

## G.1 METHODOLOGY OF ASSESSING THE SIGNIFICANCE OF POTENTIAL ENVIRONMENTAL IMPACTS

This section outlines the method used for assessing the significance of the potential environmental impacts. These impacts are for the construction, operational and decommissioning phases of the project.

For each impact, the **EXTENT** (spatial scale), **MAGNITUDE** and **DURATION** (time scale) are described, as shown in **Table 1**. These criteria are then used to determine the **SIGNIFICANCE** of the impact, firstly in the case of no mitigation and then with the most effective mitigation measure(s) in place. The mitigation described in the BAR represents the full range of plausible and pragmatic measures but does not necessarily imply that they would be implemented.

The following tables show the scales used to assess these variables and defines each of the rating categories.

**Table 1: Assessment criteria for the evaluation of impacts**

Criteria	Category	Description
<b>Extent or spatial influence of impact</b>	<b>Regional</b>	Beyond a 30km radius of the candidate site.
	<b>Local</b>	Within a 30km radius of the candidate site.
	<b>Site-specific</b>	On site or within 100 m of the candidate site.
<b>Magnitude of impact (at the indicated spatial scale)</b>	<b>High</b>	Natural and/ or social functions and/ or processes are <i>severely</i> altered
	<b>Medium</b>	Natural and/ or social functions and/ or processes are <i>notably</i> altered
	<b>Low</b>	Natural and/ or social functions and/ or processes are <i>slightly</i> altered
	<b>Very low</b>	Natural and/ or social functions and/ or processes are <i>negligibly</i> altered
	<b>Zero</b>	Natural and/ or social functions and/ or processes remain <i>unaltered</i>
<b>Duration of impact</b>	<b>Long-term</b>	More than 10 years after construction
	<b>Medium-term</b>	Up to 5 years after construction
	<b>Construction-term</b>	Up to 3 years

The **SIGNIFICANCE** of an impact is derived by considering magnitude, duration and extent of each impact. The criteria employed in arriving at the different significance ratings is shown in Table 2.

**Table 2: Definition of significance ratings**

Significance ratings	Level of criteria required
<b>High</b>	<ul style="list-style-type: none"> <li>• High magnitude with a regional extent and long-term duration</li> <li>• High magnitude with either a regional extent and medium-term duration or a local extent and long-term duration</li> <li>• Medium magnitude with a regional extent and long-term duration</li> </ul>
<b>Medium</b>	<ul style="list-style-type: none"> <li>• High magnitude with a local extent and medium-term duration</li> <li>• High magnitude with a regional extent and construction period or a site-specific extent and long-term duration</li> <li>• High magnitude with either a local extent and construction period duration or a site-specific extent and medium-term duration</li> <li>• Medium magnitude with any combination of extent and duration except site specific and construction period or regional and long term</li> <li>• Low magnitude with a regional extent and long-term duration</li> </ul>
<b>Low</b>	<ul style="list-style-type: none"> <li>• High magnitude with a site-specific extent and construction period duration</li> <li>• Medium magnitude with a site-specific extent and construction period duration</li> <li>• Low magnitude with any combination of extent and duration except site specific and construction period or regional and long term</li> <li>• Very low magnitude with a regional extent and long-term duration</li> </ul>
<b>Very low</b>	<ul style="list-style-type: none"> <li>• Low magnitude with a site-specific extent and construction period duration</li> <li>• Very low magnitude with any combination of extent and duration except regional and long term</li> </ul>
<b>Neutral</b>	<ul style="list-style-type: none"> <li>• Zero magnitude with any combination of extent and duration</li> </ul>

Once the significance of an impact has been determined, the **PROBABILITY** and **CONFIDENCE** of this impact are determined using the rating systems outlined in **Table 3** and **Table 4**. The significance of an impact should always be considered in concert with the probability of that impact occurring. Confidence provides an indication of the degree of certainty that can be placed in the impact prediction. Lastly, the **REVERSIBILITY** of the impact is estimated using the rating system outlined in **Table 5**.

**Table 3: Definition of probability ratings**

Probability ratings	Criteria
<b>Definite</b>	Estimated greater than 95 % chance of the impact occurring.
<b>Probable</b>	Estimated 5 to 95 % chance of the impact occurring.
<b>Unlikely</b>	Estimated less than 5 % chance of the impact occurring.

**Table 4: Definition of confidence ratings**

<b>Confidence ratings</b>	<b>Criteria</b>
<b>Certain</b>	Wealth of information on and sound understanding of the environmental factors potentially influencing the impact.
<b>Sure</b>	Reasonable amount of useful information on and relatively sound understanding of the environmental factors potentially influencing the impact.
<b>Unsure</b>	Limited useful information on and understanding of the environmental factors potentially influencing this impact.

**Table 5: Definition of reversibility ratings**

<b>Reversibility ratings</b>	<b>Criteria</b>
<b>Irreversible</b>	The activity will lead to an impact that is in all practical terms permanent.
<b>Reversible</b>	The impact is reversible within 2 years after the cause of the impact is removed.

## **G.2 – CONSTRUCTION AND OPERATIONAL PHASE IMPACTS**

The construction and operation of the 60-sleeper lodge will have various direct and indirect impacts on the environmental and socio-economic aspects of the proposed affected area.

The significance of all identified impacts is assessed in terms of the criteria described above.

### **2.1 Construction Phase Impacts**

The construction phase is likely to result in a number of negative impacts on the biophysical and social environments. The significance of construction phase impacts is likely to be curtailed by their relatively short duration. The construction phase impacts can be mitigated by the implementation of an Environmental Management Programme (see attached as Appendix F).

The bio-physical issues identified include:

- Fauna and flora (destruction of habitat)
- Erosion and storm water control
- Groundwater and surface water impact
- Sanitation and waste management

The socio-economic impacts identified include:

- “Sense of place” – visual impact
- Noise pollution
- Safety
- Employment opportunities (short-term)
- Cost of construction
- Traffic impacts

## 2.1.1 Biodiversity impacts (fauna and flora)

### Description of the potential impact

An Ecological Impact Assessment was conducted for all three alternative sites by Afrika Enviro and Biology. The assessment was based on a desktop investigation of aerial images as well as a single late winter site visit and accompanying desktop assessment. Due to the arid climate with a very dry winter, the vegetation is deciduous, with only a few tree species retaining leaves.

The general landscape of the area is comprised of plains to the north of the Soutpansberg Mountains with prominent rock outcrops (hills) and ridges in areas. Ephemeral drainage lines are present and draining occurs in a northerly direction.

On a national level, the study area is situated within the savannah biome and on a local scale and according to a more detailed system (Musina & Rutherford, 2006) these areas are classified as *Musina Mopane Bushveld* on the plains and *Limpopo Ridge Bushveld* on the scattered ridges and outcrops. Both of these units have a *Least Threatened* conservation status and are poorly protected.

The Limpopo Conservation Plan (LCP) is a systematic conservation plan adopted by the Province (LEDET, 2013). According to this plan, the total study area is defined as Critical Biodiversity Area-2 (CBA-2). The proposed lodge falls within the management objectives for CBA-2 which describes the following land uses to be compatible: “*Current agricultural practices including arable agriculture, intensive and extensive animal production, as well as game and ecotourism operations, as long as they are managed in a way to ensure populations of threatened species are maintained and the ecological processes which support them are not impacted.*”

The following vegetation communities and habitats are represented within the study area and the sensitivities of these plant communities and habitats are described below:

**Table 6: Ecological importance of vegetation communities present within the site**

Community / Habitat	Ecological Importance/Biodiversity Value	Sensitivity Rating
<b>Site Reference</b>	<b>Terrestrial and Riparian Communities</b>	
<b>Mixed woodland and plains</b>	Although this term is wide it best describes the vegetation found on the plains. This community can be classified to lower levels, but this would make it unnecessarily difficult to cross-reference the document. This woodland is well represented across the larger study and provides important habitat to fauna associated with the plains.	<i>Medium</i>
Present: Site 1 Site 2 Site 3		
<b>Androstachys closed woodland and rocky outcrops</b>	This is a unique community restricted to the rock outcrops. The trees are slow growing and very durable. This woodland community and rocky substrate provides micro-habitat to a wide range of fauna (Site 1 and Site 3). The large outcrops will provide macro-habitat to an even wider range of fauna (Site 2).	<i>Very high</i>
Present: Site 1 Site 2		
<b>Riparian woodland and watercourses</b>	This woodland, although poorly developed, provides important hydrological and ecological functions. Fauna associated with thickets will use this as refuge and it serves as an ecological corridor.	<i>High</i>
Present: Site 3		

Pipeline infrastructure (140mm HDPE pipeline) will be constructed to transport water from a borehole located west of the N1 to the proposed lodge on the Lion Farm. The pipeline will be established along existing access roads as far as possible to minimize the impact of vegetation removal.

### Alternative 1:

The site is located on the southern section of the study area and is easily accessible via an existing vehicle track. This alternative is also located nearest to the N1 and therefore water pipeline infrastructure can easily be established along existing access roads to minimize vegetation removal.

Several outcrops are present, surrounding a small valley basin with access via the opening to the north from where access is gained. The development is proposed on the valley floor between the surrounding outcrops and on the plain to the north of the opening.

The vegetation at alternative 1 can be described as mixed woodland, which has a medium sensitive rating, although *Acacia burkei* forms prominent thickets at the foot of the outcrops where runoff water would be plentiful. A single large specimen of the Camel Thorn<sup>1</sup> (*Acacia erioloba*) was found within the project boundary and interestingly, this is the easternmost recording of this species in its distribution range.

The rocky outcrops forms part of the *Androstachys* closed woodland and rocky outcrops plant community and habitat. The sensitivity of this habitat is very high. However, the rocky outcrops will not be affected by the proposed development as no development is proposed on these outcrops.

No Red Data Listed fauna or flora was recorded, however several protected species of trees are present within the development area and will require permission from DAFF before the relocation or removal thereof. The rocky outcrops will provide micro-habitat for several species of specialist fauna and it can be expected that especially reptiles and small mammals will find their niche underneath loose rocks and, in the cracks, and fissures present.

### Alternative 2:

This site is situated on the crest of the highest rocky outcrop located further to the east of alternative 1 and has an exceptional view from the crest in all directions. This outcrop has a relatively high elevation with steep wooded slopes which would constrain construction. Construction will lead to major cutting into the slope to construct an access road and major earthmoving (including cut-and-fill) on the crest to create a development platform.

Access by motorized vehicle to the crest is not possible and is difficult on foot as the slope becomes very steep with vertical cliffs on the southern side. Therefore, constructing the water pipeline along existing access roads is not possible, as additional access routes will have to be constructed, adding to vegetation removal during the construction phase.

The site is located in the middle and on the highest outcrop, which has *Androstachys* rocky woodland. Road construction and site clearing will lead to a significant loss of indigenous vegetation and fauna, as well as loss and fragmentation of habitat.

The northern slope is dominated by *Acacia burkei* (shrubs and trees) and other species present are *Acacia nigrescens*, *Lannea discolor*, *Sclerocarya birrea*<sup>2</sup>, *Combretum apiculatum*, *Boscia albitrunca*<sup>3</sup> and *Commiphora africana*. The higher slope and crest consists of sandstone in various stages of erosion. The formation is irregular, and the vegetation is dominated by *Androstachys johnsonii*, which forms almost homogenous closed woodland.

No Red Data Listed fauna or flora was recorded, however several protected species of trees are present within the development area. The rocky outcrop and sandstone features will provide micro-habitat for specialist fauna as well and it can be expected that especially reptiles and small mammals will find their niches underneath loose rocks and in the cracks and fissures present.

### Alternative 3:

This site is situated on the central northern plain of the study area (Figure 2.3) to the north of alternatives 1 and 2. Accessibility is via an existing vehicle track. However, the proposed site is located relatively far away

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<sup>1</sup> A protected species in terms of the National Forests Act, 1999 (Act No. 84 of 1999) and Government Notice No. R 908 of 2014.

<sup>2</sup> A protected species in terms of the legislation mentioned in Footnote 1 above.

<sup>3</sup> A protected species in terms of the legislation mentioned in Footnote 1 above.

from existing infrastructure such as electricity and water supply in comparison to Alternatives 1 and 2. The water pipeline could be constructed along existing access roads as far as possible. However, due to the distance to be covered to connect the proposed lodge with potable water, it would require the removal of a larger area of vegetation.

Sandy soil dominates the project area and several species of grass is present, characterized by sweet palatable species e.g. *Panicum coloratum*, *Stipagrostis uniplumis*, *Schmidtia pappophoroides*, *Brachiara deflexa* and *Urochloa mosambicensis*.

Woody vegetation is dominated by *Terminalia prunioides* shrubs and small trees in association with *Colospermum mopane*, *Acacia tortilis*, *Acacia nigrescens*, *Lannea discolor*, *Boscia albitrunca* and *Ximenia americana*. A single small specimen of *Adansonia digitata*<sup>4</sup> was recorded. The vegetation community or habitat represented by site alternative 3 is Riparian Woodland, of which the sensitivity is regarded to be very high.

A shallow drainage basin with a poorly defined drainage line is located in the central section of this site and is a sensitive feature. This can be classified as a first order watercourse although it is ephemeral in nature. The channel is poorly defined, 1-2m across and very shallow (0.3m). The bed and banks have a soil composition and flow is from south to north. Although no riparian vegetation is present, the availability of water is indicated by the lush vegetation and larger sizes of trees present in this area.

## Impact Assessment

### Alternative 1:

The water pipeline to be constructed is proposed along existing access routes. Therefore, vegetation removal is minimised. No Red Data species were found during the site investigation conducted. However, several protected tree species are present within the boundaries of the development area and should be remain protected if possible.

The clearance of vegetation will lead to the loss of indigenous vegetation, loss of fauna that is unable to relocate to a different location and the fragmentation of habitat.

The connectivity with the drainage basin immediately to the south of the site is of importance. However, this is however more important from a hydrological point of view than from an ecological point of view.

The impact associated with the clearance of vegetation, loss of fauna and fragmentation of habitat during the construction phase is of high magnitude. However, vegetation within the development area will be conserved as much as possible and only vegetation directly affected by structures and/or infrastructure, will be removed. Other areas affected during the construction phase will be rehabilitated after construction.

The impact is of high magnitude, site-specific and of short duration. Therefore, it is assessed to be of low significance.

### Alternative 2:

Besides the removal of vegetation for the proposed lodge in the *Androstachys* rocky woodland, access to the site does not exist and additional access roads as well as the construction of the water pipeline to supply water to the proposed lodge, will add to the loss of indigenous vegetation and fauna, as well as the loss and fragmentation of habitat.

No Red Data species were found during the site investigation. However, the loss of parts of this vegetation community is of high magnitude and the fragmentation of habitat that will occur with the construction phase of the project will also have an effect on the ecological functions of the local area. Mitigation of this impact is not possible and therefore the impact is of high significance.

From an ecological perspective, this alternative is not recommended.

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<sup>4</sup> A protected species in terms of the legislation mentioned in Footnote 1 above.

### Alternative 3:

No Red Data species were found within the perimeter of the site. However, several protected tree species were found within the perimeter of the proposed site.

Although the water pipeline would have to be very long to connect the proposed lodge with potable water supply, the pipeline will run along existing access roads, but some vegetation will still be affected.

Site clearance (for the proposed lodge and water pipeline) will lead to loss of indigenous vegetation and fauna as well as loss and fragmentation of habitat and due to the sensitivity of the vegetation communities present. Thus, the impact is considered to be of high magnitude.

Due to the localised extent and short duration of the impact, the impact has been assessed to be of low significance.

**Table 7: Significance of biodiversity impacts**

IMPACT	BEFORE MITIGATION							AFTER MITIGATION
	Magnitude	Extent	Duration	Probability	Confidence	Reversibility	Significance	Significance
Alternative 1	High	Site-specific	Long term	Probable	Sure	Reversible	Medium	Low
Alternative 2	High	Site-specific	Long term	Probable	Sure	Reversible	High	High
Alternative 3	High	Site-specific	Long term	Probable	Sure	Reversible	Medium	Low
No-go Alternative	N/A	N/A	N/A	N/A	N/A	N/A	Neutral	Neutral

The site assessment disqualifies Site 2 as viable alternative at this stage due to the significance of impacts related to its ecology and biology. It is recommended that either alternative Site 1 or Site 3 be considered for this project as the potential impacts can be efficiently mitigated to an acceptable level and the extent will be localized to the site footprints.

### **Mitigation Measures**

- The connectivity with the drainage basin immediately to the south of the site alternative 1 must be designed and managed in such a manner to ensure ecological connectivity that surface water runoff from the development site may not be impeded or diverted from its natural flow patterns towards the basin.
- At Site 1, limit the development footprint to the mixed woodland on the valley floor;
- Conserve the *Androstachys* rocky woodland and rocky outcrops at Site 1 by way of a buffer zone;
- Conserve as much as possible of the natural vegetation within the development footprint;
- The potential presence of important herbaceous plants must be investigated by a specialist (during their growth period) before construction and if present these must be managed or relocated per the specialist's recommendation;
- Employ an alien invasive management plan to ensure that invasive vegetation does not establish on site or the surrounding area; and
- Use only locally available indigenous flora for landscaping purposes.

### **2.1.2 Impact on increased soil erosion and storm water**

#### **Description of the potential impact**

##### Alternative 1:

The topography of the area suggests that storm water would run from the eastern, southern and western boundaries of the development area, to the centre of the proposed development. Depending on the velocity

of the storm water runoff, the occurrence of erosion is increased when vegetation is cleared, and if storm water is not properly mitigated.

Alternative 2:

With the highest point of this proposed development being in the centre of the development area, the clearance of vegetation would increase the possibility of erosion and storm water would run outwards toward the boundaries of the proposed site.

Alternative 3:

The topography of alternative 3 is relatively flat. However, a shallow drainage basin with a poorly defined drainage line is located in the central section of the site. This can be classified as a first order watercourse, although it is ephemeral in nature. Vegetation clearance would increase erosion and sedimentation of the watercourse as water drains naturally towards the drainage line during heavy rainfall periods. Hardened surfaces surrounding the drainage line will change the natural flow and velocity of water, and subsequently increase erosion during rainy periods.

**Impact Assessment**

Alternative 1:

The clearance of vegetation, disturbance of soil and especially the topography of the proposed site, increases the risk of erosion. Therefore, the significance of this impact has been given a medium rating without the implementation of mitigation measures. The construction of storm water infrastructure is proposed to divert storm water from accumulating within the proposed development area and the construction of erosion protection measures are also proposed at all areas where the possibility of erosion is increased. After mitigation measures, the impact is assessed to be of low significance.

Alternative 2:

As with alternative 1, the clearance of vegetation, disturbance of soil and the topography of the proposed site increases the risk of erosion as storm water would run off from the centre of the development area towards the boundaries (north, east, south and west) of the site. The significance of this impact has therefore been assessed to be medium without the implementation of mitigation measures.

Alternative 3:

Alternative 3 is relatively flat, with the drainage basin located in the central section of the site.. The disturbance of soil and clearance of vegetation increases the risk of erosion and sedimentation of the watercourse and for this reason, the impact has also been assessed to have a medium significance without the implementation of mitigation measures.

**Table 8: Significance of increased soil erosion and storm water**

IMPACT	BEFORE MITIGATION							AFTER MITIGATION
	Magnitude	Extent	Duration	Probability	Confidence	Reversibility	Significance	Significance
Erosion, and Storm water control								
Alternative 1	Medium	Local	Construction	Probable	Sure	Reversible	Medium	Low
Alternative 2	Low	Local	Construction	Probable	Sure	Reversible	Low	Very Low
Alternative 3	Medium	Local	Construction	Probable	Sure	Reversible	Medium	Low
No-go Alternative	N/A	N/A	N/A	N/A	N/A	N/A	Neutral	Neutral



## Mitigation Measures

- The contractor must monitor the site and manage drainage of the construction site to avoid standing water and soil erosion. Sand bags must be used in areas that are prone to erosion;
- Storm water must be controlled and channelled to prevent soil loss from the site;
- The time that stripped areas are exposed without vegetation must be minimised wherever possible; and
- Replacement of topsoil and revegetation must commence immediately after the completion of an activity.

Please refer to the Environmental Management Programme (Appendix F) for all other measures to be implemented to minimise the impact of increased erosion and storm water.

### 2.1.3 Impact on groundwater and surface water

#### Description of the potential impact

##### Alternative 1:

Proposed site alternative 1 is surrounded by several sandstone outcrops, forming a small valley basin on which the development is proposed. This drainage line drains from the south to the north during heavy rainfall periods.

A small waterhole is located approximately 150m south of the boundary of the proposed site while the Mutamba River is located another 1.5km south of the small watering hole. Due to the distance between alternative site 1 and the Mutamba River, the proposed lodge would not have any impact on the Mutamba River. However, the impact of the lodge on the watering hole located 150m south of alternative 1 must be mitigated.

There are no other water resources identified within close proximity to the alternative 1 site.

##### Alternative 2:

The only water resources identified within the boundaries of the site or within close proximity of the alternative 2 site is the Mutamba River, located approximately 700m south of the site. This water resource would not be directly affected by development at this site. .

##### Alternative 3:

A shallow drainage basin with a poorly defined drainage line is located in the central section of the alternative 3 site. The channel is poorly defined, 1-2m across and very shallow (0.3m). The ephemeral watercourse drains in a northerly direction and meets with a channelled valley-bottom wetland as identified within the National Wetlands Map (NFEPA Wetland Map), approximately 2.6km north of the proposed alternative 3 site. Construction activities could therefore have an impact on the drainage line located within the centre of this development.

#### Impact Assessment

##### Alternative 1:

Storm water will drain from these rocky outcrops towards the centre of the development area and then drain in a northerly direction. Construction activities could affected nearby groundwater and surface water resources negatively if mitigation measures are not implemented. The impact is assessed to be of medium significance prior to mitigation measures being implemented.

### Alternative 2:

Due to the location and proximity of the Mutamba River, it is unlikely that the proposed lodge would have any impact on the water resource. The impact is assessed to be of low significance.

### Alternative 3:

Construction activities within the watercourse or within a close proximity to the watercourse could affect the water quality, as sediments and hazardous substances could affect the drainage basin (when and if water flows within the ephemeral watercourse). Due to the distance between the proposed alternative site 3 and the wetland into which the watercourse drains (2.6km north of the site), it is unlikely that any hazardous substances would reach the wetland. However, the watercourse (drainage basin) would be affected, and the impact is assessed to be of medium significance.

**Table 9: Significance of impact on groundwater and surface water**

IMPACT	BEFORE MITIGATION							AFTER MITIGATION
	Magnitude	Extent	Duration	Probability	Confidence	Reversibility	Significance	Significance
Ground and surface water impact								
Alternative 1	Medium	Local	Construction	Probable	Sure	Reversible	Medium	Low
Alternative 2	Low	Local	Construction	Probable	Sure	Reversible	Low	Very Low
Alternative 3	Medium	Local	Construction	Probable	Sure	Reversible	Medium	Low
No-go Alternative	N/A	N/A	N/A	N/A	N/A	N/A	Neutral	Neutral

### **Mitigation Measures**

- Spillages of any potentially hazardous materials should be cleaned immediately to avoid contamination of runoff;
- Mixing or decanting of all chemicals and hazardous substances must take place either on a tray or on an impermeable surface; and
- The conditions contained in the Water Use Licence must be adhered to.

Please refer to the Environmental Management Programme (Appendix F) for all other measures to be implemented to minimise any impact on ground or surface water.

### **2.1.4 Impact on heritage and paleontological resources**

#### **Description of potential impact**

A Heritage and Palaeontological Impact Assessment was conducted by G&A Heritage to determine the heritage and palaeontological sensitivities of each alternative site.

The project area is underlain by Karoo Supergroup sediments of potentially high paleontological sensitivity in the south and by low-sensitivity Precambrian basement rocks, Quaternary sand and alluvium in the north.

#### Alternative 1:

Fieldwork studies and archival studies indicate that the site was found to be devoid of artefacts or occupation sites. A Stone Age rock shelter was discovered outside the boundary of the development area, but will not be affected by the proposed development.

The surrounding rock formations were investigated for rock art or Mfuba games. However, none were noted.

The rocky outcrops where alternative 1 is located, represent some of the best-known exposures of Early Jurassic desert sandstones of the Clarens Formation and are thus of special geo-heritage interest.

Alternative 2:

Fieldwork studies and archival studies indicate that this location contained a well-defined Early Iron Age site. Only one decorated sherd could be found during the fieldwork session. The lack of stone walling suggests that it could be a very early Mapungubwe Industry site. Several possible grain bin foundations or foundations of some other kind was identified on the site.

As with alternative 1, the rocky outcrop where alternative 2 is located, also represent some of the best-known exposures of Early Jurassic desert sandstones of the Clarens Formation and are thus of special geo-heritage interest.

**Impact Assessment**

Alternative 1:

Although a rock shelter was found outside the boundary of the proposed site, the area to be affected was found to be devoid of any artefacts of any heritage or cultural significance. In terms of the Palaeontological Assessment and Palaeo Sensitivity Map, the palaeontological sensitivity was found to be high and a field assessment is subsequently required. The significance of the impact on the heritage and palaeontological resources is rated as low prior to the implementation of mitigation measures.

Alternative 2:

An important Early Iron Age site was discovered within the development area of alternative 2 and it is recommended that this alternative be avoided since these archaeological deposits are of great value provincially and nationally. In terms of the Palaeontological Assessment and Palaeo Sensitivity Map, the palaeontological sensitivity was found to high and a field assessment is subsequently required. The impact has been assessed as high without the implementation of mitigation measures. It is recommended that this alternative not be considered.

Alternative 3:

The project area was found to be devoid of any artefact which could be of heritage or cultural significance. In terms of a palaeontological viewpoint, alternative 3 is also of low sensitivity and subsequently the significance of the impact has been rated as very low prior to the implementation of mitigation measures.

In terms of the palaeontological sensitivity, alternative 3 overlies an area of low-sensitivity and is not problematic from a palaeontological viewpoint.

**Table 10: Significance of heritage and palaeontological impact**

IMPACT	BEFORE MITIGATION							AFTER MITIGATION
	Magnitude	Extent	Duration	Probability	Confidence	Reversibility	Significance	Significance
Heritage and Palaeontological impact								
Alternative 1	Medium	Site-specific	Construction	Probable	Sure	Reversible	Low	Very Low
Alternative 2	High	Site-specific	Construction	Probable	Sure	Reversible	High	High
Alternative 3	Low	Site-specific	Construction	Probable	Sure	Reversible	Very Low	Very Low
No-go Alternative		N/A	N/A	N/A	N/A	N/A	Neutral	Neutral

From a heritage and palaeontological perspective, the least sensitive sites for the proposed lodge would be Alternatives 1 or 3.

**Mitigation Measures**

It is recommended that a palaeontological field investigation is conducted, in order to ensure that no palaeontological resources are affected by the proposed lodge development.

Various mitigation measures are recommended should any sub-surface remains of heritage sites be identified. Please refer to the attached Environmental Management Programme (Appendix F).

## 2.1.5 Impact on sanitation and waste management

### Description of potential impact

Construction waste is normally created during the construction phase and it is essential that the management of this waste is effective to prevent any pollution. Since there are currently no sanitation facilities on the site, the activities during the construction process could potentially lead to sewage pollution, should adequate temporary facilities not be provided.

### Impact Assessment

#### Alternative 1:

Due to the drainage line located at alternative 1, impact is of high magnitude. However, due to the extent and short duration of the impact, the significance of the impact can be rated to be of low significance.

#### Alternative 2:

There are no water resources located within a close proximity to site alternative 2 and for this reason, the impact is of low significance prior to the implementation of mitigation measures.

#### Alternative 3:

The drainage line located within the centre of the development area increases the impact pollution would have on the environment and for this reason the impact is of high significance. The extent and short duration of the impact does however minimise the significance of the impact to be low.

**Table 11: Significance of improper sanitation and waste management**

IMPACT	BEFORE MITIGATION							AFTER MITIGATION
	Magnitude	Extent	Duration	Probability	Confidence	Reversibility	Significance	Significance
Sanitation and waste management								
Alternative 1	High	Site-specific	Construction	Probable	Sure	Reversible	Low	Very Low
Alternative 2	Low	Site-specific	Construction	Probable	Sure	Reversible	Very Low	Very Low
Alternative 3	High	Site-specific	Construction	Probable	Sure	Reversible	Low	Very Low
No-go Alternative	N/A	N/A	N/A	N/A	N/A	N/A	Neutral	Neutral

### Mitigation Measures

- Chemical toilet facilities must be provided for construction staff and must be cleaned regularly. All toilet facilities must be placed at least 50m from any water resource;
- All construction waste must be placed in closed bins and removed to a registered landfill site; and
- Adequate management is required during the construction phase to minimise any risk of littering and pollution.

Other recommended mitigation measures are included within the Environmental Management Programme (Appendix F).

## 2.1.6 Traffic Impact

### Description of potential impact

In order to obtain water from the borehole located on the western side of the Ekland Safaris property, a 140mm HDPE Class 9 pipeline, will have to traverse the N1 underground, to supply water to the lodge proposed on the eastern section of Ekland Safaris (east of the N1 between Louis Trichardt and Musina). Depending on how the construction of the pipeline is proposed, the construction of the pipeline over the N1 might cause some traffic disruptions. Should it be possible to pipe-jack the pipeline underneath the road, no traffic disruption will occur. The assessment below is based on the assumption that excavation will be required for the pipe to cross the road.

### Impact Assessment

The significance of the impact would remain the same for alternative 1, 2 or 3 as the pipeline will have to traverse the N1 for all of these alternative locations. As the impact on traffic disruptions are of medium magnitude, restricted to the site and only be endured during the construction period, the impact is of low significance.

**Table 12: Significance of impact on traffic disruptions**

IMPACT	BEFORE MITIGATION							AFTER MITIGATION
	Magnitude	Extent	Duration	Probability	Confidence	Reversibility	Significance	Significance
<b>Traffic impact</b>								
<b>Alternative 1</b>	Low	Site-specific	Construction	Probable	Sure	Reversible	Low	Very Low
<b>Alternative 2</b>	Low	Site-specific	Construction	Probable	Sure	Reversible	Low	Very Low
<b>Alternative 3</b>	Low	Site-specific	Construction	Probable	Sure	Reversible	Low	Very Low
<b>No-go Alternative</b>	N/A	N/A	N/A	N/A	N/A	N/A	Neutral	Neutral

### Mitigation measures

- Stop and go arrangements should be implemented when the pipeline is constructed underneath the N1 with one lane remaining open for vehicles to pass; and
- The contractor must regulate the flow of traffic and minimise any delays as far as possible.

Other recommended mitigation measures are included within the Environmental Management Programme (Appendix F).

## 2.1.7 Visual Impact

### Description of the potential impact

Construction activities normally have a negative visual impact on surrounding land users, as vegetation is cleared and replaced by construction material, vehicles and material storage areas. Alternative 1 and 3 are not located near any areas that are visible to the public, and therefore these proposed alternative sites would not affect any adjacent landowners or occupiers negatively.

Site alternative 2 is located on the highest rocky outcrop in view of the road that runs parallel with the Mutamba River and leads to Nzhelele Dam. Construction of the development at site alternative 2 would have an impact on frequent users of this road.

## Impact Assessment

During construction, the visual impact of construction activities is site-specific and temporary in nature and with the implementation of mitigation measure, this impact can be minimised to be of low significance.

As site alternatives 1 and 3 are not visible to any surrounding landowners or users, the visual impact is of low magnitude and subsequently rated to be of low significance. However, alternative 2 is visible to adjacent land users and is therefore of medium magnitude. However, due to the impact being site-specific and of short duration, the impact is of low significance.

**Table 13: Significance of the visual impact during construction**

IMPACT	BEFORE MITIGATION							AFTER MITIGATION
	Magnitude	Extent	Duration	Probability	Confidence	Reversibility	Significance	Significance
Alternative 1	Low	Site-specific	Construction	Probable	Sure	Reversible	Low	Very Low
Alternative 2	Medium	Site-specific	Construction	Probable	Sure	Reversible	Medium	Low
Alternative 3	Low	Site-specific	Construction	Probable	Sure	Reversible	Low	Very Low
No-go Alternative	N/A	N/A	N/A	N/A	N/A	N/A	Neutral	Neutral

## Mitigation Measures

- Where possible, make use of existing roads instead of clearing new roads;
- No new roads should be created on steep slopes, as cuttings will continue to be visible for many years and unvegetated spoil slopes below the road will remain visible prior to revegetation;
- Ensure a clean site policy during the construction phase – litter should be removed on a regular basis during construction;
- The design of the lodge structures should not break the skyline, unless it is for the construction of lightning arrestors;
- Materials and textures of the lodge buildings should blend with the colours and textures of the natural environment;
- Use of reflective materials (e.g. metals and glass) in the lodge buildings should be minimised or avoided to minimise glare.
- Plant locally indigenous shrubs and trees as screens around the periphery of the lodge.

Other recommended mitigation measures are included within the Environmental Management Programme (Appendix F).

### 2.1.8 Noise disturbance

#### Description of the potential impact

Construction activities, construction vehicles and construction personnel on site could cause an increase in noise levels at the construction site, which may negatively affect adjacent land owners or users. However, adjacent land users or occupiers are located further than 500m from the proposed alternative sites.

## Impact Assessment

Due to the proximity of the alternative sites to adjacent land owners or occupiers, the magnitude of the noise impact is low for all 3 proposed alternative sites. The impact is also site-specific and of a temporary nature and for this reason the impact is rated to be of very low significance for all 3-alternative sites.

**Table 14: Significance of noise during construction**

IMPACT	BEFORE MITIGATION							AFTER MITIGATION
	Magnitude	Extent	Duration	Probability	Confidence	Reversibility	Significance	Significance
Noise disturbance								
Alternative 1	Low	Site-specific	Construction	Probable	Sure	Reversible	Low	Very Low
Alternative 2	Low	Site-specific	Construction	Probable	Sure	Reversible	Low	Very Low
Alternative 3	Low	Site-specific	Construction	Probable	Sure	Reversible	Low	Very Low
No-go Alternative	N/A	N/A	N/A	N/A	N/A	N/A	Neutral	Neutral

## Mitigation Measures

The impact is of very low significance and therefore no mitigation is proposed.

## 2.1.9 Safety of employees and the public during construction

### Description of the potential impact

Construction activities could lead to injuries to staff or the public. These activities include:

- Movement of construction vehicles to and from the site; and
- Handling of equipment and material.

## Impact Assessment

The impact is of high magnitude, however, due to the extent of the impact and temporary nature thereof, the impact for all 3 proposed alternative sites is considered to be of low significance if mitigation measures are implemented.

**Table 15: Significance of health and safety of employees during construction**

IMPACT	BEFORE MITIGATION							AFTER MITIGATION
	Magnitude	Extent	Duration	Probability	Confidence	Reversibility	Significance	Significance
Safety								
Alternative 1	High	Site-specific	Construction	Probable	Sure	Reversible	Low	Very Low
Alternative 2	High	Site-specific	Construction	Probable	Sure	Reversible	Low	Very Low
Alternative 3	High	Site-specific	Construction	Probable	Sure	Reversible	Low	Very Low
No-go Alternative	N/A	N/A	N/A	N/A	N/A	N/A	Neutral	Neutral



## Mitigation Measures

- All necessary signage and traffic measures, such as speed limits, must be implemented for safe movement of vehicles to and from the proposed development;
- The site and crew are to be managed in strict accordance with the Occupational Health and Safety Act, 1993 (Act No.85 of 1993) and the National Building Regulations;
- Ensure that the handling of equipment and materials is supervised and adequately instructed; and
- Adequate first aid facilities must be available on site for the emergency treatment of staff and members of the public.

### 2.1.10 Socio-economic impact (improved employment opportunities)

#### Description of potential impact

Besides the creation of 150 temporary job opportunities, the construction of the proposed lodge would not have any impact on the socio-economic environment during construction.

#### Impact Assessment

There will be a positive economic impact during the construction phase, as temporary employment will be provided. Should the construction of the proposed lodge not be approved, no job opportunities will be created, and the impact will therefore be insignificant.

**Table 16: Significance of the socio-economic impact during construction**

IMPACT	BEFORE MITIGATION							AFTER MITIGATION
	Magnitude	Extent	Duration	Probability	Confidence	Reversibility	Significance	Significance
<b>Socio-economic impact (job opportunities during construction)</b>								
<b>Alternative 1</b>	High (+)	Local	Construction	Certain	Definite	Reversible	Medium (+)	High (+)
<b>Alternative 2</b>	High (+)	Local	Construction	Certain	Definite	Reversible	Medium (+)	High (+)
<b>Alternative 3</b>	High (+)	Local	Construction	Certain	Definite	Reversible	Medium (+)	High (+)
<b>No-go Alternative</b>	High (-)	Local	Construction	Certain	Definite	Reversible	Neutral	High (-)

## Mitigation Measures

The contractor should preferentially use local suppliers and labour for the construction of the proposed lodge.

## 2.2 Operational Phase Impacts

A number of potential long-term (operational) impacts were identified:

#### Biophysical impacts:

- Loss of biodiversity
- Flooding (storm water management)

- Sanitation and waste management
- Aesthetic value (Visual impact)

### Socio-economic impacts:

- Permanent employment opportunities

### 2.2.1 Loss of biodiversity

#### Description of potential impact

Some vegetation within the project area will have to be removed to make way for the structures of the 60-sleeper lodge. Some vegetation will therefore be lost permanently. However, the proposed lodge will preserve natural vegetation within the site as much as possible.

#### Impact Assessment

In accordance with the Ecological Report, the ecological significance of site alternatives 1 and 3 was regarded to be low if mitigation measures are implemented. Site alternative 2 is not recommended for construction at all and thus the ecological impact during the operational phase will remain high.

Some areas within the footprint area that are cleared of vegetation during construction will be rehabilitated with indigenous vegetation as soon as construction is complete. Due to the significance of vegetation communities and habitat present at alternatives 1 and 3, the magnitude of this impact is high. The operational phase impact is site-specific but will be of long-term duration and is of medium significance. Rehabilitation of disturbed areas will mitigate the impact to be of low significance.

**Table 19: Significance of loss of biodiversity during the operational phase**

IMPACT	BEFORE MITIGATION							AFTER MITIGATION
	Magnitude	Extent	Duration	Probability	Confidence	Reversibility	Significance	Significance
Alternative 1	High	Site-specific	Long-term	Definite	Sure	Reversible	Medium	Low
Alternative 2	High	Site-specific	Long-term	Define	Sure	Reversible	High	High
Alternative 3	High	Site-specific	Long-term	Definite	Sure	Reversible	Medium	Low
No-go Alternative	N/A	N/A	N/A	N/A	N/A	N/A	Neutral	Neutral

#### Mitigation measures

- Areas affected by the development must be rehabilitated with indigenous vegetation; and
- An alien invasive mitigation plan must be compiled and implemented.

## 2.2.2 Risk of flooding (Storm water management)

### Description of the potential impact

#### Alternative 1:

As described above, alternative 1 is surrounded by sandstone rock formations that delineates the site on the eastern, southern and western boundaries of the site at approximately 700m asl., while the lowest point (690m asl.) is located in the centre of the proposed development, sloping slightly toward the north. The site therefore forms a drainage basin towards the centre of the development area and for this reason. Thus, storm water will have to be managed appropriately to prevent flooding during heavy rainfall periods.

#### Alternative 2:

Due to the topography of site alternative 2, there is no risk of the project area being flooded. However, the development area is very steep, with the lowest point of the development area being at the boundaries of the proposed development. Although flooding will not be of concern for site alternative 2, the topography of the site would still require proper storm water management measures to be implemented.

#### Alternative 3:

A drainage line, classified as a first order watercourse, is located within the centre of the proposed development area. Therefore, storm water must be managed properly to prevent flooding and erosion.

### Impact Assessment

#### Alternative 1:

The impact of improper storm water management at site alternative 1 is of high magnitude, site-specific and of long duration. Therefore, the impact is assessed to be of medium significance. However, with the construction of storm water structures to divert all storm water from the centre of the development, the impact can be effectively mitigated to be of low significance.

#### Alternative 2:

Flooding is not an issue of concern for site alternative 2. However, the topography of the site requires the implementation of a proper storm water management plan to ensure that storm water does not cause any erosion. The impact is of low significance.

#### Alternative 3:

As with alternative 1, improper storm water management at site alternative 3 is of high magnitude. A storm water management plan will be required to reduce the impact to be of low significance.

**Table 20: Significance of flooding during the operational phase**

IMPACT	BEFORE MITIGATION							AFTER MITIGATION
	Magnitude	Extent	Duration	Probability	Confidence	Reversibility	Significance	Significance
<b>Storm water management (Flooding)</b>								
<b>Alternative 1</b>	High	Site-specific	Long-term	Probable	Sure	Reversible	Medium	Low
<b>Alternative 2</b>	Medium	Site-specific	Long-term	Probable	Sure	Reversible	Low	Very Low
<b>Alternative 3</b>	High	Site-specific	Long-term	Probable	Sure	Reversible	Medium	Low
<b>No-go Alternative</b>	N/A	N/A	N/A	N/A	N/A	N/A	Neutral	Neutral

## Mitigation Measures

- Storm water structures are proposed to divert any storm water from the development area; and
- Storm water management plan must be compiled and implemented to prevent flooding and erosion.

### 2.2.3 Sanitation and Waste Management

#### Description of the potential impact

Should solid waste not be managed properly, it would cause impacts such as visual impacts (litter), could cause injury or deaths to animals, act as health and safety hazards to people, and attract vermin. Should sewage not be properly managed, it will result in health and safety hazards, and would cause the pollution of surface water, through the release of untreated sewage,

Solid waste generated during the operational phase of the development will be collected, temporarily stored on site and removed by a third-party contractor to the nearest registered landfill site. It is also proposed that a sewage treatment plans will be established on the site to treat sewage to legal standards before release of water back into the natural environment.

#### Alternative 1:

The effluent treatment plant is currently proposed at a higher point within the development footprint and therefore not near the drainage basin within the centre of the development area. Thus, sewage from the proposed lodge will not drain towards the sewage treatment plant. However, septic tanks are proposed within the drainage basin towards the northern section of the development area, and will drain into French drains that release cleaned water into the soil. Provided these septic tank systems are managed well, and emptied according to their required schedule, no negative impacts can be expected.

#### Alternative 2:

The proposed development area for site alternative 2 is rocky with steep slopes. The establishment and construction of septic tanks and an effluent treatment plant within the development area would be challenging and will have to be well engineered.

#### Alternative 3:

The drainage line located within the development area increases the risk of ground and/or surface water pollution if septic tanks and the effluent treatment plant aren't properly managed.

## Impact Assessment

#### Alternative 1:

Due to the characteristics of the site, the impact of improper sanitation and waste management is of high magnitude, site-specific and of long duration and for this reason the impact is assessed to be of medium significance prior to the implementation of mitigation measures.

#### Alternative 2:

The topography and characteristics of the site will constrain construction on site alternative 2, which implies that proper management of sanitation and waste will be very challenging. Due to the difficult terrain, it is likely that sewage infrastructure will experience more frequent failures at this site than at other sites, leading to more frequent leaks and spillages. The impact is therefore of medium significance and due to the topographical constraints, the implementation of mitigation measures to ensure proper sanitation and waste management is possible, is limited.

### Alternative 3:

Due to the characteristics of the site, the impact of improper sanitation and waste management is of high magnitude, site-specific and long duration and for this reason the impact is of medium significance prior to the implementation of mitigation measures.

**Table 21: Significance of improper sanitation and waste management during operation**

IMPACT	BEFORE MITIGATION							AFTER MITIGATION
	Magnitude	Extent	Duration	Probability	Confidence	Reversibility	Significance	Significance
Sanitation and waste management								
Alternative 1	High	Site-specific	Long term	Definite	Sure	Reversible	Medium	Low
Alternative 2	High	Site-specific	Long term	Define	Sure	Reversible	Medium	Medium
Alternative 3	High	Site-specific	Long term	Definite	Sure	Reversible	Medium	Low
No-go Alternative	N/A	N/A	N/A	N/A	N/A	N/A	Neutral	Neutral

### 2.2.4 Aesthetic Value (Sense of Place)

#### Description of the potential impact

The impact is assessed to determine which alternative would detract the least from the aesthetic value of the existing natural environment.

Alternative 1 and 3 are not located near any areas that are visible to the public, and therefore these proposed alternative sites would not affect any adjacent landowners or occupiers negatively.

Site alternative 2 is located on the highest rocky outcrop in view of the road that runs parallel with the Mutamba River and leads to Nzhelele Dam. The presence of a lodge on these rocky outcrops would continue to have an impact on frequent users of this road.

#### Alternative 1:

Since this location is in a valley, surrounded by rock outcrops, it is very well shielded from view and would create the least visual impact of the three alternatives. The closest public roads are the N1 (1.5km of the lodge location) and the road to Nzhelele Dam, 1km south of the lodge location. The views from both these roads are screened by the rock outcrops around the lodge.

#### Alternative 2:

The site is located on the highest outcrop east of the lion farm with exceptional views from the crest in all directions. The lodge would be visible from the road to the Nzhelele Dam. This road passes 500m south of the proposed lodge location.

#### Alternative 3:

Alternative 3 is relatively flat and besides the drainage line (first order water course which is short lived), there are no attractive features that would add to the aesthetic value which the lodge would like their guests to experience. This site is located at least 3.5 km from the nearest roads (the N1 and the road to Nzhelele Dam), and due to the screening effect of the dense riverine bush and the distance from the nearest receptors, it's impact would be similarly low to that of alternative 1.

## Impact Assessment

### Alternative 1:

Due to the screening provided by the topography, the magnitude of visual impact will be very low, the impacts will be of long duration and the extent will be site-specific.

### Alternative 2:

Due to the high position in the landscape, the magnitude of visual impact will be medium, the impact will be of long duration and the extent of the impacts will be local.

### Alternative 3:

Due to the screening provided by the trees and the distance from the nearest receptors, the magnitude of visual impact will be very low. The impacts will be of long duration and the extent will be site-specific.

**Table 22: Aesthetic impact of the proposed lodge**

IMPACT	BEFORE MITIGATION							AFTER MITIGATION
	Magnitude	Extent	Duration	Probability	Confidence	Reversibility	Significance	Significance
Visual Impact								
Alternative 1	Very low	Site-specific	Long term	Definite	Sure	Reversible	Very Low	Very Low
Alternative 2	Medium	Local	Long term	Define	Sure	Reversible	Medium	Low
Alternative 3	Very Low	Site-specific	Long term	Definite	Sure	Reversible	Very Low	Very Low
No-go Alternative	N/A	N/A	N/A	N/A	N/A	N/A	Neutral	Neutral

## Mitigation Measures

- The design of the lodge structures should not break the skyline, unless it is for the construction of lightning arrestors;
- Materials and textures of the lodge buildings should blend with the colours and textures of the natural environment;
- Use of reflective materials (e.g. metals and glass) in the lodge buildings should be minimised or avoided to minimise glare.
- Plant locally indigenous shrubs and trees as screens around the periphery of the lodge.

### 2.2.5 Permanent employment opportunities

#### Description of the potential impact

Permanent job opportunities will be created by the establishment of the 60-sleeper lodge. The job opportunities created will be:

- 80 unskilled labour opportunities and
- 20 skilled labour opportunities.

## Impact Assessment

The establishment of 100 permanent job opportunities will have a positive socio-economic impact on the local community as this will give members of the local community the opportunity to provide for their families. Therefore, the impact is positive and of high significance. It is imperative that unskilled labour is sourced locally.

## Mitigation Measures

The impact is positive and therefore does not require any mitigation measures. However, it is imperative that unskilled labour is sourced locally.

**Table 23: Positive socio-economic impact during operation**

IMPACT	BEFORE MITIGATION							AFTER MITIGATION
	Magnitude	Extent	Duration	Probability	Confidence	Reversibility	Significance	Significance
<b>Job opportunities (+)</b>								
<b>Alternative 1</b>	High	Local	Long-term	Definite	Sure	Reversible	High (+)	High (+)
<b>Alternative 2</b>	High	Local	Long-term	Define	Sure	Reversible	High (+)	High (+)
<b>Alternative 3</b>	High	Local	Long-term	Definite	Sure	Reversible	High (+)	High (+)
<b>No-go Alternative</b>	High	Local	Long-term	Definite	Sure	Reversible	Neutral	Neutral