4 Access and Haul Roads

During construction / operation, rehabilitation and closure of the Project, access and haul roads will require an effective dust suppression management programme, such as the use of non-polluting chemicals that will retain moisture on the road surface.

10.5 Structures and buildings

Paint buildings and structures with colours that reflect and compliment the natural colours of the surrounding landscape. To further reduce the potential of glare, the external surfaces of buildings and structures should be articulated or textured to create the interplay of light and shade.

10.6 Lighting

Light pollution is already a problem in the area caused by existing mining and processing activities and should be seriously and carefully considered and kept to a minimum wherever possible. Light pollution is largely the result of bad lighting design, which allows artificial light to shine outward and upward into the sky, where it's not wanted, instead of focusing the light downward, where it is needed. Improperly designed lighting washes out the darkness of the night sky and radically alters the light levels in rural areas where light sources shine as 'beacons' against the dark sky and are generally not wanted.

Of all the pollutions faced, light pollution is perhaps the most easily remedied. Simple changes in lighting design and installation yield immediate changes in the amount of light spilled into the atmosphere. The following are measures that must be considered in the lighting design of the Project:

- Install light fixtures that provide precisely directed illumination to reduce light "spillage" beyond the immediate surrounds of the site.
- Avoid high pole top security lighting along the periphery of the site and use only lights that are activated on illegal entry to the site.
- Minimise the number of light fixtures to the bare minimum, including security lighting, which should be carefully directed away from sensitive viewing areas.
- Wherever possible, lights should always be directed downwards so as to avoid illuminating the sky.

11. SIGNIFICANCE OF IMPACT

The *sensitivity* of impact, rated in Table 8, is further qualified with *extent*, *duration* and *probability* criteria to determine the *significance* of the visual impact. Table 9 below summarises the *significance* of the visual impact during the Construction and Decommissioning Phases. Table 10 summarises the impact during operation and Table 11 rates the *significance* of impact at Closure. These results are based on the **worst-case scenario** when the impacts of all aspects of the Project are taken together using the impact criteria in Appendix C.

The unmitigated impact for the Construction and Decommission Phases of the ADF is rated *moderate* significance. This is the result of major movement and activities on the site as the structures and infrastructure are being built or decommissioned. However, as these activities occur at ground level, existing vegetation will shield these activities from directly surrounding viewers. Mitigation will be difficult during this period and the rated impact would not drop significantly even with management measures. The most significant mitigation measure is to ensure that dust is controlled during these operations as, if not, clouds of dust would appear above the tree line and be visible from most of the study area.

During the Operational Phase the significance of unmitigated impact is rated *moderate*. With effective and ongoing management as described in Section 7, the mitigated impact (specifically for the night-time impacts) can be reduced but the significance of impact remains to *moderate*. However, the full impact of this phase would only occur when the waste disposal facility has reached a height of 5 - 10m (i.e protrude above the existing tree line).

At Closure, when all structures and associated infrastructure is removed and the site effectively managed and rehabilitated, the mitigated would reduce to *low*. In the unmitigated scenario, if infrastructure is to remain, the impact would remain *moderate*, as for the Operational phase.

The unmitigated impact of the FGD system, gypsum & limestone handling area and the railway yard will be very low during the construction phase. During this phase there will be more activity on site which will be visible for motorist travelling along the boundary of the Medupi Power Station. During the operational, decommissioning and closure phase the components will be absorbed by the existing structures and will therefore be seen as a whole. It will contribute as a cumulative impact to the overall impact of the Medupi Power Station.

During the evening the Project will contribute to the cumulative light impact that is currently caused by the mining activities and the power plant facilities (Medupi and Matimba).

The Project will contribute to the negative cumulative impact the mining activities has on the study area.

Table 9: Summary of the cumulatively rated visual impact per phase of the project

CONSTRUCTION AND DECOMMISSIONING PHASES

Potential Visual Impact	ENVIRONMENTAL SIGNIFICANCE									
	Management: Unmitigated					Management: Mitigated				
	Sev	D	SP	P	SIG	Sev	D	SP	P	SIG
Alteration to the visual quality of the study area due to the physical presence, scale and size of the construction and decommissioning of the ADF and its associated infrastructure with a moderate impact on the aesthetic quality of the landscape and on key views from nearby roads (D1675 and D 1925) and residential/ tourist areas (Komunati Lodge, Lephalale Game Traders, Hooi Kraal). For viewers from Geelhoutskloof and Rietfontein the significance will be low since the project will be screened by the koppies. Mitigation measures are feasible assuming effective implemented and managed in the long term which could reduce the impact during construction and decommission activities.	2	1	2	1	**5** **Moderate**	1	1	2	1	**4** **Moderate**
Alteration to the visual quality of the study area due to the physical presence, scale and size of the construction and decommissioning of the FGD system, gypsum & limestone handling area and the railway yard and its associated infrastructure with a low impact on the aesthetic quality of the landscape and on key views from nearby roads (D2649). Mitigation measures will be difficult since the components will be observed as part of the Medupi Power Station.	1	1	2	0.75	**3** **Low**	1	1	2	0.75	**3** **Low**

Note:

Sev = Intensity/Nature of impact D = Duration of impact Sp = Spatial Scale / Extent of impact

P = Probability/Likelihood of Occurrence SIG = Significance of impact

Significance = (Intensity + extent + duration) x Likelihood

Table 10: Summary of the cumulatively rated visual impact per phase of the Project

OPERATION PHASE (assuming duration is between 10 - 20 years)

Potential Visual Impact	ENVIRONMENTAL SIGNIFICANCE									
	Management: Unmitigated					Management: Mitigated				
	Sev	D	SP	P	SIG	Sev	D	SP	P	SIG
Alteration to the visual quality of the study area due to the physical presence, scale and size of the construction and decommissioning of the Project and its associated infrastructure with a moderate impact on the aesthetic quality of the landscape and on key views from nearby roads (D1675 and D 1925) and residential/ tourist areas (Komunati Lodge, Lephalale Game Traders, Hooi Kraal). For viewers from Geelhoutskloof and Rietfontein the significance will be low since the project will be screened by the koppies. Mitigation measures are feasible for the first few years of the Operational Phase, assuming effective implemented and managed in the long term. Once the Project rise above the tree line the mitigation measures will not be able to mitigate the visual impact. Mitigation measures such as good housekeeping will however contribute to the nuisance effect of the Project.	4	3	2	1	**9** **Moderate**	4	3	2	0.75	**6.75** **Moderate**
Alteration to the visual quality of the study area due to the physical presence, scale and size of the construction and decommissioning of the FGD system, gypsum & limestone handling area and the railway yard and its associated infrastructure with a low impact on the aesthetic quality	1	2	2	0.2	**1** **Low**	1	2	2	0.2	**1** **Low**

of the landscape and on key views from nearby roads (D2649). Mitigation measures will be difficult since the components will be observed as part of the Medupi Power Station.										

Notes:

Sev = Intensity/Nature of impact D = Duration of impact Sp = Spatial Scale / Extent of impact

P = Probability/Likelihood of Occurrence SIG = Significance of impact

Significance = (Intensity + extent + duration) x Likelihood

Table 11: Summary of the cumulatively rated visual impact of the Project

CLOSURE PHASE

The assumption here is that the project is deconstructed and rehabilitation is effective

Potential Visual Impact	ENVIRONMENTAL SIGNIFICANCE									
	Management: Unmitigated					Management: Mitigated				
	Ser	D	SP	P	SIG	Ser	D	SP	P	SIG
Alteration to the visual quality of the study area due to the physical presence, scale and size of the construction and decommissioning of the Project and its associated infrastructure with a moderate impact on the aesthetic quality of the landscape and on key views from nearby roads (D1675 and D 1925) and residential/ tourist areas (Komunati Lodge, Lephalale Game Traders, Hooi Kraal). For viewers from Geelhoutskloof and Rietfontein the significance will be low since the project will be screened by the koppies. Mitigation measures are feasible assuming effective implemented and managed in the long term which could reduce the impact during closure of the project.	2	5	2	1	**9** **Moderate**	2	5	2	0.75	**6.75** **Moderate**
Alteration to the visual quality of the study area due to the physical presence, scale and size of the construction and decommissioning of the FGD system, gypsum & limestone handling area and the railway yard and its associated infrastructure with a low impact on the aesthetic quality of the landscape and on key views from nearby roads (D2649). Mitigation measures will be difficult since the components will be observed as part of the Medupi Power Station.	1	1	2	0.2	**0.8** **Low**	1	1	2	0.2	**0.8** **Low**

Notes:

Sev = Intensity/Nature of impact D = Duration of impact Sp = Spatial Scale / Extent of impact

P = Probability/Likelihood of Occurrence SIG = Significance of impact

Significance = (Intensity + extent + duration) x Likelihood

12. CONCLUSION

The study area is relatively flat with koppies and mountains concentrated to the south and the south-east of the study area. The vegetation on site is characterized by dense bushveld and the visual resource value of the study area can be regarded as moderate as it is a mixture of natural environment and human activities such as mining, the power stations and infrastructure.

The sense of place can be divided into a serene, peaceful sense of place when visiting the game farms located to the south and west of the study site but travelling to the north and the east the sense of place changes to a more active / urban sense of place as the Matimba and Medupi Power Stations arise.

Potential sensitive viewers / receptors are mostly concentrated along the D1925 which is located immediately south of Site 13. Sensitive viewers are located along the D1675, which runs along the northern boundary of the project site. Motorists travelling along the D1925 and the D2649 have minimal visual exposure to mining activities, the ash disposal facilities and the power stations, whereas motorist travelling along the D1675 are exposed to these activities.

Although there are other mining activities located to the north and east of the proposed project site, the new ash disposal facility will be intrusive to sensitive viewing sites within the study area as it is proposed to be located in an area that falls within the viewshed of residential units and tourist lodges. In the early stages of its development, the new ash disposal facility will be screened from viewers travelling along the D1675 and viewers located to the south of the project site, due to the dense vegetation cover, but will become visible once it rises above the tree line. The ADF, from its inception, will however be visible from elevated sites such as the Lephalale Game Traders lodge. The FGD system, gypsum & limestone handling area and the railway yard will be absorbed by the existing structures and infrastructure of the Medupi Power Station and will therefore not be seen as individual components but the viewer will rather experience/observe it as part of the Medupi Power Station.

Using Zitholele's impact assessment criteria, the significance of the impact of the ADF during construction and decommissioning was rated as *moderate*. During the operational phase the significance will remain *moderate* even when mitigation measures are implemented because the ash facility will become more visible once it rises above the tree line. The receptors that will mostly be affected by these activities are viewers travelling along the D1675 and D1925 as well as viewers staying at or visiting the Komunati Lodge, Landelani Game Farms, Lephalale Game Farm / Lodge and Hooi Kraal.

During the closure phase the significance could be reduced to *low* but only if the ash disposal facility is removed, should the facility remain on site the significance will remain *moderate*.

The unmitigated impact of the FGD system, gypsum & limestone handling area and the railway yard will be very low during the construction phase. During this phase there will be more activity on site which will be visible for motorist travelling along the boundary of the Medupi Power Station. During the operational,

decommissioning and closure phase the components will be absorbed by the existing structures and will therefore be seen as a whole. It will contribute as a cumulative impact to the overall impact of the Medupi Power Station.

During the evenings the Project will contribute to the cumulative light impact of the study area.

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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. **5**	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. **3**	Low rolling hills, foothills, or flat valley bottoms; or few or no interesting landscape features. **1**
Vegetation and landcover	A variety of vegetative types as expressed in interesting forms, textures, and patterns. **5**	Some variety of vegetation, but only one or two major types. **3**	Little or no variety or contrast in vegetation. **1**
Water	Clear and clean appearing, still, or cascading white water, any of which are a dominant factor in the landscape.	Flowing, or still, but not dominant in the landscape.	Absent, or present, but not noticeable. **0**

	5	**3**	
Colour	Rich colour combinations, variety or vivid colour; or pleasing contrasts in the soil, rock, vegetation, water or snow fields. **5**	Some intensity or variety in colours and contrast of the soil, rock and vegetation, but not a dominant scenic element. **3**	Subtle colour variations, contrast, or interest; generally mute tones. **1**
Influence of adjacent scenery	Adjacent scenery greatly enhances visual quality. **5**	Adjacent scenery moderately enhances overall visual quality. **3**	Adjacent scenery has little or no influence on overall visual quality. **0**
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 *** 5+**	Distinctive, though somewhat similar to others within the region. **3**	Interesting within its setting, but fairly common within the region. **1**
Cultural modifications	Modifications add favourably to visual variety while promoting visual harmony. **2**	Modifications add little or no visual variety to the area, and introduce no discordant elements. **0**	Modifications add variety but are very discordant and promote strong disharmony. **-4**

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))

High	Moderate	Low
Areas that exhibit a very positive character with valued features that combine to give the	Areas that exhibit positive character but which may have evidence of alteration to	Areas generally negative in character with few, if any, valued features. Scope for positive

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.	/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.	enhancement frequently occurs.

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

High	Moderate	Low	Positive
If the project: - Has a substantial negative effect on the visual quality of the landscape; - Contrasts dramatically with the patterns or elements that define the structure of the landscape; - Contrasts dramatically with land use, settlement or enclosure patterns; - Is unable to be 'absorbed' into the landscape.	If the project: - Has a moderate negative effect on the visual quality of the landscape; - Contrasts moderately with the patterns or elements that define the structure of the landscape; - Is partially compatible with land use, settlement or enclosure patterns. - Is partially 'absorbed' into the landscape.	If the project: - Has a minimal effect on the visual quality of the landscape; - Contrasts minimally with the patterns or elements that define the structure of the landscape; - Is mostly compatible with land use, settlement or enclosure patterns. - Is 'absorbed' into the landscape.	If the project: - Has a beneficial effect on the visual quality of the landscape; - Enhances the patterns or elements that define the structure of the landscape; - Is compatible with land use, settlement or enclosure patterns.
Result Notable change in landscape characteristics over an extensive area and / or intensive change over a localized area resulting in major changes in key views.	*Result* Moderate change in landscape characteristics over localized area resulting in a moderate change to key views.	*Result* Imperceptible change resulting in a minor change to key views.	*Result* 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

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

Visual Exposure

Visual exposure relates directly to the distance of the view. It is a criterion used to account for the limiting effect of increased distance on visual impact. The impact of an object 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.

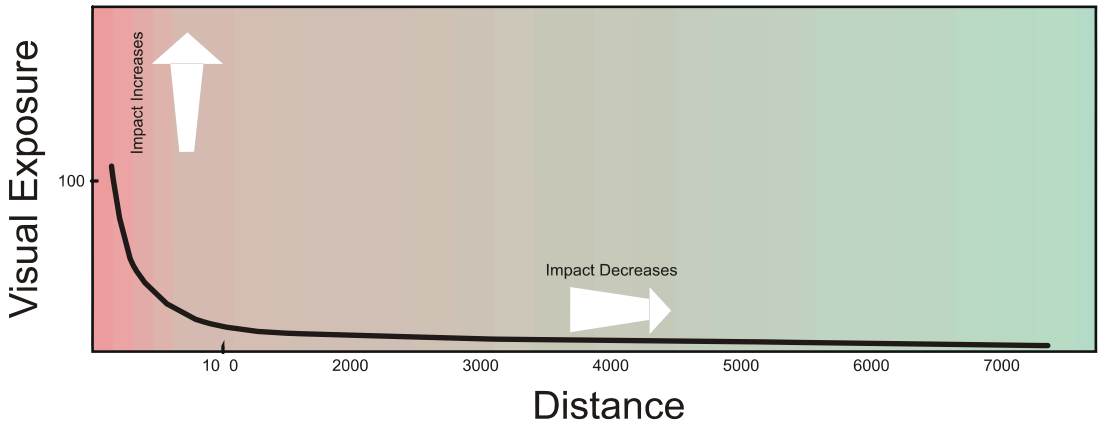
Areas seen from 5.0km to 8.0km and sometimes up to 16km and beyond are considered background. Landforms become the most dominant element at these distances.

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

High	Moderate	Low	Negligible
Total loss of or major 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. High scenic quality impacts would result.	Partial loss of or alteration to key elements / features / characteristics of the baseline. 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. Moderate scenic quality impacts would result	Minor loss of or alteration to key elements / features / characteristics of the baseline. 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. Low scenic quality impacts would result.	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 that are not uncharacteristic with the surrounding landscape – approximating the 'no change' situation. 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 C: CRITERIA FOR SIGNIFICANCE OF IMPACT ASSESSMENT

The impacts will be ranked according to the methodology given by Zitholele Consulting and as described below. Where possible, mitigation measures will be provided to manage impacts. In order to ensure uniformity, a standard impact assessment methodology will be utilised so that a wide range of impacts can be compared with each other. The impact assessment methodology makes provision for the assessment of impacts against the following criteria, as discussed below.

Nature of the impact

Each impact should be described in terms of the features and qualities of the impact. A detailed description of the impact will allow for contextualisation of the assessment.

Extent of the impact

Extent intends to assess the footprint of the impact. The larger the footprint, the higher the impact rating will be. The table below provides the descriptors and criteria for assessment.

Table 1: Criteria for the assessment of the extent of the impact.

Extent Descriptor	Definition	Rating
Site	Impact footprint remains within the boundary of the site.	1
Local	Impact footprint extends beyond the boundary of the site to the adjacent surrounding areas.	2
Regional	Impact footprint includes the greater surrounds and may include an entire municipal or provincial jurisdiction.	3
National	The scale of the impact is applicable to the Republic of South Africa.	4
Global	The impact has global implications	5

Duration of the impact

The duration of the impact is the period of time that the impact will manifest on the receiving environment. Importantly, the concept of reversibility is reflected in the duration rating. The longer the impact endures, the less likely it is to be reversible. See

Table 2 for the criteria for rating duration of impacts.

Table 2: Criteria for the rating of the duration of an impact.

Duration	Definition	Rating

Descriptor		
Construction / Decommissioning phase only	The impact endures for only as long as the construction or the decommissioning period of the project activity. This implies that the impact is fully reversible.	1
Short term	The impact continues to manifest for a period of between 3 and 5 years beyond construction or decommissioning. The impact is still reversible.	2
Medium term	The impact continues between 6 and 15 years beyond the construction or decommissioning phase. The impact is still reversible with relevant and applicable mitigation and management actions.	3
Long term	The impact continues for a period in excess of 15 years beyond construction or decommissioning. The impact is only reversible with considerable effort in implementation of rigorous mitigation actions.	4
Permanent	The impact will continue indefinitely and is not reversible.	5

Potential intensity of the impact

The concept of the potential intensity of an impact is the acknowledgement at the outset of the project of the potential significance of the impact on the receiving environment. For example, SO_2 emissions have the potential to result in significant adverse human health effects, and this potential intensity must be accommodated within the significance rating. The importance of the potential intensity must be emphasised within the rating methodology to indicate that, for an adverse impact to human health, even a limited extent and duration will still yield a significant impact.

Within potential intensity, the concept of irreplaceable loss is taken into account. Irreplaceable loss may relate to losses of entire faunal or floral species at an extent greater than regional, or the permanent loss of significant environmental resources. Potential intensity provides a measure for comparing significance across different specialist assessments. This is possible by aligning specialist ratings with the potential intensity rating provided here. This allows for better integration of specialist studies into the environmental impact assessment. See

Table 3 and Table 4 below.

Table 3: Criteria for impact rating of potential intensity of a negative impact.

Potential Intensity Descriptor	Definition of negative impact	Rating
High	Any impact to human health/mortality/loss of a species.	16
Moderate-High	Significant impact to faunal or floral populations/loss of livelihoods/individual economic loss	8
Moderate	Reduction in environmental quality/loss of habitat/loss of heritage/loss of welfare amenity	4
Moderate-Low	Nuisance impact	2

Low	Negative change with no associated consequences.	1

Table 4: Criteria for the impact rating of potential intensity of a positive impact.

Potential Intensity Descriptor	Definition of positive impact	Rating
Moderate-High	Met improvement in human welfare	8
Moderate	Improved environmental quality/improved individual livelihoods.	4
Moderate-Low	Economic development	2
Low	Positive change with no other consequences.	1

It must be noted that there is no HIGH rating for positive impacts under potential intensity, as it must be understood that no positive spinoff of an activity can possibly raise a similar significance rating to a negative impact that affects human health or causes the irreplaceable loss of a species.

Likelihood of the impact

This is the likelihood of the impact potential intensity manifesting. This is not the likelihood of the activity occurring. If an impact is unlikely to manifest then the likelihood rating will reduce the overall significance.

Table 5 provides the rating methodology for likelihood.

The rating for likelihood is provided in fractions in order to provide an indication of percentage probability, although it is noted that mathematical connotation cannot be implied to numbers utilised for ratings.

Table 5: Criteria for the rating of the likelihood of the impact occurring

Likelihood Descriptor	Definition	Rating
Improbable	The possibility of the impact occurring is negligible and only under exceptional circumstances.	0.1
Unlikely	The possibility of the impact occurring is low with a less than 10% chance of occurring. The impact has not occurred before.	0.2
Probable	The impact has a 10% to 40% chance of occurring. Only likely to happen once in every 3 years or more.	0.5
Highly Probable	It is most likely that the impact will occur and there is a 41% to 75% chance of occurrence.	0.75
Definite	More than a 75% chance of occurrence. The impact will occur regularly.	1

Cumulative Impacts

Cumulative impact are reflected in the in the potential intensity of the rating system. In order to assess any impact on the environment, cumulative impacts must be considered in order to determine an accurate

significance. Impacts cannot be assessed in isolation. An integrated approach requires that cumulative impacts be included in the assessment of individual impacts.

The nature of the impact should be described in such a way as to detail the potential cumulative impact of the activity.

Significance Assessment

The significance assessment assigns numbers to rate impacts in order to provide a more quantitative description of impacts for purposes of decision making. Significance is an expression of the risk of damage to the environment, should the proposed activity be authorised.

To allow for impacts to be described in a quantitative manner in addition to the qualitative description given above, a rating scale of between 1 and 5 was used for each of the assessment criteria. Thus the total value of the impact is described as the function of significance, spatial and temporal scale as described below:

Impact Significance = (extent + duration + potential intensity) x likelihood

Table 6 provides the resulting significance rating of the impact as defined by the equation as above.

Table 6: Significance rating formulas.

Score	Rating	Implications for Decision-making
< 3	Low	Project can be authorised with low risk of environmental degradation
3 - 9	Moderate	Project can be authorised but with conditions and routine inspections. Mitigation measures must be implemented.
10 - 20	High	Project can be authorised but with strict conditions and high levels of compliance and enforcement. Monitoring and mitigation are essential.
21 - 26	Fatally Flawed	Project cannot be authorised

An example of how this rating scale is applied is shown below:

Table 7: Example of Rating Scale

Nature	Extent	Duration	Potential Intensity	Likelihood	Rating
Emission of SO_2 to the environment in concentrations above the minimum emissions standards. The area is a priority hotspot in terms of air emissions and there are several industrial operations	*Global*	Long term	HIGH	**Probable**	High
	5	4	16	0.5	12.5

that contribute to extensive emissions of SO_2.					

Notation of Impacts

In order to make the report easier to read the following notation format is used to highlight the various components of the assessment:

- Extent- *in italics*
- Duration – in underline
- Potential intensity – IN CAPITALS
- Likelihood - in **bold**

Please note that the impact rating system may change slightly to accommodate ease of use. However, the basic principle of the rating system will remain the same.

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.

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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 also specializes in Visual Impact Assessments.

EXPERIENCE: **NEWTOWN LANDSCAPE ARCHITECTS cc.** ***Member***

Current — Responsible for project management, landscape design, urban design, and visual impact assessment.

Senior Lecturer: Department of Architecture, University of Pretoria.

1991 - 1994 **GRAHAM A YOUNG LANDSCAPE ARCHITECT** - ***Sole proprietor***

1988 - 1989 — Designed major transit and CBD based urban design schemes; designed commercial and recreational landscapes and a regional urban park; participated in inter-disciplinary consulting teams that produced master plans for various beachfront areas in KwaZulu Natal and a mountain resort in the Drakensberg.

1989 - 1991 **CANADA** - ***Free Lance***

Designed golf courses and carried out golf course feasibility studies (Robert Heaslip and Associates); developed landscape site plans and an end-use plan for an abandoned

mine (du Toit, Allsopp and Hillier); conducted a visual analysis of a proposed landfill site.
.

1980 - 1988 **KDM (FORMERLY DAMES AND MOORE)** - *Started as a Senior Landscape Architect and was appointed Partner in charge of Landscape Architecture and Environmental Planning in 1984*. Designed commercial, corporate and urban landscapes; completed landscape site plans; developed end-use master plans for urban parks, college and technikon sites; carried out ecological planning studies for factories, motorways and a railway line.

1978 - 1980 **DAYSON & DE VILLIERS - *Staff Landscape Architect***

Designed various caravan parks; designed a recreation complex for a public resort; conducted a visual analysis for the recreation planning of Pilgrims Rest; and designed and supervised the installation of various private gardens.

EDUCATION:

Bachelor of Landscape Architecture, 1978, (BLArch), University of Toronto, Canada;

Completing a master's degree in Landscape Architecture, University of Pretoria; Thesis: Visual Impact Assessment;

Senior Lecturer - Department of Architecture, University of Pretoria.

PROFESSIONAL:

Registered Landscape Architect – South African Council for Landscape Architectural Profession (2001);
Board of Control for Landscape Architects of South Africa (1987) – Vice Chairman 1988 to 1989;
Professional Member - Institute of Landscape Architects Southern Africa (1982) – President 1986 - 1988;
Member Planning Professions Board 1987 to 1989;
Member International Association of Impact Assessment;

AWARDS:

Torsanlorenzo International Prize, Landscape design and protection 2nd Prize Section B: Urban Green Spaces, for Intermediate Phase Freedom Park (2009)
Phase 1 and Intermediate Phase Freedom Park: Special Mention World Architecture Festival, Nature Category (2008)
Moroka Park Precinct, Soweto: ILASA Merit Award for Design (2005) and Gold Medal United Nations Liveable Communities (LivCom) Award (2007)
Isivivane, Freedom Park: ILASA Presidential Award of Excellence Design (2005)
Information Kiosk, Freedom Park: ILASA Merit Award for Design (2005)

Moroka – Mofola Open Space Framework, Soweto: ILASA Merit Award for Planning (2005)

Mpumalanga Provincial Government Complex: ILASA Presidential Award of Excellence (with KWP Landscape Architects for Design (2003)

Specialist Impact Report: Visual Environment, Sibaya Resort and Entertainment World: ILASA Merit Award for Environmental Planning (1999);

Gillooly's Farm, Bedfordview (with Dayson and DeVilliers): ILASA Merit Award for Design;

COMPETITIONS:

Pan African Parliament International Design competition – with MMA architects (2007) Finalist

Leeuwpan Regional Wetland Park for the Ekurhuleni Metro Municipality (2004) Landscape Architectural Consultant on Department of Trade and Industries Building (2002) – Finalist

Landscape Architecture Consultant on Project Phoenix Architectural Competition, Pretoria (1999): Winner;

Mpumalanga Legislature Buildings (1998): Commissioned;

Toyota Fountain (1985): First Prize - commissioned;

Bedfordview Bike/Walkway System - Van Buuren Road (1982): First Prize - commissioned;

Portland Cement Institute Display Park (1982): Second Prize

CONTRIBUTOR:

Joubert, O, 10 Years + *100 Buildings – Architecture in a Democratic South Africa Bell-Roberts Gallery and Publishing*, South Africa (2009)

- Freedom Park Phase 1 and Intermediate Phase (NBGM), Pretoria, Gauteng

Galindo, M, *Collection Landscape Architecture*, Braun, Switzerland (2009)

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In *1000 X Landscapes*, Verlagshaus Braun, Germany (2008)

- Freedom Park Phase 1 and Intermediate Phase (NBGM), Pretoria, Gauteng
- Riverside Government Complex (NLAKWP), Nelspruit, Mpumalanga;
- Moroka Dam Parks Precinct, Soweto, Gauteng.

In *Johannesburg: Emerging/Diverging Metropolis*, Mendrision Academy Press, Italy (2007)

- Moroka Dam Parks Precinct, Soweto, Gauteng.

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B.Sc Degree in Environmental Science from the University of North West, Potchefstroom Campus (2003). M.Sc Degree in Ecological Remediation and Sustainable Utilization from the University of North West, Potchefstroom Campus (2007). She is currently employed by Newtown Landscape Architects working on the following projects.

EXPERIENCE: Environmentalist: Newtown Landscape Architects

Responsible for the environmental work, which includes Basic Assessments, Environmental Impact Assessments (Scoping & EIA), Environmental Management Plans (EMP), Environmental Auditing as well as Visual Impact Assessments.

Current Projects:

Orchards Extension 49-53, Pretoria - Environmental Impact Assessment and Environmental Management Plan

Tanganani Ext 8, Johannesburg - Environmental Impact Assessment and Environmental Management Plan

Diepsloot East Development, Diepsloot **-** Environmental Impact Assessment and Environmental Management Plan

Klerksoord Ext 25 & 26, Pretoria – Environmental Impact Assessment

Ennerdale Ext 16, Johannesburg - Environmental Impact Assessment and Environmental Management Plan

Glen Marais Ext 102 & 103, Kempton Park - Basic Assessment and Environmental Management Plan

Princess Plot 229, Princess - Environmental Assessment (S24G Application)

Uthlanong Drive Upgrade – Mogale City Local Municipalty project in Kagiso, Basic Assessment for the upgrade of the stormwater and the roads

Luipaardsvlei Landfill Site – Mogale City Local Municipalty project in Krugersdorp, the expansion of the existing landfill site.

MCLM Waste Water Treatment Works – Mogale City Local Municipalty project in Magaliesburg, the expansion of the existing facility.

Rand Uranium (Golder Associates Africa (Pty) Ltd), Randfontein – VIA

Dorsfontein West Expansion (GCS (Pty) Ltd), Kriel – VIA

Mine Waste Solutions (GCS (Pty) Ltd), Stilfontein – VIA

Ferreira Coal Mining (GCS (Pty) Ltd), Ermelo – VIA

De Wittekrans Mining (GCS (Pty) Ltd), Hendrina – VIA

EDUCATION:

May 2009	Public Participation Course, International Association for Public Participation, Golder Midrand
May 2008	Wetland Training Course on Delineation, Legislation and Rehabilitation, University of Pretoria.
April 2008	Environmental Impact Assessment: NEMA Regulations – A practical approach, Centre for Environmental Management: University of North West.
Feb 2008	Effective Business Writing Skills, ISIMBI
Oct 2007	Short course in Geographic Information Systems (GIS), Planet GIS

Jan 2004 – April 2007	M.Sc Degree in Ecological Remediation and Sustainable Utilization, University of North West, Potchefstroom Campus. Thesis: Tree vitality along the urbanization gradient in Potchefstroom, South Africa.
Jan 2001 – Dec 2003	B.Sc Degree in Environmental Science, University of Potchefstroom

PROFESSIONAL REGISTRATION:

Sep 2009	Professional National Scientist – 400204/09