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The vegetation of the area of the proposed Shangoni Initiative, Kruger National Park

May 2016

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by
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Commissioned by

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DECLARATION OF INDEPENDENCE

I, George Johannes Bredenkamp, Id 4602105019086, declare that I:

- Hold a DSc in biological sciences, am registered with SACNASP (Reg No 400086/83) as a professional ecological scientist which sanctions me to function independently as a specialist consultant
- Declare that, as per prerequisites of the Natural Scientific Professions Act No. 27 of 2003, this project was my work from its inception, reflects exclusively my observations and unbiased scientific interpretations, and was executed to the best of my ability
- abide by the Code of Ethics of the SACNASP
- Am the owner of Eco-Agent CC, CK 95/37116/23
- Act as an independent specialist consultant in the field of ecology, vegetation science, botany and wetlands
- Am committed to biodiversity conservation but concomitantly recognize the need for economic development
- Am assigned as specialist consultant by Limosella Consulting for the proposed project “The vegetation of the area of the proposed Shangoni Initiative, Kruger National Park” described in this report
- Do not have or will not have any financial interest in the undertaking of the activity other than remuneration for work performed
- Have or will not have any vested interest in the proposed activity proceeding
- Have no and will not engage in conflicting interests in the undertaking of the activity
- Undertake to disclose to the client and the competent authority any material information that have or may have the potential to influence the decision of the competent authority required in terms of the Environmental Impact Assessment Regulations 2014
- Will provide the client and competent authority with access to all information at my disposal, regarding this project, whether favourable or not.
- Reserve the right to only transfer my intellectual property contained in this report to the client(s), (party or company that commissioned the work) on full payment of the contract fee. Upon transfer of the intellectual property, I recognise that written consent from the client(s) will be required for me to release any part of this report to third parties.

GJ Bredenkamp

EXECUTIVE SUMMARY

The South African National Parks Board (SANPARKS) intends to develop a strategically located entrance to the Kruger National Park (KNP) at Giyani (Limpopo Province). The project comprises a new entrance gate, named the Shangoni Gate, a high-water bridge over the Shingwedzi River, a new reception centre with education facilities, a picnic site, a camp site, a tented camp) and a ca. 50 kilometer tarred road that connects new gate with the H1-6 Road (Figure 1). The new road will be an upgrade of a suitable portion of the gravelled S52 route to Bataleur camp and the graded Shangoni Ranger patrol track, which is currently not used as a tourist road. To the east the upgraded road will cross the Shingwedzi River as well as the Tshanga tribuatary, initially at the existing low water bridges, which may be upgraded. Most of the road will be north of and parallel to the Shingwedzi River. The section between the Shingwedzi Low Water bridge) and the H1-6 will traverse through mopane veld south of the river. A short alignment has to be constructed to connect the western terminal end of the Shangoni Ranger patrol road with the reception centre. The upgraded road will be six meters wide with a one meter shoulder on each side.

The area needed for the reception centre will be less than one hectare and that of the picnic site, tented camp and camping terrain will each be less than three hectares.

The location of preferred and alternative sites for each of these three amenities were provided by SANPARKS. The structures for the picnic site and camping site, as well as the tented camp are not permanent, built structure and are therefore all lacated within or close to the riparian zone or floodplain of the Shingwedzi River. More permanent emenities will be constructed in the adjacent mopane woodland so as to minimize impact on the riparian zone vegetation

The vegetation survey included a total floristics survey that included woody species, grasses and herbaceous species. Survey plots were locates at all alternative sites for the Shangoni Gate, the bridge over the Shingwedzi River, Reception offices, picnic sites, camp sites and tented camp sites, as well as along the >50 km long proposed road (new roads and upgrades).

The vegetation vegetation data were processed in order to indentify different plant communities. Each plant community at all sites and along the roads are described including total plant species composition, this includes red data species, protected species, NEMBA species and invasive species, in accordance with the relevant legislation, and requirements of SANPARKS.

The regional vegetation classification (Mucina & Rutherford, 2006) indicated that four vegetation types could potentially be influenced by the proposed development, namely Makuleke Sandy Bushveld, Tsende Mopaneveld, Mopane Gabbro Shrubveld and Subtropical Alluvial Vegetation

The following eleven vegetation mapping units were identified along the transect:

Mapping units / Plant Community	Sensitivity	Mucina & Rutherford (2006)

1. *Senegalia nigrescens - Colophospermum mopane* Woodland	Medium	Maluleke Sandy Bushveld (SVl1) [rather Lowveld Rugged Mopaneveld SVmp6)]
2. Sandy *Colophospermum mopane – Terminalia sericea* Woodland	Medium	Tsende Mopaneveld
3. Tsende Sandveld	Medium-High	Tsende Mopaneveld
4*. Colophospermum mopane* Woodland	Medium	Tsende Mopaneveld
5. *Terminalia prunioides – Colophospermum mopane* Bush	Medium-High	Tsende Mopaneveld (rather Lowveld Rugged Mopaneveld)
6. *Colophospermum mopane – Vachellia tortilis* Open Shrubveld	Medium-High	Sodic patches in Mopane Basalt Shrubveld
7. Shrub Mopane	Medium-Low	Mopane Basalt Shrubveld
8. Mopane Gabbro Shrubveld	Medium	Mopane Gabbro Shrubveld
9. Drainage Lines	High	Various
10. Flood Plains	High	Subtropical Alluvial Vegetation
11. Shingwedzi River Riparian	High	Subtropical Alluvial Vegetation

Although most plant communities at the proposed gate locations and for the reception offices as well as along the proposed roads were in a good condition, representing natural, close to pristine vegetation, most are widespread, not rare and not threatened. Furthermore, only limited vegetation will have to be removed in order to broaden the roads, and road reserves. Limited numbers of nationally protected trees do occur within this zone. These include *inter alia Scerocarya birrea, Combretum imberbe* and *Philenoptera violacea.* Although some vegetation will be destroyed, in general the impact of the proposed development on this vegetation in the broad sense, is considered to be low.

All sites, preferred and alternative, suggested for the picnic sites, tented camps and camping sites occur within floodplain of the Shingwedzi River. These ecosystems and vegetation are regarded to be ecologically sensitive. These areas may also be occasionally flooded, resulting in the specific plant species composition found in the riparian zone and floodplain areas. Several large and valuable trees occur within these areas, e.g. *Diospyros mespiliformis, Spirostachys africana, Xanthocercis zambesiaca, Philenoptera violocea*, *Combretum imberbe, Ficus sycomorus* and others occur in these areas. However, the suggested low impact development in these areas should not affect any of these trees, if the sites are planned and developed in such a way that these trees are protected. It is also suggested that any more permanent infrastructure, e.g. ablution blocks, community kitchen and wash-up areas, staff accommodation, parking areas etc are located in the Mopaneveld adjacent to but outside the floodpain area. Should these development procedures be followed, the impact on this sensitive area and its vegetation should be fairly low.

The report further addresses the possible occurrence of red data species, but none were recorded during the field survey.

No invasive plant species were recorded within the relevant transects.

In general, from a vegetation and flora point of view, the proposed development included in the Shangoni Initiative can be supported

1. BACKGROUND AND ASSIGNMENT

The South African National Parks Board (SANPARKS) introduced the Shangoni Initiative that includes the development of a new access gate, the Shangoni Gate, to the Kruger National Park. The project further entails a high water bridge over the Shingwedzi River, close to the new gate, a reception / education building, a picnic site, a tented camp, a camping terrain, and a 50 km road upgrade to connect the access gate with the H1-6 Road between Shingwedzi and Mopane Rest Camps.

EcoAgent CC was appointed by Limosella Consulting to do a vegetation assessment along the transect (called “the site”) of this project. The project is known as the Shangoni Initiative.

In accordance with The Natural Scientific Professions Act (Act 27 of 2003) only a person registered with the South African Council for Natural Scientific Professions may practice in a consulting capacity. Prof GJ Bredenkamp (SACNASP Reg No 400086/83) undertook an independent assessment of the vegetation of the site. A field survey was conducted 16-21 April 2016.

This investigation is in accordance with the EIA Regulations No. R982-985, Department of Environmental Affairs and Tourism, 4 December 2014 emanating from Chapter 5 of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as well as the National Water Act 1998 (Act 36 of 1998) and other relevant legislation.

Scope of the study

The scope of the study is interpreted as follows:

- Assess, map and describe the vegetation at the proposed gate site, reception / education building, picnic site, tented camp, and camping terrain, as well as the approximately 50 km road upgrade that will connect the access gate with the H1-6 Road between Shingwedzi and Mopane Rest Camps. Sites indicated as alternatives should also be investigated.
- Assess the flora in terms of NEMA, NEMBA and other relevant legislation (as well as relevant minimum requirements of MTPA and SANPARKS with regard to red data species, protected species and invasive species.
- Indicate possible impacts of the proposed development on the vegetation and flora.

- Suggest mitigation measures in order to limit the impact of the proposed development.

This study does not include a wetland assessment, although the vegetation of the identified wetland ecosystems is described and included in the vegetation map.

Assumptions and Limitations

The most important limitation was that the vegetation survey was done at the end of a very droughty summer and the herbaceous vegetation was already dormant. A further limitation was that SANPARKS was unsure about the location of preferred and alternative sites for the picnic sites, camping sites and tented camp sites.

2. RATIONALE

It is widely recognised that it is of utmost importance to conserve natural resources in order to maintain ecological processes and life support systems for plants, animals and humans. To ensure that sustainable development takes place, it is therefore important that the environment is considered before relevant authorities approve any development. This led to legislation protecting the natural environment. The Environmental Conservation Act (Act 73 of 1989), the National Environmental Management Act, 1998 (NEMA) (Act 107 of 1998), the National Environmental Management Biodiversity Act, 2004. (Act 10 0f 2004) and the National Water Act 1998 (Act 36 of 1998) ensure the protection of ecological processes, natural systems and natural beauty as well as the preservation of water resources and biotic diversity in the natural environment. It also ensures the protection of the environment against disturbance, deterioration, defacement or destruction as a result of man-made structures, installations, processes or products or human activities. A draft list of Threatened Ecosystems was published (Government Gazette 2009) as part of the National Environmental Management Biodiversity Act, 2004. (Act 10 0f 2004). Details of these Threatened Ecosystems have been described by SANBI & DEAT (2009) and a list of Threatened or Protected Species (TOPS) regulations is also available (NEMBA Notice 388 of 2013). International and national Red Data lists have also been produced for various threatened plant and animal taxa.

All components of the ecosystems (physical environment, including water resources, vegetation, animals) of a site are interrelated and interdependent. A holistic approach is therefore imperative to effectively include the development, utilisation and, where necessary, conservation of the given natural resources in an integrated development plan, which will address all the needs of the modern human population (Bredenkamp & Brown 2001).

In order to evaluate the vegetation it is necessary to make a thorough inventory of the ecosystems along the transect of the proposed power line. This inventory should then serve as a scientific and ecological basis for the planning exercises.

Definitions and Legal Framework

Authoritative legislation that lists impacts and activities on vegetation and biodiversity including wetlands and riparian areas that requires authorisation includes:

- The Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996),
- The Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983),
- The Environmental Conservation Act, 1989 (Act No. 73 of 1989),
- The National Environment Management Act, 1998 (Act No. 107 of 1998) as amended in 2010 and 2014,
- The National Environmental Management Biodiversity Act, 2004. (Act 10 of 2004),
- The National Environmental Management Biodiversity Act, 2004. (Act 10 of 2004), Draft List of Threatened Ecosystems. Government Gazette RSA Vol. 1477, 32689, Cape Town, 6 Nov 2009,
- The National Environmental Management: Waste Act [NEM:WA] (Act 59 of 2008),
- The National Forests Act, 2006 (Act 84 of 1998 as amended in 2006),
- The National Heritage Resources Act, 1999 (Act No. 25 of 1999),
- The National Environmental Management: Protected Areas Act (Act 57 0f 2003),
- The Mineral and Petroleum Resources Development Act 28 of 2002,
- The National Water Act, 1998 (Act No. 36 of 1998), and
- The Environmental Impact Assessment Regulations Notice 733 of 2014.

3. STUDY AREA

3.1 Location and the receiving environment

The South African National Parks Board (SANPARKS) intends to develop a strategically located entrance to the Kruger National Park (KNP) at Giyani (Limpopo Province). The project comprises a new entrance gate, named the Shangoni Gate, a high-water bridge over the Shingwedzi River, a new reception centre with education facilities, a picnic site, a camp site, a tented camp) and a ca. 50 kilometer tarred road that connects new gate with the H1-6 Road (Figure 1). The new road will be an upgrade of a suitable portion of the gravelled S52 route to Bataleur camp and the graded Shangoni Ranger patrol track, which is currently not used as a tourist road. To the east the upgraded road will cross the Shingwedzi River as well as the Tshanga tribuatary, initially at the existing low water bridges, which may be upgraded. Most of the road will be north of and parallel to the Shingwedzi River (Figure 1). The section between the Shingwedzi Low Water bridge) and the H1-6 will traverse through mopane veld south of the river. A short alignment has to be constructed to connect the western terminal end of the Shangoni Ranger patrol road with the reception centre (Figures 1, 8 and 9). The upgraded road will be six meters wide with a one meter shoulder on each side.

The area needed for the reception centre will be less than one hectare and that of the picnic site, tented camp and camping terrain will each be less than three hectares.

The location of preferred and alternative sites for each of these three amenities were provided by SANPARKS. The structures for the picnic site and camping site, as well as the tented camp are not permanent, built structure and are therefore all lacated within or close

to the riparian zone or floodplain of the Shingwedzi River. More permanent emenities will be constructed in the adjacent mopane woodland so as to minimize impact on the riparian zone vegetation.

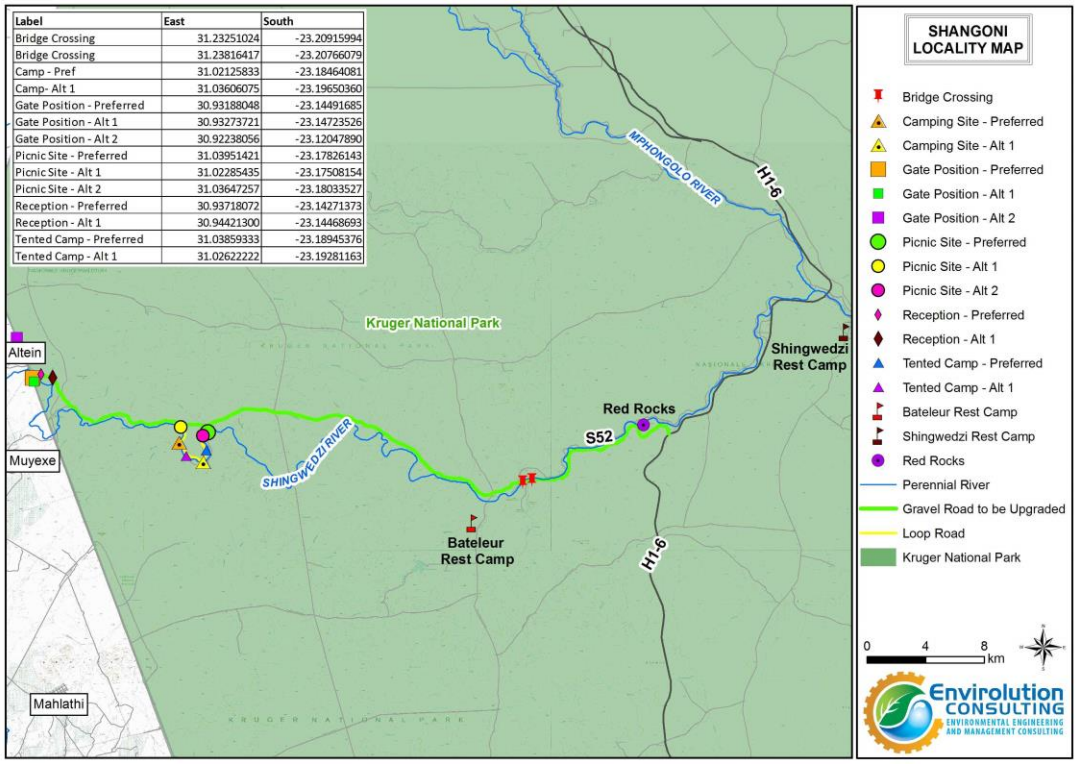

Figure 1a: The location of the entire study area. Note that from the H1-6 westwards to the first crossing of the Shingwedzi River, the upgraded road will be south of the river, and further westwards, north of the river.

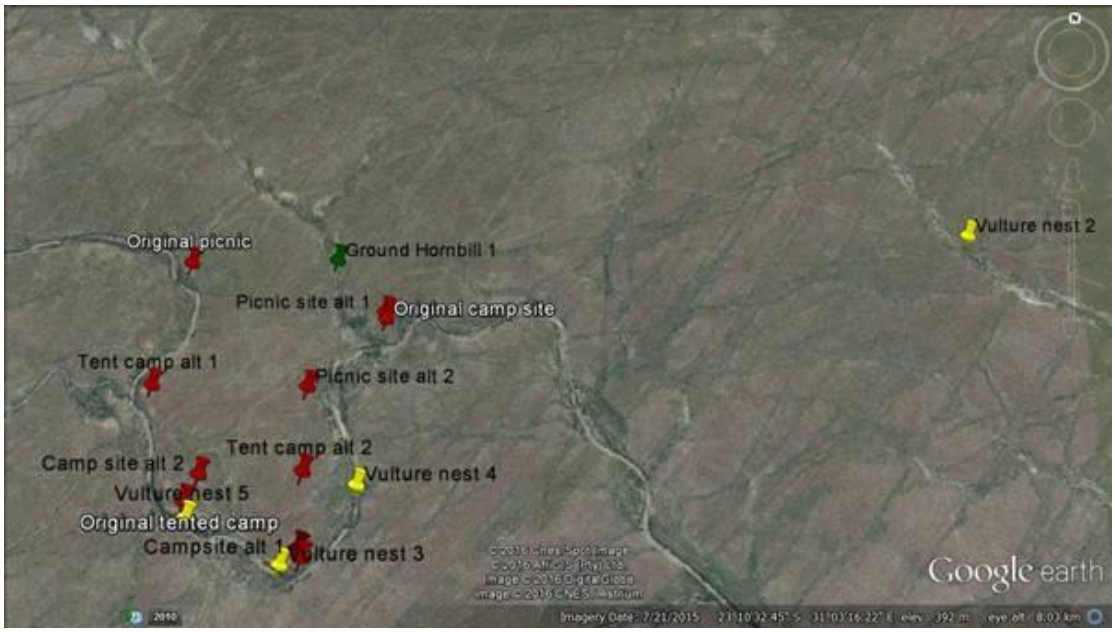

Figure 1b: The preferred and alternative localities of the picnic site, tented camp site and camping site. The location of four vulture and one ground hornbill nests are also indicated.

3.2 Regional Climate

Climate is characterised by very hot summers and summer rainfall of about 500 mm per annum, and the winters are very dry. The area is frost free, with a high mean annual temperature of about 21.7^{o}C.

3.3 Geology, Land types and Soil

Most of the area is underlain by quartz-feldspar rocks of the Goudplaats Gneiss Basement (Figure 2), with limited patches of dolerite and gabbro, and very limited basalt in the east, close to Shingwedzi.

Most of the western area of the site is found within the Fa land type while the eastern areas around Shingwedzi are of the Ia land type. Limited areas are representative of the Fb and Ea land types (Figure 3). Substrates vary from red sandy soil, to lighter-coloured soil imbedded with rock and gravel, to alluvial soil along water courses.

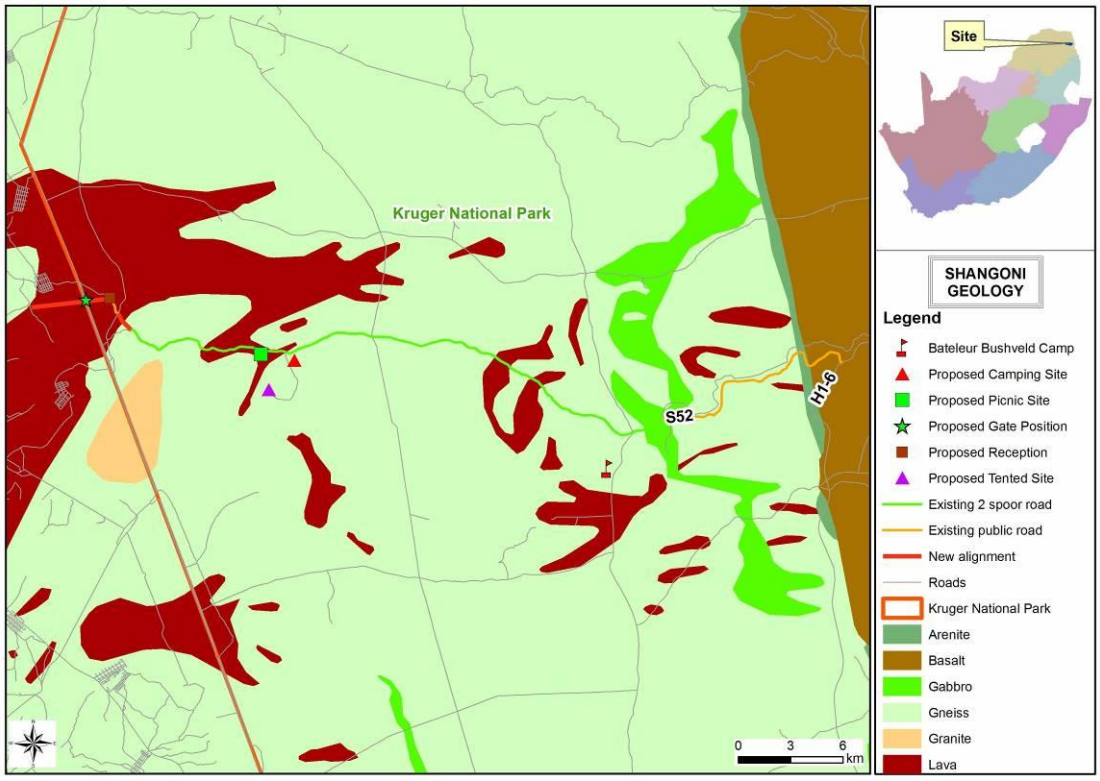

Figure 2: The geology of the area of the study site.

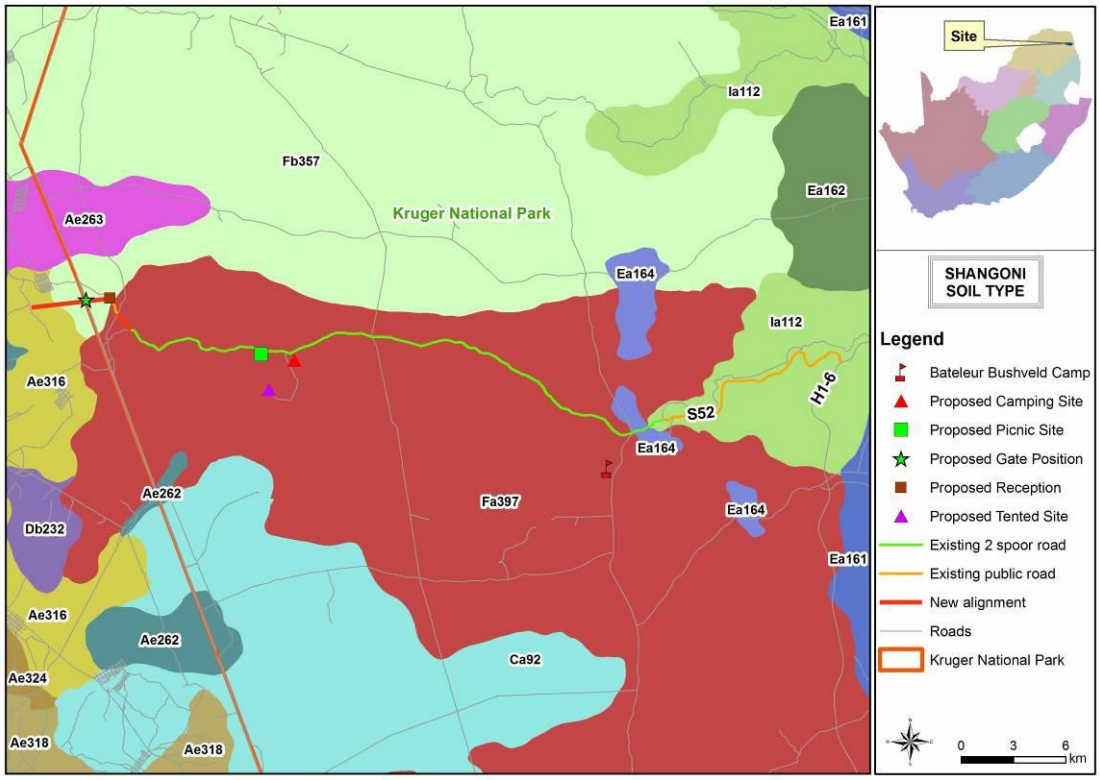

Figure 3 Land types of the study area

3.4 Topography and drainage

The topography of the region is gently undulating plain with an altitude of 440 m in the west to 300 m above sea level in the east. The Shingwedzi River is seasonal, but during normal rainfall seasons a number of hippo pools remain during winter and provide water for game. A number of dry washes decant storm water into the River and the Tshanga tributary (Figure 4).

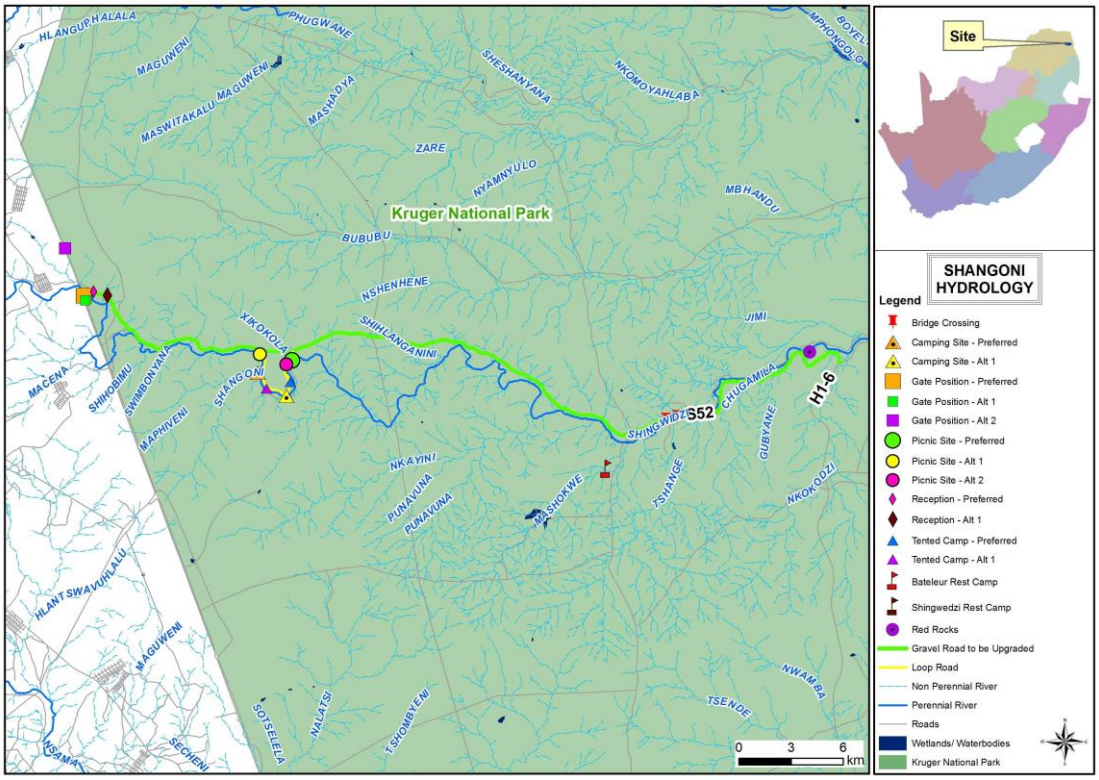

Figure 4: The hydrology map illustrates the many dry washes that decant storm water into the Shingwedzi River.

3.5 Land-use

The land-use is conservation within the Kruger National Park.

3.6 Regional Vegetation Types

The site is in the Mopani veld type (Veld Type 15), as described by Acocks (1988). According to Low & Rebelo (1996) the site is within Mopane Bushveld (Vegetation Type 10). According to the vegetation map and descriptions of Mucina and Rutherford (2006) the site is mainly located in Tsende Mopaneveld (Vegetation Unit SVmp 5), but small patches of Makuleke Sandy Bushveld (SVl 1)), Mopane Gabbro Shrubveld (SVmp 8) and Subtropical Alluvial Vegetation (AZa 7) also occur (Figure 6)(Figure 5).

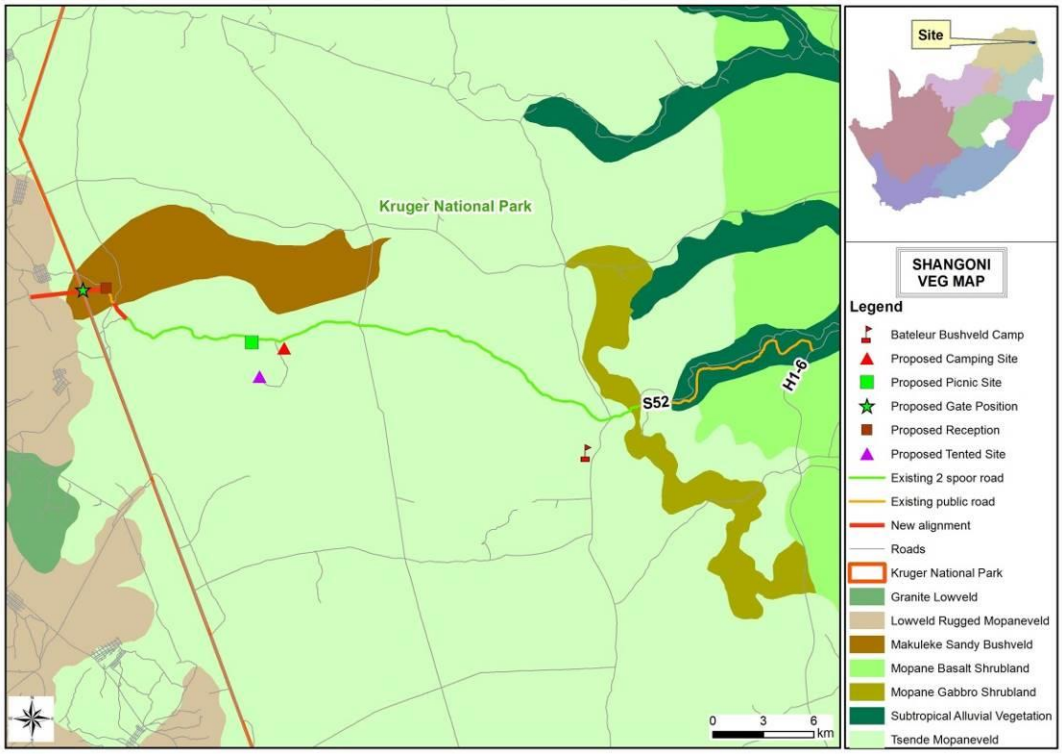

Figure 5: Regional Vegetation Types (Mucina & Rutherford 2006).

3.7 Critical Biodiversity Areas

Critical Biodiversity Areas are not present within the Kruger National Park, though are indicated for areas adjacent to the Park (Figure 6). Critical Biodiversity Areas (CBA's) are terrestrial and aquatic features in the landscape that are critical for retaining biodiversity and supporting continued ecosystem functioning and services (SANBI 2007). These form the key output of a systematic conservation assessment and are the biodiversity sectors inputs into multi-sectoral planning and decision making. CBA's are therefore areas of the landscape that need to be maintained in a natural or near-natural state in order to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services. In other words, if these areas are not maintained in a natural or near-natural state then biodiversity conservation targets cannot be met. Maintaining an area in a natural state can include a variety of biodiversity-compatible land uses and resource uses (Desmet *et al*., 2009).

In addition, the assessment also made provision for Ecological Support Areas (ESA's), which are areas that are not essential for meeting biodiversity representation targets/thresholds but which nevertheless play an important role in supporting the ecological functioning of critical biodiversity areas and/or in delivering ecosystem services that support socio-economic development, such as water provision, flood mitigation or carbon sequestration. The degree of restriction on land use and resource use in these areas may be lower than that recommended for critical biodiversity areas (Desmet *et al*., 2009).

3.8 Conservation Status

The entire study site area is conserved within the Kruger National Park.

4. METHODS

Initial preparations:

For background information, the relevant maps, aerial photographs and other information on the natural environment of the concerned area were obtained.

Site visit and vegetation survey

The field survey was done on 16-21 April 2016 by Prof GJ Bredenkamp, accompanied by the biodiversity specialists Dr IL Rautenbach, Prof AE McKechnie, and Ms ML Thompson. At times other specialists and SANPARKS officials also joined the biodiversity team.

At each of the preferred / alternative sites for the proposed gate, reception offices, picnic sites, tented camp sites and camp sites, as well as along the proposed road, the vegetation / habitats were stratified into relatively homogeneous units on recent Google Earth images of the area. At several sites within each relatively homogeneous unit a description of the dominant and characteristic species was made. These descriptions were based on total floristic composition, following established vegetation survey techniques (Mueller-Dombois & Ellenberg 1974; Westhoff & Van der Maarel 1978). Data recorded included a list of the plant species present, including trees, shrubs, grasses and forbs. Comprehensive species lists were therefore derived for each plant community / ecosystem present on the site. These vegetation survey methods have been used as the basis of a national vegetation survey of South Africa (Mucina *et al*. 2000) and are considered to be an efficient method of describing vegetation and capturing species information. Notes were additionally made of any other features that might have an ecological influence.

The identified systems are not only described in terms of their plant species composition, but also evaluated in terms of the potential habitat for red data plant species.

Critically Endangered, Endangered, Vulnerable and Protected Species (NEMBA species, TOPS species) are evaluated against the list published in Department of Environmental Affairs and Tourism Notice No. 2007 (National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004)).

Protected trees are identified in accordance with the list of nationally protected trees published in Government Notice No. 29062 3 (2006) (National Forests Act, 1998 (Act No. 84 0f 1998), as Amended (Department of Water Affairs Notice No 897, 2006).

Lists of Red Data plant species for the area were obtained from the SANBI data bases, with updated threatened status, (Raimondo *et al* 2009) for the map grid 2628BD. These lists were then evaluated in terms of habitat available on the site, and also in terms of the present development and presence of man in the area.

Alien invasive species, according to the Conservation of Agricultural Resources Act (Act No.43 of 1983) as listed in Henderson (2001) and other weeds in Bromilov (2010) are indicated.

Medicinal plants are indicated according to Van Wyk, Van Oudthoorn & Gericke (1997).

Threatened ecosystems are in accordance with SANBI & DEAT (2009), and SANBI 2011).

Conservation Value
The following conservation value and sensitivity categories were used for each site:

High: Ecologically sensitive and valuable land with high species richness and/or sensitive ecosystems or red data species that should be conserved and no development allowed.
Medium-high: Land where sections are disturbed but which is in general ecologically sensitive to development/disturbances.
Medium: Land on which low impact development with limited impact on the vegetation / ecosystem could be considered for development. It is recommended that certain portions of the natural vegetation be maintained as open space.
Medium-low: Land of which small sections could be considered for conservation but where the area in general has little conservation value.
Low: Land that has little conservation value and that could be considered for development with little to no impact on the vegetation.

Ecological Sensitivity
It has been clearly demonstrated that vegetation not only forms the basis of the trophic pyramid in an ecosystem, but also plays a crucial role in providing the physical habitat within which organisms complete their life cycles (Kent & Coker 1992). Therefore, the vegetation of an area will largely determine the ecological sensitivity thereof.

The vegetation sensitivity assessment aims to identify whether the vegetation within the study area is of conservation concern and thus sensitive to development:

In order to determine the sensitivity of the vegetation (ecosystem) on the site, weighting scores are calculated per plant community. The following six criteria are used and each allocated a value of 1-3.

- Conservation status of a regional vegetation unit;
- Listed ecosystem (e.g. wetlands, hills and ridges etc)
- Legislative protection (e.g. threatened ecosystems ,SANBI & DEAT 2009)

- Plant species of conservation concern (e.g. red listed, nationally or provincially protected plant species, habitat or potential habitat to plants species of conservation concern, protected plants or protected trees);
- Situated within ecologically functionally important features (e.g. wetlands or riparian areas; important habitat for rare fauna species)
- Conservation importance (e.g. untransformed and un-fragmented natural vegetation, high plant species richness, important habitat for rare fauna species).

Sensitivity is calculated as the sum the values of the criteria. The vegetation with the lowest score represents the vegetation that has the least / limited sensitivity). A maximum score of 18 can be obtained, a score of 13-18 indicated high sensitivity

The sensitivity scores are as follows:

Scoring	14-18	7-13	0-6
Sensitivity	High	Medium	Low

A score of Medium-High (score 10-13) or Medium Low (score 7-9) can also be allocated.

Development on vegetation that has High sensitivity will normally not be supported, except that specific circumstances may still lead to support of the proposed development. Portions of vegetation with a Medium-High sensitivity should be conserved**.**

Development may be supported on vegetation considered to have a Low sensitivity.

Plant Species Status

Plant species recorded in each plant community with an indication of the status of the species by using the following symbols:
A = Alien woody species; D = Dominant; d = subdominant; G = Garden or Garden Escape; M = Medicinal plant species; P = Protected trees species; p = provincially protected species; RD = Red data listed plant; W = weed.

Plant Species Richness

Species Richness is interpreted as follows: Number of indigenous species recorded in the sample plots representing the plant community. Alien woody species and weeds are not included.

Categories of plant species richness are as follows:

No of species	**Category**
1-24	Low
25-39	Medium
40-59	High
60+	Very High

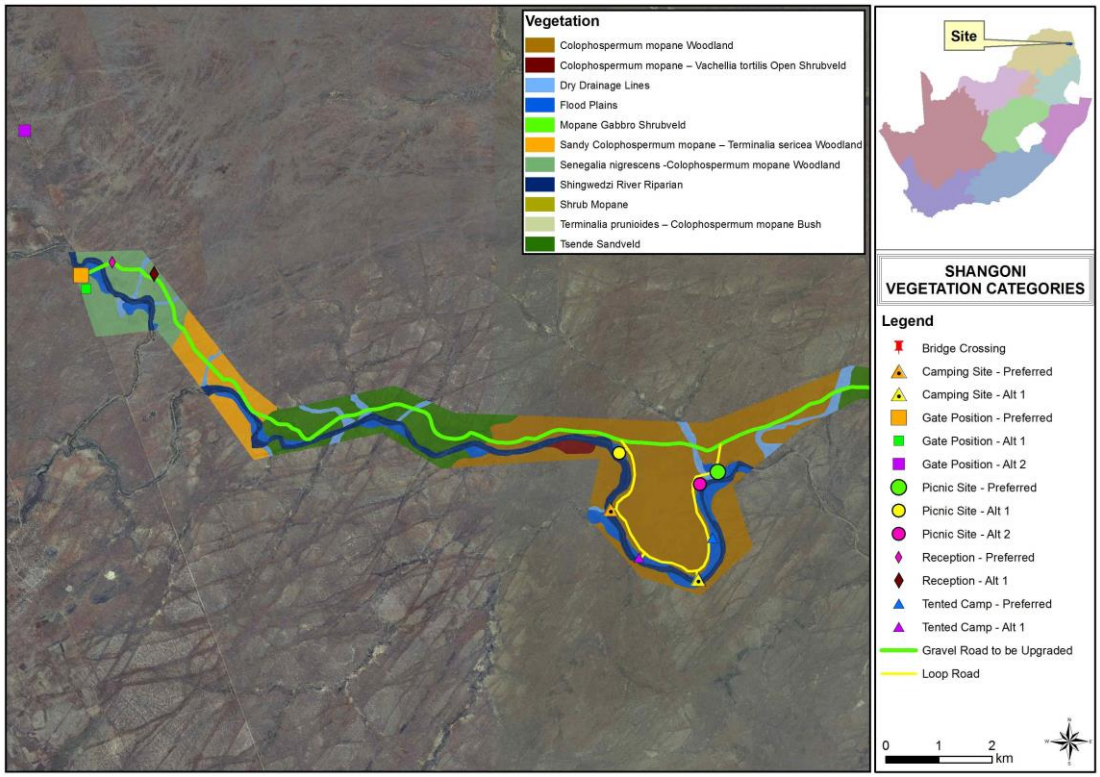

Figure 6: Vegetation map of the study site - part 1 (west)

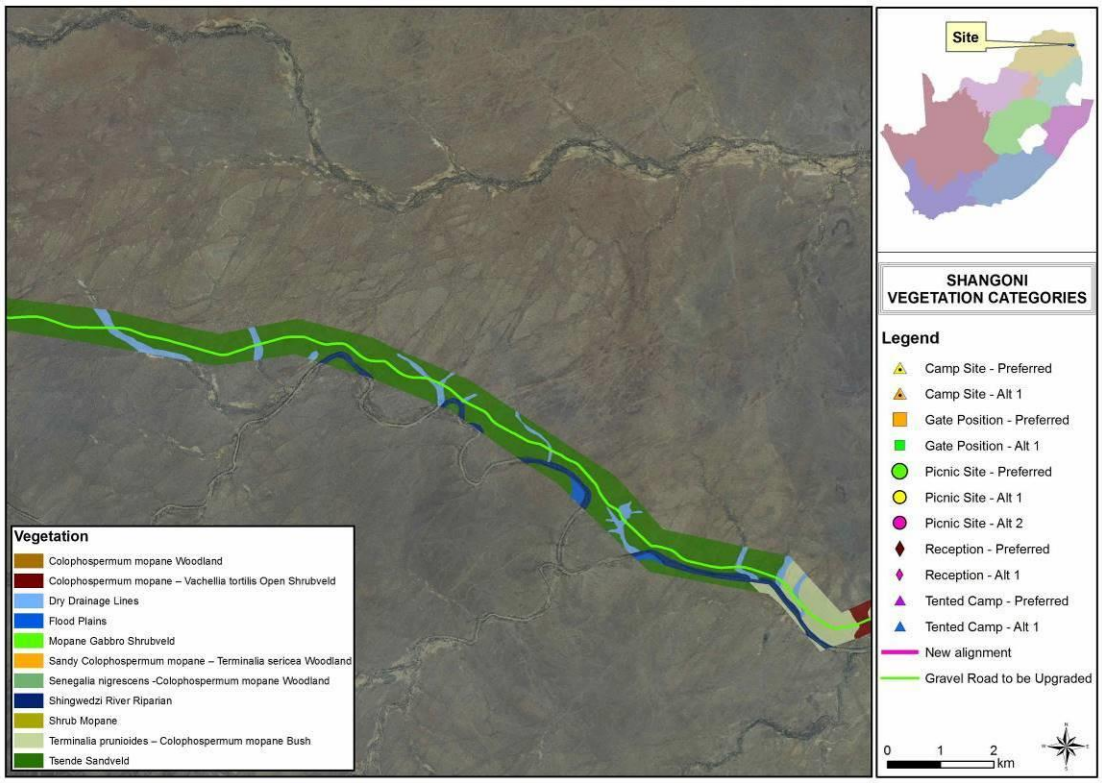

Figure 6: Vegetation map of the study site - part 2 (central)

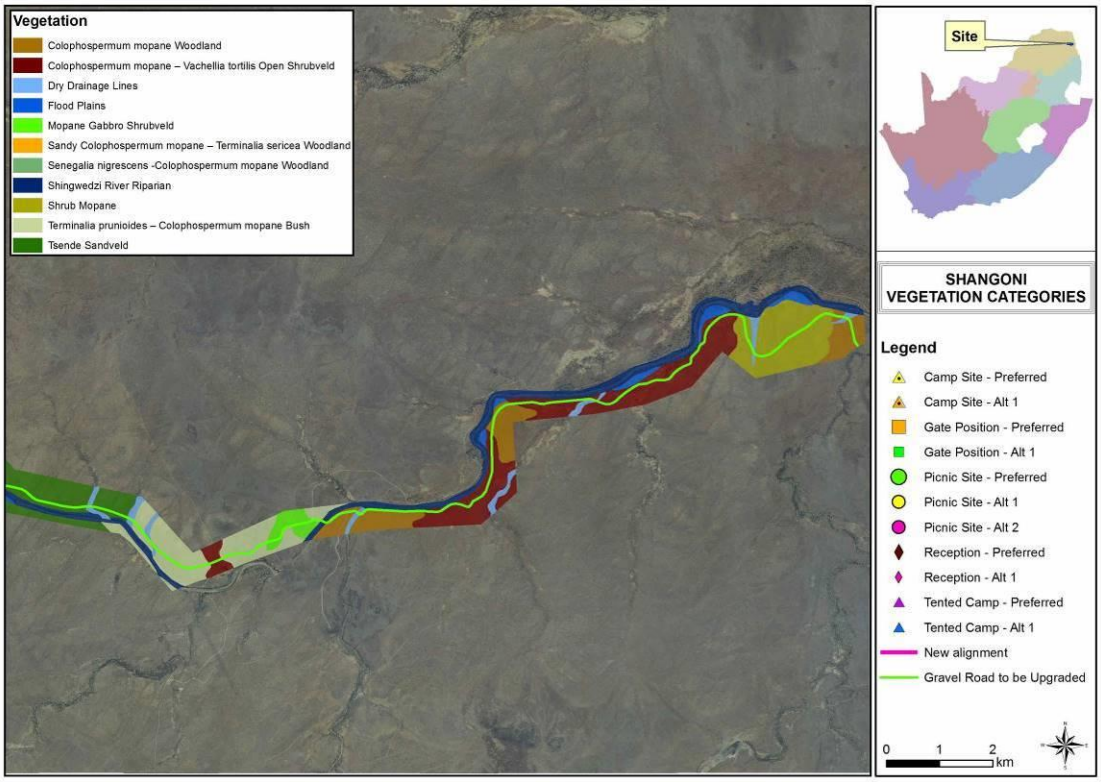

Figure 6: Vegetation map of the study site - part 3 (east)

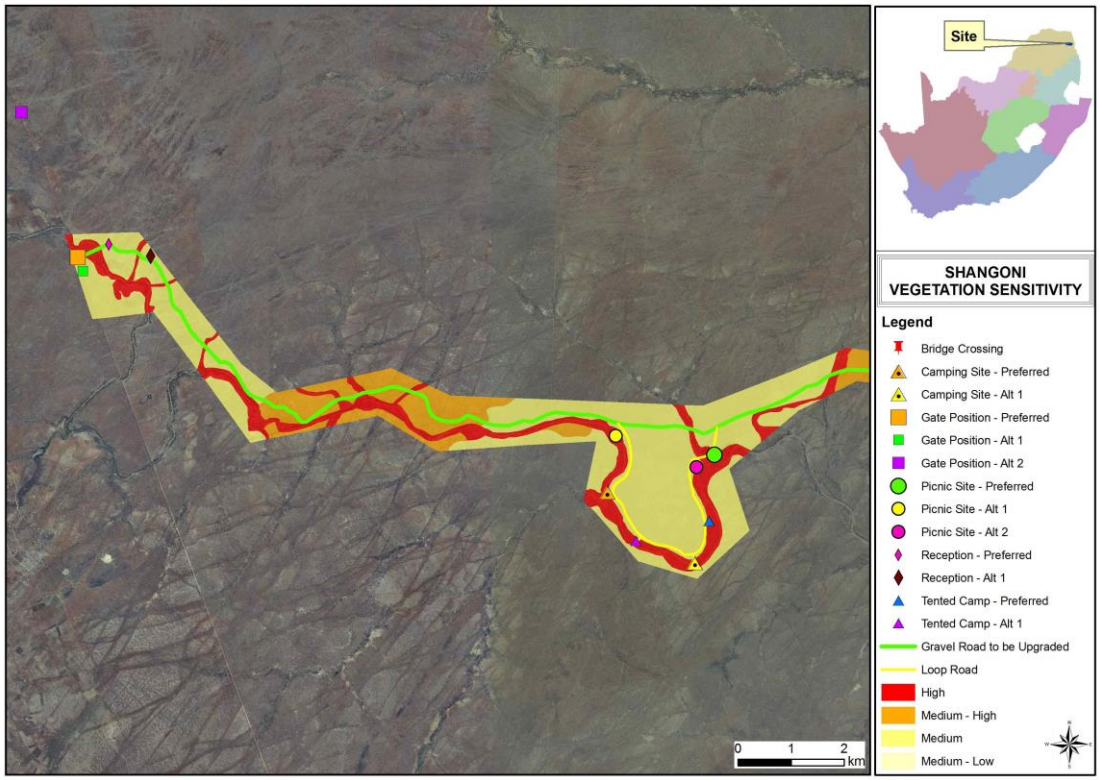

Figure 7: Sensitivity map of the study site - part 1 (west)

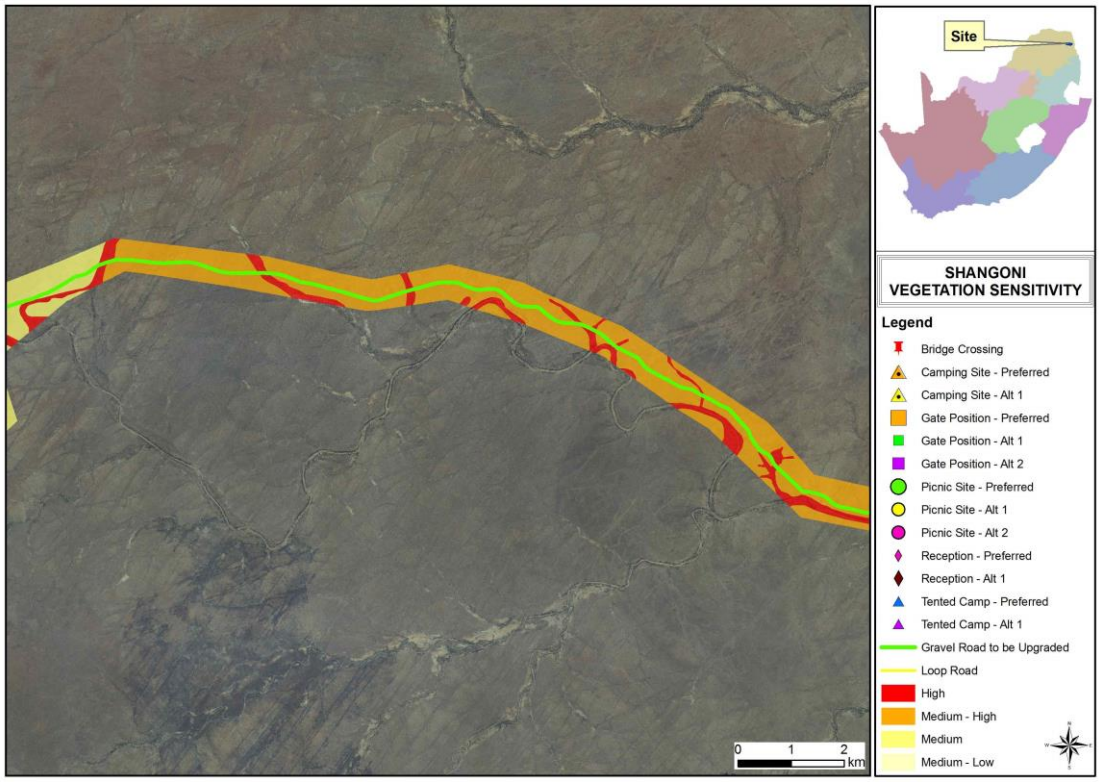

Figure 7: Sensitivity map of the study site - part 2 (central)

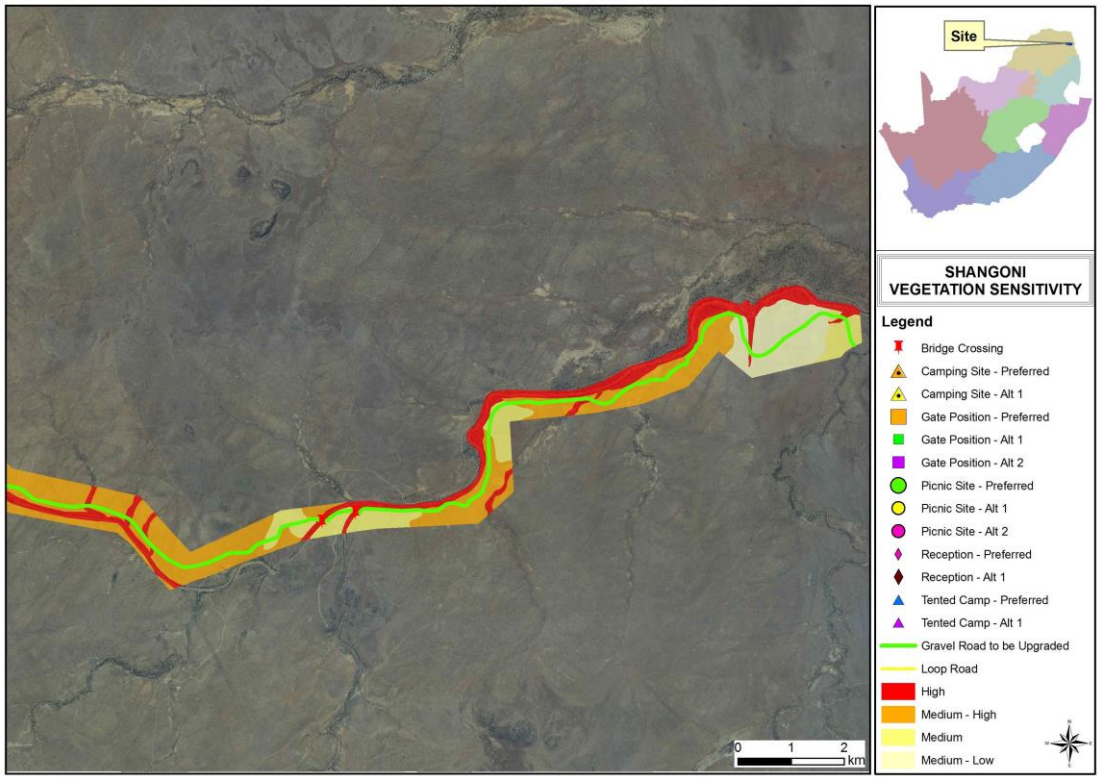

Figure 7 Sensitivity map of the study site - part 3(east):

5. RESULTS: VEGETATION AND FLORA

5.1 Classification of the vegetation

The regional vegetation classification (Mucina & Rutherford, 2006) indicated that 4 different vegetation types could potentially be influenced by the proposed development (Figure 5). These are, from west to east:
Makuleke Sandy Bushveld, Tsende Mopaneveld, Mopane Gabbro Shrubveld and Subtropical Alluvial Vegetation

Eleven vegetation mapping units were identified along the transect (Table 5.1).

Table 5.1: Mapping units

Mapping units / Plant Community	Sensitivity	Mucina & Rutherford (2006)
1. *Senegalia nigrescens* - *Colophospermum mopane* Woodland	Medium	Maluleke Sandy Bushveld (SVl1) [rather Lowveld Rugged Mopaneveld SVmp6)]
2. Sandy *Colophospermum mopane* – *Terminalia sericea* Woodland	Medium	Tsende Mopaneveld
3. Tsende Sandveld	Medium-High	Tsende Mopaneveld
4. *Colophospermum mopane* Woodland	Medium	Tsende Mopaneveld
5. *Terminalia prunioides* – *Colophospermum mopane* Bush	Medium-High	Tsende Mopaneveld (rather Lowveld Rugged Mopaneveld)
6. *Colophospermum mopane* – *Vachellia tortilis* Open Shrubveld	Medium-High	Sodic patches in Mopane Basalt Shrubveld
7. Shrub Mopane	Medium-Low	Mopane Basalt Shrubveld
8. Mopane Gabbro Shrubveld	Medium	Mopane Gabbro Shrubveld
9. Drainage Lines	High	Various
10. Flood Plains	High	Subtropical Alluvial Vegetation
11. Shingwedzi River Riparian	High	Subtropical Alluvial Vegetation

5.2 Description of the plant communities

The distribution of the plant communities identified in this study is shown in the vegetation map (Figure 6) while the sensitivity of the plant communities is indicated in Figure 7.

5.2.1 *Senegalia nigrescens-Colophospermum mopane* Woodland

This Woodland (Figure 8) is located on the western boundary of the KNP (Figure 6), on both sides of the Shingwedzi River. The preferred and alternative sites for the Shangoni Gate are located here (Figure 9). Within the KNP boundary fence, the

vegetation is cleared for a fire break and also for a track along the fence (Figure 9). The preferred and alternative sites for the Reception building and associated infrastructure are also located within this plant community (Figures 6 and 10), but on the north-eastern side of the Shingwedzi River. The access road will cross this plant community from the Gate, via a bridge over the Shigwedzi River, to the Reception site.

According to Mucina and Rutherford (2006) this vegetation is mapped as Maluleke Sandy Bushveld (SVl1), however, the detailed vegetation survey on the site indicates that the vegetation rather represents Lowveld Rugged Mopaneveld (SVmp6), which occurs directly west of the KNP western boundary fence. This is particularly indicated by the prominence of *Senegalia nigrescens* (Figure 9).

Other prominent trees that were recorded here include *Colophospermum mopane, Terminalia sericea, Combretum collinum* and *Combretum imberbe.* Although the herbaceous layer has a very low cover, species such as *Cenchrus ciliaris* and *Urochloa mosambicensis* were conspicuously present. Forbs were found only scattered with very low cover.

The fence-line effect of the western boundary fence is very conspicuous, with *Senegalia nigrescens* totally dominant west of the fence, outside the KNP, but much less prominent east of the fence inside the KNP, where *Colophospermum mopane* is more prominent.

Figure 8: The *Senegalia nigrescens-Colophospermum mopane* Woodland at the Shangoni Gate site

Figure 9: The preferred site for the Shangoni Gate on the western boundary of the KNP. Note the prominence of *Senegalia nigrescens* behind the fence.

Figure 10: The *Senegalia nigrescens-Colophospermum mopane* Woodland at the Reception site.

***Senegalia nigrescens-Colophospermum mopane* Woodland summary**			
Status	Natural Mopane bushveld		
Soil	Reddish brown, clay-loam	**Rockiness**	0%
Conservation value:	High	**Ecological sensitivity**	Medium
Species richness	Medium	**Need for rehabilitation**	Low
Dominant spp.	*Senegalia nigrescens, Colophospermum mopane*		

The following plant species were recorded from the *Senegalia nigrescens-Colophospermum mopane* Woodland found at the specific proposed development sites and along the proposed road transect:

Trees and shrubs, dwarf shrubs

Colophospermum mopane	d	*Euclea divinorum*	
Combretum apiculatum		*Philenoptera violacea*	P
Combretum collinum		*Senegalia nigrescens*	d
Combretum hereroense		*Terminalia sericea*	
Combretum imberbe	P		

Grasses and sedges

Aristida congesta barbicollis		*Panicum coloratum*	
Bothriochloa radicans		*Setaria sphacelata*	
Cenchrus ciliaris	d	*Sporobolus africanus*	
Cymbopogon pospischilii		*Themeda triandra*	
Eragrostis superba		*Urochloa mosambicensis*	d
Heteropogon contortus			

Forbs

Abutilon angulatum	*Senna italica*
Ipomoea sinensis	*Solanum panduriforme*
Jatropha zeyheri	*Waltheria indica*
Melhania acuminata	

Number of species

	Indigenous	Aliens / Weeds	Total	Red Data	Protected	Medicinal
Trees and shrubs	9	0	9	0	2	0
Grasses	11	0	11	0	0	0
Forbs	7	0	7	0	0	0
Total	27	0	27	0	2	0

Discussion

The sites of the proposed Shangoni Gate and Reception area, and the area of the road to connect the Gate with the Reception area, are covered with Mopane bushveld with medium plant species richness, but two nationally protected tree species occur, namely *Combretum imberbe* and *Philenoptera violacea.* It is doubted that any individuals of *Combretum imberbe* will be in the way of the proposed development, though several smaller (up to 1.5 m tall) individuals of *Philenoptera violacea* occur within the transect. A permit from the provincial department of Forestry is needed to remove, or even cut, nationally protected trees (The Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983) and the National Forests Act, 2006 (Act 84 of 1998 as amended in 2006). This area is furthermore transected by the Shingwedzi River and also a few small, dry drainage lines and the road will have to cross these. (The vegetation of the River, drainage lines and flood plains is discussed under a separate heading).

5.2.2. Sandy *Colophospermum mopane-Terminalia sericea* Woodland

This woodland occurs along the proposed road transect from about 23°09'14.8"S; 30°56'56.9"E south-eastwards to about 23°09'45.1"S; 30°57'23.6"E (Figure 6). The north-western part of this road cuts through natural woodland vegetation, while the south-eastern part runs on the existing ranger's road. The road will cross small drainage lines.

The most prominent tree species are *Colophospermum mopane, Senegalia nigrescens, Combretum apiculatum, Combretum collinum* and *Terminalia sericea.* The herbaceous layer was quite dry, but the grasses *Bothriochloa radicans, Urochloa mosambicensis, Schmidtia pappophoroides* and *Cenchrus ciliaris* were locally prominent, while some forbs occurred scattered in the veld, but they were never dominant.

Sandy *Colophospermum mopane-Terminalia sericea* Woodland summary			
Status	Natural bushveld		
Soil	Light brown sandy loam	**Rockiness**	0-5%
Conservation value:	High	**Ecological sensitivity**	Medium
Species richness	Medium	**Need for rehabilitation**	Low
Dominant spp.	*Colophospermum mopane, Combretum apiculatum, Terminalia sericea*		

Figure 11: Typical Sandy *Colophospermum mopane-Terminalia sericea* Woodland.

The following plant species were recorded in this plant community:

Trees, Shrubs and Dwarf shrubs

Cassia abbreviata		*Flueggea virosa*	
Cissus cornifolia		*Ochna inermis*	
Colophospermum mopane	D	*Peltophorum africanum*	
Combretum apiculatum		*Philenoptera violacea*	P
Combretum collinum		*Pterocarpus rotundifolius*	
Combretum hereroense		*Senegalia nigrescens*	
Commiphora pyracanthoides		*Terminalia sericea*	d

Grasses and sedges

Aristida congesta barbicollis		*Heteropogon contortus*	
Bothriochloa radicans	d	*Melinis repens*	
Cenchrus ciliaris	d	*Perotis patens*	
Cymbopogon pospischilii		*Pogonarthria squarrosa*	
Digitaria eriantha		*Schmidtia pappophoroides*	d
Digitaria eriantha		*Themeda triandra*	
Eragrostis superba		*Urochloa mosambicensis*	

Forbs

Ocimum americanum		*Boerhavia coccinea*	
Waltheria indica		*Vernonia fastigiata*	
Commelina africana		*Ceratotheca triloba*	
Dicoma tomentosa		*Solanum panduriforme*	

Number of species

	Indigenous	**Aliens / Weeds**	**Total**	**Red Data**	**Protected**	**Medicinal**
Trees and shrubs	14	0	14	0	1	0
Grasses	14	0	14	0	0	0
Forbs	8	0	8	0	0	0
Total	36	0	36	0	1	0

Discussion

This is natural bushveld with medium to High species richness and the nationally protected tree *Philenoptera violacea* was present. A permit from the provincial department of Forestry is needed to remove, or even cut, nationally protected trees (The Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983) and the National Forests Act, 2006 (Act 84 of 1998 as amended in 2006).

5.2.3. *Tsende* Sandveld

The Tsende Sandveld (Gertenbach 1983) occurs widespread in the region, and a large part of the route of the proposed road will transect this plant community. This landscape is undulating granite terrain with distinct uplands and bottomlands. Amphibolite from the Swaziland System occurs fairly regularly and the remainder of the landscape is intersected by numerous dolerite intrusions. An interesting phenomenon about the dolerite intrusions is that they have a south-west/north-east orientation (Gertenbach 1983).

Figure 12: An aerial view of the numerous south-west/north-east orientated dolerite intrusions in the Tsende Sandveld.

The dominant woody plants of this landscape are as follows: On the sandy uplands within the slightly undulating landscape, *Combretum apiculatum* is quite prominent (Figure 13) and *Colophospermum mopane, Cissus cornifolia, Albizia harveyi, Mundulea sericea, Terminalia sericea, Grewia bicolor, Dichrostachys cinerea. Sclerocarya caffra, Dalbergia melanoxylon, Peltophorum africanum, Strychnos madagascariensis and Commiphora africana* also present.

However, moving towards the bottomlands the soil becomes more clayey and *Colophospermum mopane* becomes totally dominant (Figure 14), with *Combretum apiculatum* and most of the other sand-loving species are absent.

Figure 13: Sandy uplands in Tsende Sandveld with *Combretum apiculatum* prominent

Figure 14: Clayey bottomland in Tsende Sandveld with *Colophospermum mopane* prominent.

The following plant species were recorded in this plant community:

Trees and Shrubs

Albizia harveyi		*Flueggea virosa*	
Bridelia mollis		*Grewia bicolor*	
Cassia abbreviata		*Grewia flavescens*	
Cissus cornifolia		*Grewia monticola*	
Colophospermum mopane	D	*Peltophorum africanum*	
Combretum apiculatum		*Philenoptera violacea*	P
Combretum hereroense		*Sclerocarya birrea*	P
Combretum imberbe	P	*Senegalia nigrescens*	
Combretum zeyheri		*Strychnos madagascariensis*	
Commiphora africana		*Terminalia sericea*	d
Dalbergia melanoxylon		*Vachellia gerrardii*	
Dichrostachys cinerea		*Vachellia tortilis*	

Grasses and sedges

Andropogon gayanus		*Heteropogon contortus*	
Aristida congesta barbicollis		*Melinis repens*	
Aristida meridionalis		*Panicum maximum*	
Bothriochloa radicans	d	*Perotis patens*	
Brachiaria nigropedata		*Pogonarthria squarrosa*	
Cymbopogon pospischilii		*Schmidtia pappophoroides*	d
Digitaria eriantha		*Themeda triandra*	
Eragrostis superba		*Urochloa mosambicensis*	
Fimbristylis complanata			

Forbs

Agathisanthemum bojeri	*Indigofera filipes*
Blepharis integrifolia	*Ipomoea magnusiana*
Boerhavia coccinea	*Melhania forbesii*
Ceratotheca triloba	*Ocimum americanum*
Cleome monophylla	*Orthosiphon australis*
Clerodendrum ternatum	*Phyllanthus asperulatus*
Commelina africana	*Rhynchosia totta*
Corchorus asplenifolius	*Solanum panduriforme*
Dicoma tomentosa	*Talinum caffrum*
Dolichos trilobus	*Tephrosia polystachya*
Heliotropium steudneri	*Vernonia fastigiata*
Hermbstaedtia odorata	*Waltheria indica*

Number of species

	Indigenous	Aliens / Weeds	Total	Red Data	Protected	Medicinal
Trees and shrubs	24	0	24	0	3	0
Grasses and sedges	17	0	17	0	0	0
Forbs	24	0	24	0	0	0
Total	65	0	65	0	3	0

Tsende Sandveld summary			
Status	Natural diverse bushveld		
Soil	Sandy on uplands, clayey in bottomlands	**Rockiness %**	0-15
Conservation priority:	Medium-High	**Sensitivity:**	Medium-High
Species Richness:	Very High	**Need for rehabilitation**	Low
Dominant spp.	*Combretum apiculatum, Colophospermum mopane*		

Discussion

The species richness in this area is very high, but this is a result of the mosaic of upland sandy and lowland clayey areas in the undulating landscape. Several drainage lines and dolerite dykes in the area also cross the road. Although several individuals of the nationally protected trees *Sclerocarya birrea, Combretum imberbe* and *Philenoptera violacea* were noted, very few will be in the transect of the road. Nevertheless, a permit from the provincial department of Forestry is needed to remove, or even cut, nationally protected trees (The Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983) and the National Forests Act, 2006 (Act 84 of 1998 as amended in 2006).

5.2.4. *Colophospermum mopane* Woodland

Some areas within the Tsende Sandveld, especially flat the areas with amphibolite (Figure 6), have reddish clayey soils and these areas are covered with vegetation where *Colophospermum mopane* is totally dominant, with very few other woody species present. The grass layer is also fairly open (Figure 15).

The following plant species were recorded in this plant community:

Trees, Shrubs and Dwarf shrubs

Cassia abbreviata *Cissus cornifolia*

Colophospermum mopane	D	*Flueggea virosa*	
Combretum hereroense		*Philenoptera violacea*	P
Dalbergia melanoxylon		*Senegalia nigrescens*	

Grasses and sedges

Aristida congesta barbicollis		*Heteropogon contortus*	
Bothriochloa radicans	d	*Melinis repens*	
Digitaria eriantha		*Panicum coloratum*	
Digitaria eriantha		*Themeda triandra*	
Eragrostis sp		*Urochloa mosambicensis*	
Eragrostis superba			

Forbs

Ceratotheca triloba		*Ocimum americanum*	
Commelina africana		*Sida dregei*	
Dicoma tomentosa		*Solanum panduriforme*	
Hermbstaedtia odorata		*Waltheria indica*	

Number of species

	Indigenous	**Aliens / Weeds**	**Total**	**Red Data**	**Protected**	**Medicinal**
Trees and shrubs	8	0	8	0	1	0
Grasses and sedges	11	0	11	0	0	0
Forbs	8	0	8	0	0	1
Total	27	0	27	0	1	1

***Colophospermum mopane* summary**			
Status	Natural bushveld		
Soil	Clayey loam	**Rockiness %**	0-5
Conservation priority:	Medium-Low	**Sensitivity:**	Medium-Low
Species Richness:	Medium	**Need for rehabilitation**	Low
Dominant spp.	*Colophospermum mopane*		

Discussion

Due to the flat, relatively monotonous landscape and vegetation, only limited drainage lines occur, and relatively few species are present. The protected tree

Philenoptera violacea was locally present, but probably not in the way of the proposed road.

Figure 15: Typical *Colophospermum mopane* Woodland

5.2.5. *Terminalia prunioides – Colophospermum mopane* Bush

This plant community is restricted to rocky areas between 23°12'30.1"S; 31°11'58.1" E and 23°12'32.1"S; 31°13'50.2"E (Figure 6). This is very dense bush, with *Terminalia prunioides* and *Colophospermum mopane* dominant.

Figure 16: The very dense *Terminalia prunioides-Colophospermum mopane* Bush

The most prominent species include:

Trees and Shrubs

Cissus cornifolia		*Maerua parvifolia*	
Colophospermum mopane	D	*Pappea capensis*	
Combretum apiculatum		*Rhigozum zambesiacum*	
Commiphora africana		*Sclerocarya birrea*	P
Commiphora mollis		*Terminalia prunioides*	D
Dichrostachys cinerea		*Vachellia tortilis*	
Grewia bicolor		*Ziziphus mucronata*	
Grewia flavescens			

Grasses and Sedges

Aristida congesta	*Fingerhuthia africana*
Bothriochloa radicans	*Melinis repens*
Digitaria eriantha	*Panicum maximum*
Enneapogon cenchroides	*Schmidtia pappophoroides*

Forbs

Abutilon angulatum
Corchorus asplenifolius
Crabbea velutina
Hemizygia elliotii
Hibiscus sidiformis
Kyphocarpa angustifolia
Melhania forbesii
Pavonia burchellii
Sericorema remotiflora
Solanum panduriforme
Tephrosia polystachya

Number of species

	Indigenous	**Aliens / Weeds**	**Total**	**Red Data**	**Protected**	**Medicinal**
Trees and shrubs	15	0	15	0	1	0
Grasses and sedges	8	0	8	0	0	0
Forbs	11	o	11	0	0	0
Total	34	0	34	0	1	0

Terminalia prunioides-Colophospermum mopane summary			
Status	Transformed		
Soil	Rocky and gravelly	**Rockiness %**	5-20
Conservation priority:	Medium-High	**Sensitivity:**	Medium High
Species Richness:	Medium	**Need for rehabilitation**	Low
Dominant spp.	*Terminalia prunioides, Colophospermum mopane*		

Discussion

This vegetation is related to the Letaba River Rugged Veld (Gertenbach 1983), rather than the Tsende Mopaneveld (Mucina and Rutherford 2006). This plant community occupies a relatively small along the Shingwedzi River, and particularly the area within the study site. Although the nationally protected tree *Sclerocarya birrea* was noted in this vegetation, it is doubted that it will be in the way of the proposed road.

5.2.6. *Colophospermum mopane – Vachellia tortilis* Open Shrubveld

This plant community is restricted to sodic soils, along the S52. The soil is often bare with very limited herbaceous vegetation and with only few trees and shrubs (Figure

6). The soil is highly erodible and therefore this ecosystem has a medium-high ecological sensitivity. [At one locality close to the road and adjacent to the open shrubveld (approx. 23°10'37.1"S; 31°17'47.5"E) is a small hill with sandy soil and dominated by *Combretum apiculatum*].

The most prominent woody species include *Vachellia tortilis, Colophospermum mopane* and *Salvadora australis.*

Figure 17: The *Colophospermum mopane-Vachellia tortilis* Open Shrubveld

The most prominent species include:

Trees and Shrubs

Colophospermum mopane	d	*Maerua parvifolia*	
Combretum apiculatum		*Salvadora australis*	d
Dichrostachys cinerea		*Vachellia tortilis*	d

Grasses and Sedges

Chloris virgata	*Sporobolus ioclados*
Eragrostis lehmanniana	*Tragus berteronianus*

Forbs

Kyphocarpa angustifolia	*Trianthema salsoloides*
Sericorema remotiflora	

Number of species

	Indigenous	Aliens / Weeds	Total	Red Data	Protected	Medicinal
Trees and shrubs	6	0	6	0	1	0
Grasses and sedges	4	0	4	0	0	0
Forbs	3	0	3	0	0	0
Total	13	0	13	0	0	0

-Colophospermum mopane-Vachellia tortilis Open Shrubveld summary			
Status	Sodic areas		
Soil	Hard sodic soil	**Rockiness %**	0
Conservation priority:	High	**Sensitivity:**	Medium-High
Species Richness:	Low	**Need for rehabilitation**	Low
Dominant spp.	*Vachellia tortilis, Colophospermum mopane*		

Discussion

This vegetation is restricted to low-lying sodic soil causing it to be ecologically sensitive.

5.2.7. Shrub Mopani

A small patch shrub mopane occurs at the eastern end of the proposed road (S52), close to the H1-6 main road. The *Colophospermum mopane* shrubs are 1-1.5 m tall. Very limited other woody species are present.

The most prominent species include:

Trees and Shrubs

Colophospermum mopane D

Grasses and Sedges

Bothriochloa radicans
Eragrostis superba
Schmidtia pappophoroides
Tragus berteronianus

Forbs

Aptosimum sp
Blepharis sp
Evolvulus alsinoides
Kyphocarpa angustifolia

Number of species

	Indigenous	Aliens / Weeds	Total	Red Data	Protected	Medicinal
Trees and shrubs	1	0	1	0	0	0
Grasses and sedges	4	1	4	0	0	0
Forbs	4	0	4	0	0	0
Total	9	0	9	0	0	0

Shrub Mopane summary			
Status	Short natural bush		
Soil	Clay loam	**Rockiness %**	0
Conservation priority:	Medium	**Sensitivity:**	Medium-Low
Species Richness:	Low	**Need for rehabilitation**	Low
Dominant spp.	*Colophospermum mopane*		

Figure 18: Shrub Mopane

Discussion

This plant community is very small within the study site, has low species richness and contains no protected species.

5.2.8. Mopane Gabbro Shrubveld

A very small patch of this vegetation occurs at about 23°12'45.5"S; 31°13'24.6"E. This area is dominated by *Colophospermum mopane.* The vegetation is similar to the Shrub Mopane (paragraph 5.2.7) and are not described further.

5.2.9. Dry Drainage lines

Several dry drainage lines will be crossed by the proposed road (Figure 6). These ecosystems are considered to be wetlands (National Water Act, 1998 (Act No. 36 of

1998). Some of these drainage lines are quite wide with a sandy bed, while others are narrow and almost not noticeable (Figure 19). This report does not include any wetland or river assessment, though an overview of the vegetation of these drainage lines is given.

Most of the general plant species that occur in the Mopane bushveld are also present in or along the drainage lines, but the vegetation is generally taller (Figure 14). The dominant woody plants include *Combretum apiculatum, Senegalia nigrescens* and *Colophospermum mopane.* However, *Cissus cornifolia, Albizia harveyi, Mundulea sericea, Terminalia sericea, Grewia bicolor, Dichrostachys cinerea, Sclerocarya caffra, Dalbergia melanoxylon, Peltophorum africanum, Strychnos madagascariensis* and *Commiphora africana* are also abundantly present.

The following plant species were recorded in this plant community:

Trees and Shrubs

Albizia harveyi		*Grewia flavescens*	
Bridelia mollis		*Grewia monticola*	
Cassia abbreviata		*Mundulea sericea*	
Cissus cornifolia		*Ochna inermis*	
Colophospermum mopane	d	*Pappea capensis*	
Combretum apiculatum		*Peltophorum africanum*	
Combretum hereroense		*Philenoptera violacea*	P
Combretum imberbe	P	*Phyllanthus reticulatus*	
Combretum zeyheri		*Sclerocarya birrea*	P
Commiphora africana		*Senegalia nigrescens*	d
Dalbergia melanoxylon		*Strychnos madagascariensis*	
Dichrostachys cinerea		*Terminalia sericea*	
Diospyros mespiliformis		*Vachellia gerrardii*	
Elaeodendron transvaalensis	P	*Vachellia robusta*	
Flueggea virosa		*Vachellia tortilis*	
Grewia bicolor		*Ximenia caffra*	

Grasses and sedges

Andropogon gayanus		*Melinis repens*	
Aristida congesta barbicollis		*Panicum maximum*	
Bothriochloa radicans	d	*Pogonarthria squarrosa*	
Cymbopogon pospischilii		*Schmidtia pappophoroides*	
Digitaria eriantha		*Setaria incrassata*	
Eragrostis superba		*Themeda triandra*	
Fimbristylis complanata		*Urochloa mosambicensis*	
Heteropogon contortus			

Forbs

Agathisanthemum bojeri		*Blepharis integrifolia*	

Ceratotheca triloba
Cleome monophylla
Clerodendrum ternatum
Commelina africana
Corchorus asplenifolius
Dicoma tomentosa
Dolichos trilobus
Heliotropium steudneri
Hermbstaedtia odorata
Indigofera filipes
Ipomoea magnusiana
Melhania forbesii
Ocimum americanum
Orthosiphon australis
Phyllanthus asperulatus
Rhynchosia totta
Solanum panduriforme
Tephrosia polystachya
Vernonia fastigiata
Waltheria indica

Number of species

	Indigenous	**Aliens / Weeds**	**Total**	**Red Data**	**Protected**	**Medicinal**
Trees and shrubs	32	0	32	0	4	0
Grasses and sedges	15	0	15	0	0	0
Forbs	22	0	24	0	0	0
Total	69	0	69	0	4	0

Drainage Lines summary			
Status	Drainage lines		
Soil	Often sandy in beds, rocky banks or vertic soils	**Rockiness %**	0-15
Conservation priority:	High	**Sensitivity:**	High
Species Richness:	Very High	**Need for rehabilitation**	Low
Dominant spp.	*Combretum apiculatum, Colophospermum mopane, Senegalia nigrescens*		

Discussion

The species richness in this area is very high in and along the drainage lines. Although several individuals of the nationally protected trees *Sclerocarya birrea, Combretum imberbe* and *Philenoptera violacea* and to a lesser degree *Elaeodendron transvaalensis* were noted, very few will be in at the specific localities where the road will cross the drainage lines. A permit from the provincial department of Forestry is needed to remove, or even cut, nationally protected trees (The Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983) and the National Forests Act, 2006 (Act 84 of 1998 as amended in 2006).

Figure 19: A collage of different Drainage Lines

5.2.10. Flood Plains

The Shingwedzi River is a relatively dry, seasonal river that has flowing water only seasonally, during higher rainfall years. However, great floods may occur occasionally. Flood plains do occur at some localities, usually directly outside the riparian on the banks of the River (Figure 6). Particularly prominent are the floodplains in the river loop where the development of a picnic site, tented camp site and camping site is planned.

The floodplains are generally flat sandy plains with scattered large trees but with a scanty herbaceous layer (Figure 20).

The most abundant large trees include *Spirostachys africana, Diospyros mespiliformis Philenoptera violacea, Croton megalobotrys, Vachellia robusta.* The grass cover is scanty, with large bare patches of soil. Prominent grass species are *Panicum coloratum* and *Urochloa mosambicensis.*

Conspicuous forbs that were noted include *Sida cordifolia* and *Justicia flava.*

The following plant species were recorded:

Trees and Shrubs

Colophospermum mopane	d	*Combretum imberbe*	P
Diospyros mespiliformis	d	*Combretum mossambicense*	
Combretum apiculatum		*Croton megalobotrys*	
Combretum hereroense		*Euclea divinorum*	

Flueggea virosa		*Spirostachys africana*	D
Gymnosporia senegalensis	d	*Strychnos madagascariensis*	
Hyphaene petersiana		*Vachellia robusta*	
Mundulea sericea		*Vangueria infausta*	
Philenoptera violacea	P	*Ziziphus mucronata*	dM
Senegalia nigrescens	d		

Grasses and sedges

Aristida congesta	*Heteropogon contortus*
Cymbopogon pospischilii	*Melinis repens*
Dactyloctenium giganteum	*Panicum coloratum*
Digitaria eriantha	*Panicum maximum*
Eragrostis lehmanniana	*Urochloa mosambicensis*

Forbs

Boerhavia coccinea	*Leucas sexdentata*
Dicoma tomentosa	*Melhania forbesii*
Heliotropium ciliatum	*Ocimum americanum*
Heliotropium steudneri	*Sida cordifolia*
Hermbstaedtia odorata	*Tribulus terrestris*
Hibiscus calyphyllus	*Waltheria indica*
Justicia flava	

Number of species recorded:

	Indigenous	**Aliens / Weeds**	**Total**	**Red Data**	**Protected**	**Medicinal**
Trees and shrubs	19	0	19	0	2	1
Grasses and sedges	10	0	10	0	0	0
Forbs	13	0	13	0	0	0
Total	42	0	42	0	2	1

Flood Plains summary			
Status	Flood plain as part of river		
Soil	Deep sandy alluvium loam	**Rockiness %**	0
Conservation priority:	High	**Sensitivity:**	High
Species Richness:	High	**Need for rehabilitation**	Low
Dominant spp.	*Spirostachys africana, Colophospermum mopane*		

Figure 20: A collage of photos of the Flood Plains ecosystem at proposed sites for the picnic site, tented camp site and camp site. The soil, vegetation and plant species composition of all these sites are similar, representative of the same flood plain ecosystem.

Discussion

Both the preferred and alternative proposed sites for the development of a picnic site, tented camp and camping site are located within the flood plains along the Shingwedzi River. The soil, vegetation and plant species composition of all these sites are similar (Figure 20). Although this ecosystem is regarded as ecologically sensitive, the proposed development is low-profile and low impact developments that do not include permanent structures. The more permanent structures e.g. ablution blocks, staff accommodation, parking areas etc. are located in the Mopaneveld directly adjacent to the flood plain (Figure 21).

Figure 21: The Mopaneveld in the background, immediately outside the flood plains

5.2.11. Shingwedzi River

The Shingwedzi River (Figure 22) enters the KNP on the western boundary and flows eastwards past Shingwedzi Rest Camp and then to the eastern boundary where it flows into Mozambique (Figure 6). The new road basically runs along the Shingwedzi River from the western boundary (Shangoni Gate) to the H1-6 main road, close to Shingwedzi Rest Camp (Figure 6). A properly constructed (high) bridge will have to be constructed over the River, between the new gate and the proposed Reception facilities (Figure 23). The road will again cross the Shingwedzi River (Figure 24) and also the Tshanga River (Figure 25) at existing low water bridges. Furthermore the new picnic site, tented camp site and camp site will be developed on the flood plains of the Shingwedzi River (see 5.2.10 above). The dominant plant species along these rivers are *Spirostachys africana, Diospyros mespiliformis, Vachellia robusta, Ficus sycomorus, Gymnosporia senegalensis, Vachellia robusta* and *Philenoptera violacea.* The herbaceous cover is scanty and varies annually. All river systems in South Africa are considered to be ecologically sensitive (The National Environment Management Act, 1998, National Water Act 1998).

Trees and Shrubs

Colophospermum mopane	d	*Combretum mossambicense*	
Combretum apiculatum		*Croton megalobotrys*	
Combretum hereroense		*Dalbergia melanoxylon*	
Combretum imberbe	P	*Diospyros mespiliformis*	d

Euclea divinorum		*Phyllanthus reticulatus*	
Ficus sycomorus	d	*Senegalia nigrescens*	d
Flueggea virosa		*Spirostachys africana*	d
Gymnosporia senegalensis	d	*Strychnos madagascariensis*	
Hyphaene petersiana		*Vachellia robusta*	
Mundulea sericea		*Ximenia caffra*	
Philenoptera violacea	P	*Ziziphus mucronata*	dM

Grasses and sedges

Aristida congesta	*Eragrostis lehmanniana*
Bothriochloa radicans	*Heteropogon contortus*
Cymbopogon pospischilii	*Melinis repens*
Dactyloctenium giganteum	*Panicum coloratum*
Digitaria eriantha	*Panicum maximum*
Enneapogon cenchroides	*Urochloa mosambicensis*

Forbs

Boerhavia coccinea		*Melhania forbesii*	
Crinum moorei	p	*Ocimum americanum*	
Dicoma tomentosa		*Pupalia lappacea*	
Heliotropium ciliatum		*Sida cordifolia*	
Heliotropium steudneri		*Sida rhombifolia*	
Hermbstaedtia odorata		*Tephrosia rhodesica*	
Hibiscus calyphyllus		*Tribulus terrestris*	
Justicia flava		*Waltheria indica*	
Leucas sexdentata			

Number of species recorded:

	Indigenous	**Aliens / Weeds**	**Total**	**Red Data**	**Protected**	**Medicinal**
Trees and shrubs	22	0	22	0	2	1
Grasses and sedges	12	0	12	0	0	0
Forbs	17	0	17	0	0	0
Total	51	0	51	0	2	1

Shingwedzi River summary			
Status	Seasonal River		
Soil	Deep sandy alluvium loam	**Rockiness %**	0
Conservation priority:	High	**Sensitivity:**	High
Species Richness:	High	**Need for rehabilitation**	Low
Dominant spp.	*Spirostachys africana, Diospyros mespiliformis, Vachellia robusta, Ficus sycomorus, Croton megalobotrys, Gymnosporia senegalensis*		

Discussion

The River is considered to be ecologically sensitive.

Figure 22: A collage of photos showing the Shingwedzi River showing high river baks with riparian vegetation and sandy and rocky river beds.

Figure 23: The site proposed for the new bridge over the Shingwedzi River, close to the proposed new Shangoni Gate.

Figure 24: The existing low bridge over the Shingwedzi River.

5.3 Species of Conservation Concern

A list of Species of Conservation Concern for the grids 2330BB, 2331AA and 2331AB was obtained from the database on the SANBI (POSA 2016) website. Threatened species are those that are facing high risk of extinction, indicated by the categories Critically Endangered (CE), Endangered (EN) and Vulnerable (VU). Species of Conservation Concern include the Threatened Species, but additionally have the categories Near Threatened (NT), Data Deficient (DD), Critically Rare (CR), Rare (R) and Declining (D). This is in accordance with the new Red List for South African Plants (Raimondo *et al*. 2009).

No plant species of conservation concern were previously recorded from the grids 2330BB, 2331AA and 2331AB, as listed by SANBI.

5.4 Protected species

Several Nationally Protected tree (National Forests Act 1998) or NEMBA plant species (Government Notice No. 2007, National Environmental Management: Biodiversity Act, 2004) were recorded from within the study area. These include:

Combretum imberbe
Elaeodendron transvaalensis
Philenoptera violacea
Sclerocarya birrea

Other plant species found in the general area, but not recorded from the study area include:
Adansonia digitata
Afzelia quanzensis
Balanites maughanii
Breonadia salicina

A further plant provincially protected plant species recorded from the study area is *Crinum moorei*.

5.5 Alien species

Declared weeds and invader plant species have the tendency to dominate or replace the canopy or herbaceous layer of natural ecosystems, thereby transforming the structure, composition and function of natural ecosystems. Therefore, it is important that these plants controlled and eradicated by means of an eradication and monitoring program. Some invader plants may also degrade ecosystems through superior competitive capabilities to exclude native plant species (Henderson, 2001).

The amended Regulations (Regulation 15) of the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) (CARA) identifies three categories of problem plants:
Category 1 (Declared weeds): plants may not occur on any land other than a biological control reserve and must be controlled or eradicated. Therefore, no person shall establish plant, maintain, propagate or sell/import any category 1 plant species;
Category 2 (Declared invaders): plants are plants with commercial application and may only be cultivated in demarcated areas (such as biological control reserves) otherwise they must be controlled; and
Category 3 (Declared invaders): plants are ornamentally used and may no longer be planted, except those species already in existence at the time of the commencement of the regulations (30 March 2001), unless they occur within 30 m of a 1:50 year flood line and must be prevented from spreading.

In addition, a second draft of the Alien and Invasive Species Regulations, as well as a new draft list of categories of invasive species in terms of the National Environmental Management: Biodiversity Act (Act 10 of 2004) was published in the Government Gazette No. 32090, in April 2009. Any species designated under section 70 cannot be propagated, grown, bought or sold by the industry without a permit. Whereas CARA previously classified problem plants into two groups - declared weeds and plant invaders - the amended regulations make provision for four groups: declared weeds (Category 1 plants), plant invaders (Category 2 and Category 3 plants) and indicators of bush encroachment. The first three groups consist of undesirable alien plants and are covered by Regulation 15. Bush encroachers, which are indigenous plants that require sound management practices to prevent them from becoming problematic, are covered separately by Regulation 16.

Below is a brief explanation of the three categories in terms of the National Environmental Management: Biodiversity Act (Act 10 of 2004) (NEMBA):

Category 1a: Invasive species requiring compulsory control. Remove and destroy. Any specimens of Category 1a listed species need, by law, to be eradicated from the environment. No permits will be issued.
Category 1b: Invasive species requiring compulsory control as part of an invasive species control program. Remove and destroy. These plants are deemed to have such a high invasive potential that infestations can qualify to be placed under a government sponsored invasive species management program. No permits will be issued.
Category 2: Invasive species regulated by area. A demarcation permit is required to import, possess, grow, breed, move, sell, buy or accept as a gift any plants listed as Category 2 plants. No permits will be issued for Category 2 plants to exist in riparian zones.
Category 3: Invasive species regulated by activity. An individual plant permit is required to undertake any of the following restricted activities (import, possess, grow, breed, move, sell, buy or accept as a gift) involving a Category 3 species. No permits

will be issued for Category 3 plants to exist in riparian zones. In terms of the amendments to the regulations under the Conservation of Agriculture Resources Act, 1983 (Act No. 43 of 1983) and Regulation 598, Government Gazette 37885, August 2014)(Alien and Invasive Species Regulations), landowners are legally responsible for the control of alien species on their properties.

No alien woody plants were recorded from the specific transect investigated

5.6 Medicinal plants

Very limited important medicinal plants were recorded from the site. These plants are labelled “M” in the description of the plant communities.

5.7 Vegetation importance and Ecological sensitivity

Table 5.1: Scoring of importance and sensitivity of the vegetation that occurs within the study area.

Vegetation	Conservation Status of regional Vegetation unit	Listed Ecosystem	Legislated Protection	Plants species of conservation concern	Ecological Function	Conservation Importance	Total Score out of max of 18
Shingwedzi River and Floodplains, mapping units 10 & 11	3	3	3	2	3	3	**17 High**
Mopane dominated plant communities, mapping units 1-9	**1**	**1**	**1**	**2**	**2**	**1**	**8 Medium**

The result of the sensitivity assessment indicates that the Shingwedzi River and associated Floodplains (mapping units 1&2), are considered to be highly sensitive. The general Mopaneveld (mapping units 1-9) has medium sensitivity, though the sensitivity of the different plant communities identified were rated between medium-

low and medium-high. This is mainly due to differences in plant species composition and plant species richness.

6. IMPACT ASSESSMENT: IMPACTS ON VEGETATION AND FLORA

6.1. Methods

The methods and format of the impact tables used in this chapter are in accordance to the requirements of the 2014 Regulations.

- The **nature**, which shall include a description of what causes the effect, what will be affected and how it will be affected.

- The **probability (P)** *of occurrence*, which shall describe the likelihood of the impact actually occurring. Probability will be estimated on a scale of 1–5, where 1 is very improbable (probably will not happen), 2 is improbable (some possibility, but low likelihood), 3 is probable (distinct possibility), 4 is highly probable (most likely) and 5 is definite (impact will occur regardless of any prevention measures).

- The **duration (D)**, wherein it will be indicated whether:

  - the lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1;

  - the lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2;

  - medium-term (5–15 years) – assigned a score of 3;

  - long term (> 15 years) - assigned a score of 4; or

  - permanent - assigned a score of 5;

- The **extent (E)**, wherein it will be indicated whether the impact will be local (limited to the immediate area or site of development) or regional, and a value between 1 and 5 will be assigned as appropriate (with 1 being low and 5 being high):

- The **magnitude (M)**, quantified on a scale from 0-10, where 0 is small and will have no effect on the environment, 2 is minor and will not result in an impact on processes, 4 is low and will cause a slight impact on processes, 6 is moderate and will result in processes continuing but in a modified way, 8 is high (processes are altered to the extent that they temporarily cease), and 10 is very high and results in complete destruction of patterns and permanent cessation of processes.

- the **significance (S)**, which shall be determined through a synthesis of the characteristics described above and can be assessed as low, medium or high;

- the significance rating is calculated by the following formula:

  S (significance) = (D + E + M) x (P)

» the **status**, which will be described as either positive, negative or neutral.

» the degree to which the impact can be reversed.

» the degree to which the impact may cause irreplaceable loss of resources.

» the *degree* to which the impact can be *mitigated.*

Impacts should be identified for the construction and operational phases of the proposed development. Proposed mitigation measures should be practical and feasible such that they can be realistically implemented by the applicant.

6.2 Impacts on the vegetation and flora

Impacts on vegetation are indicated for the following developments:

- The new Shangoni Gate and Reception Area
- New bridge over Shingwedzi River
- New roads
- Upgrade of existing roads
- Picnic site, camping site and tented camp site

6.2.1 New Shangoni Gate and Reception Area

Table 6.1: Loss of indigenous vegetation or indigenous plant species due to clearing for construction for the new Shangoni Gate and the Reception Areas. This impact table is applicable for both alternative sites for the Gate and also the Reception Area.
Nature: Some, though limited, indigenous vegetation will have to be cleared at the location of the new Gate, and also at the Reception Area.

	Without mitigation		**With mitigation**	
CONSTRUCTION PHASE				
Probability	Probable	3	Probable	2
Duration	Short term	2	Short term	2
Extent	Local	1	Local	1
Magnitude	Minor	2	No effect	1
Significance	**Low**	**15**	**Low (negligible)**	**8**
Status (positive or negative)	Negative		Negative	
OPERATIONAL PHASE				
Probability	Probable	2	Probable	1
Duration	Permanent	5	Permanent	5
Extent	Local	1	Local	1
Magnitude	Low	4	Minor	2
Significance	**Low**	**20**	**Low (negligible)**	**8**
Status (positive or negative)	Negative		Negative	
Reversibility	Low		Low	
Irreplaceable loss of resources?	Low		Low	
Can impacts be mitigated?	Yes			

Mitigation:

- Limit disturbance of natural vegetation to a minimum;
- Avoid removal of large trees;
- Rehabilitate disturbances immediately after construction;
- Do not plant any non-indigenous trees or shrubs or any garden ornamentals at he gate, use KNP indigenous plant species only;
- Rehabilitated areas must be monitored to ensure the establishment of re-vegetated areas;
- Remove and control all alien woody plant species that may appear during

construction and operational phases.
Cumulative impacts: Expected that very little accumulative effects will occur. .
Residual Risks: None is anticipated provided that the mitigation measures are implemented correctly.

Table 6.2: Increase of alien invasive plant at the site of the new Shangoni Gate. This impact table is applicable to both alternative sites for the Gate.

Nature: Disturbance of indigenous vegetation during construction and even during the operational phase results in bare areas, suitable for invasive plants to get established. The new entrance road and people moving through the gate cause a transports system for seeds and other propagules of plants, particularly of alien invasive plant species. Should disturbance occur, an increase in alien species can be expected within the disturbed areas.				
	Without mitigation		**With mitigation**	
CONSTRUCTION PHASE				
Probability	Probable	3	Improbable	2
Duration	Short term	2	Short-term	2
Extent	Local	1	Local	1
Magnitude	Low	3	Low	2
Significance	**Low**	**18**	**Low**	**10**
Status (positive or negative)	Negative		Neutral	
OPERATIONAL PHASE				
Probability	Probable	2	Improbable	1
Duration	Permanent	5	Permanent	5
Extent	Local	1	Local	1
Magnitude	Low	2	Low	1
Significance	**Low**	**16**	**Very Low**	**7**
Status (positive or negative)	Negative		Neutral	
Reversibility	Moderate		High	
Irreplaceable loss of resources?	Low		Low	
Can impacts be mitigated?	Yes			
Mitigation: • An alien invasive management programme must be incorporated into the Environmental Management Programme; • Ongoing alien plant control must be undertaken during construction and operational phases; • Areas which have been disturbed will be quickly colonised by invasive alien species. An ongoing management plan must be implemented for the clearing/eradication of alien species during the operational phase; • Monitor all sites disturbed by construction activities for colonisation by exotics or invasive plants and control these as they emerge.				
Cumulative impacts: Moderate, should mitigation measure not be implemented. Alien invader				

plant species pose an ecological threat as they alter habitat structure, lower biodiversity, change ecosystem services and processes e.g. change nutrient cycling and productivity, and modify food webs. Allowing invasive plant species to establish and expand their distribution range without control may have vast accumulative effects.
Residual Risks: Establishment and increase of woody alien species pose an ecological threat. None anticipated provided that the mitigation measures are implemented correctly and rehabilitation of the site is undertaken.

6.2.2 New bridge over Shingwedzi River

Table 6.3: Loss of indigenous vegetation due to clearing for construction of the bridge

Nature: To construct a new bridge is a major operation that may cause some clearing of riparian vegetation. Riparian vegetation is regarded as ecologically highly sensitive, as it is associated with a river, and all rivers (wetlands) in South Africa are regarded as ecologically sensitive. This report is not a wetland assessment, and this impact addresses vegetation and flora only. The construction of the bridge may result in the loss of indigenous species, or disturbance of plant species (though the area to be cleared is local, small and isolated). The removal of vegetation will also expose soil increasing the risk of erosion of the river banks. Large trees, including protected trees, do occur scattered within the riparian zone. The investigation however indicates that removal of large trees for the construction is improbable, though not impossible, depending on the specific location of the bridge. This impact table is applicable to the alternative sites investigated. Protected tree species that may be of special concern are *Combretum imberbe* and *Philenoptera violacea.*

	Without mitigation		**With mitigation**	
CONSTRUCTION PHASE				
Probability	Definite	5	Definite	5
Duration	Short-term	2	Short-term	2
Extent	Limited to Site	1	Limited to Site	1
Magnitude	Low	4	Low	3
Significance	**Medium**	**35**	**Low**	**30**
Status (positive or negative)	Negative		Negative	
OPERATIONAL PHASE				
Probability	Definite	5	Definite	5
Duration	Permanent	5	Permanent	5
Extent	Limited to Site	1	Limited to Site	1
Magnitude	Moderate	3	Low	1
Significance	**Medium**	**45**	**Medium**	**35**
Status (positive or negative)	Negative		Negative	
Reversibility	Low		Medium	
Irreplaceable loss of resources?	Moderate		Low	
Can impacts be mitigated?	Yes			

Mitigation: • The clearing of vegetation must be kept to a minimum and remain within the footprint of the bridge – erosion of the river banks must be avoided at all times; • Disturbed areas must be rehabilitated immediately after construction has been completed in that area by sowing appropriate indigenous grass species, this is to avoid erosion of the river banks; • During the construction phase workers must be limited to areas under construction and access to the undeveloped riparian areas must be strictly controlled; • Rehabilitated areas must be monitored to ensure the establishment of re-vegetated areas.
Cumulative impacts: Expected to reduce and fragment the natural riparian vegetation to a limited extent.
Residual Risks: None anticipated provided that the mitigation measures are implemented correctly.

Notes:

- Loss of protected, rare or red data plant species within the footprint areas of the bridge is unlikely, though possible. Depending on the exact position of the bridge.

Table 6.4: Increase of alien invasive plant species at the new bridge

Nature: Alien invasive plant species will encroach into disturbed areas, particularly along rivers and the riparian zone. Rivers provide a major transport system for plant seeds and other propagules, and are particularly prone to establishment of invasive plant species.				
	Without mitigation		**With mitigation**	
CONSTRUCTION PHASE				
Probability	Probable	3	Improbable	2
Duration	Short-term	2	Short-term	2
Extent	Local	1	Local	1
Magnitude	Moderate	5	Low	4
Significance	**Low**	**24**	**Low**	**14**
Status (positive or negative)	Negative		Negative	
OPERATIONAL PHASE				
Probability	Probable	3	Very Improbable	1
Duration	Permanent	5	Permanent	5
Extent	Local	1	Local	1
Magnitude	Low	2	Low	1
Significance	**Low**	**16**	**Low**	**7**
Status (positive or negative)	Negative		Negative	
Reversibility	Low		Medium	
Irreplaceable loss of resources?	Low		Low	
Can impacts be mitigated?	Yes			
Mitigation: • An alien invasive management programme must be incorporated into the Environmental Management Programme; • Ongoing alien plant control must be undertaken; • Areas which have been disturbed will be quickly colonised by invasive alien species. An ongoing management plan **must** be implemented for the clearing/eradication of alien species. • Monitor all sites disturbed by construction activities for colonisation by exotics or invasive plants and control these as they emerge.				
Cumulative impacts: Moderate, should mitigation measure not be implemented. Alien invader plant species pose an ecological threat as they alter habitat structure, lower biodiversity, change ecosystem services and processes e.g. change nutrient cycling and productivity, and modify food webs.				

Residual Risks: None anticipated provided that the mitigation measures are implemented correctly and rehabilitation of the site is undertaken.

6.2.3 New Roads

Table 6.5: Loss of indigenous vegetation due to clearing for construction of new roads in natural vegetation

Nature: The transect of the new roads will be cleared of vegetation. This is limited to a relatively short distance in the western part of the site, from the Shangoni Gate to the Shingwedzi River, and a short distance across Mopane vegetation just after the Reception Area. This will result in the loss of indigenous species, disturbance of plant species and the fragmentation of plant communities. The removal of vegetation will also expose soil increasing the risk of erosion.				
	Without mitigation		**With mitigation**	
CONSTRUCTION PHASE				
Probability	Definite	5	Definite	5
Duration	Short-term	2	Short-term	2
Extent	Limited to transect of the new road	1	Limited to the transect of the new road	1
Magnitude	Low	4	Low	3
Significance	**Medium**	**35**	**Low**	**30**
Status (positive or negative)	Negative		Negative	
OPERATIONAL PHASE				
Probability	Definite	5	Definite	5
Duration	Permanent	5	Permanent	5
Extent	Limited to the transect of the new road	1	Limited to transect of the new road	1
Magnitude	Moderate	7	Low	5
Significance	**High**	**65**	**Medium**	**55**
Status (positive or negative)	Negative		Negative	
Reversibility	Low		Medium	
Irreplaceable loss of resources?	Moderate		Moderate	
Can impacts be mitigated?	Yes			

Mitigation:

- The clearing of vegetation must be kept to a minimum and remain within the footprint of the new road;
- Disturbed areas on road shoulder must be rehabilitated immediately after construction has been completed in that area (e.g.by sowing appropriate indigenous grass species);
- During the construction phase workers must be limited to areas under construction and access to the undeveloped areas must be strictly controlled;
- Rehabilitated areas must be monitored to ensure the establishment of re-vegetated areas.

Cumulative impacts: Expected to reduce and fragment the natural mopane savanna along the transect of the new road.

Residual Risks: None anticipated provided that the mitigation measures are implemented correctly.

Table 6.6: Increase of alien invasive plant species

Nature: Alien invasive plant species will encroach into disturbed areas.				
	Without mitigation		**With mitigation**	
CONSTRUCTION PHASE				
Probability	Highly Probable	4	Probable	3
Duration	Short-term	2	Short-term	2
Extent	Limited to transect of road	1	Limited transect of road	1
Magnitude	Moderate	5	Low	4
Significance	**Moderate**	**32**	**Low**	**21**
Status (positive or negative)	Negative		Negative	
OPERATIONAL PHASE				
Probability	Highly Probable	4	Improbable	1
Duration	Permanent	5	Permanent	5
Extent	Limited transect of road	1	Limited to transect of road	1
Magnitude	Low	2	Low	1
Significance	**Medium**	**32**	**Low**	**7**
Status (positive or negative)	Negative		Negative	
Reversibility	Moderate		High	
Irreplaceable loss of resources?	Low		Low	
Can impacts be mitigated?	Yes			

Mitigation:

- An alien invasive management programme must be incorporated into the Environmental Management Programme;
- Ongoing alien plant control must be undertaken;
- Areas which have been disturbed will be quickly colonised by invasive alien species. An ongoing management plan **must** be implemented for the clearing/eradication of alien species.
- Monitor all sites disturbed by construction activities for colonisation by exotics or invasive plants and control these as they emerge.

Cumulative impacts: Moderate, should mitigation measure not be implemented. Alien invader plant species pose an ecological threat as they alter habitat structure, lower biodiversity, change ecosystem services and processes e.g. change nutrient cycling and productivity, and modify food webs.

Residual Risks: None anticipated provided that the mitigation measures are implemented correctly and rehabilitation of the site is undertaken.

6.2.4 Upgrading of existing roads

Table 6.7: Loss of indigenous vegetation due to clearing for upgrading of existing roads.

Nature: The existing ranger road transect and existing S52 will be upgraded, implying widening of the existing road. The shoulder(s) of the existing roads will be cleared of vegetation. This is applicable for the major part of the study site, up to the H1-6 main road. This will result in the loss of indigenous species and disturbance of plant communities. Although limited, some large trees, including some protected tree species may be in the way of the road.				
	Without mitigation		**With mitigation**	
CONSTRUCTION PHASE				
Probability	Definite	5	Definite	5
Duration	Short-term	2	Short-term	2
Extent	Limited to transect of the existing road	1	Limited to the transect of the existing road	1
Magnitude	Low	3	Low	2
Significance	**Medium**	**30**	**Low**	**25**
Status (positive or negative)	Negative		Negative	
OPERATIONAL PHASE				
Probability	Definite	5	Definite	5
Duration	Permanent	5	Permanent	5
Extent	Limited to the transect of the existing road	1	Limited to transect of the existing road	1
Magnitude	Moderate	3	Low	2
Significance	**High**	**45**	**Medium**	**40**
Status (positive or negative)	Negative		Negative	
Reversibility	Low		Medium	
Irreplaceable loss of resources?	Moderate		Moderate	
Can impacts be mitigated?	Yes			

Mitigation: • The clearing of vegetation must be kept to a minimum and remain within the footprint of the road; • Disturbed areas on road shoulder must be rehabilitated immediately after construction has been completed in that area (e.g.by sowing appropriate indigenous grass species); • During the construction phase workers must be limited to areas under construction and access to the undeveloped areas must be strictly controlled; • Rehabilitated areas must be monitored to ensure the establishment of re-vegetated areas.
Cumulative impacts: Expected to reduce the natural mopane savanna along the transect of the existing road. In context with the Mopaneveld in general this impact is considered to be minimal.
Residual Risks: None anticipated provided that the mitigation measures are implemented correctly.

Notes:

- Loss of protected, rare or red data plant species within the footprint areas of the road is highly unlikely, but locally possible.

Table 6.8: Increase of alien invasive plant species

Nature: Alien invasive plant species will encroach into disturbed areas on the road shoulders.				
	Without mitigation		**With mitigation**	
CONSTRUCTION PHASE				
Probability	Probable	3	Improbable	2
Duration	Short-term	2	Short-term	2
Extent	Limited to road shoulders	1	Limited to road shoulders	1
Magnitude	Moderate	5	Low	4
Significance	**Low**	**24**	**Low**	**14**
Status (positive or negative)	Negative		Negative	
OPERATIONAL PHASE				
Probability	Improbable	2	Very Improbable	1
Duration	Permanent	5	Permanent	5
Extent	Limited to road shoulders	1	Limited to road shoulders	1
Magnitude	Low	2	Low	1
Significance	**Low**	**16**	**Low**	**7**
Status (positive or negative)	Negative		Negative	
Reversibility	Moderate		High	
Irreplaceable loss of resources?	Low		Low	
Can impacts be mitigated?	Yes			
Mitigation: • An alien invasive management programme must be incorporated into the Environmental Management Programme; • Ongoing alien plant control must be undertaken; • Areas which have been disturbed will be quickly colonised by invasive alien species. An ongoing management plan **must** be implemented for the clearing/eradication of alien species. • Monitor all sites disturbed by construction activities for colonisation by exotics or invasive plants and control these as they emerge.				
Cumulative impacts: Moderate, should mitigation measure not be implemented. Alien invader plant species pose an ecological threat as they alter habitat structure, lower biodiversity, change ecosystem services and processes e.g. change nutrient cycling and productivity, and modify food webs.				

Residual Risks: None anticipated provided that the mitigation measures are implemented correctly and rehabilitation of the site is undertaken.

6.2.4 Development of Picnic Site, Camp Site and Tented Camp Site

Table 6.9: Loss of indigenous vegetation due to clearing for development.

Nature: The preferred and alternative sites chosen for the development of the Picnic Site, Camp Site and Tented Camp Site are all located within the prominent loop in the Shingwedzi River in the western part of the site (Figures 1a, 1b and 6). Furthermore, all these sites are located within the flood plains along the Shingwedzi River. The soil, vegetation and plant species composition of all these sites are similar. Although this ecosystem is regarded as ecologically sensitive, the proposed development is low-profile and low impact developments that do not include permanent structures. The more permanent structures e.g. ablution blocks, staff accommodation, parking areas etc. are located in the (terrestrial) mopaneveld directly adjacent to the (riverine) flood plain. The sites should furthermore avoid intruding into riparian zone on the river banks. The soil of these flood plain areas is almost bare with a very scanty herbaceous layer. Large trees occur scattered over these areas, and some are protected tree species. The trees are needed for shading of the picnic site, camp site and tented camp site, and will not be removed.

	Without mitigation		**With mitigation**	
CONSTRUCTION PHASE				
Probability	Definite	5	Definite	5
Duration	Short-term	2	Short-term	2
Extent	Limited to site	1	Limited to site	1
Magnitude	Low	2	Low	1
Significance	**Medium**	**25**	**Low**	**20**
Status (positive or negative)	Negative		Negative	
OPERATIONAL PHASE				
Probability	Definite	5	Definite	5
Duration	Permanent	5	Permanent	5
Extent	Limited to site	1	Limited to site	1
Magnitude	Moderate	3	Low	2
Significance	**High**	**45**	**Medium**	**40**
Status (positive or negative)	Negative		Negative	
Reversibility	Medium		High	
Irreplaceable loss of resources?	Low		Low	
Can impacts be mitigated?	Yes			

Mitigation: • The clearing of vegetation must be kept to a minimum and remain within the footprint of the particular site; • No large trees may be removed (they are needed for shade); • During the construction phase workers must be limited to areas under construction and access to the undeveloped areas must be strictly controlled; • Rehabilitated areas must be monitored to ensure the establishment of re-vegetated areas;
Cumulative impacts: are considered to be minimal.
Residual Risks: None anticipated provided that the mitigation measures are implemented correctly.

Table 6.10: Increase of alien invasive plant species

Nature: Alien invasive plant species may encroach into disturbed areas within the sites.				
	Without mitigation		**With mitigation**	
CONSTRUCTION PHASE				
Probability	Probable	3	Improbable	2
Duration	Short-term	2	Short-term	2
Extent	Limited to sites	1	Limited to sites	1
Magnitude	Moderate	5	Low	4
Significance	**Low**	**24**	**Low**	**14**
Status (positive or negative)	Negative		Negative	
OPERATIONAL PHASE				
Probability	Improbable	2	Very Improbable	1
Duration	Permanent	5	Permanent	5
Extent	Limited to road shoulders	1	Limited to road shoulders	1
Magnitude	Low	2	Low	1
Significance	**Low**	**16**	**Low**	**7**
Status (positive or negative)	Negative		Negative	
Reversibility	Moderate		High	
Irreplaceable loss of resources?	Low		Low	
Can impacts be mitigated?	Yes			

Mitigation:

- An alien invasive management programme must be incorporated into the Environmental Management Programme;
- Ongoing alien plant control must be undertaken;
- Areas which have been disturbed will be quickly colonised by invasive alien species. An ongoing management plan **must** be implemented for the clearing/eradication of alien species.
- Monitor all sites disturbed by construction activities for colonisation by exotics or invasive plants and control these as they emerge.

Cumulative impacts: Very little

Residual Risks: None anticipated provided that the mitigation measures are implemented correctly and rehabilitation of the site is undertaken.

7. GENERAL DISCUSSION AND CONCLUSION

Although most plant communities at the proposed gate locations and for the reception offices as well as along the proposed roads were in a good condition, representing natural, close to pristine vegetation, most are widespread, not rare and not threatened. Furthermore, only limited vegetation will have to be removed in order to broaden the roads, and road reserves. Limited numbers of nationally protected trees do occur within this zone. These include *inter alia Scerocarya birrea, Combretum imberbe* and *Philenoptera violacea.* Although some vegetation will be destroyed, in general the impact of the proposed development on this vegetation in the broad sense, is considered to be low.

All sites, preferred and alternative, suggested for the picnic sites, tented camps and camping sites occur within floodplain of the Shingwedzi River. These ecosystems and vegetation are regarded to be ecologically sensitive. These areas may also be occasionally flooded, resulting in the specific plant species composition found in the riparian zone and floodplain areas. Several large and valuable trees occur within these areas, e.g. *Diospyros mespiliformis, Spirostachys africana, Xanthocercis zambesiaca, Philenoptera violocea*, *Combretum imberbe, Ficus sycomorus* and others occur in these areas. However, the suggested low impact development in these areas should not affect any of these trees, if the sites are planned and developed in such a way that these trees are protected. It is also suggested that any more permanent infrastructure, e.g. ablution blocks, community kitchen and wash-up areas, staff accommodation, parking areas etc are located in the Mopaneveld adjacent to but outside the floodpain area. Should these development procedures be followed, the impact on this sensitive area and its vegetation should be fairly low.

The report further addresses the possible occurrence of red data species, but very few occur within areas that will be affected by the rdevelopment.

Very limited invasive plant species were recorded.

In general, from a vegetation and flora point of view, the proposed development included in the Shangoni Initiative can be supported

Mitigation measures

- During the construction phase workers must be limited to areas under construction and access to the undeveloped areas must be strictly controlled;
- Limit disturbance close to the Shingwedzi River to a minimum;
- Rehabilitate disturbances caused by the development immediately afer construction;

- Rehabilitated areas must be monitored to ensure the establishment of re-vegetated areas
- Remove and control all alien woody plant species that may appear during construction and operational phases
- Avoid erosion at spruits at all times
- No large trees, particularly protected trees, may be removed, woody plants should only be cut shorter if absolutely necessary
- Control all waste dumping and avoid pollution, especially of watercourses at all times.

It is concluded that the impact on vegetation and flora, and in particular plant species of conservation concern will be small. Should the conservation authorities of regard it as feasible and acceptable to develop the new gate and reception area, relevant roads and picnic site, camping site and tented camp areas, it is suggested that, from a **vegetation and flora** point of view, the development can be supported.

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Theses: (M.Sc. and D.Sc.) on plant community ecology and wildlife management in nature reserves in South African grassland and savanna.

Professional titles:
- MSAIE South African Institute of Ecologists and Environmental Scientists
  - 1989-1990 Council member
- MGSSA Grassland Society of Southern Africa
  - 1986 Elected as Sub-editor for the Journal
  - 1986-1989 Serve on the Editorial Board of the Journal
  - - 1990 Organising Committee: International Conference: Meeting Rangeland challenges in Southern Africa
  - 1993 Elected as professional member
- PrSciNat. South African Council for Natural Scientific Professions **Registration Number 400086/83**
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  - 1992-1994: Publicity Committee
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Professional career:

- Teacher in Biology 1970-1973 in Transvaal Schools
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- 17 popular scientific papers.
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1988-1993 Elected to the **Council** of SAAB.
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• Succulent Society of South Africa
  1987 - 2000
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