APPENDIX L: VISUAL STUDY
Langer Heinrich Uranium Mine, Swakopmund, Namibia

Specialist Study Report
Visual Assessment

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GLOSSARY OF TERMS

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

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).

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 about an object beyond which the visual impact of its most visible features will be insignificant due primarily due to distance.
EXECUTIVE SUMMARY

Introduction
A visual analysis has been undertaken to assess and evaluate the significance of potential visual impacts of the proposed expansion of the Langer Heinrich Uranium Mine situated approximately 81 kilometres east of Swakopmund in Namibia. This specialist report forms part of the Environmental Impact Assessment for the proposed project.

Landscape character, landscape quality and “sense of place” determined that the visual resource (scenic beauty of the study area) is of high quality. The visibility of the project was established and then qualified in terms of its visual intrusion and exposure. Photographic panoramas were taken from representative viewpoints and altered through a computer simulation technique to characterise the nature of the visual intrusion of the proposed project components on the landscape. The significance of impacts was then predicted using severity, duration, spatial scale and probability criteria.

Aim and Objectives
The main aim of the study is to ensure that the visual consequences of the proposed expansion of the mining operations are understood and adequately considered in the planning process. The objectives of the study are to:

- To define the visual resource and sense of place of the greater area;
- To identify the sensitive receptors/lines of site;
- To determine the cumulative visual impact by simulating the key proposed infrastructure components with those that are already in place or approved;
- To assess the cumulative visual impact; and
- To provide input, together with Metago, other specialists and LHU, into the visual management measures going forward.

Visual Resource
The study area is blessed with landscapes of immense scenic beauty which is the major attraction to tourists visiting the area. The sense of place of the area is primarily based on the lack of human activity and natural structures within the study area, coupled with a sense of remoteness and the rugged beauty of the landscape. These areas are however being compromised by the presence of mining and prospecting activities within the area. It is anticipated that the physical presence of the proposed expansion activities associated with the LHU will have a cumulative negative impact on the visual and aesthetic environment.

Predicted Impact
It is concluded that the LHU Expansion Project will exert a moderate to high negative influence on the visual environment. The high impact, however, pertains only to the water extraction works in the Swakop River Valley. With mitigation this impact can be reduced to low. The impact for the remainder of the expansion project is predicted to be moderate due primarily to its distance from sensitive viewing areas and the fact that views of the expansion project activities will be in the middle-distance to background.
During the construction phase the significance of the impact is predicted to be *high* even with mitigating measures in place. The cause of this is the extra ‘animation’ of activities, which will bring attention to them.

The cumulative impact is predicted to be *high negative*. The major contributing factor being the impact of the activities associated with the open pit mining areas when they occur to the north and north east of Bloedkoppie.

At decommissioning, and assuming management procedures are successful, the impact is predicted to be *high negative* as would be the case for the construction phase. Structures and infrastructure will be dismantled and removed from the area. The tailings dam and some waste rock dumps will however remain.

With effective implementation, mitigation measures and attempts to reverse negative opinion of the mine could reduce the impact of the mining activities and the predicted impact would be *moderate*.

At closure and assuming all mitigation measures are successful, the impact will reduce dramatically to *low*.

The tourist activities associated with the historic war sites near the Swakop River and the Bloedkoppie and surrounding wilderness areas will be most affected by the expansion project. There is also no avoiding the impact that the mine will have on tourist views from Bloedkoppie and the impact the mine will have on the sense of place of the wilderness areas to the north and east of the mine. Perhaps the vantage points at Bloedkoppie could be used to house an ‘information’ pavilion that would explain the mining operation to the public and bring people up to vantage points that would afford views of the activities – and perhaps changes some perceptions.

Option C is the preferred option as it is the most ‘compact’ of the solutions as it would the smallest ‘footprint’ and have the least impact on the visual environment.

***NLA***
1.0 INTRODUCTION

1.1 Project Overview
Langer Heinrich Uranium (Pty) Ltd (LHU), a wholly owned subsidiary of Paladin Energy Ltd, owns and operates the Langer Heinrich uranium mine situated approximately 90 kilometers east of Swakopmund in the Namib Naukluft National Park. The mine operates under the approvals of a mining license (ML 140), an environmental impact assessment (EIA) and an environmental management plan (EMP).

The motivation for the project is economic in nature. LHU has identified an opportunity to increase its supply in line with a growing global demand for uranium that will be used in power generation. The project will benefit society and the surrounding communities both directly and indirectly. Direct economic benefits will be derived from wages, taxes and profits. Indirect economic benefits will be derived from the procurement of goods and services and the increased spending power of additional employees. The challenge facing LHU is to contribute these benefits while at the same time preventing and/or mitigating potential negative social and environmental impacts.

Prior to the commencement of the expansion project, authorization is required in terms of the Environmental Management Act, 7 of 2007. Although the proposed EIA regulations have not yet been promulgated in a final form, the draft regulations and Namibian Environmental Policy for EIA (1995) have been used as a guideline where relevant. In this regard, a project specific environmental impact assessment (EIA) is required as part of the application for authorization for new mining and beneficiation related activities.

In addition to compliance with the Environmental Management Act, 7 of 2007, LHU has requested that the EIA takes the environmental and social aspects of the Equator Principles and related International Finance Corporation Performance Standards into account. Other Namibian legislation, international conventions and protocols, regional agreements, and best practice guidelines and standards will be referenced in the EIA/EMP where relevant.

This specialist report deals with the visual issues associated with the proposed project and will form part of the EIA application to be submitted to the Namibian authorities for approval.

1.2 Project Site
Langer Heinrich Uranium Mine is situated approximately 81km east of Swakopmund. The study area is located on the eastern edge of the Desert Zone, in the northerly part of the Namib Naukluft Park. The study area is situated within and beneath a 1 – 2 km wide, flat-bottomed valley, between the Langer Heinrich Mountains to the north (1 152m above mean sea level [amsl]) and the Schiefer Mountains to the south (883m amsl). The valley is 710 m amsl at its high point and descends gradually towards the west to an elevation of 550 m amsl. (Refer to Figure 01)

1.3 Terms of Reference
It was proposed that a detailed investigation be conducted by Newtown Landscape Architects cc.
Architects. The investigation will have the following objectives:

- To define the visual resource and sense of place of the greater area;
- To identify the sensitive receptors/lines of site;
- To determine the cumulative visual impact by simulating the key proposed infrastructure components with those that are already in place or approved;
- To assess the cumulative visual impact; and
- To provide input, together with Metago, other specialists and LHU, into the visual management measures going forward.

1.4 Limitation/Alternatives

When considering the post rehabilitation land use alternatives, the option considered to date is rehabilitation back to some form of conservation/eco-tourism capability. This concept may be modified in consultation with relevant stakeholders during the remaining mine life.

The scoping/baseline report describes and discusses the alternatives that were being considered for certain components of the project. The alternative selection process can however not be completed without more detailed input from certain specialist investigations. However, alternatives being investigated in this report relate to surface infrastructure layout options (Option A and Option B), water supply options, power supply options as well as the “no project” option.

1.5 Public Concerns

Issues raised to date by authorities and Interested & Affected parties during the Scoping phase pertain to:

- EIA procedural issues;
- technical/project related issues;
- decommissioning and closure;
- water supply;
- power supply;
- soils;
- biodiversity;
- heritage resources;
- groundwater;
- air quality;
- geology;
- radiological aspects;
- noise;
- transport; and
- socio-economic.

Whilst visual issues were not raised as a major concern, some farmers to the north of the site voiced concern of the power supply lines associated with the water pipe proposed to be installed in the Swakop River immediately south of their farms in an area where German battlefields have been identified.
2.0 AIM OF THE SPECIALIST STUDY

The main aim of the study is to ensure that the visual consequences of the proposed expansion to the mine are understood and adequately considered in the planning process by addressing the objectives stated in the Terms of Reference.

3.0 APPROACH AND METHODOLOGY

The visual impact of a new development is measured as the change to the landscape (visual resource) caused by the physical presence of the development and the magnitude of that change i.e. the degree to which the change compromises, enhances or maintains the visual quality of a particular area. This approach reflects the layman’s concerns that normally are:

- Will I be able to see the new development?
- What will it look like?
- Will the development compromise views in the area?

Consequently it is imperative to depict that change in as realistic a manner as possible (Zube et. al.; Van Dortmont in Lange 1994) by simulating the project’s appearance using a technique that portrays an accurate characterisation of the project in its setting. The resultant change to the landscape can then be observed.

To minimize the qualitative aspects involving human values and associations, the more quantifiable aspects of the landscape have been emphasized in this study. Landscape character, landscape quality (Warnock, S. & Brown, N. 1998) and “sense of place” (Lynch, K. 1992) are used to evaluate the visual resource. These 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.

Visual impact is determined using visual intrusion, visibility and visual exposure (Hull, R.B. and Bishop, I.E. 1988) criteria to assess the change to the visual resource caused by the proposed development. The significance of the impact is then qualified by sensitivity (Ittleson et al., 1974), severity (Institute of Environmental Assessment/The Landscape Institute 1996) and the duration of potential impacts. For a detailed description of the method refer to Appendices A and B. The diagram below graphically illustrates the visual impact process.
Diagram 1: Visual Impact Assessment Process

4.0 DESCRIPTION OF THE PROJECT
Refer to Figures 2 for the layout of the existing mine and Figures 7, 8, 9 and 10, which are photographs of the existing mine.

Three options (Option A, B and C – essentially a hybrid of options A and B) for the satellite crushing plant, satellite mine workshop, heap leach pad, and related surface infrastructure facilities are still being considered. Refer to Figures 3 and 4 for options A and B and 4A for Option C. The final layout and site selection process requires input from the all other specialist work on the project. This will be included in the EIA/EMP report.

The main components in of the expansion project are as follows:
1. Upgrade to the processing plant
2. Increased rate of mining
3. Satellite mine workshop
4. Satellite crushing plant  
5. Heap leach pad  
6. Tailings thickener  
7. Provision of additional pumps, and power (either generators or a power line) to the Swakop river for abstracting the full allotment of groundwater  
8. Temporary contractors camp

A detailed description is available in Metago’s EIA report.

4.12 Timetable
Subject to authorization, construction of the various project components will begin in the second half of 2009. The estimated life of mine, taking the project into account, is approximately 25 years.

5.0 THE ENVIRONMENTAL SETTING

5.1 Surrounding Land Use
Land in the ML is primarily used for the current mining operations. Land immediately surrounding the ML is used for conservation, eco-tourism and mineral exploration activities. In this regard, the ML (47km² in extent) is located in the Namib Naukluft Park (50 000km² in extent). Refer to Figure 5.

There are no communities living in the vicinity of the ML. The closest communities are:
- The Swakop River farming community – the closest farm is approximately 20km from the ML;
- Arandis – approximately 50km from the ML;
- Swakopmund – approximately 90km from the ML;
- Walvisbay – approximately 90km from the ML; and
- The Topnaar Nama nomadic community – along the Kuiseb River between 80 to 100km from the ML.

There are a number of significant tourist attractions within the Namib Naukluft Park within the same region as the ML. The closest of these is Bloedkoppie (approximately 7km from the current plant operations and approximately 1km from the south eastern ML boundary) and some German graves, approximately 10km away (east) from current operations. Approximately 15km directly north of the mine, along the Swakop River and its environs, farmers (of the farms Modderfontein, Jakkalswater, Geluk and Vredelus) have identified war sites. These are an attraction for tourists who are often taken by vehicle and/or on foot into the Swakop River valley to view these, which occur in the vicinity of the mine’s proposed borehole extraction site. Further away (approximately 30 to 50km), the Welwitschia plains and the Moon landscape are popular attractions. The ‘wilderness’ landscape to the east of Bloekoppie and the ML is a popular camping and ‘adventure’ area. The current access road to these areas passes immediately south of the far eastern section of the ML and then moves directly east through the Tinkasvlakkte into the eastern portion of the Namib Naukluft National Park.
A network of roads exists within the study area. These include:

- The gravel C28 through the Namib Naukluft Park that links Swakopmund to Windhoek;
- The LHU access road off the C28 that leads to the mine; and
- Various unnamed tourist gravel roads within the Namib-Naukluft Park.

The NamWater pipeline (and related servitude) runs alongside the C28 for about 50km and then branches off to follow the LHU access road to site. The section of water pipeline adjacent to the C28 is located above ground, whilst the section adjacent to the LHU access road is underground. The power line servitude to LHU runs from the Kuiseb Substation straight to the LHU access road, from where it runs parallel with this road to the operations. There is also an above ground water pipeline between the Swakop River boreholes and the ML running alongside the Langer Heinrich Mountains towards the operations area.

There are a number of other mining and mineral exploration companies in the region that are engaged in, exploration, construction and/or operational activities. Those closer to LHU include:

- Rössing Uranium Limited (operational);
- Extract Resources (exploration);
- Reptile Mining (exploration);
- Bannerman Resources (exploration & feasibility phase);
- Areva Resources Namibia/Trekkopie (construction);
- The Forester Group/Valencia (ML awarded but not yet in construction phase); and
- Nova Energy (exploration).

5.2 Landscape Character

One of the major attractions to tourists visiting the Namib Naukluft Park is the scenic beauty of the park, and the associated sense of place. This is primarily based on the lack of human activity and natural structures inside the park, coupled with a sense of remoteness and the value of the visual resource.

LHU is situated in the Desert Biome within the Central Namib vegetation zone. This biome has significant vegetation, insect and reptile endemism (species restricted to this biome).

The rivers in and around the ML are normally dry. Occasionally storm water entering the rivers in the upland areas reaches the sea. Perennial surface water occurs at a few points in the rivers, but subsurface water is present in the larger rivers all year. The Swakop and Khan are the major ephemeral rivers in the region. The Gawib, in which the ML is situated, is an ephemeral river that has its catchment to the east of LHU and drains towards the Swakop river. Present day runoff is restricted to the Gawib and Tinkas Rivers, which both flow into the Swakop River north of the Langer Heinrich Mountain. The Tinkas River catches runoff from the eastern end of the Valley, while the Gawib River drains the western end of the valley.
The landscape of the study area primarily consists of light colored gravel plains with all their remarkable contrasts of light-colored pegmatites and dark-colored dolerite. The plains are ‘punctuated’ with a rocky jumble of mountains, the largest and highest in the study area is Langer Heinrich Mountain, and incised with a series of dry river beds as described above. Refer to Figures 10, 11, 12 and 13 and to Figure 6 which indicates the various viewing points of the photographs. Bloedkoppie also stands out above the surrounding plain (Figure 12 and 14) and at sunset is rendered red (hence the name) by the late afternoon light. It is a popular tourist destination as a campground and many visitors climb to its summit where spectacular 360 degree views across the landscape are appreciated (Figure 13). Most vegetation occurs in the river valleys (Figure 7) but with recent rains the plains are covered with a sea of fine grasses (Figures 8, 10, 11, 12, 13 and 14).

There are however man-made interventions which compromised this ‘idyllic’ scene. Air quality within and outside the ML, the background dust, is compounded by operational sources such as:

- Stockpiles, materials handling, material processing, mining, vehicle entrainment on gravel roads;
- Fume emissions from diesel generators, heaters/boilers;
- Fume generation form vehicle exhaust systems.

Noise pollution also originates from operational activities including: drilling, blasting; vehicle movement, materials processing, power generation. Potential receptors of noise are tourists that frequent the various attractions in the Namib Naukluft Park (specifically the Bloedkoppie area). The sensitivity of noise receptors usually increases at night when conditions are still and ambient noise levels are at their lowest.

5.3 Sense of Place

Central to the concept of sense of place is that the landscape requires uniqueness and distinctiveness. The primary informant of these qualities is the spatial form and character of the natural landscape taken together with the cultural transformations and traditions associated with the historic use and habitation of the area. According to Lynch (1992), sense of place, “is the extent to which a person can recognize or recall a place as being distinct from other places – as having a vivid, unique, or at least particular, character of its own.”

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.

The landscape of the study area is undoubtedly a beautiful and rugged and in its ‘purest’ (especially the ‘wilderness areas’ to the east of the ML – Figures 13 and 14) is almost surrealistic – a vast, eerie gravel plain, with low lying partially vegetated dry river courses, in a setting of sharply etched pegmatite hills. The physical presence of the existing mine and the associated noise and dust pollution however have a negative effect on the scenic beauty and sense of place of the study area. Based on the criteria listed in Table 1
below, the study area has a high scenic quality rating and the mining area itself moderate (because of the setting) to low.

5.4 Landscape Quality and Aesthetic Value
Landscapes with greater diversity or containing "distinctive" features are classified as having a higher scenic value than landscapes with low diversity, few distinctive features, or more “common” elements. Generally, the greater the diversity of form, line, texture, and colour in a landscape unit or area, the greater the potential for high scenic value. Scenic quality classifications are:

- High - distinctive landscape and strong sense of place
- Moderate - common landscape
- Low - minimal landscape and weak sense of place

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 value is the emotional response derived from the experience of the environment with its particular natural and cultural attributes. The response can either be 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 the seen view, visual quality or scenery, and includes atmosphere, landscape character and sense of place (Schapper 1993). Refer to Appendix A for further elaboration. The landscape as described in Section 5.2 has been divided into four basic landscape character types each with its own set of physical, visual and aesthetic characteristics.

Scenic quality ratings (using the scenic quality rating criteria described in Appendix A) were assigned to each of the landscape units defined in Figure 5. The highest value is assigned to the rocky terrain associated with the mountains and hills. A high visual value is also afforded to the various river valleys, where vegetation is also apparent. The combinations of topographic relief, natural features and natural vegetation characteristic of these areas, stand out within the context of the region and evoke distinct and unique images to produce a strong sense of place.

The openness, vastness and subtle variation in colour of the gravel plains, evoke a reasonably strong sense of place resulting in a moderate scenic quality rating. The scenic beauty of the mining licence area has been compromised by the presence of the mine, waste rock piles, plant and other infrastructure resulting in a moderate to low value.
within the context of the sub-region.

Based on the discussion in this section, the specialist experience of the author and the criteria in Appendix A, scenic quality values for the various landscape types are rated in Table 1 below.

### Table 1: Value of Visual Resource – expressed as Scenic Quality

<table>
<thead>
<tr>
<th>Landscape Type</th>
<th>Scenic Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mountains and River valleys</td>
<td>High</td>
</tr>
<tr>
<td>This landscape type is considered to have a high value because it is a:</td>
<td></td>
</tr>
<tr>
<td>Landscape that exhibits a very positive character with valued features that combine to give the experience of unity, richness and harmony. It is a landscape that may be considered to be of particular importance to conserve and which may be sensitive change in general and which may be detrimental if change is inappropriately dealt with.</td>
<td></td>
</tr>
<tr>
<td>Gravel Plains</td>
<td>Moderate</td>
</tr>
<tr>
<td>This landscape type is considered to have a moderate value because it is a:</td>
<td></td>
</tr>
<tr>
<td>Landscape that exhibits positive 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.</td>
<td></td>
</tr>
<tr>
<td>Mining area</td>
<td>Low</td>
</tr>
<tr>
<td>This landscape type is considered to have a low value because it is a:</td>
<td></td>
</tr>
<tr>
<td>Landscape that generally is negative in character with few, if any, valued features. Scope for positive enhancement frequently occurs.</td>
<td></td>
</tr>
</tbody>
</table>

### 5.5 Sensitivity of the 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).

Figure 5 indicates all landscape elements evident within the study area. The diagram is also an attempt to rate the value of these elements. The natural hills and river valleys constitute the highest value and infrastructural features such as the existing mine, power lines and other infrastructure, the lowest value. The natural hills and river valleys are the landscape types that present the highest sensitivity to change.

### 6.0 VISUAL RECEPTORS

#### 6.1 Views

Arguably the major attraction to tourists visiting the Namib Naukluft Park is the scenic
beauty of the park and the related sense of place. This is primarily based on the lack of human activity and structures inside the park, coupled with a sense of remoteness and the value of the visual resource. In this study we are concerned with views to the site that may originate in so called sensitive viewing areas (refer to Appendix B) as it is from these areas that an intrusion on an important view would be considered to generate a negative impact.

6.2 Sensitive viewer locations
The sensitivity of visual receptors and views are depended on the location and context of the viewpoint, the expectations and occupation or activity of the receptor or the importance of the view, which may be determined with respect to is popularity or numbers of people affected, its appearance in guidebooks, on tourist maps, and in 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.

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, on trains or other transport routes;
- People at their place of work.

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 (Institute of Environmental Assessment & The Landscape Institute (1996))

Within the study area the most sensitive public views of the existing mine and proposed expansion project are therefore from Bloedkoppie, and the ‘wilderness’ areas to the east of the ML. Sensitive (public/tourist) views are also in the vicinity of the Swakop River south of the farm Modderfontein where German war sites occur.

Views from the C28 are also considered important although they are distant from the mine and for the most part would be blocked by topography. Views 5 and 6 in Figures 10 and 11 are indicative of views from the C28 south west of the mine. Views of the mining area that will be impacted are primarily from Bloedkoppie (Views 10a and 10b Figure 13 and View 12 from the far east end of the ML.)
7.0 SEVERITY OF VISUAL IMPACT

Visual impact is determined using visual intrusion, visibility and visual exposure criteria qualified by sensitivity and severity of impact as discussed in Section 3.0 and Appendix B. The objective is to assess the change (worst case scenario) to the visual resource caused by the proposed development when all project components are taken together.

It has been established that the study area has a special sense of place and is a unique and valuable visual resource. Negative visual impacts have already occurred due to currently mining and infrastructure activities. It is expected that, as a result of the cumulative visual intrusion of the proposed expansion activities, that further negative impact will occur on the visual environment and the sense of place of the study area. These impacts can be expected during the construction, operational, decommissioning and closure phases of the LHU Mine expansion project.

7.1 Visibility
In determining the visibility of the project, the worst-case scenario i.e. visibility of the project’s features and its infrastructure at maximum height and size, was used. The ‘zone of potential influence’ (the area defined as the radius about the centre point of the tallest features beyond which the visual impact of the most visible features will be insignificant) was established at 10.0km. Beyond 10.0km the impact of the expansion project would have reduced considerably due to the diminishing effect of distance and atmospheric conditions on visibility.

A viewshed analysis was created for the project and the spatial pattern generated by the analysis is illustrated in Figures 17 and 18. It shows the area from which the project could potentially be visible. It also indicates that the visibility of the mine is ‘contained’ to the valley created by the Langer Heinrich mountains in the north and the Schiefer Mountains in the south. Visibility ‘spills’ to the west but the public does not have access into these areas. Views from the C28 will not be affected as the view to the mine is either blocked by a rise in topography between it and the mine (blocking views from the south) or the viewer would be further than 10km from the mine (views from the west).

The most visible aspect of the existing mine and the expansion project, is the eastern section immediately to the north and east of Bloedkoppie. Therefore the most sensitive viewing areas affected by the project are Bloedkoppie and its surrounding camping sites and the ‘wilderness’ areas to the east of the ML. These areas will be frequented primarily by tourist seeking a ‘wilderness’ experience. The majority of people visiting or travelling through the area will however pass by the mine on the C28 and not be aware of its activities.

All options (Figures 3, 4, 4A and 17 and 18) will have a similar impact on sensitive views frequenting the areas to the south east and east of the mining area because in either option the visible activities of the project would be the same i.e. the expansion activities within the existing mining area. The difference between Option A and Option B is
primarily in the far western section of the mining area. Neither option will have a major impact on public views due to distance and the fact that the topography of the area will screen most of the expansion activities. However, from a visual impact point of view, Option C is preferred as it is more ‘contained’ and also occurs partially to the east of a local ridge line thereby further concealing it from views from the west. Option B is spread to the west and extends beyond the local ridge making it generally more visible to views from the west.

The proposed pipeline and associated electricity supply line, which terminates in the Swakop River will be visible by tourists and farmers visiting the war sites in the vicinity. This would not be a frequent occurrence but nevertheless the physical presence of the pipe and electricity lines will impact on the ‘wilderness/cultural’ experience that the tourists seeks out in these areas.

Using the criteria in Table 3, visibility for the project during the construction and operational phases is predicted to be moderate to high, which will be reduced to low at closure because the structures will be removed and the mined out areas and tailings dams would have been rehabilitated. The tailings dam and some waste rock dumps would be the only remaining features.

<table>
<thead>
<tr>
<th>Table 2: Visibility</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>High</strong></td>
</tr>
<tr>
<td>If the extension to the mine and its infrastructure is visible from over half the zone of potential influence, and/or views are mostly unobstructed from sensitive viewing areas – for the water pipeline and electricity supply line.</td>
</tr>
</tbody>
</table>

7.2 Visual Exposure

Visual exposure is divided into four ratings, each with their respective qualification. Refer to table 4 below.

The extension to the mine is highly visible as discussed above. Exposure from views at Bloedkoppie and local tourist roads would be high as the mining activities (pits) would appear in the foreground to middle distance – this is however an accumulative impact as the open pit mining areas are part of the existing mine plan.
Table 3: Visual Exposure Ratings

<table>
<thead>
<tr>
<th>Exposure</th>
<th>High Exposure (significant contribution to visual impact)</th>
<th>Moderate Exposure (moderate contribution to visual impact)</th>
<th>Low Exposure (minimal influence on visual impact)</th>
<th>Insignificant Exposure (negligible influence on visual impact)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance</td>
<td>0 - 2.0 km</td>
<td>2.0 - 5.0 km</td>
<td>5.0 - 10.0 km</td>
<td>Over 10.0 km</td>
</tr>
</tbody>
</table>

Exposure will reduce to low after closure when these activities have been rehabilitated.

7.3 Visual Intrusion

Critical viewpoints (views 10a, 10b and 12 in Figures 23, 25 and 25) are representative of views from within the sensitive viewing area and would experienced by most people visiting this section of the study area. These views along with viewpoint 1, which is within the ML, were used for the photographic simulations in Figures 21 to 25. Figures 19 and 20 indicate a basic computer model for each option overlaid onto an aerial image as well as the location of the views used in the simulations. Because the Crusher, Mine Workshop and Heap Leach Pad will not have a major effect of views for the defined sensitive areas (they are approximately 8.0km away – and as can be seen in view 10a, at this distance the existing plant and tailings facility are mostly ‘absorbed’ into the landscape and do not impose negatively on the landscape they have not been modeled into the simulations.

The before and after scenarios simulated in Figures 21 (Option A) and 22 (Option B) illustrate the TSF and mined areas superimposed on the existing landscape. This view is however not a public view and therefore was not considered in the final analysis when determining the significance of visual impact imposed by the proposed project. They merely simulate the visual intrusion of the development on the landscape.

The simulations in Figures 23 and 24 are indicative of views experienced from on top of Bloedkoppie – a popular tourist viewing point. From this vantage point the existing mining operation is visible in the background and the expansion of the existing mining activities to the east would be visible in the middle distance when looking both the west (towards the existing mine) and to the east (towards the wilderness area). The expansion activities proposed to the west of the existing mine would be partially visible but at a distance of over 8.0km and therefore not intrusive.

View 12 Figure 25 indicates the mining activity at the far eastern side of the ML. This is indicative of foreground views should the public have access to near the edge of the ML. This would only be the case from the National Park access road which runs to the immediate south of the ML and east of Bloedkoppie.

Using the criteria in Table 2 below it is predicted that the proposed expansion project will have a moderate impact on visual intrusion and therefore contribute to the severity of impact and the cumulative impact on the visual environment.
Table 4: Visual Intrusion

<table>
<thead>
<tr>
<th>High</th>
<th>Moderate</th>
<th>Low</th>
<th>Positive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mostly at the water</td>
<td>For the expansion activities at near the existing facilities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>extraction site</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Because the proposed development:
- **Has a substantial negative effect on the visual quality of the landscape;**
- **Contrasts dramatically with the patterns or elements that define the structure of the landscape;**
- **Contrasts with land use, settlement or enclosure patterns;**
- **Cannot be ‘absorbed’ into the landscape from key viewing areas**

**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.

Because the proposed development:
- **Has a moderate negative effect on the visual quality of the landscape;**
- **Contrasts with the patterns or elements that define the structure of the landscape;**
- **Is partially compatible with land use (current mining activities) patterns of the general area.**
- **Is partially ‘absorbed’ into the landscape from key viewing areas**

**Result**
Moderate change in landscape characteristics over localized area, resulting in a moderate change to key

Because the proposed development:
- **Contrasts minimally with the patterns or elements that define the structure of the landscape;**
- **is mostly compatible with land use, (utility) patterns.**
- **is ‘absorbed’ into the landscape from key viewing areas**

**Result**
Moderate change in landscape characteristics over localized area resulting in a minor change to a few key views.

The proposed development:
- **Has a beneficial effect on the visual quality of the landscape;**
- **Enhances the patterns or elements that define the structure of the landscape;**
- **Is compatible with land use, settlement or enclosure patterns.**

**Result**
Positive change in key views.

Intrusion will reduce dramatically after decommissioning and at closure as the structures are removed. The remaining tailings dam and rock dumps will however need to be ‘vegetated’ with indigenous grasses and shaped to avoid sharp ‘engineered’ angles.

The cumulative impact of the mine (both visually and on sense of place) will however be **high** for the open pit operations as they move to the east and nearer the Bloedkoppie camping site and access roads to the eastern sections of the Namib Naukluft National Park.

7.4 Sensitivity

When visual intrusion, visibility and visual exposure are taken together, and then qualified with landscape (landscape receptors) and visual (visual receptors) sensitivity, the impact of the extension to the mine on the visual resource can be determined. A description of these criteria is given in Table 5 below with the criteria applicable to the HLU project.
highlighted.

Table 5: Sensitivity of Receptors

<table>
<thead>
<tr>
<th>High</th>
<th>Moderate</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>For water extraction site</strong></td>
<td><strong>For activities at the existing mine site</strong></td>
<td><strong>Landscape Receptors</strong></td>
</tr>
<tr>
<td>Landscape Receptors</td>
<td>Landscape Receptors</td>
<td>For example, a relatively unimportant landscape, the nature of which is potentially tolerant of substantial change (able to ‘absorb’ the project)</td>
</tr>
<tr>
<td>For example, important components or landscape of particularly distinctive character susceptible to relatively small changes or the landscape is unable to ‘absorb’ any aspect of the project</td>
<td>For example a landscape of moderately valued characteristics reasonably tolerant of change or the landscape is able to partially absorb the project.</td>
<td></td>
</tr>
<tr>
<td><strong>Visual Receptors</strong></td>
<td><strong>Visual Receptors</strong></td>
<td><strong>Visual Receptors</strong></td>
</tr>
<tr>
<td>For example viewed from residential properties, public rights of way, tourist attractions and or the majority of the I&amp;AP’s are opposed to the proposed extension to the mine</td>
<td>For example sporting and recreational facilities and/or there is a split between I&amp;AP’s who either support or oppose the proposed extension to the mine.</td>
<td>For example, industry or mining and/or most I&amp;AP’s are supportive of the proposed extension to the mine.</td>
</tr>
</tbody>
</table>

The sensitivity is high for both landscape receptors and for visual receptors.

7.5 The Effect of Lighting on Visual Impact

The darkness or rather lack of man-made light sources in the study area, contribute significantly to the wilderness character of the area and its strong sense of place. Lighting for the proposed new structures, security lighting, parking areas and along internal access roads will result in a general glow above the development and ‘spot lights’ of brightness in the dark sky – both static and animated by vehicles. The impact will be especially noticeable when viewed from sensitive viewing areas as the bright lights would be viewed against an extremely dark landscape devoid of other major light sources, other than from the existing mining operations. The impact of trucks along the C28 will also have an effect on this ‘wilderness’ experience at night. Therefore the effect of lighting will have a major cumulative impact the night sky.

7.6 Severity of Visual Impact

Table 6 summarizes the results of the criteria in Tables 3, 4 and 5 is used to ultimately determine visual impact. These ratings are based on the worst-case scenario (in this instance the impact of the power lines and water pipe in the Swakop River) when the impact of all project components is consolidated. I.e. if one component is predicted to have a high impact and another a low impact the value given for the general impact of the project is predicted to be high.
### Table 6: Severity of Visual Impact

<table>
<thead>
<tr>
<th>Phase</th>
<th>Visual Quality of the Study Area</th>
<th>Visual Intrusion</th>
<th>Visibility</th>
<th>Visual Exposure</th>
<th>Sensitivity</th>
<th>Sev. of Visual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prior to start-up</td>
<td>Moderate to high</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Construction Phase (start up)</td>
<td>High</td>
<td>Moderate to High</td>
<td>High</td>
<td></td>
<td>Landscape Receptors</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Visual Receptors</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>High</td>
<td></td>
</tr>
<tr>
<td>Operational Phase</td>
<td>High</td>
<td>Moderate to High</td>
<td>High</td>
<td></td>
<td>Landscape Receptors</td>
<td>High</td>
</tr>
<tr>
<td>(Assuming mitigation is successful)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Visual Receptors</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>High</td>
<td></td>
</tr>
<tr>
<td>Decommissioning Phase</td>
<td>Moderate</td>
<td>Moderate to High</td>
<td>High</td>
<td></td>
<td>Landscape Receptors</td>
<td>High</td>
</tr>
<tr>
<td>Closure Phase (Assuming mitigation is successful)</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td></td>
<td>Visual Receptors</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>High</td>
<td></td>
</tr>
</tbody>
</table>

The negative visual impact during the start-up and operational periods is predicted to be **high** (substantial deterioration in quality resulting in a high negative impact and contribution to the cumulative impact of the mine on the visual environment) for the following reasons:

- Project components are highly visible key tourist viewing areas (Swakop River and environs);
- The project’s exposure to views from these areas there will result in a high degree of visual intrusion;
- The physical features of the mine will contribute to the cumulative effect that the mining industry has on the sense of place of the area. The most significant impact being on the nearby tourist attractions of Bloedkoppie and associated wilderness areas caused by the expansion of open the pit mining activities of the existing mine to east;
- The impact at night will have a major contribution to the cumulative effect of light ‘pollution’ already evident in the study area.
8.0 MITIGATING MEASURES

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

- Mitigation measures should be designed to suite 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 extent, relative scale and physical presence of the proposed extensions to the mine, make mitigating measures difficult to achieve. However, the following general actions must be considered.

**Site Establishment**

- The absolute minimum amount of vegetation and topsoil should be removed from the development areas. Ensure that all existing natural vegetation is retained wherever possible and incorporated into the site design.

**Structures**

- Paint buildings and structures with colours that reflect and complement the natural colour of the surrounding Namib-Naukluft landscape. Avoid pure whites and pure blacks.
- To reduce the potential of glare, external surfaces of buildings and structures should be articulated or textured to create interplay of light and shade. Avoid shiny or bare metal.
- Roofs of tall structures to be painted a ‘dirty’ grey or light blue.

**Tailings Dam and Waste Rock Dumps**

- Final shaping and dumping should be implemented such that the sides of the dumps are articulated in a fashion that create areas of light and shadow interplay. Option C tailings facility is the preferred option from a visual perspective as it is the most contained.
- Harsh, steep engineered slopes should be avoided if at all possible as these could impose an additional impact on the landscape by contrasting with existing topographic forms. The tailings dam and rock dumps are the only features that will remain after decommissioning and it is important that a long-term view of their integration with the surrounding landscape be taken.
- Grass seeding and ‘rock dumping’ should be undertaken.
Access Roads
- Internal dirt roads will require an effective dust suppression management programme such as regular use of non-polluting chemicals that will retain moisture in the road surface. This is especially relevant during the construction phase.

Lighting
The negative impact night lighting, glare and spotlight effects, can be mitigated using a variety of methods:
- Install light fixtures that provide precisely directed illumination to reduce light “spillage” beyond the immediate surrounds of the of the concentrator plant, refrigeration plant, the incline and vent shafts but which still illuminate the buildings/roads.
- Avoid high pole top flood and security lighting in these areas.

Management
- Good house keeping is essential. The operation should be keep clear of litter and the ‘unruly’ storage of materials at all times.

Water pipe line, boreholes and electricity supply lines
- The water pipe, borehole infra-structure and power supply line should be routed underground in the Swakop River valley in the vicinity of tourist activities associated with the historic and culturally valuable German war sites. A detailed inspection of the tourist routes in this area should guide the extent to which these activities should be routed below ground. The intent however, is to avoid visual conflict with the tourist ‘routes’ in the area.

Perceptions and liaison with National Park Authorities
The Bloedkoppie and surrounding wilderness areas along with the war site areas to the north of the existing mine, will be most affected by the project. There is no avoiding the impact that the mine will have on tourist views from Bloedkoppie and the impact the mine will have on the sense of place of the wilderness areas to the east of the mine – this however is a cumulative impact caused by the open pit mining areas proposed to the north and north east of Bloedkoppie. Perhaps the vantage points at Bloedkoppie could be used to house an ‘information’ pavilion that would explain the mining operation to the public. These would bring people to vantage points that would afford views of the activities. In some instances mined out mines/mining activities have become tourist attractions (mostly because of the vast scale of the operation and peoples’ general curiosity) if the area is kept clean and well maintained.

Currently access to the Namib Naukluft National Park wilderness areas east of the mine is via a dirt road immediately south of the eastern sections of the mining lease area and would afford close up views of the open pit mining activities. This
It is suggested that the build a new access road that would route the visitor further south and east of the mine and therefore travelling along the road would not impact significantly on the wilderness experience of the visitor as s/he enters the area.

9.0 SIGNIFICANCE OF VISUAL IMPACT

The severity of impact, rated in Table 6, is further qualified with extent, duration and probability criteria to determine the significance of the visual impact. The method and formula used in these tables are summarized in Appendix C.

A range of visual resource impacts across the study area would result from the construction, operation, decommissioning and closure of the proposed HLU expansion project. Specifically, impacts would result from the project activities being seen from sensitive viewpoints immediately adjacent the site and from effects to the scenic and sense of place values of the landscape. The significance of visual impact is predicted using the worst-case operational scenario, first without mitigation measures and second with mitigation measures as proposed in Section 8.0.
Table 7: Significance of Visual Impact

<table>
<thead>
<tr>
<th>Environmental Impacts</th>
<th>Scale</th>
<th>Severity</th>
<th>Duration</th>
<th>Degree of Certainty</th>
<th>Significance without Mitigation</th>
<th>Mitigation Measures</th>
<th>Mitigation Potential</th>
<th>Significance with Mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction Phase</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- The minimum amount of existing vegetation and topsoil should be removed from construction areas. Ensure, wherever possible, all existing natural vegetation is retained and incorporated into the site design. Eradication of vegetation should be done in ‘natural manner’, avoiding harsh straight lines.</td>
<td>Reasonable</td>
<td>High Negative</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- Dust suppression techniques should be in place at all times during the construction and operational phases.</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- Install light fixtures that provide precisely directed illumination to reduce light “spillage” beyond the immediate surrounds of the of the concentrator plant, refrigeration plant, the incline and vent shafts but which still illuminate the buildings/roads.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- Avoid high pole top flood and security lighting in these areas.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- Route the water pipe, borehole infrastructure and power supply lines underground in the vicinity of the Swakop River Valley</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Local (Moderate)</td>
<td>High</td>
<td>Short Term (Low)</td>
<td>Definite (High)</td>
<td>High Negative</td>
<td>- Final shaping and dumping should be implemented such that the sides of the dumps are articulated in a fashion that create areas of light and shadow interplay. Option C is the preferred option from a visual perspective as it is the most contained.</td>
<td>Reasonable</td>
<td>Moderate Negative</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- Harsh, steep engineered slopes should be avoided if at all possible as these could impose an additional impact on the landscape by contrasting with existing topographic forms. The tailings dam and waste rock dumps are the only features that will remain after decommissioning and it is important that a long-term view of its integration with the surrounding landscape be taken.</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- Grass seeding and ‘rock dumping’ of the final dams should be undertaken.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- The proposed mine is located in a landscape of high value not tolerant of change;
- The construction activities are visible from less than half the zone of potential influence,
- Views from Bloedkoppie and the wilderness areas north and east of the ML are the most sensitive. Some mine activities will be visible from these areas – especially the areas north of the mine.
- Construction activities will be visible from these areas – especially the areas north of the mine.
- Construction activities (start up) will cause a major change in landscape characteristics over localized area resulting in major changes in key views in the short term and have a high negative effect on the visual quality of the area.
- Construction activities will add to the cumulative negative effect on the visual quality of the landscape caused by the existing mine.

- The proposed mine is located in a landscape of high value not tolerant of change;
- The operation activities are visible from less than half the zone of potential influence.
- Views from Bloedkoppie and the wilderness areas north and east of the ML are the most sensitive. Some mine activities will be clearly visible from these areas – especially the areas north of the mine.
- Operation activities will cause a major change in landscape characteristics over localized area resulting in major changes in key views in the short term and have a high negative effect on the visual quality of the area.
- Operation activities will add to the cumulative negative effect on the visual quality of the landscape caused by the existing mine.
### Environmental Impacts

<table>
<thead>
<tr>
<th>Decommissioning Phase</th>
<th>Scale</th>
<th>Severity</th>
<th>Duration</th>
<th>Degree of Certainty</th>
<th>Significance without Mitigation</th>
<th>Mitigation Measures</th>
<th>Mitigation Potential</th>
<th>Significance with Mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Local (Moderate)</td>
<td>High</td>
<td>Short Term (Low)</td>
<td>Definite (High)</td>
<td>High Negative</td>
<td>Dust suppression techniques should be in place at all times during the construction and operational phases.</td>
<td>Reasonable</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Remove the water pipe, borehole infrastructure and power supply lines and rehabilitate the landscape</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Shape tailings dam and waste rock dumps.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Remove all infrastructure and rehabilitate all disturbed areas including roads.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Closure</th>
<th>Scale</th>
<th>Severity</th>
<th>Duration</th>
<th>Degree of Certainty</th>
<th>Significance without Mitigation</th>
<th>Mitigation Measures</th>
<th>Mitigation Potential</th>
<th>Significance with Mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Local (Moderate)</td>
<td>Low</td>
<td>Permanent</td>
<td>Reasonable</td>
<td>Moderate Negative</td>
<td>Ongoing management of rehabilitated areas until established.</td>
<td>Reasonable</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Ensure that the top platform of the tailings dam is covered with rock and seeded with indigenous grass species.</td>
<td></td>
</tr>
</tbody>
</table>
10.0 CONCLUSION AND RECOMMENDATIONS

It is concluded that the LHU Expansion Project will exert a moderate to high negative influence on the visual environment. The high impact, however, pertains only to the water extraction works in the Swakop River Valley. With mitigation this impact can be reduced to low. The impact for the remainder of the expansion project is predicted to be moderate due primarily to its distance from sensitive viewing areas and the fact that views of the expansion project activities will be in the middle-distance to background. During the construction phase the significance of the impact is predicted to be high even with mitigating measures in place. The cause of this is the extra ‘animation’ of activities, which will bring attention to them.

The cumulative impact is predicted to be high negative. The major contributing factor being the impact of the activities associated with the open pit mining areas when they occur to the north and north east of Bloedkoppie.

At decommissioning, and assuming management procedures are successful, the impact is predicted to be high negative as would be the case for the construction phase. Structures and infrastructure will be dismantled and removed from the area. The tailings dam and some waste rock dumps will however remain.

With effective implementation, mitigation measures and attempts to reverse negative opinion of the mine could reduce the impact of the mining activities and the predicted impact would be moderate.

At closure and assuming all mitigation measures are successful, the impact will reduce dramatically to low.

The tourist activities associated with the historic war sites near the Swakop River and the Bloedkoppie and surrounding wilderness areas will be most affected by the expansion project. There is also no avoiding the impact that the mine will have on tourist views from Bloedkoppie and the impact the mine will have on the sense of place of the wilderness areas to the north and east of the mine. Perhaps the vantage points at Bloedkoppie could be used to house an ‘information’ pavilion that would explain the mining operation to the public and bring people up to vantage points that would afford views of the activities – and perhaps changes some perceptions.

Option C is the preferred option as it is the most ‘compact’ of the solutions as it would the smallest ‘footprint’ and have the least impact on the visual environment.

***NLA***
Appendix A:
DETERMINING A LANDSCAPE AND THE VALUE OF THE VISUAL RESOURCE

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

1.0 Landscape 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.

2.0 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.

3.0 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.

4.0 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).

4.1 Scenic Quality - Explanation of Rating Criteria:
(modified from 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 dune formations (Namibia), 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:** *(can also be heritage sites)* 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.

### 4.2 Scenic Quality Inventory and Rating Chart
(Modified from The Visual Resource Management System, Department of the Interior of the USA Government, Bureau of Land Management)

<table>
<thead>
<tr>
<th>Key factors</th>
<th>Rating Criteria and Score</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Landform</strong></td>
<td>High vertical relief as expressed in prominent cliffs, or massive rock outcrops, or severe surface variation or highly eroded formations including dune systems; or detail features dominant and exceptionally striking and intriguing such as inselbergs. 5</td>
</tr>
<tr>
<td><strong>Vegetation</strong></td>
<td>A variety of vegetative types as expressed in interesting forms, textures, and patterns. 5</td>
</tr>
<tr>
<td><strong>Water</strong></td>
<td>Clear and clean appearing, still, or cascading white water, any of which are a dominant factor in the landscape. 5</td>
</tr>
<tr>
<td><strong>Colour</strong></td>
<td>Rich colour combinations, variety or vivid colour; or pleasing contrasts in the</td>
</tr>
</tbody>
</table>
4.3 Visual Resource Management (VRM)
(modified from The Visual Resource Management System, Department of the Interior of the USA Government, Bureau of Land Management)

The Visual Resource Management (VRM) system provides a way to identify and evaluate scenic values to determine the appropriate levels of management. It also provides a way to analyze potential visual impacts and apply visual design techniques to ensure that surface-disturbing activities are in harmony with their surroundings. Visual values are considered throughout the process, and the area’s visual resources can then assigned to management classes with established objectives for managing:

1. **Class I Objective.** The objective of this class is to preserve the existing character of the landscape. This class provides for natural ecological changes; however, it does not preclude very limited management activity. The level of change to the characteristic landscape should be very low and must not attract attention.

2. **Class II Objective.** The objective of this class is to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, colour, and texture found in the predominant natural features of the characteristic landscape.

3. **Class III Objective.** The objective of this class is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.

4. **Class IV Objectives.** The objective of this class is to provide for management activities which require major modifications of the existing character of the landscape. The level of...
change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic elements.

4.4 Rating Scenic Quality (based on experience of author - subjective)

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

<table>
<thead>
<tr>
<th>High</th>
<th>Moderate</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Areas that exhibit a very positive character with valued features that combine to give the experience of unity, richness and harmony. These are landscapes that may be considered to be of particular importance to conserve and which may be sensitive change in general and which may be detrimental if change is inappropriately dealt with.</td>
<td>Areas that exhibit positive character but which may have evidence of alteration to /degradation/erosion of features resulting in areas of more mixed character. Potentially sensitive to change in general; again change may be detrimental if inappropriately dealt with but it may not require special or particular attention to detail.</td>
<td>Areas generally negative in character with few, if any, valued features. Scope for positive enhancement frequently occurs.</td>
</tr>
</tbody>
</table>
Appendix B:
METHOD FOR DETERMINING THE MAGNITUDE OF LANDSCAPE AND VISUAL IMPACT

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

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

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**

<table>
<thead>
<tr>
<th>High</th>
<th>Moderate</th>
<th>Low</th>
<th>Positive</th>
</tr>
</thead>
</table>
| 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. |

<table>
<thead>
<tr>
<th>Result</th>
<th>Result</th>
<th>Result</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Notable change in landscape characteristics over an extensive area and/or intensive change over a localized area resulting in major changes in key views.</td>
<td>Moderate change in landscape characteristics over localized area resulting in a moderate change to key views.</td>
<td>Imperceptible change resulting in a minor change to key views.</td>
<td>Positive change in key views.</td>
</tr>
</tbody>
</table>

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 10 m contour intervals to create the Digital Terrain Model (DTM). The DTM includes features such as vegetation, rivers, roads and nearby urban areas. These features were ‘draped’ over the topographic data to complete the model used to generate the viewshed analysis. 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:

<table>
<thead>
<tr>
<th>Visual Receptors</th>
<th>Visual Receptors</th>
<th>Visual Receptors</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>Moderate</td>
<td>Low</td>
</tr>
<tr>
<td>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.</td>
<td>If the development is visible from less that half the zone of potential influence, and/or views are partially obstructed and or many viewers are affected.</td>
<td>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.</td>
</tr>
</tbody>
</table>

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 – 5.0 km) which, in turn is greater than the impact of the object in the background (greater than 5.0 km) 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 1000 m would be 25% of the impact as viewed from 500 m. At 2000 m it would be 10% of the impact at 500 m. The inverse relationship of distance and visual impact is well recognised in visual analysis literature (e.g.: Hull and Bishop (1988)) and is used as an important criteria for the study. This principle is illustrated in the figure below.

Effect of Distance on Visual Exposure

Sensitivity of Visual Receptors
When visual intrusion, visibility and visual exposure are incorporated, and qualified by sensitivity criteria (visual receptors) the 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 is 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.

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 travelling through or past the affected landscape in cars, on trains or other transport routes;
• People at their place of work.

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

<table>
<thead>
<tr>
<th>High</th>
<th>Moderate</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Users of all outdoor recreational facilities including public rights of way (tourist routes), whose intention or interest may be focused on the landscape;</td>
<td>People engaged in outdoor sport or recreation (other than appreciation of the landscape, as in landscapes of acknowledged importance or value);</td>
<td>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).</td>
</tr>
<tr>
<td>Communities where the development results in changes in the landscape setting or valued views enjoyed by the community;</td>
<td>People travelling through or past the affected landscape in cars, on trains or other transport routes;</td>
<td>Roads going through urban and industrial areas</td>
</tr>
<tr>
<td>Occupiers of residential properties with views affected by the development.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Magnitude 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 judgement. (Institute of Environmental Assessment and The landscape Institute (1996)).

### Magnitude of Visual Impact

<table>
<thead>
<tr>
<th>High</th>
<th>Moderate</th>
<th>Low</th>
<th>Negligible</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total loss of or major alteration to key elements/features/characteristics of the baseline.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Partial loss of or alteration to key elements/features/characteristics of the baseline.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minor loss of or alteration to key elements/features/characteristics of the baseline.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very minor loss or alteration to key elements/features/characteristics of the baseline.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

I.e. Pre-development landscape or view and/or introduction of elements considered to be totally uncharacteristic when set within the attributes of the receiving landscape.

I.e. Pre-development landscape or view and/or introduction of elements that may be prominent but may not necessarily be considered to be substantially uncharacteristic when set within the attributes of the receiving landscape.

I.e. Pre-development landscape or view and/or introduction of elements that may not be uncharacteristic when set within the attributes of the receiving landscape.

Very minor loss or alteration to key elements/features/characteristics of the baseline.

High scenic quality impacts would result.

Moderate scenic quality impacts would result.

Low scenic quality impacts would result.

Negligible scenic quality impacts would result.

### Cumulative Effects

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

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

The potential significance of every environmental impact identified is determined by using a ranking scale, based on the following:

CRITERIA FOR ASSESSING IMPACTS

<table>
<thead>
<tr>
<th>PART A: DEFINITION AND CRITERIA*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition of SIGNIFICANCE</td>
</tr>
<tr>
<td>Definition of CONSEQUENCE</td>
</tr>
<tr>
<td>Criteria for ranking the SEVERITY of environmental impacts</td>
</tr>
<tr>
<td>H</td>
</tr>
<tr>
<td>M</td>
</tr>
<tr>
<td>L</td>
</tr>
<tr>
<td>L+</td>
</tr>
<tr>
<td>M+</td>
</tr>
<tr>
<td>H+</td>
</tr>
<tr>
<td>Criteria for ranking the DURATION of impacts</td>
</tr>
<tr>
<td>L</td>
</tr>
<tr>
<td>M</td>
</tr>
<tr>
<td>H</td>
</tr>
<tr>
<td>Criteria for ranking the SPATIAL SCALE of impacts</td>
</tr>
<tr>
<td>L</td>
</tr>
<tr>
<td>M</td>
</tr>
<tr>
<td>H</td>
</tr>
</tbody>
</table>

PART B: DETERMINING CONSEQUENCE

<table>
<thead>
<tr>
<th>SEVERITY = L</th>
</tr>
</thead>
<tbody>
<tr>
<td>DURATION</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>SEVERITY = M</td>
</tr>
<tr>
<td>DURATION</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>SEVERITY = H</td>
</tr>
<tr>
<td>DURATION</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

| L | Localised Within site boundary Site |
| M | Fairly widespread Beyond site boundary Local |
| H | Widespread Far beyond site boundary Regional/ national |

PART C: DETERMINING SIGNIFICANCE

<table>
<thead>
<tr>
<th>SPATIAL SCALE</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROBABILITY</td>
</tr>
<tr>
<td>Possible/ frequent impacts</td>
</tr>
<tr>
<td>---------------------------</td>
</tr>
<tr>
<td>Likely/ frequent</td>
</tr>
<tr>
<td>Unlikely/ seldom</td>
</tr>
</tbody>
</table>

**CONSEQUENCE**

**PART D: INTERPRETATION OF SIGNIFICANCE**

<table>
<thead>
<tr>
<th>Significance</th>
<th>Decision guideline</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>It would influence the decision regardless of any possible mitigation.</td>
</tr>
<tr>
<td>Medium</td>
<td>It should have an influence on the decision unless it is mitigated.</td>
</tr>
<tr>
<td>Low</td>
<td>It will not have an influence on the decision.</td>
</tr>
</tbody>
</table>

*H = high, M = medium and L = low and + denotes a positive impact.*
Appendix D:
CRITERIA FOR PHOTO/COMPUTER SIMULATION

To characterize the nature and magnitude of visual intrusion of the proposed project, a photographic simulation technique was used. This method was used because according to Sheppard (in Lange 1994) a visual simulation is good 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 (Zube et. al.; Van Dortmont in Lange 1994), which shows the proposed development from a typical static observation points (Critical View Points).

A panoramic photograph was taken of the landscape using a single lens reflex camera scanned into digital format. The resulting image when viewed from 500 mm (the distance from your eyes to a book) approximates the size of image the naked eye would see in reality. The angle of the panoramic view simulates the eyes field of peripheral vision. A photograph of a physical model of the proposed development, taken from the same perspective as the landscape photograph, was then superimposed onto the original image using Adobe Photoshop software to simulate the visual effect of the proposed development.
Appendix E:
VIEWSHED ANALYSIS

A Digital Terrain Model (DTM) was created by capturing topographic and land use data in digital format. Using the DTM, the programme performs a viewshed analysis on the lattice surface (a fine grid of cells extending over the entire study area). Each cell has stored information relating to x, y (plan) and z (height) co-ordinates. It computes a line of sight analysis across the current lattice from a selected vantage point in a 360 degree arc to define the area from which a vantage point may be seen.
Appendix F:

CURRICULUM VITAE OF AUTHOR

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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 specializes in Visual Impact Assessments and has won an Institute of Landscape Architects Merit Award for his VIA work.

EXPERIENCE:

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.
AWARDS:

Institute of Landscape Architects Merit Awards:
Moroka Park Precinct, Soweto: Merit Award for Design (2005) and Gold Medal United Nations Liveable Communities (LivCom) Award (2007)
Isivivane, Freedom Park: Presidential Award of Excellence Design (2005)
Information Kiosk, Freedom Park: Merit Award for Design (2005)
Moroka – Mofola Open Space Framework, Soweto: Merit Award for Planning (2005)
Specialist Impact Report: Visual Environment, Sibaya Resort and Entertainment World: Merit Award for Environmental Planning (1999);
Gillooly’s Farm, Bedfordview (with Dayson and DeVilliers): Merit Award for Design;

COMPETITIONS:

Landscape Architectural Consultant on Department of Trade and Industries Building (2002) – Finalist
Toyota Fountain (1985): First Prize - commissioned;
Bedfordview Bike/Walkway System - Van Buuren Road (1982): First Prize - commissioned;

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;
Member Planning Professions Board 1987 to 1989;
Member International Association of Impact Assessment;

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.
REFERENCES:


The Bureau Of Land Management (BLM), *The Visual Resource Management System*, Department Of The Interior of the USA Government.


Environmental Scoping/Baseline Report for the Proposed Expansion Project at Langer Heinrich Uranium Mine (April 2009), Metago Environmental Engineers (Pty) Ltd
Figure 1: LOCALITY - Langer Heinrich Uranium Mine
Figure 2: EXISTING INFRASTRUCTURE - Langer Heinrich Uranium Mine
Figure 3: PROPOSED INFRASTRUCTURE - OPTION A  Langer Heinrich Uranium Mine
Figure 4: PROPOSED INFRASTRUCTURE - OPTION B  Langer Heinrich Uranium Mine
Figure 4a: PROPOSED INFRASTRUCTURE - OPTION C  Langer Heinrich Uranium Mine
Figure 6: VIEW POINTS - Langer Heinrich Uranium Mine
View 1: from access road, Langer Heinrich Mountain to the left of view with existing infrastructure just off center to the right in far middle ground

View 2: from inside licence area looking north

Figure 7: LANDSCAPE CHARACTER - Views 1 & 2
Figure 8: LANDSCAPE CHARACTER - View 3a & 3b
View 3c: looking east on the access road towards the plant

View 4a: looking west from within mining area

Figure 9: LANDSCAPE CHARACTER - View 3c & 4a
Proposed Expansion of Langer Heinrich Uranium Mine
Newtown Landscape Architects cc

Visual Impact Assessment Draft
July 2009

Figure 10: LANDSCAPE CHARACTER - View 4b & 5

View 4b: looking east from within mining area

View 5: on road C28 looking northeast, Langer Heinrichberg on the left and bloedkoppie on the right
View 6: on road C28 looking north towards Langer Heinrichberg - existing mine not visible

View 7: on tourist road passing east of Bloedkoppie, Bloedkoppie to left of road and Langer Heinrichberg in background

Figure 11: LANDSCAPE CHARACTER - View 6 & 7
Figure 12: LANDSCAPE CHARACTER - View 8 & 9
Figure 13: LANDSCAPE CHARACTER - View 10a & 10b

View 10a: looking west, view from Bloedkoppie towards existing mining area, Langer Heinrichberg in background

View 10b: from Bloedkoppie looking north east across the mining area
View 11: on a minor road running east-west, northeast of Bloedkoppie, looking east

View 12: Far east end of mining area, Bloedkoppie just off centre to the left

Figure 14: LANDSCAPE CHARACTER - View 11 & 12
Figure 15: LANDSCAPE CHARACTER - View 13
Figure 16: LANDSCAPE CHARACTER - View 14a & 14b
Figure 17: VIEWSHED ANALYSIS: Option A and C - Langer Heinrich Uranium Mine
Figure 18: VIEWSHED ANALYSIS: Option B - Langer Heinrich Uranium Mine
Figure 19: COMPUTER MODEL: Option A - Langer Heinrich Uranium Mine
Figure 20: COMPUTER MODEL: Option B - Langer Heinrich Uranium Mine
Figure 21: SIMULATION - View1 Option A

View 1: from access road, Langer Heinrich Mountain to the left of view with existing infrastructure just off center to the right in far middle ground - BEFORE

View 1: from access road - AFTER
View 1: from access road, Langer Heinrich Mountain to the left of view with existing infrastructure just off center to the right in far middle ground - BEFORE

View 1: from access road, larger TSF to the right and out of the photo - AFTER

Figure 22: SIMULATION - View1 Option B
Figure 23: SIMULATION - View 10a Both Options
Figure 24: SIMULATION - View 10b Both Options

View 10b: View from Bloedkoppe looking north west across mining area BEFORE

View 10b: View from Bloedkoppe looking north west across mining area AFTER
View 12: from within the mining area (far east end) with Bloedkoppie just off centre to the left BEFORE

View 12: from within the mining area (far east end) with Bloedkoppie just off centre to the left BEFORE

Figure 25: SIMULATION - View 12 Both Options