TERMS OF REFERENCE FOR THE UPDATED SPECIALIST FOREST VEGETATION STUDY

Specialists are required to make the necessary updates to their findings and impact assessments based on the comments received during the August to October Public Participation Process for the Bhangazi Lodge Draft Basic Assessment Report (BAR). These terms of reference pertain to the Specialist Forest Vegetation Study. The findings from the required updates will be integrated into the Final BAR.

In this regard, we are requesting the following:

- Updating the impact assessment based on the comments from Nicholas Scarr, particularly comments 8- 11 of Mr Scarr's correspondence. These impacts are in connection with the biosewage layout and how it will affect the undisturbed forest by causing significant root and tree damage. In particular, the specialist will need to reassess the cumulative impacts associated with the sewer system layout.
- Updated specialist report should speak to these sections of the BAR:
    - Section 8.13: Impact of the Proposed Development on Flora (Loss of Further Forest)
    - Section 8.1.3: Impact of the Proposed Development on Flora (Increase in the Level of Alien Plant Infestation of the Area)
    - Section 8.1.4: Impact of the Proposed Development on Flora (Potential Loss of Forest Canopy and Understory)
    - Section 8.3: Potential Cumulative Impacts "(in line with the first bullet point in the ToR).
- Provide an education opinion to the forest-related concerns raised by Nicolas Scarr.
- Indicating where changes in the specialist report have been made (e.g. underlining the sections of the report that have been changed).

An updated sewage layout will be shared with the specialist once it is available. This will be used a reference for undertaking the impact assessment.

Any other requirements by the specialist can be communicated to Thembeka Environmental by contacting:

Kamogelo Mokhine
kamogelo@thembeka-env.co.za
0735887110

or

Samantha Moodley
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0716781951

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

Dr Derek Berliner
Eco-logic consulting

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

	(For official use only)
File Reference Number:	12/12/20/ or 12/9/11/L
NEAS Reference Number:	DEAT/EIA
Date Received:	

Application for integrated environmental authorisation and waste management licence in terms of the-

(1) National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2010; and

(2) National Environmental Management Act: Waste Act, 2008 (Act No. 59 of 2008) and Government Notice 718, 2009

PROJECT TITLE

Lake Bhangazi lodge Forest specialist report

Specialist:	Forest ecologist		
Contact person:	Derek Berliner		
Postal address:	7 cormorant circle Imhofs Gift ,Kommetjie		
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E-mail:	Eco-logic@merb.co.za		
Professional affiliation(s) (if any)	SAIE		

Project Consultant:	Ditto above		
Contact person:			
Postal address:			
Postal code:		Cell:	
Telephone:		Fax:	
E-mail:			

4.2 The specialist appointed in terms of the Regulations_

I, Dr Derek Berliner , declare that --

General declaration:

I act as the independent specialist in this application;
I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
I declare that there are no circumstances that may compromise my objectivity in performing such work;
I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
I will comply with the Act, Regulations and all other applicable legislation;
I have no, and will not engage in, conflicting interests in the undertaking of the activity;
I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
all the particulars furnished by me in this form are true and correct; and
I realise that a false declaration is an offence in terms of regulation 71 and is punishable in terms of section 24F of the Act.

Signature of the specialist:

Eco-logic consulting

Name of company (if applicable):

21 May 2021

Date:

SPECIALIST FOREST ECOLOGIST REPORT

VEGETATION SURVEY FOR BASIC ASSESMENT FOR THE PROPOSED LAKE BHANGAZI LODGE

Dr Derek Berliner
Eco-logic consulting

For
Environmental Resources Management Southern Africa Pty Ltd

08 November
2018
First update 12 August 2020

Second update 25 March 2021
(updated headers indicated with yellow highlights

Table of Contents

Executive summary

The Bhangazi Community Trust proposes to develop a cultural tourism lodge within the designated area of the Bhangazi Heritage Site. A large portion of the project area has already been disturbed as an old fishing holiday camp. There is an extension of that footprint area, required for the development of the Bhangazi lodge accommodation units, into the neighbouring forest (greenfield section).

As part of the Basic Assessment report, a specialist study has been requested that addresses the requirement of DAFF to determine the extent of damage to the forest, (quantity and species of trees).

To assess this impact, the accommodation units were assumed to have a 10-meter square footprint. The layout plan, as provided by the client, was used with google earth, to obtain the general position. This was adjusted on the ground so that each plot was deliberately located within the existing gaps in the undergrowth, provided units were at least ten meters from the forest edge, and not closer than about 15 meters apart. For each plot, the number, size class, and species of trees that within each plot was recorded.

The forest types around lake Bhangazi area include Swamp forest, Northern Dune forests and Northern Coastal Forests. The proposed development occurs in the later forest type only.

No red data plants species were found in the forest, however four species of protected tree in terms of the National Forests Act are present within the study area. This affects only one of the accommodation units (7a) where two large Marula trees occur. It is recommended to leave out this unit , as well as unit 7b, to allow for better spacing between units.

Three forest dependent red data mammals were seen using the forest. These include Tonga Red Squirrel (*Paraxerus palliates tongensis*), listed as endangered; Samango Monkey (Cercopithecus albogularis), listed as vulnerable ; Red Duiker (Cephalophus Natalens) , listed as least concern. Two forest depended red data birds were seen in the area including Southern Banded Snake-Eagle (*Cicaetus cinerascens*) and, Crowned Eagle (*Stephanoaetus coronatus*), both listed as near threatened. It is not believed that the development will have any significant impacts on these animals, although it is recommended that a survey be conducted in the forest for any potential nesting sites of the latter two species, before development proceeds.

The impacts to trees in the top disturbed section (old fisherman's camp) should be exceptionally low, as there should limited need to remove larger trees. These trees contribute enormously to the aesthetics of the camp. Some of these trees are also on the protected tree list (see table 5).

The impacts within the greenfield section of the forest will depend to some extent on how carefully the platforms are positions and constructed within the existing gaps in the forest undergrowth. Although the forest is intact , there is evidence of historical disturbance in the form of limited undergrowth clearing, probably for campsites. Using a 10-meter square plot for each accommodation unit, it was approximated that for at least half of the units, the removal of at least one or two tree(s) with a stem circumference of 60 cm (or stem diameter of 180 mm) will be required. Most plots will require some pruning and or removal of smaller trees and saplings. It is not believed that this will have any significant lasting impact on the forest integrity.

1 Introduction

1.1 Understanding of brief

The Bhangazi Community Trust proposes to develop a cultural tourism lodge within the designated area of the Bhangazi Heritage Site.

A large portion of the project area has already been disturbed as an old fishing holiday camp. There is an extension of that footprint area, required for the development of the Bhangazi lodge accommodation units, into the neighbouring forest (greenfield section).

Before the proposed project can begin, environmental authorisation must be obtained in terms of the Environmental Impact Assessment (EIA) Regulations of the National Environmental Management Act (No 107 of 1998, as amended) (NEMA). The proposed project triggers listed activities in terms of the NEMA EIA Listing Notices 1 and 3 (GNR. 983 and 985) and therefore requires the completion of a Basic Assessment (BA). As the project is proposed to take place within a World Heritage Site, the National Department of Environmental Affairs is the designated Competent Authority.

This report comprises a specialist study to be included as part of the Basic Assessment report, to be done by a forest ecologist, and that addresses the requirement of DAFF, that among other issues, 'a vegetation study be commission to highlight the quantity and species of trees that need to be trimmed or removed to accommodate the development'.

1.2 Legal context

The main Acts of relevance include:

- World Heritage Convention Act, 1999 (Act 49 of 1999).
- National Environmental Management Act, 1998 (Act 107 of 1998) (NEMA).
- National Environmental Management: Protected Areas Act, 2003 (Act 57 of 2003).
- National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004).
- National Heritage Resources Act, 1999 (Act 25 of 1999).
- KwaZulu-Natal Heritage Act, 2008 (Act 4 of 2008).
- National Forests Act, 1998 (Act 84 of 1998).
- National Water Act, 1998 (Act 36 of 1998).
- Marine Living Resources Act, 1998 (Act 18 of 1998).
- Seashore Act, 1935 (Act 21 of 1935).
- Maritime Zone Act, 1994 (Act 15 of 1994).
- National Environmental Management: Integrated Coastal Management Act, 2008 (Act 24 of 2008).
- National Environmental Management: Waste Act, 2008 (Act of 59 2008)

Of importance to this report, is the National Forests Act, 1998 (Act 84 of 1998). Section 18 (a) , that refers to 'natural forests must not be destroyed, save in exceptional circumstance'…' and that trees within a natural forest may not be cut, destroyed, damaged or removed'.

1.3 Layout and geo-referencing of lodge accommodation units

The layout plan provided by the client, (see figure 1) was used with google earth satellite imagery, to locate and geo-reference units on the ground. Each unit within the forest (greenfield section) was designated by an alpha-numeric code from 1a to 11a, for the 2 bed units, and 1b to 6b, for the 4 bed accommodation units.

A photograph and GPS pin drop using google maps was taken at each unit's approximated 10 x10 meter plot. Each plot was marked on the ground using a white masking tape band around one of the trees near the centre, (see table1, of GPS points for each plot).

Because the layout plan provided by the client was conceptual,(i.e., has not been surveyed on the ground), the location of each plot on the ground could not be exactly determined accuracy. Effort was made to locate each plot in the most open areas, provided it met the constraints that each unit is not closer than about 15 meters apart and that they were at least 10 meters from the forest margin .

Using these assumptions, the total footprint of all the accommodation units in the green fields section is (11 x 10 + 6 x 10) i.e., 1160 square meters. A mitigation measure to reduce these impacts has been suggested in the revised report to both reduce the size of each unit's footprint from 10 meters square to 8 meters square as well as reducing the total number of units so that the total accommodation footprint is reduced to 970 m^2.

Table 1 Approximated geographic coordinates for accomadtooon units in the forest. (note: acuracy of geolocation, using google maps under a forest canopy is unknown)

Unit code	South	East		Unit code	South	East
1a	28 08 21	32 32 34		1b	28 08 22	32 32 34
2a	28 08 15	32 32 38		2b	28 08 23	32 32 35
3a	28 0816	32 32 37		3b	28 08 23	32 32 35
4a	28 08 18	32 32 37		4b	28 08 24	32 32 35
5a	28 08 24	2 32 36		5b	28 08 24	32 32 36
6a	28 08 18	32 32 36		6b	28 08 24	32 32 37
7a	28 08 19	32 32 36				
8a	28 08 20	32 32 36				
9a	28 08 21	28 32 36				
10a	28 08 23	28 32 35				
11a	28 08 23	32 32 35				
Main complex	28 08 22	32 32 35				

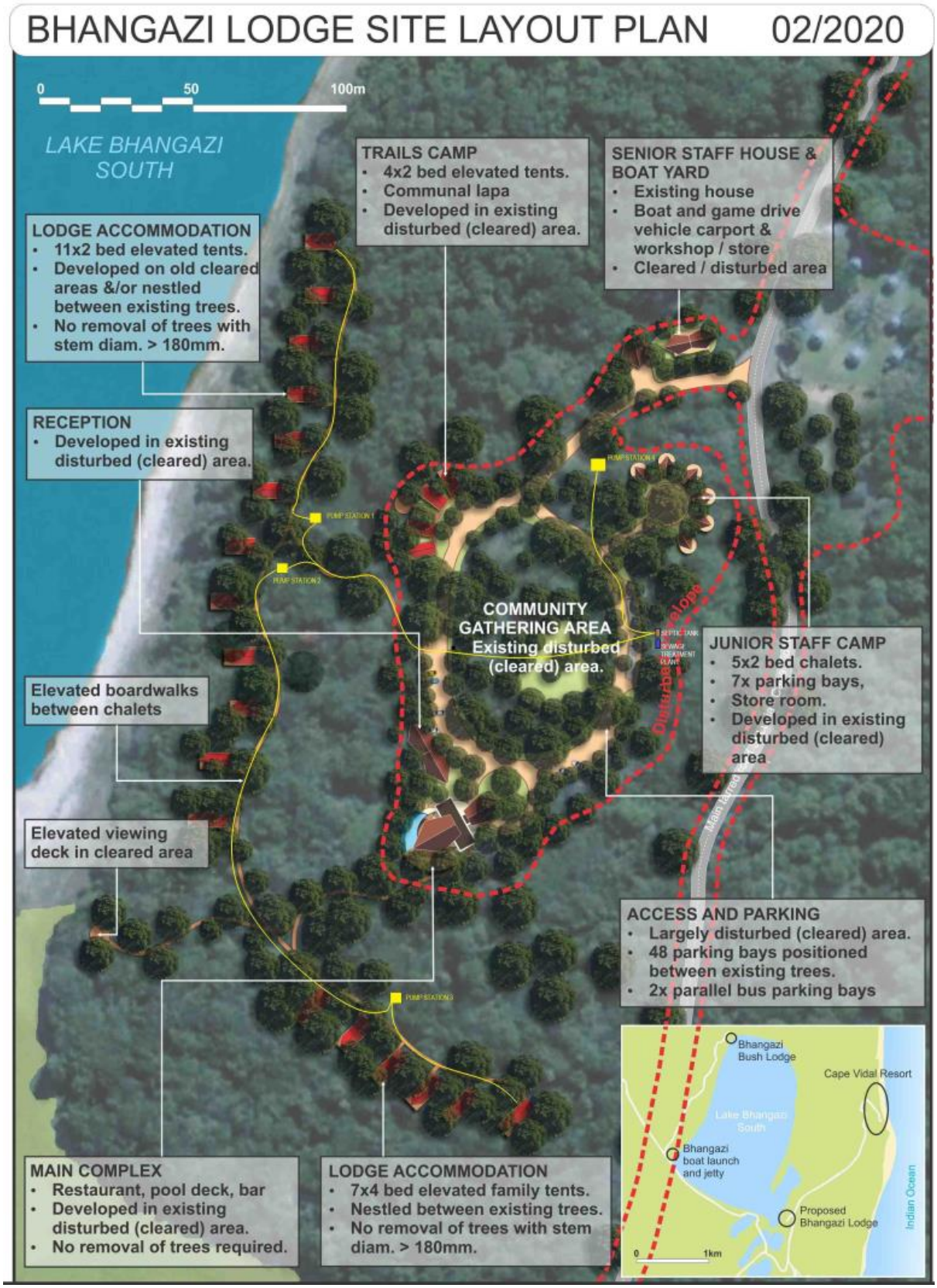

Figure 1 Layout plan of the proposed lodge.

1.4 Tasks and approach

The key task was to provide an objective study of the impacts to the forest by the placement of the planned accommodation units within the forest (greenfield section). To do this, an assumption had to be made that the accommodation units would consist of tented camps placed on elevated platforms that would occupy a standard 10 x 10-meter plot. The main restaurant complex, also planned for the green fields section, was assumed to be 25 x 25-meter plot. Each plot was deliberately located within the most open area of the forest that satisfied the constraints that units should be within the 15 m contour, at least ten meters from the forest edge and not closer than about 15 meters apart. For each plot, the number, size class and species of trees that fell within each plot footprint was recorded.

Tree identification was facilitated by 'The TreeApp South Africa, (2018) and Boon (2010). Tree species were identified to the best of my ability, but there is the possibility that some trees may have been incorrect identified. A list of tree species identified in this, and the biodiversity study is provided in appendix1. The tree diversity of these forest is exceptionally high, and this list is by no means complete.

Figure 2 Plots were located as far as possible in existing openings. Alpha-numeric codes were given to each plot and marked by attaching tape to the largest tree within or close to the plot. Bottom left notices the open patches within forest undergrowth.

The following tasks, described in table2, below, were addressed in this report.

Table 2. Tasks and the approach taken.

Task	Approach
1. Description of vegetation communities potentially impacted by the proposed lodge	Site visit. Google earth mapping Literature review
2. Assess the status of plant species of concern confirmed to occur in the study area, and comment on the likelihood of occurrence of other such species	Site visit. Literature review Interviews with local community members working in the area.
3. Assess the integrity of the vegetation communities, including current impacts and whether the vegetation is benefiting from the protection status of the area	Site visit. Literature review Interviews with locals
4. Determine whether forest adjacent to the lakeshore wetlands qualifies as Riparian Vegetation according to DAFF Wetland Delineation Guidelines, and if so, indicate Riparian Vegetation boundary.	Site visit. Literature review. Google earth mapping
5. Description of proposed project impacts on forests, and suggested mitigation measures	Site visit. Review of project plans and interviews with developers and consultants. Use of 10 x10 m plots for accommodation and 25 x25 m plot or the main complex
6. Description of the number and types of trees that will be impacted by the proposed development (list >60 cm circumference)	Filed work. Approximated location of each accommodation unit within the forest using google earth maps.
7 Report writing	Home based

2 Description of vegetation communities potentially impacted by the proposed lodge.

The Park is located at the southern end of the Maputaland Centre of Plant Endemism, part of the Maputaland-Pondoland-Albany biodiversity hotspot. There is enormous diversity of habitat and vegetation types within the Isimangaliso wetland park . Mucina and Rutherford (2006) classify the

main forest types around lake Bhangazi as Northern Coastal Forest (FOz 7) and Northern Dune forests (AZd4). (see figure, 3 below)

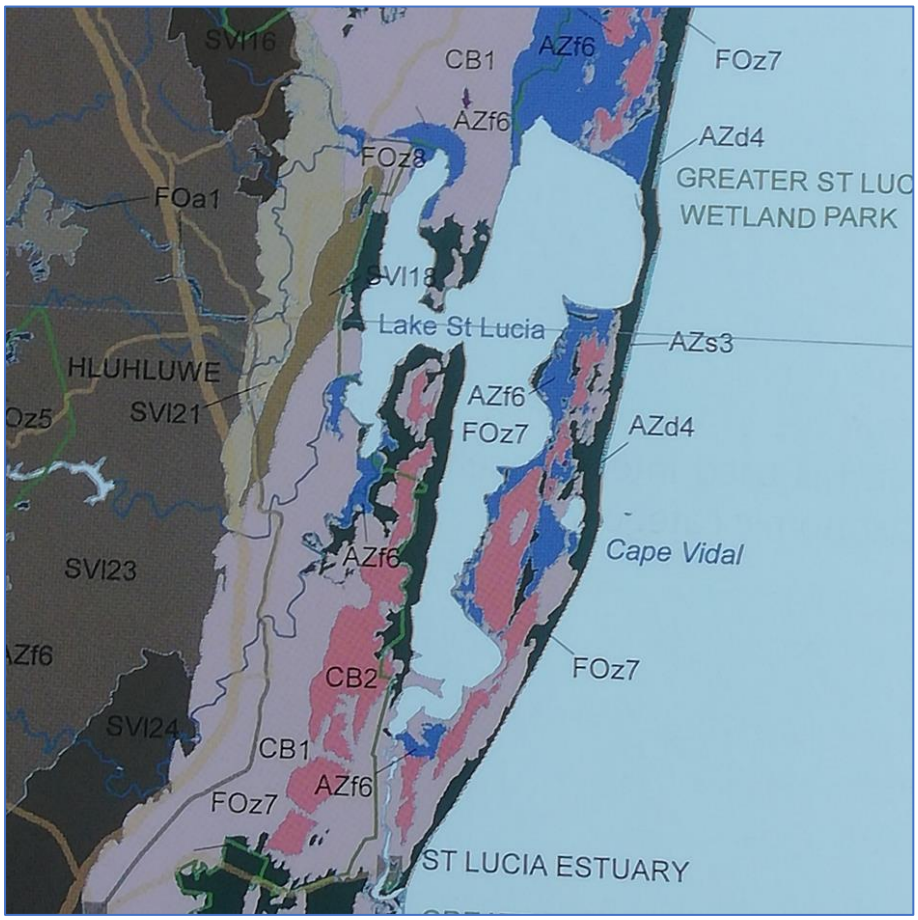

Figure 3 The natural vegetation in which the proposed lodge is to be situated consists primarily of Northern Coastal Forest (FOz 7) according to Mucina and Rutherford (2006).

Figure 4 Habitat and vegetation types within the lake Bhangazi study area: Mapululand Dune forest (background); Low land coastal forest (middle right, where lodge accommodation is planed); hydrophilic grassland- scrub , (foreground) and Subtropical Freshwater lake.

The vegetation communities within the broader study area are described below. Only the coastal forest habitat , where the accommodation units are planned will be impacted. It is unlikely that any other vegetation communities in the study area will be impacted.

Subtropical Freshwater Wetlands
These freshwater lakes are in areas of low relief in large depressions on the landward side of the coastal dune barrier. They are fed from relatively small catchments and maintained largely from ground water seepage. The lakes are nutrient poor because of the predominantly sandy, leached nature of their substrates.

Tall and short hydrophilic grasslands
These habitats may be dynamic and change according to fluctuating water levels, fire and herbivory, they include grasses, sedges, reeds, and shrubs.

Transition zones and ecotones
The line of transition between the forests, and the wetland areas, are remarkably sharp. With dominant forest edge species such as *Brachylaena discolor , Vepris lanceolate*, and *Albizia adianthifolia* the forest margin is clearly healthy and intact. Occasional inundation of the grasslands adjacent to the forest, as well as occasional fires, prevents establishment of trees in this zone. Since the soils are pale and sandy, it is apparent that it is seldom, if ever, wet for long enough for organic material to accumulate and thus this ecotone between the forest and the lake consists of hygrophilous grasslands, rather than a wetland. These grasslands form a transition zone between the forests and the true wetlands around the lake edges.

Dune forests
Von Maltitz et. al, (2003) classifies this forest type as KwaZulu-Natal dune forests and are described as shrubby thicket to tall forest occurring along the KwaZulu-Natal coastline on the primary dune cordon inland from salt spray zone. These forests show a distinct gradient of change from the beach to the landward side of the dunes. Characterised by sandy substrata, rolling dune field topography,

strong winds and adjacent to ocean beaches. Multi-stemming common and herb layer dominated by *Isoglossa woodii.* These a species rich forests with many tropical and subtropical species reaching their southern distribution limits along north-south gradient.

Two main gradients are found in the dune area, a gradient from the coast inwards and a gradient from mature to secondary stands. High forest communities of mature stands are dominated by *Sideroxylon inerme* and are about 16m in height. By contrast coastal thicket is dominated by *Euclea schimperi* and *Eugenia capensis* and is only a few meters tall. Multistemmed trees are the norm.

Natural disturbances include dramatic storms during summer, as well as fire, wind, and slumping of unstable dune sand substrate. The high degree of salt spray and strong winds help to shape the structure and species composition of the dune forest. Potential recruitment bottlenecks and arrested succession caused by dominant herb layer (esp. *Isoglossa woodii*). Slash and burn agriculture has played an important role in the current community structures, and more recently dune mining is a major man induced disturbance to this vegetation type.

Northern Coastal Forest
Von Maltitz et. al (2003) classifies the forest type where the lodge accommodation is planned , as 'KwaZulu-Natal Coastal Forests', while Scots-Shaw (2011) refers to them as 'Maputaland Moist Coastal Lowlands Forest' and has listed them as being "Endangered".
They are described by Von Maltitz *et. al*, (2003). As " Medium to tall, species rich forest strongly associated with the flat to rolling topography of the coastal lowlands of KwaZulu-Natal in form of small-sized patches - remnants of formerly dominating vegetation type of the region. These forests occur in the immediate hinterland of coastal dunes or on free-draining deep sands of the Maputaland coastal plain. Many tropical species reach their southern distribution along the affected range. Typically dominating canopy and sub-canopy layers are found in trees such as *Albizia adianthifolia, Dyospyros inhacaensis*, *Drypetes arguta*, *Dyospyros natalensis, Englerophytum natalense, Protorhus longifolia, Teclea gerradii Manilkara concolor*. Shrub layer and synusiae of climbers are well-developed, dense, and rich in subtropical elements.

Disturbance events include fire, large animals, cyclones, and tornadoes. Iron-age farmers cleared much of the forest for agriculture. At present they are highly susceptible to alien plant invasion, of concern in many areas is *Chromolaena odorata*.

3. The status of plants in the study areas.

The iSimangaliso Wetland Park lies within the Maputaland Centre of Endemism (van Wyk and Smith, 2001) which, in turn is a part of the Maputaland-Pondoland-Albany Biodiversity Hotspot. The iSimangaliso Wetland Park Integrated Management Plan (2000), states that 2185 plant species have been recorded in the Park. These represent 9% of the flora of South Africa and 31% of the flora of KwaZulu-Natal. A total of 44 species are endemic to the region and three species are known to occur only within the Park. It is not known if these species occur within the study site.

Four species which are protected in terms of the National Forests Act are present within the study area (see table 5, below). Examination of the Protected Tree Species list suggests that it is possible for several other protected tree species to occur within the greater project area, these are given in table 6 below.

Table 3 Protected trees identified within the project area, along with their conservation status.

Scientific name	Common name	Conservation status
Sideroxylon inerme	White-milkwood	Least concern
Mimusops caffra	Coast Red-milkwood	Least concern
Sclerocarya birre	Marula	Least concern
Ficus trichopoda	Swamp Fig	Least concern

Table 4. Protected trees that may potentially occur within the greater project area , along with conservation status.

Scientific name	Common name	Conservation status
Warburgia salutaris	Pepper-bark tree	Endangered
Prunus africana	Red stinkwood	Vulnerable
Pittosporum viridiflorum	Cheese wood	Least concern
Podocarpus falcatus	Yellow wood	Least concern
Cleistanthus schlectheri	False tamboti	Least concern

Although none of the below plants were positively identified to occur within the project site, based on their occurrence within similar vegetation types, or plant distribution modelling SANBI, 2017), there is a small possibility that some may occur in, or near the project site. See table 6 and 7 , below.

Tale 6 Rare plants occurring within the broader Lake Bhangazi area, but not necessary in the study site, based on forest type (from forest plant database developed by Berliner, 2009).

Forest Type	**Species**	**Endemic**	**Status**	**Trend**
Kwazulu-Natal Coastal	*Elaeodendron croceum*	No	LC	Declining
Kwazulu-Natal Dune	*Adenia gummifera*	No	NT	Declining
Kwazulu-Natal Dune	*Vanilla roscheri*	No	NT	Declining
Kwazulu-Natal Dune	*Elaeodendron croceum*	No	LC	Declining
Licuati Sand	*Newtonia hildebrandtii*	No	LC	Declining
Licuati Sand	*Combretum mkuzense*	No	NT	
Swamp	*Raphia australis*	No	VU	
Kwazulu-Natal Dune	*Aloe thraskii*	SA	NT	
Kwazulu-Natal Dune	*Bonatea lamprophylla*	SA	VU	
Kwazulu-Natal Dune	*Didymoplexis verrucosa*	SA	VU	

Table 5 Rare plants potentially occurring within the quarter degree square of Lake Bhangazi area (using rare plant distributing modelling done by SANBI)

Scientific name	**Conservation status**
Brachystelma vahrmeijeri	Endangered
Didimoplexus verrucosa	?
Knipofia leucocephala	Critically Endangered
Searsia kwazuluana	Vulnerable
Warburgia salutaris	Endangered

4. The integrity of the vegetation communities

The disturbed areas on the ridge consist of open areas and buildings situated amongst large mature trees, this is the site where the old Banghazi fisherman's camp was located.

The forest below is in good condition, showing little signs of recent human disturbance, however, from a closer look under the canopy, it is apparent that human disturbance occurred, some time back. This can be seen in the form of clearings made in the undergrowth, probably for camp sites. There are also several strange concrete and brick structures, including slabs, and a circular structure that may have been used for water storage, situated close to the big forest fig, where the main complex is planned (see figure 6).

Alien plant infestation is extremely low, although a few individuals of two species of invasive alien plants were seen within the forest, these include, *Chromeleana oderata, and Caesalpinia pulcherrima.*

The forest margins along the north eastern fringe of the forest, facing the lake, are intact and in good condition (see figure below).

Figure 5 Intact and healthy forest margins

The forest canopy, beneath where the lodge accommodation is planned, is 85-95 % intact. There are a few gaps, indicating possibly some historical disturbance associated with the camp site. There are numerous paths in the undergrowth made by, and still used by, hippos.

There is also evidence of past human presence in the forest, as old litter such as old glass bottles, plastic and other non-degradable rubbish occur in a few places, supporting the idea that the forest may have been used as a camp site in the past (see figure 6).

Figure 6 Evidence of past human habitation in the forest. Litter, brick and concrete structures in the forest.

Figure 7. Evidence of past clearing of undergrowth within the forest. Most of the accommodation units are in or close to areas that have had undergrowth cleared for campsites, some years ago. This is the sight of unit 1A.

Of interest, is the age of these coastal forests. The presence of well-established woodland species within the forest, such as *Sclerocarya birre* , *Ziziphus mucronata, and Acacia kosiensis,* more typical of woodlands and savannahs, than coastal forest, and the absence of many very large trees, seem to

imply that these forests are of relatively recent origin, and that this area may have been a woodland prior to a forest. It is known that the extent of coastal and dune forest of the North coast have undergone significant changes during iron age hunter gatherer times, as well as more recently during the colonial period of forest exploitation and removal of local populations . For example, Weisser & Marques, (1979), have shown, using air-photos, that the coastal strip between Richards Bay and the Mfolozi River, was mature *Acacia karroo* Woodlands in 1937, but was replaced by Secondary Dune Forest by 1974.

The causes of these changes probably lie in changes in human impacts brought about by the assumption of control of the area by the Department of Forestry from about 1949. Under this and later the apartheid regime local populations were forced out of the area, resulting in a decline in livestock, a decline in fires and a halt to clearing for cultivation, thus allowing forest succession.

5. Can the forest be considered as riparian vegetation ?

To delineate any wetland the following criteria are used based on the document :
A practical field procedure for identification and delineation of wetlands and riparian areas, make use of the following criteria (DWAF, 2005):

- Wetland (hydromorphic) soils that display characteristics resulting from prolonged. saturation such as grey horizons, mottling streaks, hard pans, organic matter depositions, iron, and manganese concretion resulting from prolonged saturation.
- The presence, at least occasionally, of water loving plants (hydrophytes);
- A high-water table that results in saturation at or near the surface, leading to anaerobic conditions developing in the top 50 cm of the soil.
  • Topographical location of the wetland in relation to the landscape.

From the above criteria, these forests can neither be considered as riparian, or wetland vegetation. This is because the forests species are typical of coastal forests and not those typical of swamp or riparian forests. In addition, the grasslands adjacent to the forest are not true wetlands as evidence from the soil texture and colour. These areas are only occasionally flooded and for short periods, not sufficiently long enough to build up organic matter, characteristic of wetland soils (see biodiversity study, Terratest, 2018) . True wetlands occur further down the slope.

5 Description of proposed project impacts on forests, suggested avoidance mitigation, and residual impacts on forest

5.1 The mitigation hierarchy

The mitigation hierarchy should be followed at all stages of the project, see figure 8,below.

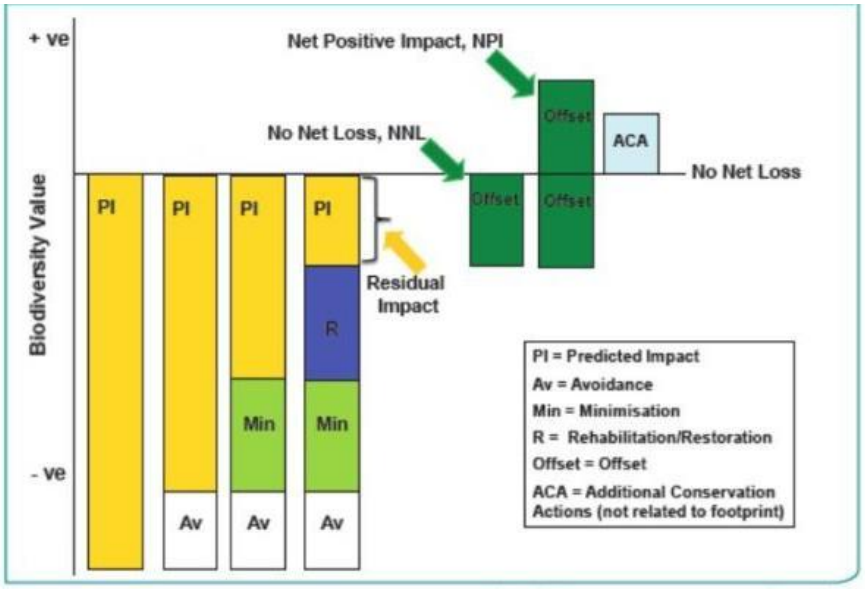

Figure 8 The mitigation hierarchy to manage biodiversity impacts.

The impacts associated with the development within the greenfield section, as well as recommended avoidance and mitigation measures are presented in table 8, below.

6. Impacts, cumulative impacts, and recommended mitigations

6.1 Impact, avoidance, mitigation table

In the table below impacts associated with the construction activity specifically to the ecological integrity of the forest are discussed, along with avoidance and mitigation.

Table 6 Impacts associated with the construction of lodge accommodation within the forest. Avoidance and mitigation strategies are recommended to minimize residual impacts. The assumption is made that the footprint of accommodation units are 10 square meters and structures to be built on elevated wooden platforms. Refer to table 8 for more details.

Activity	Impact /risk	Avoidance	Mitigation	Residual impact
Construction of platforms for tented camps	Removal of trees that are in footprint. Loss of canopy cover integrity Loss of understory cover, small increased risk of erosion (RISK INCREASED EROSION; LOW)	As far as possible build flexible structure shapes to fit around larger trees. Placing of platforms in old camp sites, with open understory	Enrichment planting of similar trees removed during construction, by planting nursery grown out tree , as close to where they were removed	Short term: increased light penetration into forest, changes in run-off Medium term: negligible as forest will recover as canopy closes over light gaps.
Construction of footpaths in forest	Possible soil compression, increased risk of soil erosion (RISK WITH MITIGATION LOW	As far as possible use current hippo paths	Use elevated boardwalks	Short term: Hippos may not be happy but will adapt their foraging behaviour. Medium term: negligible

Vegetation disturbance & increase human traffic	Increased risk of alien invasive plant spread. (RISK HIGH) Possible disturbance of local bird and wildlife populations Possible nesting site of Southern banded snake eagle (heard calling inside forest)	Minimise construction footprint, and need for vegetation removal (reduce number of units and only build where prior clearing of understory has occurred) Survey for possible nesting sites. Monitor rare and endangered fauna in area	Remove alien invasive plants during, and after construction, incorporate into an environmental management plan	The risk of alien plant spread needs ongoing management . Short term: some wildlife may be scared off Medium term: wildlife adapts, some species attracted to modified habitats, some leave.
Permanent presence of humans in or close to wildlife habitats	Increased human wildlife conflicts in an unfenced camp (hippos, buffalo, monkeys, bush pigs etc)	Electric fence around camp Strict control of refuse.	Create awareness to visitors not to feed wildlife	If managed, residual impacts are negligible
Construction activities associated with installation of bio-sewage system piping.	Increased risk of bringing in invasive plants. Trampling and compaction of forest floor by workforce. Additional pruning of roots and trees. Concrete mixing and possible spilling. Disturbance of natural water drainage resulting in pooling around collection tanks.	Workers check clothes for seeds. Minimise number of workers entering forest. Cover disturbed areas with thick layer of forest mulch and revegetate as soon as possible. Use same paths that boardwalks will be on for all movement into forest and construction activities. All digging done manually, no heavy machinery, small workforce.	Ongoing Invasive alien management programme As far as possible construction activities (cement mixing etc) done in disturbed areas outside forest. Forest ecologist present during layout and surveying of paths and all structures. A storm-water management plan bult into construction layout Minimise exposure at any one time by clearing and filling as soon possible. All exposed areas to be mulched and planted with idigenouse, shade tolerant ground	Requires ongoing alien Invasive plant management in disturbed areas. Excessive activity around construction sites can lead to trampling and compaction of forest floor

			cover (eg. plectranthus, Clivia spp.).	
Holes for bio-sewage system collection tanks (need to be close to units, for gravity fed, will be in forest)	Digging three holes in forest (0.5 meter deep x 2,2 x1.4) Will disturb forest flora and most likely need to cut through tree roots, and some overhead canopy pruning. Disturbance of natural water drainage around construction sites resulting in water pooling around tree roots with a risk of rotting. Disturbance of trees structural integrity and health	Try to place collection tanks in already disturbed areas, such as old camp sites, or more open areas of forest. Allow for adequate drainage of water around collection tanks	Forest ecologist present during layout of construction Minimise root disturbance. Follow root cutting and treatment protocol (see note under section 6.1, below) Storm water management built into layout design	Root pruning may render some tree structurally unstable that may only manifest over time. Root pruning may cause some trees to lose viability and die. This may only manifest over a period of time.
Risk of bio sewage spills	Possible risk of (figs ?) tree roots growing into holding tanks risk of spillage	Use reinforcements barriers around collection tanks	Do not use any toxic chemicals in sewage system	Minimal risk

6. 2 Root damage mitigation protocol

Pruning tree roots requires that you cut one of two important components to your tree's root system: structural roots or feeder roots. Structural roots, which begin at the base of the tree and prevent it from falling, grow mostly horizontally. These roots grow thinner in diameter as they move away from the trunk. Feeder roots are small, fibrous roots that are responsible for taking up water and nutrients. The more of these roots that are cut, the more your tree's ability to feed itself becomes impaired. Feeder root damage is often indicated by stunted growth, pale-coloured leaves, and premature defoliation.

When trees are stressed, they become weakened and more vulnerable to pests and disease. Fungal infections such as wilts or rots and insect pests such as beetles, borers and scale insects are commonly found in trees distressed by cut roots. Many mature trees might not survive the combined attack of root pruning, insect pests and disease.

Cutting a tree root that is larger than 2 inches in diameter or cutting too close to the trunk interferes with the structure of the tree. Roots provide the support necessary to keep your tree standing, and without the support structure, your tree becomes unstable. This can lead to your tree falling over during high winds or rainstorms.

Possible impacts of the construction activities in the forest may include :

- Physical injury to the tree trunks and branches, reduce tree health and death.
- oil compaction in the root zone
- Severed roots cause structural instability.
- Smothered roots from added fill soil
- Increased wind and sunlight exposure
- Drainage changes leading to water pooling.

Root cutting and removal can be accomplished without crippling or killing trees provided a few protocols are adhered to these include:

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- Root proximity to trunk and extent of root removal. The closer to the trunk that roots are cut, the more significant and severe the damage will be to your tree. Never remove more than 25% of a tree's roots. The tree will likely die or fall, or both.
- Drainage: try to ensure disturbed area has adequate drainage to avoid water pooling round tree roots.
- Re mulching and filling in around root. Keep topsoil after the holes are dug to use as mulch over and around disturbed areas. The mulch helps condition the soil, moderates soil temperatures, maintains moisture, and reduces competition from weeds and grass.
- Damaged Bark, trunk wounds, and pruning. Where bark has been damaged along the trunk or on major limbs, remove loose bark to avoid areas where water can accumulate beneath bark . Pruning should be neat and cut at clean 45-degree angles, avoid spiting of limbs.
- Wound Dressings. Wound dressings were once thought to accelerate wound closure, protect against insects and diseases, and reduce decay. However, research has shown that dressings generally do not reduce decay or speed closure and rarely prevent insect or disease infestations. Most experts recommend that wound dressings not be used. If a dressing must be used for cosmetic purposes, use only a thin coating of a nontoxic material.
- Time of root pruning. Tree roots should preferable be cut during late winter when the tree is metabolically least active (avoid pruning spring/early summer). After cutting, minimise the time that the roots are exposed to prevent drying, and keep the soil moist.

6.3 A note on the cumulative impacts and forest integrity.

With reference to point 11 of the letters from an interested and affected party (Mr N. Scarr, dated 19 October 2020) : With reference to the installation of the bio-sewage system :

"*This would give rise to at least eighteen associated excavations, the individual and cumulative impacts of which would not be insignificant, given both the abundance. and diversity of biological material, over and above extensive tree and plant root networks,1 contained within the forest floor, and the importance of soil structure to the forest's integrity"*

According to the updated layout plan of the bio sewage system, apart from the board walk, only three excavations will be required within the forested section. These are the collection tanks. Most of the piping and electrical feeds can be located under the board walk, thus minimizing the overall footprint of the system. The footprint of each collection unit is also not extensive (2,2 x 1,5). It is believed that these can be sensitively located so as to minimise tree removal , however there may be the need for pruning and root removal, and possibly having to remove some smaller trees.

If the correct tree and root pruning protocols are followed (see section 5.1) this is unlikely to have any permanent effect on the integrity of the forest or forest floor. Forests are inherently resilient to disturbance and recover with time.

In conclusion, provided the construction is done with sensitivity and the correct tree and root removal protocols are adhered to (see section 6.2 and table 6), the integrity of the forest and forest floor will not be compromised. (Also see note provided in separate document on scientific definition of ecological integrity and the difference between ecosystem collapse after loss of integrity and recoverable ecosystem disturbance)

7. Description of the number and type of trees impacted by the proposed development.

7.1 Forested section: accommodation units

To facilitate a comparative assessment, the assumptions were made that each accommodation unit has a footprint of 10 square meters; that units will not be closer than 15 meters apart; and that units will be placed at least 10 meters away from the forest edge, inside the forest .

Table 8, below, provides a summary of the extent to which lodge accommodation may impact on trees. Of interest is how many, if any, larger trees with a stem circumference of 60 cm or more (equivalent to a stem diameter of 180 mm) would need to be removed. To some extent, this depends on how the construction of the platform is done, as some of the tree removals may be avoidable with careful placing of the platforms.

Table 7 . Impact of lodge accommodation, on forest tree species. Three tree size classes were used. Note that large trees were considered as those with a stem circumference > 60 cm (equivalent to a stem diameter of 180 mm)

Development section	**Number of trees in 10 x 10 m plot with stem circumference (cm)**				**Other species present**
	10-29	**30-59**	**>= 60**	**Species > 60**	
Lodge accommodation (11X2)					
unit 1 a	4	3	2	*Diospyros natalensis Clerodendron glabra*	*Vepris lancelota Ziziphus mucronata*
unit 2 a	0	4	0		*Sersia nebulosa Grewia occidentalis Strichnos Gerradii*
unit 3 a	8	0	0		*Sclerocarya birrea, Trichelia emmitca*
unit 4 a	7	1	0		*Trichelia emmetica, Celtis African*
unit 5 a	7	0	2	*Celtis African, Clerodendron glabra*	*Vepris lanceolate, Ficus trichopoda*

unit 6 a	15	2	1	*Vepris lanceolate*	*Celtis African, Clerodendron glabra, Grewia occidentalis Strichnos Gerradii*
unit 7 a	10	0	2	*Sclerocarya birrea*	*Diospyros natalensis; Harpephyllum caffrum*
unit 8 a	7	0	0		*Clerodendron glabra, Albizia adianthifolia, Strichnos gerrradii Protorhus longifolia*
unit 9 a	8	0	1	*Trichelia emmetica*	*Diospyros natalensis Clerodendron glabra Albizia adianthifolia*
unit 10 a	6	2	1	*Trichelia emmetica*	*Clerodendron glabra Diaspyros natalensis Celtis Africana Ficus trichapodia Ficus craterostoma Hyphaene coriacea Brachylaena discolour*
unit 11 a	4	4	2	*Albizia adianthifolia Sersia natalensis*	*Clerodendron glabra Diaspyros natalensis Sersia nebulosa*
Lodge accommodation (7 x4)					
unit 1 b	3	4	0		*Euclea natalensis Albizia adianthifolia*
unit 2 b			2	*Albizia adianthifolia Protorhus longifolia*	*Euclea natalensis*
unit 3 b	5	2	2	*Albizia adianthifolia Diaspiros natalensis*	*Clerodendron glabra Brachyleana discolour Celtis Africana*
unit 4 b	10	4	0		*Albizia adianthifolia Diaspiros natalensis Brachylaena discolour*
unit 5 b	9	4	0		*Brachylaena discolour Searsia nebulosi Searsia gueniensis*
unit 6 b	6	0	1	*Protorhus longifolia*	*Brachylaena discolour Ziziphus mucronata*
unit 7 b	Could not fit in, leave out				
Main complex *(plot 25x25)*	10	6	3	*Albizia adianthifolia Celtis Africana Trichelia emmitica*	*Ficus craterostoma Hyphaene coriacea Trichelia emmitica*

Note: Plots 11 and 1b fall close to each other and the main complex , and it is suggested that these units are left out of the plans.

7.2 Forested section: bord walks.

The exact positioning of the board walks paths has yet to be determined at the time of the field visit, so it was not possible to evaluate the exact impact on trees.

There are existing hippo paths which some of the patch can be aligned to that may minimised the need for tree removal.

Based on the tree density in the forest it is likely that board walk construction will require significant tree pruning, some root removal. However, it is believed that it could be constructed with minimal tree removal, however a number of smaller trees will probably need to be removed.

7.3 Forested section: Bio-sewage collection tanks

At least three bio-sewage collection tanks will be situated in the forested section. These will be buried under ground. The dimensions are approximately 2.2 x 1.5 and 0.5 meter high. Depending on where they located, they can be placed to avoid tree removal, however some pruning and root damage are likely.

7.4 Disturbed areas, with existing structures

The old fishing camp comprises of disturbed areas, with several open patches and existing structures, in various states of disrepair. Many large and beautiful trees occur in and around almost all these structures. Many of these trees are protected species. The trees occurring in these sections, are mostly around the edges , and it should not be necessarily to remove any of these trees. In some cases, minor pruning may be required. The large trees within this section include: *Syzygium cordatum, Trichelia emmitica, Ficus craterostoma, Celtis Africana, Sclerocarya birrea; Apodytes diminuta, Protorhus longifolia, Mimusops caffra Sideroxylon innerme*, and a large exotic Ficus spp.

Reception area

Figure 9.The proposed reception area , with two large water-berry trees on the edges of the plot

Trail's camp (4x2 units)

Figure 10. Proposed trails camp area with existing structure, surrounded by a large marula that may need to be pruned.

Senior staff camp (5x2 units)

Figure 11 Proposed senior staff camp on old, disturbed areas with building in a state of disrepair, surrounded by figs and white stinkwoods

Access and Parking area

Figure 12 The proposed parking area has large opens spaces, with old buildings interspaced with several large and medium size trees.

Community gathering area.

Figure 13. The proposed community gathering area has a large open space with several large water-berry and Natal mahogany trees on the edges.

8. Concluding remarks

The impacts associated with the proposed Bhangazi lodge development in the greenfield section, i.e., inside the forest, where the lodge accommodation units and main complex are planned have been considered.

The impacts within the greenfield section of the forest need to be considered with the following in mind:

The time scales over which impacts are considered. In the short term the construction will result in some loss of understory and possibly minor gaps in the canopy, in the medium term, (5 years, or more) the forest will recover, and gaps, if any, in the canopy will close over.

Diligence in applying avoidance, mitigation and tree and root pruning protocols during construction,(as recommended, in table 6) can significantly reduce impacts. In particular the placing of the units, boardwalks and sewage collection tanks needs be done with sensitivity and the supervision of a forest ecologist, in particular to minimizing the need to remove larger trees. Careful placement of unit platforms within existing understory gaps is also important.

It is approximated that about just over half of the units within the greenfield section of the development, may need to have at least one, or more trees, with a stem circumference of 60 cm or more (equivalent to a stem diameter of 180 mm), removed. In all cases, except for the main complex, there are never more than two trees, (larger than 60 cm) that fall within the approximated footprint (see table 8). None of these trees, apart from the two large Marula trees in unit 7a, are protected or endangered. The Marula tree being a national protected tree species (DAFF, 2017).

The main complex has been shifted outside the greenfields area thus significantly reducing the impact footprint. This will also preserve the integrity of a number of large iconic trees such as the forest fig n that feel close to the footprint of this structure.

To reduce the footprint and to ensure a reasonable space between units, it is recommended that accommodation units be reduced by two units. Unit 7a has two large Marula trees that should not be cut down, while unit 7b , falls too close to the main complex to fit in comfortably. In addition, changes to shift the restaurant complex and pool area from the Greenfields section to the existing disturbed areas of the fishmen as camp need to be considered.

Section 18 of the National Forests Act, (Act 84 of 1998) states that ‘natural forests must not be destroyed save in exceptional circumstances. Although this development will result in minor loss of forest trees, the forest will certainly not be destroyed, nor will the forest floor integrity be compromised.

Low density- low impact ecotourism is a valid form of sustainable use of natural forests. The placement of the accommodation units within the forest, (rather than on top of the ridge) will significantly improve the marketability and quality of the nature experience of the lodge. This will also allow good views of the lake and the surrounding grasslands that are utilised by game (buffaloes, hippos, waterbuck and kudu etc).

There is also the urgent need for the land claimants, the Bhangazi community, to realise economic benefits from their land. This particularly, in the face of mounting pressure to mine rare minerals within this area, as such, all efforts must be made to promote ecotourism as an alternative and sustainable form of land use to sand mining.

Appendix 1 : Updated impact footprint plan

As a proposed mitigation on the footprint of the greenfields section amendments to the impact footprint has resulted in a generalised decrease in impact on the greenfields sections , these changes are listed in the table below.

Mitigation Measure	**Nett Result**
Remove proposed new access road, in favour of using the existing access road to the fishing camp area.	No longer need to clear an extent of 200m2 (forested area) for the access road alignment.
Relocate restaurant and pool complex from forest zone to disturbed fishing camp zone.	No longer need to clear an extent of 350 m2 (forested area) for the restaurant and pool complex.
Following above, no requirement for new access road leading to restaurant complex.	No longer need to clear an extent of 200 m2 (forested area) for the service road alignment.
Reducing the size of the proposed 2 and 4 bed chalet units from 75 m2 to 50 m2 and 40 m2 respectively.	Potentially cleared area reduced from 1350 m2 to 970 m2 (footprint of raised decks, not necessarily clearance of forest canopy).
Forest infrastructure limited to chalets and boardwalks only, all on raised timber decks.	Reduction of impact on undergrowth.
Bio-sewage system	Reduced footprint in forest with only three collection tanks located in forest and remainder of structures outside of forest or located under boardwalks

These changes do not impact significantly on the result of this report but are in line with the recommendations made in this report to reduce the impact on the greenfield section by reducing the total number of accommodation units as well as shifting the restaurant and pool complex from the green fields section to the disturbed areas of the fishing camp. This will make a significant reduction in the need to disturb the forested area.

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Appendix 2: Recorded tree and vine species list

Scientific name	Common name
Acacia kosiensis	Dune Sweet Thorn
Acridocarpus natalitius	Narrow-leaf Moth-fruit
Adenia gummifera	Green-stem
Adenopodia spicata	Spiny Splinter-bean
Albizia adianthifolia	Flatcrown
Allophylus natalensis	Dune False-currant
Ancylobotrys petersiana	Climbing Milk-apricot
Antidesma venosum	Tassel-berry
Apodytes dimidiata	White-pear
Bersama lucens	Glossy White-ash
Brachylaena discolor	Coast Silver-oak
Bridelia cathartica	Blue Sweet-berry
Canthium inerme	Turkey-berry
Capparis brassii	Narrow-leaf Caperbush
Catunaregam obovata	Coast Bone-apple
Celtis africana	White stinkwood
Clausena anisata	Horsewood
Clerodendrum glabrum	Tinderwood
Cussonia zuluensis	Zulu Cabbage-tree
Diospyros natalensis	Acorn berry tree
Dovyalis longispina	Coast Kei-apple
Dovyalis rhamnoides	Sourberry Kei-apple
Dracaena hookeriana	Large-leaf Dragon-tree
Drypetes natalensis	Stem-fruit Ironplum
Ekebergia capensis	Cape-ash
Englerophytum natalense	Natal Milkplum
Erythroxylum emarginatum	African Coca-tree
Euclea natalensis	Hairy Guarri
Ficus burtt-davyi	Scrambling Fig
Ficus craterostoma	forest fig
Ficus lutea	Giant-leaf Fig
Ficus natalensis	Coast Strangler Fig
Ficus trichopoda	Swamp Fig
Garcinia livingstonei	African Mangosteen
Grewia caffra	Climbing Raisin
Grewia occidentalis	Cross-berry Raisin
Gymnosporia arenicola	Dune Spikethorn
Gymnosporia nemorosa	White-spot ForestSpikethorn
Harpepyllum caffrum	Wild plum
Hymenocardia ulmoides	Red-heart Tree
Hypaene coriacea	Lala palm

Scientific name	Common name
Kraussia floribunda	Rhino coffee
Lagynias lasiantha	Smooth Pendentmedlar
Landolphia kirkii	Rubber Vine
Londolphia kirkii	Sand apricote vine
Maerua nervosa	Natal Bush-cherry
Mimusops caffra	Coast Red-milkwood
Monanthotaxis caffra	Dwaba-berry
Ochna barbosae	Sand Ochna
Ozoroa obovata	Coast Resin-tree
Pavetta gerstneri	Zulu Brides-bush
Pavetta natalensis	Coast Brides-bush
Peddiea africana	Poison-olive
Phoenix reclinata	Wild Date Palm
Pittosporum viridiflorum	Cheeze wood
Protorhus longifolia	Cape beach
Psydrax locuples	Sand Quar
Psydrax obovata	Quar
Ptaeroxlyon obliquum	Sneezwood
Rapanea melanophloeos	Poison-olive
Rhoicissus digitata	Five-finger Grape
Rhoicissus digitata	Five-finger Grape
Sclerocarya birrea	Marula
Sclerocroton integerrimum	Duiker-berry
Scutia myrtina	Cat-thorn
Searsia natalensis	Northern DuneCurrant
Searsia nebulosa	Coast Currant
Sideroxylon inerme	White-milkwood
Strelitzia nicolai	Natal Wild Banana
Strychnos gerrardii	Coast Monkey-orange
Strychnos mitis	Pit-leaf Bitterberry
Strychnos spinosa	Green Monkeyorange
Synaptolepis kirkii	Dream Herb
Syzygium cordatum	Umdoni
Tarenna junodii	Climbing Tarenna
Teclea gerrardii	Zulu Cherry-orange
Tricalysia delagoensis	Tonga Jackal-coffee
Tricalysia sonderiana	Coast Jacka;-coffee
Trichilia dregeana	Forest Natal Mahogany
Uvaria caffra	Small-fruit cluster-pear
Vangueria infausta	Velvet Wild-medlar
Vepris lanceolata	White-ironwood
Voacanga thorsii	Wild frangipany
Xylotheca kraussiana	African-dogrose
Zanthoxylum capense	Small Knobwood
Ziziphus mucronata	Buffalo-thorn