PRELIMINARY ECOLOGICAL HABITAT ASSESSMENT FOR THE PROPOSED REPLACEMENT OF THE NSELENI RIVER BRIDGE, KWAZULU-NATAL

Compiled for **Triplo 4 Sustainable Solutions** by:
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1. PROJECT DESCRIPTION

SSI Engineers and Environmental Consultants trading as Royal HaskoningDHV (RHDHV) have been appointed by the Kwazulu-Natal Department of Transport (KZN DoT) to conduct the consulting engineering services for a design of a new bridge to replace the steel truss Nseleni River Bridge on the P425 between Empangeni and Nseleni.

In terms of the National Environmental Management Act, Act 107 of 1998 and the Environmental Impact Assessment Regulations of 2010 published in Government Notice R543 to R546 of August 2010, and promulgated in terms of Chapter 5 of the National Environmental Management Act, a Basic Assessment will be required to obtain environmental authorisation.

Triplo 4 Sustainable Solutions have been appointed as independent environmental consultants to conduct a Basic Assessment for the proposed new Nseleni River Bridge. Triplo 4 Sustainable Solutions as an Independent Environmental Practitioner appointed Mr. C.L. Cook to provide a basic description of the riparian vegetation and fauna and current ecological status/habitat integrity of the proposed bridge crossing site and to provide appropriate management recommendations for the new Nseleni River Bridge.

Project Description:

Numerous design options were investigated by RHDHV with the three most suitable options given detailed consideration. The three detailed options include three bridge span configurations and two bridge deck types. Due to the future upgrade plans for the P425 combined with the importance of the P425 between Nseleni and Empangeni as an emergency alternative to the N2, the design speed was taken to be 100 km/h. The road alignment either side of the bridge approaches were carried out to conform to the design speed whilst minimising the necessary road works.

The three span continuous in-situ box girder deck has been determined to be the most suitable bridge design when considering its advantages in terms of better hydraulic performance in high floods due to the longer central span; less environmental impacts with piers at greater distances from the active river channel and aesthetical preference due to the slenderness and span arrangement.

The assignment is interpreted as follows: **Determine the current ecological status of the riparian vegetation and associated fauna within the proposed bridge site and the potential ecological impacts of the proposed new Nseleni Bridge on the immediate environment**. In order to compile the report the following had to be done:

Initial preparations:

- Obtain all relevant maps including aerial photographs (Google images) of the Nseleni Bridge site and adjacent land usage, and information on the natural environment.
- An initial site investigation (5th of March 2013) to assess the current environmental status of the proposed Nseleni bridge site with special emphasis on remaining natural habitats.
- Identify problematic areas which require immediate attention as well as management, e.g. Macro-channel bank erosion, degraded areas, reclamation areas, alien vegetation.
- Make management recommendations and mitigatory measures for the current as well as potential environmental impacts especially pertaining to the new Nseleni River Bridge.

1.1 OBJECTIVES OF THE PRELIMINARY ECOLOGICAL SURVEY/ HABITAT ASSESSMENT

- To provide a basic description of the riparian vegetation and fauna occurring around the proposed Nseleni River Bridge site.
- To provide a description of any threatened plant or animal (mammals, birds, reptiles and amphibians) occurring or likely to occur within the Nseleni River Bridge site.
- To describe the available habitats on site including areas of important conservation value or areas most likely to form important habitat for remaining threatened plant and animal species.
- To determine potential impacts of the Nseleni River Bridge site on the remaining natural vegetation and associated fauna.
- To provide management recommendations to mitigate negative and enhance positive impacts of the proposed Nseleni River Bridge project.

1.2 SCOPE OF STUDY

- An initial ecological survey documenting the dominant riparian vegetation within the proposed Nseleni River Bridge and recording sightings and/or evidence of associated fauna.
- An assessment of the ecological habitats, evaluating conservation importance and significance with special emphasis on the current status of threatened plant or animal species (Red Data Species), within the Nseleni River Bridge site.
- Literature investigations with which to augment field data were necessary.
- Identification of potential ecological impacts that could occur as a result of the Nseleni River Bridge and assess the significance of these, where possible.
- Investigate feasible and practical management recommendations that should be implemented to reduce or minimize the impacts, should the project be approved.
- Documentation of the findings of the study in a report.

1.3 CONSTRAINTS AND LIMITATIONS OF SHORT DURATION ECOLOGICAL AND FAUNAL SURVEYS

- Limitation to a base-line ecological survey for only 1 day (8 hours) during the summer months (March 2013). Due to financial as well as time constraints no comprehensive vegetation or faunal surveys were conducted but merely a basic ecological/habitat assessment based on the brief one day site visit.
- The majority of understory vegetation has been recently cut for access for the geotechnical surveys including drilling of eight boreholes at anticipated abatement and pier positions.
- The vegetation surrounding the Nseleni River Bridge consists of completely transformed agricultural habitats or previously transformed areas and dominated by weedy pioneer plants (rurals) as well as alien invasive species. Remnant patches of indigenous Subtropical Alluvial Vegetation (AZa 7) occur within the macro-channel banks or riparian zone of the Nseleni River.
- The majority of plant and animal species are extremely seasonal only emerging after sufficient heavy early summer rainfall (October-November). No comprehensive vegetation or faunal surveys have been conducted on the site.
- Limitation of historic data and available databases for the area.
- The presence of threatened species on site is assessed mainly on habitat availability and suitability as well as desk research (literature, personal records) and previous surveys conducted in similar habitats between 2010-2013).

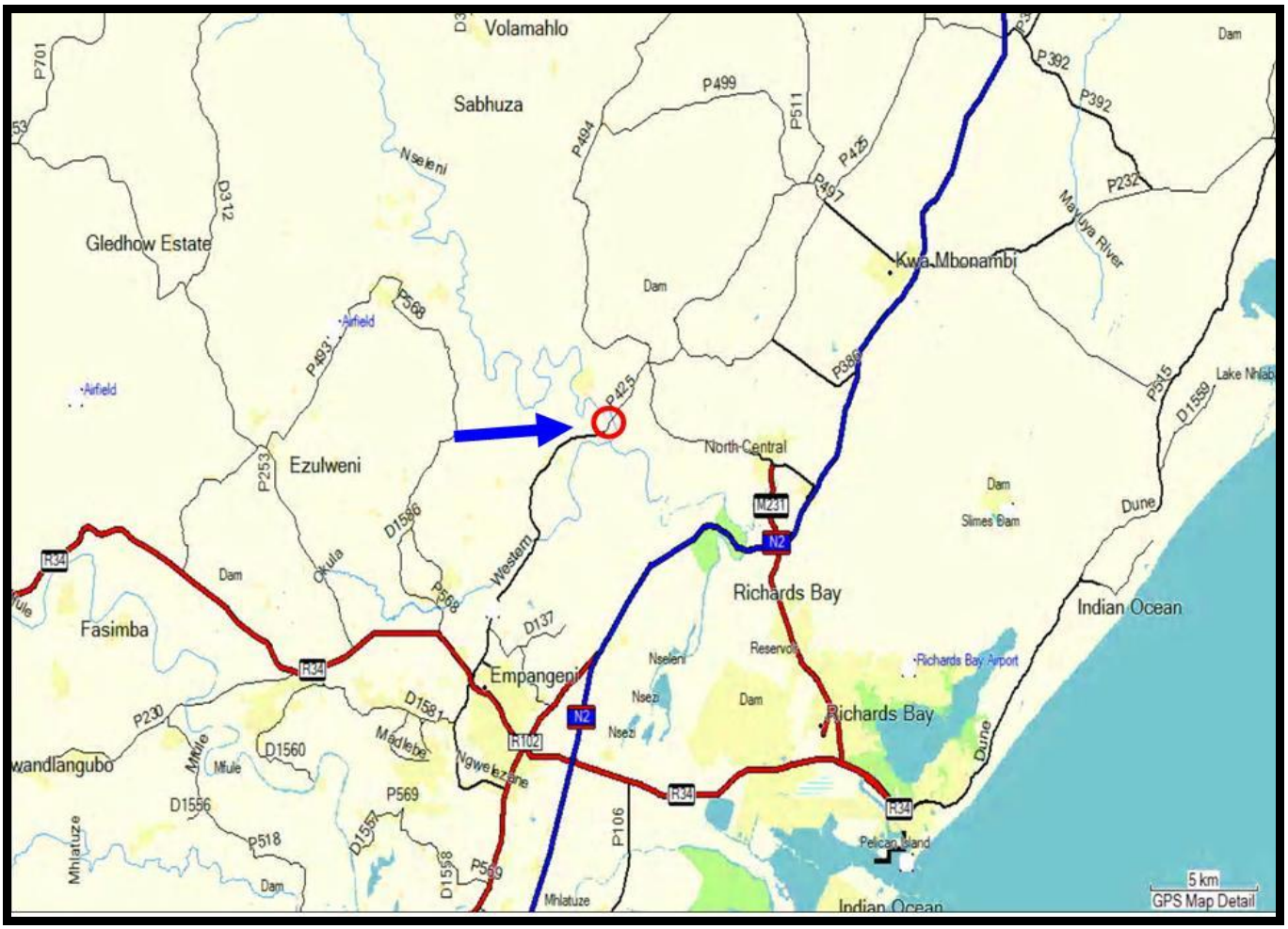


Figure1. Locality map for the proposed Nseleni River Bridge site (red circle) situated on the P425 approximately 11.3km north of Empangeni.

2. METHODOLOGY

A survey of the proposed Nseleni Bride site was carried out by driving around the P425 by car and closer inspection of the bridge site carried out on foot. As the site is situated around rural homesteads and agricultural areas (sugar-cane) the majority of natural vegetation consisting of **Zululand Coastal Thornveld (SVI 24)** has been transformed. Severe degradation of the remaining riparian vegetation due to surrounding anthropogenic activities including wood harvesting, collection of medicinal plants as well as grading of access roads and fire-breaks. Remnant patches of indigenous **Subtropical Alluvial Vegetation (AZa 7)** occurs within the riparian zone of the Nseleni River. The site was visited predominantly during daylight hours (10h30-16h30) on the 5th March 2013.

It must be stressed that due to time and financial constraints as well as inaccessibility of certain areas along the Nseleni River due to the gradient of the macro channel banks as well as thickets adjacent to the river; no comprehensive vegetation or faunal surveys were undertaken during this brief ecological survey. The understory vegetation had been recently cleared for access for the geotechnical surveys. Data was heavily supplemented by literature investigations; personal records, historic data and previous surveys conducted in the area. Different habitats were explored to identify any sensitive or specialised species which could possibly occur on the site. Habitats explored included the riparian vegetation along the Nseleni River.

The vegetation literature search was undertaken utilising *The Vegetation of South Africa, Lesotho and Swaziland* (Mucina & Rutherford 2006) for the vegetation description as well as *National Red List of Threatened Plants of South Africa* (Raimondo *et al.* 2009). **Mammal** names are as used by Skinner and Chimimba (2005), **Bird** names by Hockey, Dean & Ryan (2006); **Reptile** names by Branch (1998) and **Amphibian** names by Carruthers & Du Preez (2009).

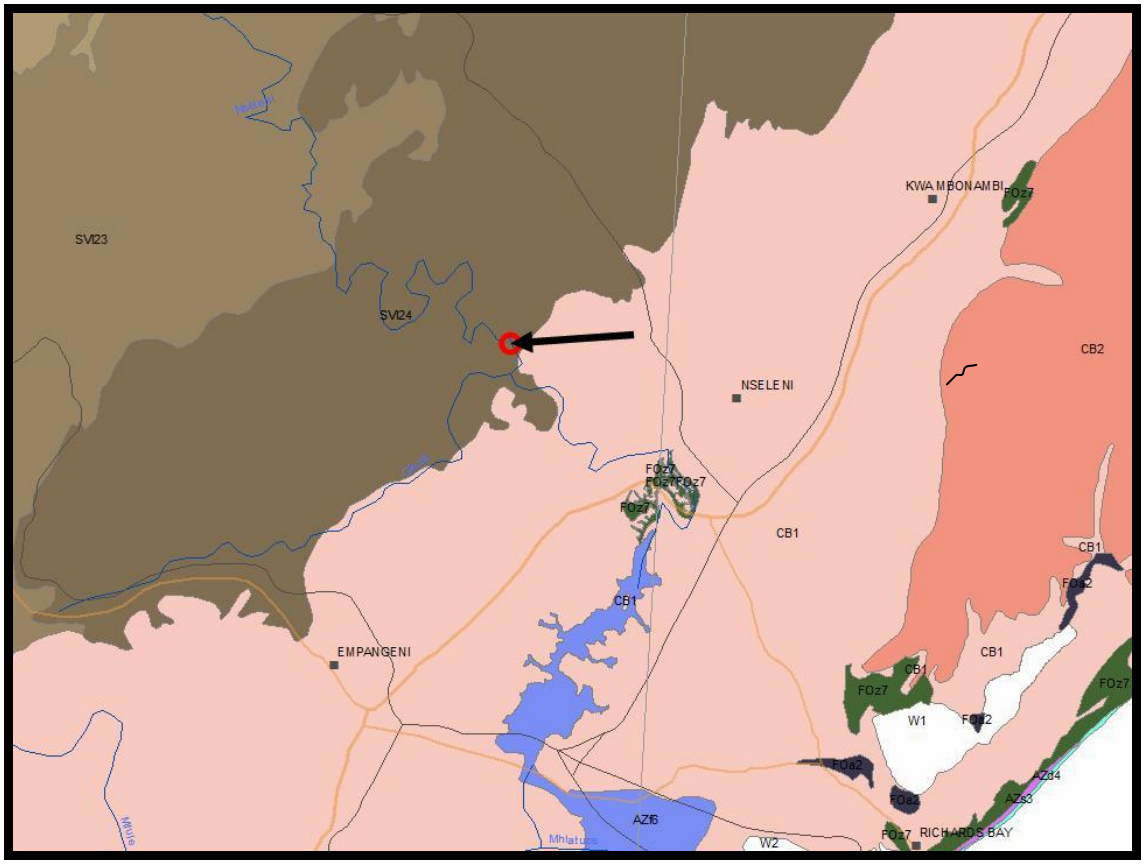


Figure2. The proposed Nseleni Bridge site is situated within **Zululand Coastal Thornveld (SVI 24)** vegetation unit (adapted from Mucina & Rutherford 2006).

3.1 STUDY AREA

The proposed new bridge is set to replace the existing steel bridge that currently services this particular location. The bridge is located at the Nseleni River crossing on Road P425. The site is located some 11.3 km north east of Empangeni and links Empangeni to the villages of Lubana and Mabuyeni. The proposed Nseleni Bridge site is situated within **Zululand Coastal Thornveld (SVI 24)** vegetation unit (adapted from Mucina & Rutherford 2006).

Zululand Coastal Thornveld (SVI 24)

Acocks (1988) called this vegetation type Coastal Forest and Thornveld whereas Low & Rebelo (1996) called it Coastal Bushveld-Grassland.

Distribution

It occurs in KwaZulu-Natal Province immediately to the west of Mtubatuba (in the north) and Empangeni (in the south) and is bisected by the iMfolozi River, extending westwards for 10-20km. Altitude between 40-300 m (Mucina and Rutherford 2006).

Vegetation and Landscape Features

Gently rolling landscapes supporting wooded grasslands dominated by *Themeda triandra*. The bush clumps are a strong feature and are more numerous on deeper soils, with *Phoenix reclinata* and *Gymnosporia senegalensis* dominant. These plant communities are species-rich relative to the surrounding vegetation. They grade into dense *Acacia* woodland on dry slopes and riverine bushland thickets and FOa 1 Lowveld Riverine Forests in valley bottoms (Mucina and Rutherford 2006).

Geology and Soils

The area is situated entirely on Letaba Formation basalts of the the Lebombo Group. The Lebombo Group, in turn, forms part of the Karoo Supergroup. Regional information indicates that the Letaba Formation consists of basaltic bedrock. A fault zone striking north east to south west is present to the east of the study area. The borehole core confirmed the presence of basaltic bedrock; however it was clear that magma segregation occurred in the basalt. The bedrock frequently had dark green colour, followed by red brown colour. Hydrothermal veins, phenocrysts and amygdales were also common (Soilkraft Geotechnical report 2013). Soils are mainly black with a high clay content (35-55%) and depth in the range of 200-300 mm. Land types mainly Ea with some Fb and Dc.

Climate

Summer rainfall but also some in winter (with an average of 20mm per winter month which is greater than any other savanna vegetation units for the period). Relatively high precipitation of around 800 mm attaining annual values up to 1 050 mm in coastal localities. High humidity and temperatures with very infrequent frost.

Conservation Status

Zululand Coastal Thornveld (SVI 24) currently has the conservation status of being **Endangered**. Of the National Conservation Target of 19% none of the area is protected in statutorily conservation areas. Highly transformed (58%) mostly by cultivation. This is high potential agricultural land which is already been transformed by sugar cane fields. Large areas close to towns (Mtubatuba) are becoming an urban sprawl. Very little of the natural plant communities remains intact. Heavy grazing has depleted the grasslands and wood harvesting has depleted the bush clumps, reducing them to only the resistant and less useful species. Stunted forms of many of the woody species (*Euclea, Diospyros, Gymnosporia, Maytenus*) invade the grassland in many places. Currently it is rare to find a site still with a natural plant composition. *Themeda triandra*, a 'decreaser species', has declined to critically low levels. Alien plant invasions are a threat, with *Chromolaena odorata, Lantana camara* are the most problematic alien invader plants threatening this vegetation type (Mucina and Rutherford 2006).

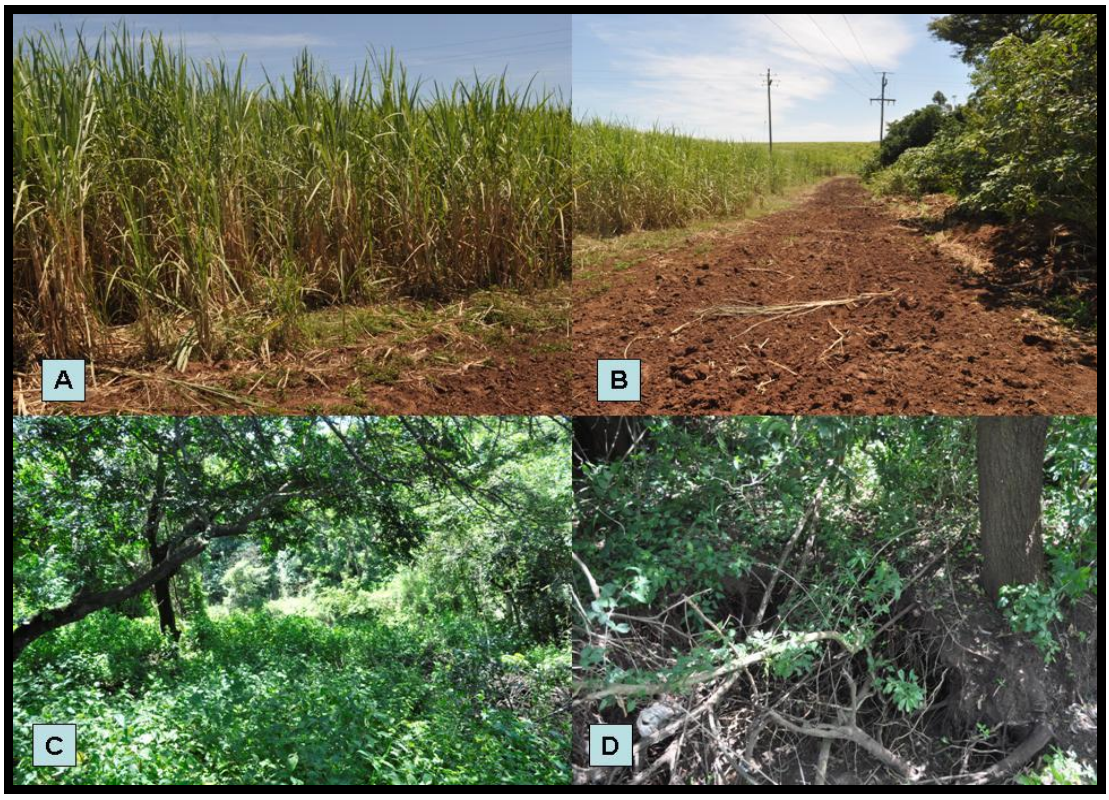


Figure3. A collage of photographs displaying the current impacts on the vegetation surrounding the Nseleni Bride site. A: The site is situated adjacent to large scale agricultural activities (sugar-cane plantations) which have completely transformed the vegetation. **B:** The scraping of roads as well as clearing of power line servitudes restricts the riparian zone to the macro-channel banks. **C:** The understory vegetation has been transformed during the recent borehole exploration activities. The vegetation is dominated by pioneer weedy plant species as well as alien invasive vegetation. **D:** Macro-channel bank erosion and slumping occurs within the disturbed areas; especially on the southern banks of the Nseleni River.

Existing impacts occurring around the proposed Nseleni Bridge site included:

- The proposed Nseleni Bride is situated approximately 20m upstream of the existing steel truss Nseleni River Bridge on the P425. The P425 road servitudes have been regularly scraped and dominated by pioneer weedy and alien plant species.
- Extensive sugar-cane plantations occur adjacent to the site. The grading of firebreaks and access roads between the Nseleni River and the sugar-cane fields as well as Eskom power line servitudes. These areas are completely transformed habitats.
- Extensive vegetation transformation around the homesteads, livestock enclosures, grazing pastures and small-scale agricultural lands.
- Alteration of then natural fire regime. Frequent fires at the incorrect time of year.
- Wood harvesting and tree clear-felling was observed along the riparian zone of the Nseleni River.
- Thicket formation and severe bush encroachment occurs in the old agricultural lands as well as old livestock enclosures as well as in certain areas along the Nseleni River by *Dichrostachys cinera*
- Illegal poaching and hunting (dogs, catapults and snares) within the riparian zone of the Nseleni River,
- Riparian zone degradation due to removal of majority of hardwood tree species for wood harvesting. Several tree species were coppicing.
- Reed invasion in certain sections of the Nseleni River due to increased phosphates levels due to washing activities as well as siltation and sedimentation due to poor vegetation and soil conservation around the site.
- Bank erosion from vegetation removal as well as sheet and rill erosion.
- Extensive littering especially adjacent to the current bridge.
- Deterioration in water quality due to presence of pit-latrines as well as washing and bathing activities within the adjacent wetlands and streams.

3.3 NSELENI RIVER & ASSOCIATED RIPARIAN ZONE

Vegetation Type	**Zululand Coastal Thornveld (SVI 24) /Subtropical Alluvial Vegetation (AZa 7)**	**Tree cover**	50-80%
Soil	Soils are mainly black with a high clay content (35-55%) and depth in the range of 200-300 mm.	**Shrub cover**	0-40 %
Topography	Valley Bottom-Nseleni River	**Herb cover**	0-80%
Land use	Homesteads and small-scale agricultural and livestock (cattle and goats) grazing activities. Wood harvesting along non-perennial drainage lines	**Grass cover**	0-20%
Dominant Grass spp.	*Aristida congesta, Hyparrhenia hirta, Panicum maximum, Panicum schinzii, Melinis repens* subsp. *repens, Setaria megaphylla, Sporobolus africanus, Eragrostis curvula,*		
Dominant Herbs	*Tagetes minuta*, Ambrosia artemissifolia*, Bidens pilosa*, Ageratina adenophora*, Chamaechrista mimusoides, Cirsium vulgare*; Conyza albida*, Conyza Canadensis*, Pteridium aquilinum Ceratotheca triloba*, Rivinia humilis*, Commelina*		

	africana, Helichrysum aureum, Datura strumonium, Solanum sisymbrifolium*, Tithonia diversifolia*, Ageratum conyzoides*[*]
Dominant Trees and shrubs	*Acacia robusta* subsp. *clavigera, Ficus sycomorus* subsp. *sycomorus, Pavetta lanceolata, Cussonia zuluensis*, *Trichilia dregeana, Scutia myrtina, Tarrena pavettoides, Gymnosporia sp., Grewia occidentalis, Galpinia transvaalica, Syzigium cordatum, , Celtis africana, Trema orientalis, Erythrina caffra, Thespesia acutiloba Ziziphus mucronata, Ehretia rigida* subsp. *rigida, Euclea crispa* subsp. *crispa.*
Alien Vegetation	*Lantana camara*, Schinus terebithifolius*, Solanum mauritianum*, Thevetia peruviana*,Tecoma stans, Melia azaderach*, Psidium guajava*, Chromolaena odorata*, Sesbania bispinosa*, Ricinus communis* var. *communis*

The transformed road reserve of the P425 comprises *Aristida congesta*, *Aristida junciformis*, *Cynodon dactylon, Digitaria spp., Chloris virgata, Sporobolus africanus, Panicum maximum, Cymbopogon sp., Eragrostis curvula, Imperata cylindrica, Hyparrhenia hirta* and *Melinis repens.* The grasses cover varies from bare batches to approximately 0-90% of the road reserves and the forbs and herbs layer is poorly developed <20%. Forbs were dominated by pioneer weedy plant species such as Peanut-Butter Cassia (*Senna didymobotrya**) Tall Fleabane (*Conyza albida**), Flax-Leaf Fleabane (*Conyza bonariensis*)*, Common Black jack (*Bidens pilosa*), Castor-Oil Plant (*Ricinus communis**), Bugweed (*Solanum mauritianum**), Tall Khaki weed (*Tagetes minuta**) Mexican Poppy (*Argemone ochroleuca**), *Ambrosia artemisifolia, Ageratum houstonianum*, Ageratum conyzoides**, *Conyza bonariensis** and *Parthenium hyserophorus*.*

[*] exotic or alien invasive vegetation

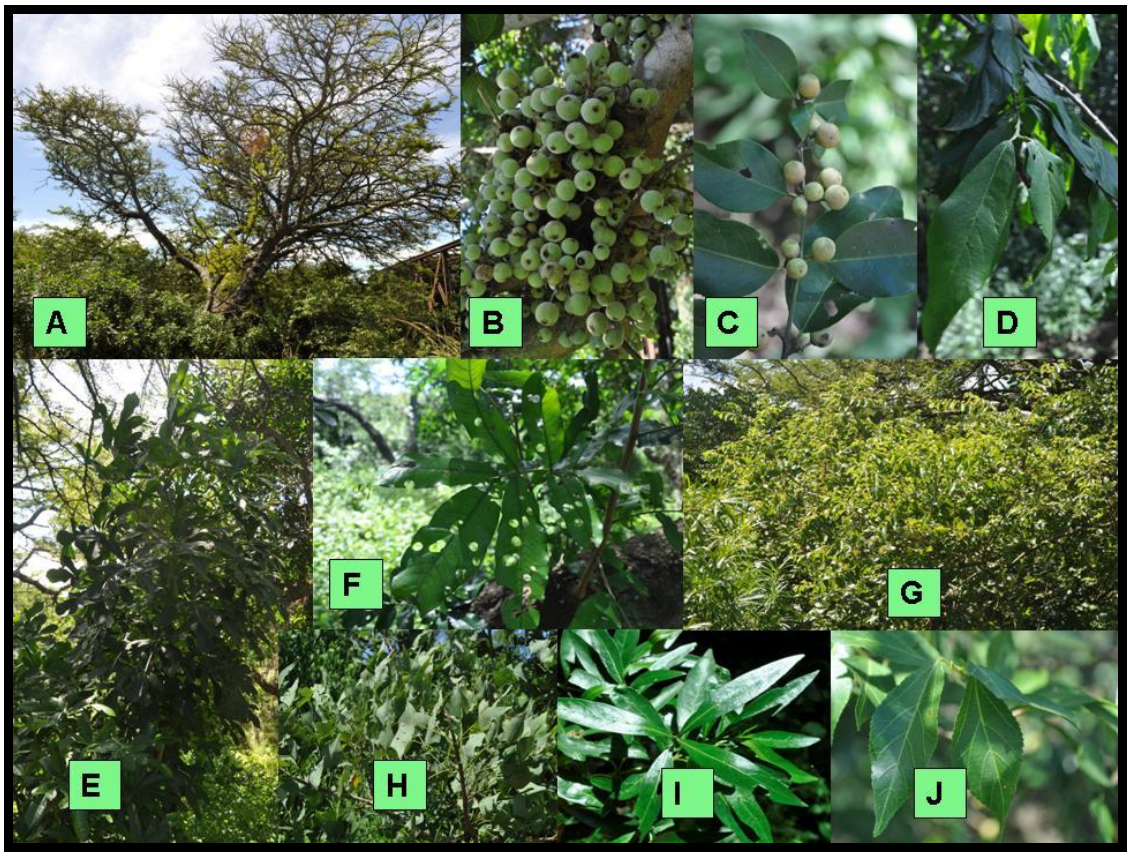


Figure4. A conglomerate of photographs displaying the dominant tree and shrub species observed within and immediately adjacent to the proposed Nseleni Bridge site. A: Broad-pod Robust Thorn (*Acacia robusta* subsp. *clavigera*); **B:** Sycamore Fig (*Ficus sycomorus* subsp. *sycomorus*); **C:** Cat Thorn (*Scutia myrtina*); **D:** Brides-bush *Tarrena pavettoides* subsp. *pavettoides;* **E:** Zulu Cabbage-tree (*Cussonia zuluensis*); **F:** Forest Natal Mahogany (*Trichilia dregeana*); **G:** Buffalo-thorn (*Ziziphus mucronata*); **H:** Coastal Coral Tree (*Erythrina caffra*); **I:** Weeping Brides-bush (*Pavetta lanceolata*) and **J:** Cross-berry Raisin (*Grewia occidentalis* var. *occidentalis*)

The riparian vegetation along the Nseleni River comprises of a dense closed canopy consisting of several large Broad-pod Robust Thorn (*Acacia robusta* subsp. *clavigera*), Sycamore Figs (*Ficus sycomorus* subsp. *sycomorus*), Forest Natal Mahogany (*Trichilia dregeana*), Buffalo-thorn (*Ziziphus mucronata*) and Coastal Coral Tree (*Erythrina caffra*). Smaller trees and shrubs observed within the proposed bridge site included Cat Thorn (*Scutia myrtina*); Brides-bush *Tarrena pavettoides* subsp. *pavettoides;* Zulu Cabbage-tree (*Cussonia zuluensis*) Weeping Brides-bush (*Pavetta lanceolata*) and Cross-berry Raisin (*Grewia occidentalis* var. *occidentalis*).
The understory vegetation has been transformed and is dominated by pioneer and weedy plant and grass species such as *Setaria megaphylla, Bidens pilosa, Rivinia humilis* as well as dense stands of Bugweed (*Solanum mauritianum**), Castor-Oil Plant (*Ricinus communis**).

Figure5. A conglomerate of photographs displaying the dominant alien invasive vegetation observed within and immediately adjacent to the proposed Nseleni Bridge site. A: Bugweed (*Solanum mauritianum**) Category 1b Weed, **B:** Yellow Oleander (*Thevetia peruviana**) Category 1b Weed; **C:** Redstar Zinnia (*Zinnia peruviana**) Weed; **D:** Peanut Butter Cassia (*Senna didymobotrya**) Category 1b Invader; **E:** Guava (*Psidium guajava**) Category 2 Invader; **F:** Saligna Gum (*Eucalyptus grandis**) Category 1b/2 Invader; **G:** Lantana (Lantana camara*) Category 1b Weed; **H:** Castor-oil Plant (*Ricinus communis**) Category 1b Weed and **I:** Brazilian Peppercorn Tree (*Schinus terebithifolius**) Category 1b Weed.

Exotic and invasive plant species were categorised according to the framework laid out by The Conservation of Agricultural Resources Act (CARA) (Act 43 of 1983). CARA defines weeds as alien plants, with no known useful economic purpose that should be eradicated. Invader plants, also considered by the Act, can also be of alien origin but may serve useful purposes as ornamentals, as sources of timber, or may have other benefits (Henderson, 2001). These plants need to be managed and prevented from spreading.

Alien and invasive plant species can be grouped three categories:

- Category 1 plants are weeds that serve no useful economic purpose and possess characteristics that are harmful to humans, animals or the environment. These plants need to be eradicated using the control methods stipulated in Regulation 15.D of the CARA.
- Category 2 plants are plants that are useful for commercial plant production purposes but are proven plant invaders under uncontrolled conditions outside demarcated areas.
- Category 3 plants are mainly used for ornamental purposes in demarcated areas but are proven plant invaders under uncontrolled conditions outside demarcated areas.

Alien invasive species recorded included *Agave americana** *Ageratum conyzoides**, *Caesalpinia decapetala**, *Chromolaena odorata**, *Ipomoea indica**, *Ipomoea purpurea**, *Lantana camara**, *Sesbania punicea**, *Leucaena leucocephala**, *Montanoa hibiscifolia**, *Rubus cuneifolius**, *Psidium guajava**, *Melia azedarach**, *Mimosa pigra**, *Ricinus communis**, *Senna didymobotrya**, *Solanum panduriforme**, *Solanum mauritianum**, *Tithonia diversifolia** are present throughout this vegetation unit.

No red data plant species were observed within the transformed understory vegetation during the brief field survey although suitable habitat remains upstream and downstream along the Nseleni River within the riparian zone for certain red listed plant species. More intensive surveys are required in order to ascertain the current conservation status of threatened plant and tree species in these areas. The replacement of the Nseleni bridge should not impact on any rare or protected plant or tree species if activities are restricted to the transformed areas of the bridge site. No vegetation clearance except for the removal of alien invasive vegetation should take place outside the bridge servitude. All indigenous tree species outside the servitude must be clearly marked and adequately protected from surrounding construction activities.

* exotic or alien invasive vegetation

4. PRELIMINARY FAUNAL SURVEY

The preliminary faunal survey focused mainly on mammals, birds, reptiles and amphibians of the study area. The survey focused on the current status of threatened animal species occurring, or likely to occur within the study area, describing the available and sensitive habitats, identifying potential impacts resulting from the replacement of the steel truss Nseleni River Bridge and providing mitigation measures for the identified impacts. Faunal data was obtained during a single site visit of the proposed development site carried out on foot on the 5th March 2013.

All animals (mammals (larger), birds, reptiles and amphibians) seen or heard; were recorded. Use was also made of indirect evidence such as nests, feathers and animal tracks (footprints, droppings) to identify animals. Previous surveys, literature investigations; personal records and historic data supplemented the initial survey. The literature search was undertaken utilising *The Vegetation of South Africa, Lesotho and Swaziland* (Mucina & Rutherford 2006) for the vegetation description. *The Mammals of the Southern African Subregion* (Skinner & Chimimba 2005) and *The Red Data Book of the Mammals of South Africa: A Conservation Assessment* (Friedmann and Daly (editors) 2004) for mammals. *Roberts-Birds of Southern Africa VII th ed.* (Hockey, Dean and Ryan (editors); 2005) and *The Escom Red Data Book of Birds of South Africa* (Barnes 2000) for avifauna (birds). A Complete Guide to the Frogs of Southern Africa (du Preez & Carruthers 2009) and *The Atlas and Red Data Book of the frogs of South Africa, Lesotho and Swaziland* (Minter et al. 2004) for amphibians. *The Field Guide to the Snakes and other Reptiles of Southern Africa* (Branch 2001) and *South African Red Data Book- Reptiles and Amphibians* (Branch 1988) for reptiles.

The majority of vegetation adjacent to the Nseleni River Bridge site is completely transformed and dominated by sugar-cane plantations and secondary succession grassland as well as pioneer weedy and alien invasive plant species. The adjacent areas are dominated by extensive sugar-cane plantations, scattered tree species around the rural homesteads and adjacent agricultural lands. High levels of habitat degradation occur around the area with wood harvesting, rock removal, sand harvesting, alien invasive plant vegetation as well as extensive overgrazing and soil erosion. The open and closed wooded riparian zone along the Nseleni Rivers offers the most favourable habitat for remaining animal species (especially birds).

Existing Impacts on the fauna on and surrounding the site included:

- The proposed Nseleni River Bridge project is situated within a rural agricultural environment which is dominated by transformed sugar-cane plantations and totally degraded vegetation dominated by limited secondary succession grasslands with consist of limited habitat diversity or impoverished habitats.

- As the site is situated around rural homesteads and agricultural areas the majority of natural vegetation consisting of Zululand Coastal Thornveld has been already transformed due to sugar-cane plantations, rural homesteads, livestock kraals and small scale agricultural lands. Severe degradation of the remaining vegetation due to surrounding anthropogenic activities including wood harvesting, collection of medicinal plants as well as extensive overgrazing by cattle and goats. This has resulted in impoverished habitats with limited faunal diversity due to habitat destruction and habitat fragmentation.

- Remnant patches Subtropical Alluvial Vegetation (AZa 7) remains along the Nseleni River as well as the endangered Zululand Coastal Thornveld vegetation upstream of the site at the Owen Sithole (Cwaka) Agricultural College.

- Littering occurs adjacent to the P425 especially adjacent to the bridge.

- Illegal hunting with dogs as well as poaching activities. Dogs and feral cats have a high impact on remaining faunal species. Children were observed hunting birds with catapults during the site visit.

- Introduction of exotic and alien invasive vegetation along the Nseleni River.

4.1 AMPHIBIANS

Amphibians are an important component of South Africa's exceptional biodiversity (Siegfried 1989) and are such worthy of both research and conservation effort. This is made additionally relevant by international concern over globally declining amphibian populations, a phenomenon currently undergoing intensive investigation but as yet is poorly understood (Wyman 1990; Wake 1991). Amphibians have declined dramatically in many areas of the world. These declines seem to have worsened over the past 25 years and amphibians are now more threatened than either mammals or birds, though comparisons with other taxa are confounded by a shortage of reliable data.

Most frogs have a biphasic life cycle, where eggs laid in water develop into tadpoles and these live in the water until they metamorphose into juvenile fogs living on the land. This fact, coupled with being covered by a semi-permeable skin makes frogs particularly vulnerable to pollutants and other environmental stresses. Consequently frogs are useful environmental bio-monitors (bio-indicators) and may acts as an early warning system for the quality of the environment.

Breeding in African frogs is strongly dependent on rain, especially in the drier parts of the country where surface water only remains for a short duration. The majority of frog species in the Kwazulu-Natal Province can be classified as explosive breeders. Explosive breeding frogs utilise ephemeral pans or inundated grasslands for their short duration reproductive cycles.

As the survey was undertaken for only 1 day during daylight hours of the summer months only a small proportion of species were active. Five frog species were recorded during brief site inspection namely Natal Tree Frog (Leptopelis natalensis), several emerging juvenile Plain Grass Frog (*Ptycadena anchietae*), Guttural Toad (*Amietophrynus gutturalis*), Snoring Puddle Frog (*Phrynobatrachus natalensis*) and Dwarf Puddle Frog (*Phrynobatrachus mababiensis*).

Ideally, a herpetological survey should be undertaken throughout the duration of the wet season (November-Mach) including several nocturnal surveys. It is only during this period that accurate frog species lists can be compiled. Twenty-nine (29) frog species have been recorded from the 2831 CD quarter degree grid square according to Frogmap (http://sarca.adu.org.za/safap/index.php). During this survey; fieldwork was augmented with species lists compiled from personal records; data from the South African Frog Atlas Project (SAFAP) (1999-2003) and published data, and the list provided below is therefore regarded as likely to be fairly comprehensive.

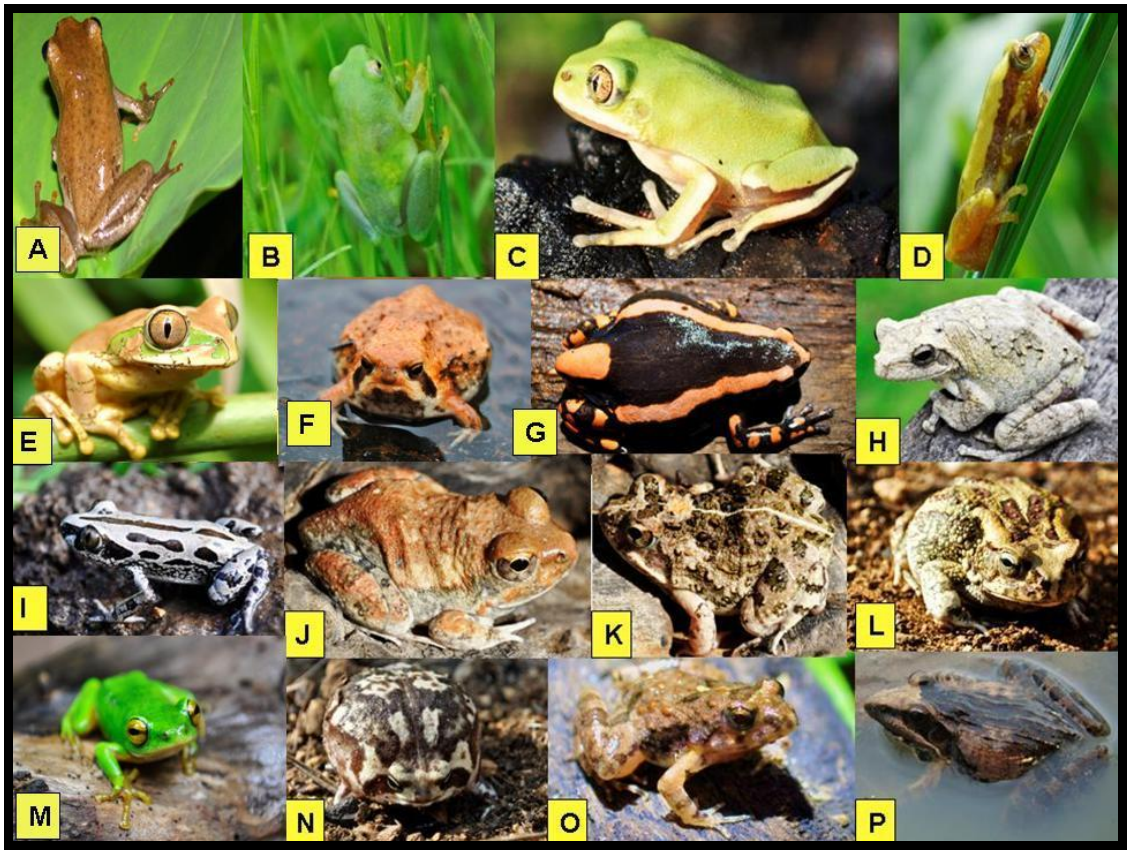


Figure6: A conglomerate of photographs of frog species likely to occur within the Nseleni River and adjacent valley bottom wetlands and dams. **A:** Painted Reed Frog (*Hyperolius marmoratus marmoratus*), **B:** Water Lily Frog (*Hyperolius pusillus*), **C:** Brown-Backed Tree Frog (*Leptopelis mossambicus*) juvenile colouration, **D:** Golden Leaf-Folding Frog (*Afrixalus aureus*); **E:** Natal Tree Frog (*Leptopelis natalensis*), **F:** Mozambique Rain Frog (*Breviceps mossambicus*), **G:** Banded Rubber Frog (*Phrynomantis bifasciatus*), **H:** Southern Foam Nest Frog (*Chiromantis xerampelina*), **I:** Bubbling Kassina (*Kassina senegalensis*), **J:** Natal Sand Frog (*Tomopterna natalensis marmorata*), **K:** Tremelo Sand Frog (*Tomopterna cryptotis*), **L:** Eastern Olive Toad (*Amietophrynus garmani*), **M:** Tinker Reed Frog (*Hyperolius tuberilinguis*), **N:** Bushveld Rain Frog (*Breviceps adspersus*), **O:** Dwarf Puddle Frog (*Phrynobatrachus mababiensis*) and **P:** Plain Grass Frog (*Ptychadena anchietae*).

Table1. Frog species recorded on the actual site or are likely to occur on the site.

Common Name	**Scientific Name**	**Status/ Distribution**	**Habitat**
Bush Squeaker	*Arthroleptis wahlbergi*	Endemic to the east coast of South Africa.	Terrestrial breeder which constructs a nest within damp leaf litter and eggs develop into froglets
Common River Frog	*Amietia* (*Afrana*) *angolensis*	Common in central and southern Africa.	Permanent standing water and streams in grassland and open woodland.
*Guttural Toad	*Amietophrynus* (*Bufo*) *gutturalis*	Common in southern Africa north of Gariep.	Permanent and semi-permanent ponds and backwaters in open grassland.
Raucous Toad	*Amietophrynus rangeri*	Common in the eastern parts of South Africa. Declining within Gauteng, Mpumalanga and Limpopo Provinces	Permanent and semi-permanent ponds and backwaters in open grassland
Red Toad	*Schismaderma carens*	Found throughout South Africa and southward throughout Kwazulu-Natal to Port Edward.	Breeds in deep muddy pools and dams as well as reed invaded backwaters within rivers.
Painted Reed Frog	*Hyperolius marmoratus marmoratus*	Common along Kwazulu-Natal Coast	Reeds and other emergent vegetation along a wide variety of water bodies including pans and rivers
Water Lily Frog	*Hyperolius pusillus*	Common in the low-lying coastal areas (Eastern Cape and Kwazulu-Natal) but further inland in the southern parts of Limpopo it is found at	Shallow pans, ponds, vleis and dams with water lilies (*Nymphaea sp*.) or at least some floating vegetation.

		higher altitudes.	
Tinker Reed Frog	*Hyperolius tuberilinguis*	Common in the Eastern parts of Southern Africa from Swaziland up to Port Edward	Reed beds on the periphery of rivers or dense vegetation surrounding seasonal pans
*Natal Tree Frog	*Leptopelis natalensis*	Common in Kwazulu-Natal	Permanent and Seasonal ponds situated in coastal forest, sand forest or coastal bushveld and occasionally grassland
Bubbling Kassina	*Kassina senegalensis*	Common throughout Southern Africa	Grassy margins of seasonally inundated pans as well as dams
*Snoring Puddle Frog	*Phrynobatrachus natalensis*	Widely distributed along the eastern sections of Southern Africa	Shallow to fairly deep water in temporary pans and pools, vleis, dams and even slow-flowing streams
*Dwarf Puddle Frog	*Phrynobatrachus mababiensis*	Widely distributed along the eastern sections of Southern Africa	Shallow to fairly deep water in temporary pans and pools, vleis, dams and even slow-flowing streams
*Plain Grass Frog	*Ptychadena anchietae*	Widely distributed along the eastern sections of Southern Africa	Vleis, inundated grassland and sedge pans, temporary roadside pools and rock puddles
Sharp-Nosed Grass Frog	*Ptychadena oxyrynchus*	Eastern Parts of South Africa	Vleis, inundated grassland and sedge pans, temporary roadside pools and rock puddles
Natal Sand Frog	*Tompoterna natalensis*	Common species in Kwazulu-Natal, Mpumalanga, Gauteng.	Streams, rivers or other places where water flows slowly but also in lothic or standing water
*Bronze Caco	*Cacosternum nanum*	Common species in Kwazulu-Natal	Vleis, inundated grassland and sedge pans, temporary roadside pools and rock puddles
Plaintive Rain Frog	*Breviceps verrucosus*	Eastern Parts of South Africa	Terrestrial breeder with eggs laid in moist leaf litter.

* recorded during brief survey

Threatened species

Two red listed frog species are known from the 2831 CD Quarter Degree Grid Cell (QDGC) namely the Natal Leaf-folding Frog (*Afrixalus spinifrons*) and Natal Kloof Frog (*Natalobatrachus bonebergi*)

NATAL KLOOF FROG (*NATALOBATRACHUS BONEBERGI*)

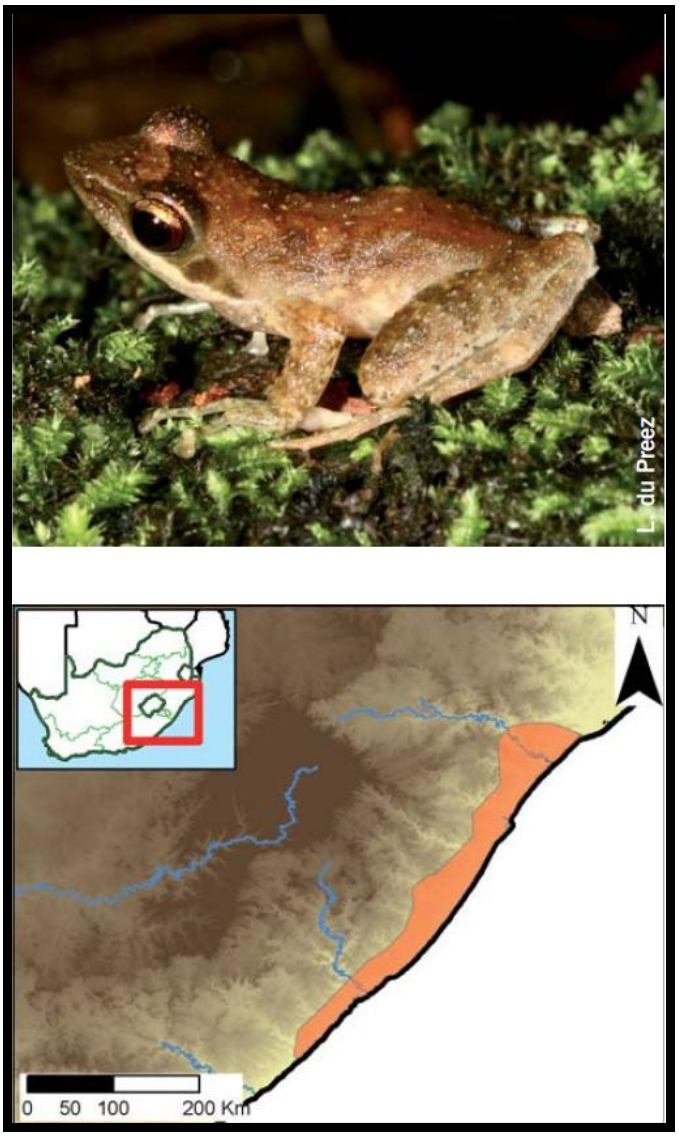


Figure7. The Natal Kloof Frog (*Natalobatrachus bonebergi*) is classified as Endangered and is restricted to the coastal forests of southern Kwazulu-Natal and southern Eastern Cape provinces, at altitudes below 900 m (Minter et al. 2004). Listed as Endangered (B2ab(ii,iii), in view that its area of occupation (AOO) is around 150 km^2, its distribution is severely fragmented, and there is a continuing decline in the extent and quality of its habitat and AOO (Measey *et al.* 2011). Photograph by Prof. L du Preez.

Geographic Range:
South Africa (Eastern Cape, KwaZulu-Natal). This species is restricted to south-eastern South Africa, where it ranges from Dwesa Nature Reserve in the Eastern Cape east to southern and central KwaZulu-Natal. Its EOO has been estimated as 15 000 km^2, with an AOO of approximately 1% of the EOO (150 km^2 and declining). It occurs in nine locations, all between 50 and 900 m.a.s.l. (Measey *et al.* 2011).

Population:
Little population information is available for this species. It is considered to be severely fragmented as >50% of individuals are in isolated patches and the distances between subpopulations are considered to be too great for dispersal within one generation (Measey *et al.* 2011).

Habitat and Ecology:
It lives in coastal forests and gallery forests, where it is usually found along streams and does not survive in open areas. It breeds in streams, hanging its eggs above water on branches, and sometimes on rock faces. The larvae fall into the water where they develop (Measey *et al.* 2011).

Major Threats:
Much of the forest habitat of this species has been lost to sugar cane cultivation and other agriculture, woodcutting, afforestation and urbanisation. It is also threatened by pollution and siltation of streams (Measey *et al.* 2011).

Conservation Actions:
A priority for conservation research is to estimate the population size of adults in subpopulations, as well as determining the cause of direct threats. Obtaining a memorandum of understanding with land owners is also of high priority. It occurs in several protected areas, including Umtamvuna Nature Reserve and Oribi Gorge Nature Reserve. However, additional habitat and waterway protection is required (Measey *et al.* 2011).

NATAL LEAF-FOLDING FROG (*AFRIXALUS SPINIFRONS*)

Figure8. Natal Leaf-folding Frog (*Afrixalus spinifrons*).

Geographic Range:

This species, which is endemic to South Africa, occurs as two subspecies: *A. s. spinifrons* occurs in the KwaZulu-Natal lowlands, and the Eastern Cape coast of South Africa at low to intermediate altitudes; *A. s. intermedius* occurs at altitudes above 1 000 to around 1 500 m.a.s.l. in western KwaZulu-Natal between the midlands and foothills of the Drakensberg. The extent of occurrence (EOO) is around 19 000 km², and the area of occupation (AOO) is estimated to be 10% of this (Measey *et al.* 2011).

Population:

This species is hard to detect but it is known to be doing well at some sites where it appears abundant. Regional declines have been observed within the KwaZulu-Natal South Coast especially in the Port-Edward to Palm Beach area (pers. obs.)

Habitat and Ecology:

It is associated with low vegetation in shrubland and dry forest. It breeds in vleis (including dams) and temporary pools and pans (including roadside pools) and uses emergent vegetation to create egg nests. Species in this genus deposit between 20 and 50 eggs on vegetation above the water. Tadpoles emerge, drop into the water and remain there until metamorphosis (Measey *et al.* 2011).

Major Threats:
Certain subpopulations are affected by loss of wetlands through urban and recreational development, afforestation, agricultural expansion, pesticides, and overgrazing by livestock. Coastal populations (i.e. *A. s. spinifrons*) may be at higher risk than those inland due to heavier development pressure along the KwaZulu-Natal coastline (Measey *et al.* 2011).

Conservation Actions:
Determining whether the two subspecies are separate species is a high conservation research priority for this species, and the entire genus in South Africa is in need of taxonomic attention. Insufficient information exists on life history of the subspecies, and monitoring of breeding sites is recommended at the extremes of the distribution. Although there are many threats to individual sites, the species as a whole is not considered to require conservation effort at this time. *Afrixalus s. intermedius* occurs in the uKhahlamba-Drakensberg National Park. *Afrixalus s. spinifrons* occurs in a number of coastal protected areas.

Listed as **Near Threatened** as although its EOO is 19 000 km², its AOO is less than 1 900 km², and there is continuing decline in the quality of its habitat, there are 11 locations and the spatial distribution of this species is not considered to be severely fragmented. However, certain sites where this species occurs do have a large number of different threats which may seriously impact on population viability in future. Loss of certain sites could easily result in less than 10 locations triggering the criteria for Vulnerable status (Measey *et al.* 2011).

The proposed replacement of the Nseleni River bridge should not negatively impact on any threatened frog species if construction activities are restricted ideally to the dry winter months as well as within the road/bridge reserve (8-10m). If construction occurs during the wet summer months adequate stormwater and soil erosion preventative measures must be implemented in order to reduce the potential deterioration of water quality within the Nseleni River.

4.2 REPTILES

All reptile species are sensitive to major habitat alteration and fragmentation. As a result of human presence in the area as well as on the site; coupled with extensive habitat transformation (sugar-cane fields) and high levels of disturbances, alterations to the original reptilian fauna are expected to have already occurred. Removal of large riparian tree species and dead trunks for firewood collection destroys numerous habitats for many arboreal reptile species. Clearing of rock material destroys vital habitat for numerous rupicolous reptile species including the Agamids, Cordylids, Geckonids and Skinks.

The majority of snake species hibernate in old tree trunks, termite mounds or under suitable rocks. The indiscriminate killing of all snake species results in the alteration of species composition, with the disappearance of the larger and the more sluggish snake species. The frequent burning of the limited overgrazed grassland vegetation has a high impact on remaining reptiles. Fires during the winter months will severely impact on the hibernating species, which are extremely sluggish. Fires during the early summer months destroy the emerging reptiles as well as refuge areas increasing predation risks. No reptile species were recorded during the brief survey due to incorrect time for surveys. A probable species list is provided in Table2 below. Due to extensive habitat transformation and degradation as well as high levels of human activities alteration to the original reptile species composition (especially snakes) has already occurred. Remaining reptile species are restricted to the closed woodland along the Nseleni River.

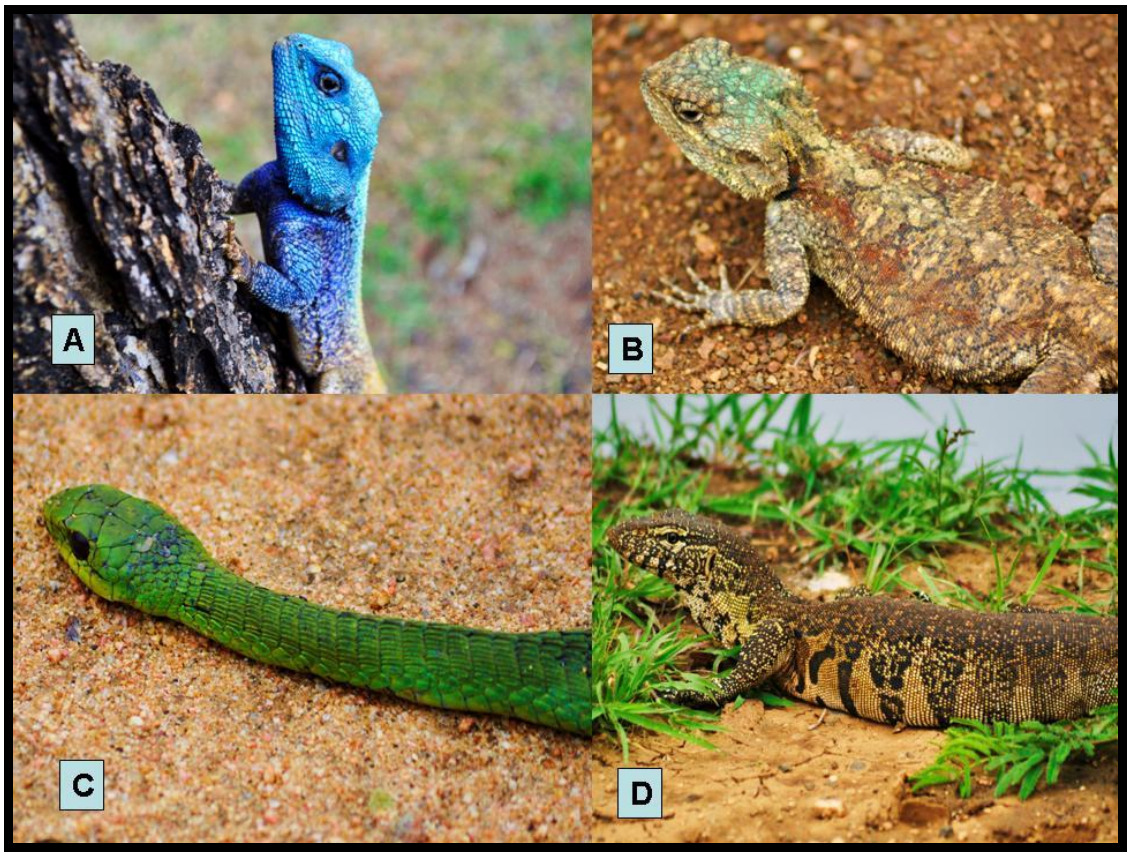


Figure9. A conglomerate of photographs displaying the reptile species likely to occur within the riparian zone of the Nseleni River. A: Male Southern Tree Agama (*Acanthocercus atricolis*), **B:** Female Southern Tree Agama (*Acanthocercus atricolis*) **C:** Boomslang (*Dispholidus typus*) and **D:** Water Monitor (*Varanus niloticus*).

Table2: Reptile species that occur or are likely to occur in the study area due to suitable habitat, and may therefore be present. Actual species lists will most likely contain far fewer species due to high levels of habitat transformation.

COMMON NAME	**SCIENTIFIC NAME**
Cape Skink	*Trachylepis* (*Mabuya*) *capensis*
Striped Skink	*Trachylepis* (*Mabuya*) *punctatissima*
*Variable Skink	*Trachylepis* (*Mabuya*) *varia*
*Yellow-throated Plated Lizard	*Gerrhosaurus flavigularis*
Flap-Necked Chameleon	*Chamaeleo dilepis*
Southern Rock Agama	*Agama atra atra*

*Southern Tree Agama	*Acathocercus atricollis*
*Nile Monitor	*Varanus niloticus*
Herald or Red-lipped Snake	*Crotaphopeltis hotamboeia*
Green Mamba	*Dendroaspis angusticeps*
Common or Rhombic Night Adder	*Causus rhombeatus*
*Boomslang	*Dispholidus typus*
*Spotted Bush Snake	*Philothamnus senivariegatus*
Common or Rhombic Egg Eater	*Dasypeltis scabra*
Dusky-Bellied Water Snake	*Lycodonomorphus laevissimus*
Brown Water Snake	*Lycodonomorphus rufulus*
Brown House Snake	*Lamprophis fuliginosus*
Green Water Snake	*Philothamnus hoplogaster*
Common Slug-eater	*Duberria lutrix*
Bibron's Blind Snake	*Typhlops bibronii*
Cape and Eastern Thread Snake	*Leptotyphlops conjunctus*
Peters' Thread Snake	*Leptotyphlops scutifrons*

THREATENED REPTILE SPECIES

COMMON NAME	SCIENTIFIC NAME	SA RED DATA STATUS (BRANCH 1988)	IUCN STATUS
Southern African Python	*Python natalensis*	Vulnerable	Vulnerable*
Striped Harlequin Snake		Rare	Near-Threatened

SOUTHERN AFRICAN PYTHON *(PYTHON NATALENSIS)*

Figure10. Suitable habitat occurs along the closed woodland riparian zone along the Nseleni River for Southern African Pythons. (Photograph taken in Stanger).

* It is unlikely that pythons will retain this threat classification when reassessed using the latest IUCN criteria, since it appears to be relatively common in certain areas and has a widespread distribution (Alexander and Marais 2007).

The Southern African Python (Python natalensis) is protected in South Africa (SA RDB, Vulnerable) and their numbers have declined due to habitat destruction, killed for their skins (fashion), 'muti', illegally collected for pets and the pet industry. The majority of pythons are indiscriminately killed due to fear and ignorance or due to road fatalities.

Habitat and Ecology: Pythons live in a wide variety of habitats, but are most common in moist, rocky, well-wooded valleys. They are frequently found in and around water, in which they bask and ambush food. They are also excellent climbers. They hunt mainly at night or in the twilight, but can also be found basking, and occasionally even hunting during the day. The diet of juveniles consists mainly of small rodents and ground living birds, although they will also take fish and water or nile monitors (leguaans). The adults feed mainly on medium-sized mammals, including dassies, hares, cane rats, duikers, etc. The larger specimens will take larger mammals, and there are accurate, and often graphically illustrated, reports of Southern African Pythons killing and swallowing very large prey items. The largest recorded prey item for any large constrictor is that of a 59 kg impala swallowed by a 4.88 m African python (Rose, 1955). Other records include, among many others, a 6 m python consuming 6 goats (Taylor, 1981), a 5 m python that ate a pointer watchdog and two of her puppies (Jensen, 1980), and a 4.28 m python devouring a six-month old female impala (illustrated in Branch, 1984). F. W. Fitz Simons (1930) even records pythons killing leopards, and a python constricting a crocodile is illustrated in Halliday and Adler (1986).

The python is the only African snake large enough to consider humans edible, albeit very rarely. There are a number of anecdotal reports of human predation by pythons. In addition to the dangers of constriction, pythons have a mouthful of large, recurved and needle-sharp teeth that can deliver a powerful and lacerating bite. Adults are also irascible, and rarely settle well into captivity.

Man is now the python's main predator, killing them for food, 'muti', skins and, short-sightedly, to rid himself of a 'pest'. Other enemies include crocodiles, honey badgers or ratels, mongoose and meerkats, etc. Pienaar, *et al.* (1983) record a young python (825 mm) in the stomach of a Cape File snake. Pythons are often killed crossing roads, and when engorged with food they are especially vulnerable to attacks by packs of wild dogs and hyaenas.

Many African tribes prize python fat and skin for use in tribal medicines and witchdoctor's 'muti', whilst a large python represents a tasty and substantial food item (see photograph in Patterson and Bannister, 1987). All pythons, but particularly juveniles, are desired by the pet trade, and would find a ready market if not

protected by law. Pythons are frequently electrocuted on the lower wires of electric fences which are erected around the increasing number of game farms.

STRIPED HARLEQUIN SNAKE (*HOMOROSELAPS DORSALIS*)

Figure11. The Striped Harlequin Snake (*Homoroselaps dorsalis*) has bee recorded from the 2831 CD QDGC. These snakes are very secretive and are only known from a few specimens. They burrow in loose soil and forage underground in tunnels and cracks, and are usually exposed in abandoned termitaria or under stones. They feed exclusively on thread snakes (*Leptotyphlops*) which they catch underground (Branch 1998).

Striped Harlequin Snake (*Homoroselaps dorsalis*), which is categorised as Rare in the out-dated Red Data List (Branch 1988) and is currently listed as Near-Threatened (NT) by the IUCN (World Conservation Monitoring Centre, 1996), though this assessment is also out-of-date. The conservation status of *H. dorsalis* will be reviewed in coming months by the South African Reptile Conservation Assessment (SARCA). Striped Harlequin Snakes have been recorded from the adjacent grid squares (2528CC, 2628AA, and 2628AC) (SARCA virtual museum). Prefers grassland and are endemic to the highveld of the Free State, Kwazulu-Natal, Swaziland, Limpopo and Gauteng. These snakes are very secretive and are only known from a few specimens. They burrow in loose soil and forage underground in tunnels and cracks, and are usually exposed in abandoned termitaria or under stones. They feed exclusively on thread snakes (*Leptotyphlops*) which they catch underground (Branch 1998).

No moribund termite mounds or loosely embedded rock material occurs within the proposed bridge site for Striped Harlequin Snakes. No thread snakes were observed under logs or loosely embedded rock material along the Nseleni River. The site offers no suitable habitat for Striped Harlequin Snakes.

No Southern African Pythons or evidence of pythons was observed during the brief field survey. Remaining Python populations would have been impacted on during the previous agricultural activities as well as adjacent rural/agricultural activities and associated high levels of disturbance. The Nseleni River and associated closed woodland riparian zone could potentially act as an important dispersal or biological corridors as well as foraging areas for remaining pythons; especially dispersing juvenile pythons. If any pythons are discovered on the site the relevant conservation authorities should be informed and the python relocated in suitable habitat away from the site. It is regarded as unlikely that study area comprises critical habitat for Southern African Pythons, at a global or provincial scale, or that the proposed replacement of the Nseleni River bridge will have an impact of more than **low significance** on the conservation status of this specie should it indeed occur.

4.3 AVIFAUNA/BIRDS

Twenty-four (24) bird species were recorded during the brief field survey (total 8 hours). Species recorded during the field survey are common, widespread and typical of a woodland environment. The majority of bird species were recorded along the Nseleni River. High levels of human disturbance as well as habitat transformation and degradation within the proposed riparian zone on the site and adjacent areas would result in the disappearance of the more secretive or sensitive bird species.

Table4: Bird species recorded during brief field survey (8hrs).

Roberts' Number	Common name	Scientific Name
94	Hadedah Ibis	*Bostrychia hagedash*
196	Natal Spurfowl	*Pternistis natalensis*
203	Helmeted Gunieafowl	*Numida meleagris*
297	Spotted Thick-Knee	*Burhinus capensis*
352	Red-Eyed Dove	*Stretopelia semitorquata*
354	Cape Turtle Dove	*Streptopelia capicola*
355	Laughing Dove	*Streptopelia senegalensis*
361	African Green-Pigeon	*Treron calvus*
371	Purple-Crested Turaco	*Gallirex porphyreolophus*
391	Burchell's Coucal	*Centropus burchellii*
424	Speckled Mousebird	*Colius striatus*
435	Brown-Hooded Kingfisher	*Halycon albiventris*
541	Fork-Tailed Drongo	*Dicrurus ludwigii*
545	Black-Headed Oriole	*Oriolus larvatus*
548	Pied Crow	*Corvus albus*
568	Dark-capped (Black-eyed) Bulbul	*Pycnonotus barbatus*
736	Southern Boubou	*Laniarius ferrugineus*
750	Olive Bush-Shrike	*Telophorus olivaceus*
758	*Common Myna	*Acridothermes tristis*
796	Cape White-Eye	*Zosterops pallidus*
801	*House Sparrow	*Passer domesticus*
814	Masked Weaver	*Ploceus velatus*
815	Lesser Masked Weaver	*Ploceus intermedius*
846	Common Waxbill	*Estrilda astrild*

Threatened species

Several threatened bird species have been recorded in the grid square within which the study area is situated. No threatened bird species were recorded during the brief survey around the Nseleni bridge alignment mainly due to high levels of habitat transformation (sugar-cane) and degradation as well as human disturbances. The closed woodland riparian zone along the Nseleni River offers suitable foraging habitat for African Crowned Eagles. All raptors are perceived as a threat to chickens and livestock and are killed. High levels of human activity and disturbances were observed adjacent to the river which restricts the likelihood of any secretive species. If however the unlikely occurrence of any threatened bird species it is highly unlikely that the small section of the riparian zone of the proposed bridge site will form critical habitat for any threatened bird species or negatively impact on any threatened bird species.

4.4 MAMMALS

No small mammal trapping was conducted due to severe time and financial constraints as well as the limitations. Fieldwork was augmented with previous surveys in similar habitats as well as published data. The area was initially traversed on foot to ascertain the presence of available refuges. Limited suitable refuges such as burrows, artificially created rock piles, stumps were observed. The majority of mammal species likely to occur around the homesteads are urban exploiters such as the House Rat and House Mouse as well as feral cats. Several mounds of the African Molerat as well as burrows on the Natal Multimammate Mouse were observed in the sandier sections adjacent to the Nseleni River. Evidence of Water Mongoose (Latrine) as well as Cape Clawless Otters scats were observed along the river. Evidence of Common Duiker and Porcupine were observed within the closed wooded pockets adjacent to the Nseleni River. Vervet Monkeys were observed foraging on Guava (*Psidium guajava**) adjacent to the river. Several Slender Mongooses were observed crossing the P425.

Mammal species recorded within the study area as well as those that may occur within the study area, on the basis of available distribution records and known habitat requirement, are included in the Table 5 below.

Table5: Mammal species recorded during field survey. Species in bold were recorded during the brief survey Identification was determined by visual observations and animal tracks (footprints and droppings).

COMMON NAME	SCIENTIFIC NAME
Common Molerat	***Cryptomys hottentotus***
Natal Multimammate Mouse	***Mastomys natalensis***
Scrub Hare	*Lepus saxtalis*
Striped Mouse	*Rhabdomys pumilio*
Grey Climbing Mouse	*Dendromus melanotis*
Brant's Climbing Mouse	*Dendromus mesomelas*
House mouse	*Mus musculus*
House Rat	*Rattus rattus*
*** Dog**	***Canis familiaris***
Cat	*Felis catus*
Common Duiker	***Sylvicapra grimmia***
Bushbuck	*Tragelaphus scriptus*

Vervet Monkey	***Cercopithecus aethiops pygerythrus***
Water Mongoose	***Atilax paludinosus***
Cape Clawless Otter	***Aonyx capensis***
Slender Mongoose	***Galarella sanguinea***
Striped Polecat	*Ictonyx striatus*
Large-spotted Genet	*Genetta tigrina*
Porcupine	***Hystrix africaeaustralis***

* introduced species

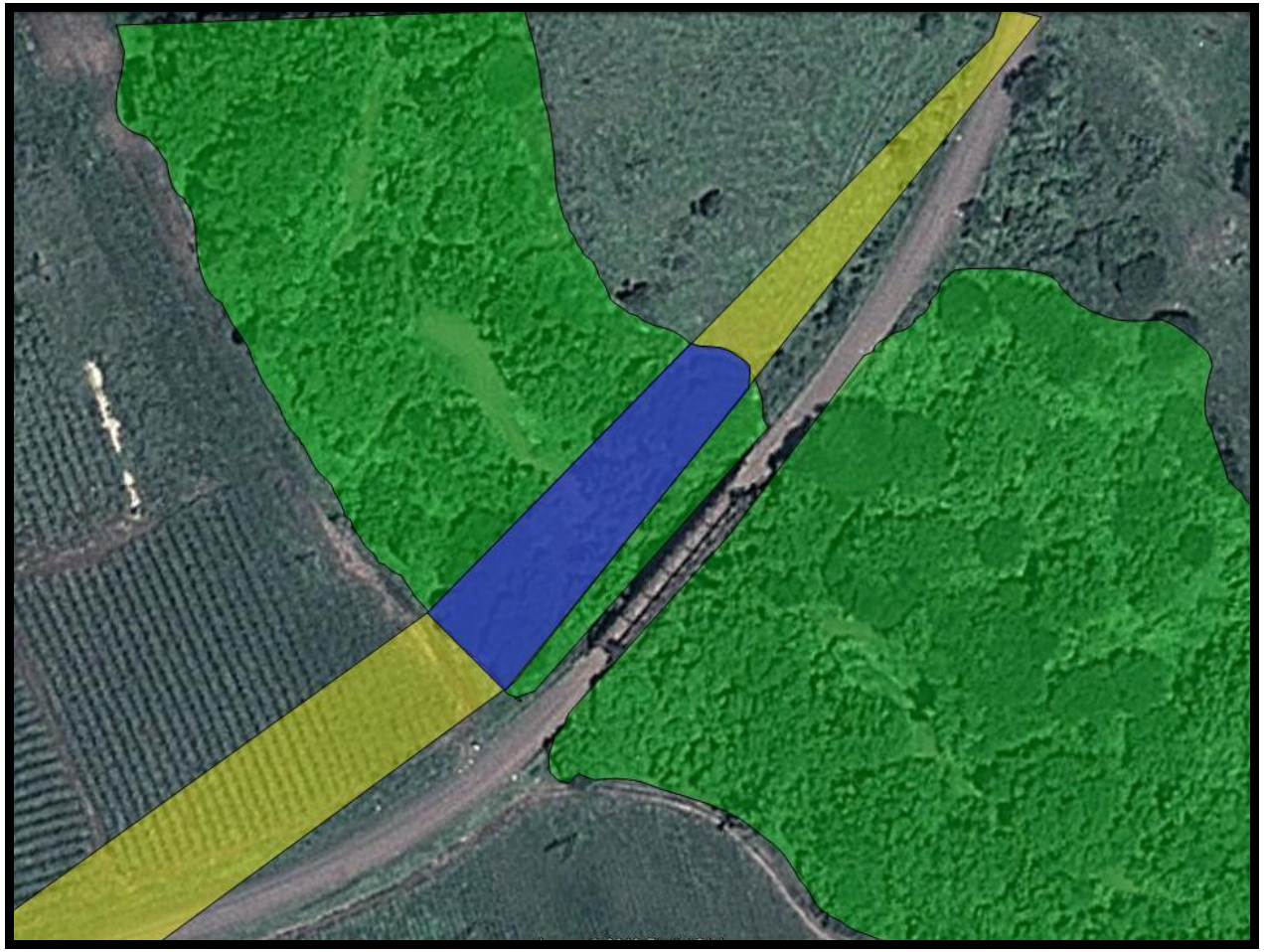
Threatened species

No sensitive or endangered mammals were recorded within the study area. The majority of larger mammal species are likely to have been eradicated or have moved away from the area due to high levels of habitat transformation and degradation. This is mainly a result of increased development pressure and human disturbances such as hunting and poaching with dogs and wire snares. The closed woodland along the Nseleni River offers suitable habitat for Bushpig, Porcupine, Bushbuck as well as smaller Duiker species including Blue, Red and Common Duiker. The population sizes will be determined by the extent of poaching activities in the area. Smaller mammal species are extremely vulnerable to snares and poaching activities as well as dogs and feral cats. It is highly unlikely that the proposed replacement of the Nseleni River bridge constitutes significant habitat for any species of threatened mammal species.

4.5 FAUNAL CONCLUSION

The proposed Nseleni River bridge is situated immediately upstream form the existing steel truss bridge. The riparian zone displays the typical Subtropical Alluvial vegetation. The understory vegetation is dominated by anthropogenic grasses and pioneer weedy plant species and invaded by alien invasive plant species. The remnant patches of open and closed woodland occurs mainly adjacent to the perennial Nseleni Rivers. The sandy soils in the adjacent agricultural lands provides suitable habitat for certain rodent species such as the House Rats (villages) as well as Multimammate Mouse. Rodents construct burrows in the sandy soils and attract other predators such as the Slender Mongoose. The wooded riparian zone forms critical habitat for remaining larger mammals species. Bird species around the existing residential areas are restricted to granivorous or seed eating birds such as Laughing Dove, Cape Turtle Dove as well as urban exploiters such as the Common Mynah and House Sparrow. The majority of bird species recorded during the site visit were observed in the remnant pockets of indigenous closed woodland patches along

the Nseleni River. Several frugivores were observed foraging within the Sycamore Figs (*Ficus sycomorus*). Reptile species are extremely sensitive to habitat destruction and transformation. Low reptile diversity is expected within the transformed areas adjacent to the Nseleni bridge site (residential homesteads, old lands and current sugar-cane lands) although suitable habitat occurs for arboreal species within the Nseleni River's riparian zone. Medium-High amphibian diversity is expected within the wooded riparian zone of the Nseleni Rivera. The Nseleni River offer suitable habitat for certain frog species including Common River Frogs (*Amietia angolensis*), Painted Reed Frog (*Hyperolius marmoratus marmoratus*) and Snoring Puddle Frog (*Phrynobatrachus natalensis*).



Figue13. Preliminary sensitivity map for the proposed replacement of the Nseleni River Bridge at (11.3 km) on the P425 highlighting sensitive habitats along the proposed alignment. The Yellow area indicates transformed habitats of the proposed re-aligned P425 (Low Sensitivity). The Blue area indicates the proposed new Nseleni bridge alignment (High Sensitivity) and the Green area indicates the riparian zone of the reach of the Nseleni River (High sensitivity).

5. SENSITIVE HABITATS

5.1 NSELENI RIVER and RIPARIAN ZONE

The rivers and associated Subtropical Alluvial riparian zone are considered to be of conservation importance for the following reasons:

- The indigenous riparian vegetation along rivers within Kwazulu-Natal, and rivers in general throughout the Kwazulu-Natal coast, are in danger of being completely replaced by alien invasive species. Any remaining areas of indigenous riparian vegetation within Kwazulu-Natal must therefore be regarded as sensitive and of high conservation importance.
- Rivers and drainage lines are longitudinal ecosystems, and their condition at any point is a reflection of not only upstream activities, but also of those within adjacent and upstream parts of the catchment (O'Keefe 1986). Any impact on the riverine area within the study area is therefore also likely to impact on upstream and downstream areas.
- Riparian zones have the capacity to act as biological corridors connecting areas of suitable habitat in birds (Whitaker & Metevecchi, 1997), mammals (Cockle & Richardson 2003) reptiles and amphibians (Maritz & Alexander 2007). Riparian zones may act as potential refugia for certain fauna and could allow for possible re-colonisation of rehabilitated habitats. The riparian vegetation plays a vital role in the re-colonisation of aquatic macro-invertebrates as well as reptiles and amphibians (Maritz & Alexander 2007). The riparian vegetation provides vital refuge, foraging and migratory passages for species migrating to and away from the rivers. The riparian zone comprises plant communities contiguous to and

affected by surface and subsurface hydrological features of perennial or intermittent water bodies (rivers and streams).

- The riparian vegetation is dependant on the river for a number of functions including growth, temperature control, seed dispersal, germination and nutrient enrichment. Riparian vegetation comprises a distinct composition of species, often different from that of the surrounding terrestrial vegetation. Tree species are positioned according to their dependence or affinity for water, with the more mesic species (water-loving) being located closest to the river channel, often with their roots in the water, and the less water-loving terrestrial species further away from the river.

Riparian habitats, also known as riparian areas, include plant communities adjacent to and affected by surface and subsurface hydrologic features, such as rivers, streams, lakes, or drainage ways. These areas may be a few metres wide near streams or more than a kilometre in floodplains. Both perennial and non-perennial streams support riparian vegetation. Because riparian areas represent the interface between aquatic and upland ecosystems, the vegetation in the riparian area may have characteristics of both aquatic and upland habitats. Many of the plants in the riparian area require plenty of water and are adapted to shallow water table conditions. Due to water availability and rich alluvial soils, riparian areas are usually very productive. Tree growth rate is high and the vegetation under the trees is usually lush and includes a wide variety of shrubs, grasses, and wildflowers.

Why are riparian areas important?

Riparian areas perform a variety of functions that are of value to society, especially the protection and enhancement of water resources, and provision of habitat for plant and animal species.

Riparian areas:

- store water and help reduce floods
- stabilize stream banks;
- improve water quality by trapping sediment and nutrients;
- maintain natural water temperature for aquatic species;
- provide shelter and food for birds and other animals;
- provide corridors for movement and migration of different species;
- act as a buffer between aquatic ecosystems and adjacent land uses;
- can be used as recreational sites; and
- provide material for building, medicinal plants, crafts and curios.

Not all riparian areas develop the same way and may not perform these functions to the same extent. It is important that a riparian area's capacity to provide the benefits listed is not reduced. Many of these areas are best managed as natural areas, rather than being converted to other uses. The riparian vegetation along the Nseleni River has been heavily impacted from surrounding anthropogenic activities. Wood harvesting occurs throughout the area. Several of the large riparian species have been removed in certain sections during previous clearance of the bulk services servitudes as well as adjacent agricultural activities. Remnant patches of indigenous closed woodland riparian vegetation occurs along the Nseleni River. Dominant riparian species included *Acacia natalitia, Acacia robusta* subsp. clavigera*, Ficus sycomorus* subsp. *sycomorus, Pavetta lanceolata, Cussonia zuluensis*, *Trichilia dregeana, Scutia myrtina, Tarrena pavettoides, Gymnosporia sp., Grewia occidentalis, Ficus sur, Dicrostachys cinerea, Dombeya rotundifolia, Schotia brachypetala, Syzigium cordatum, Celtis africana, Trema orientalis, Erythrina caffra* and *Ziziphus mucronata*.

The riparian zone, of which vegetation is a major component, has a number of important functions including:

- enhancing water quality in the river by the interception and breakdown of pollutants;
- interception and deposition of nutrients and sediments;
- stabilisation of riverbanks and macro-channel floor;
- flood attenuation;
- provision of habitat and migration routes for fauna and flora;
- provision of fuels, building materials and medicines for communities (if done on a sustainable basis); and
- recreational areas (fishing - rod and line not shade or gill nets; bird watching; picnic areas etc.).

The Nseleni River and associated riparian zone is protected under the National Water Act 36 of 1998. All rivers must be considered as sensitive habitats due to ecological and hydrological functioning as well as providing suitable habitat as well as biological or dispersal corridors for remaining faunal species. The macro-channel bank around the new bridge structure should be appropriately stabilised with gabion mattresses and re-vegetated in order to prevent further erosion.

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6: POTENTIAL IMPACTS ON THE FAUNA AND PROPOSED ENVIRONMENTAL MANAGEMENT RECOMMENDATIONS

6.1. Destruction of Faunal Habitat

At a local scale the proposed replacement Nseleni River bridge offers suitable habitat for faunal species (mainly birds) in the form of the wooded riparian zone along the Nseleni River. As the proposed site is situated within a rural-agricultural environment the majority of vegetation has been transformed or severely degraded and favourable habitat is severely fragmented. Alteration to the original faunal composition has already occurred and the secretive or sensitive species have been killed or located suitable habitat away from the site. The remaining fauna associated with the site require the conservation of the Subtropical Alluvial Vegetation along the Nseleni River connected to the remnant patch of Zululand Coastal Thornveld upstream of the site at the Owen Sithole (Cwaka) Agricultural College. These sensitive habitats could potentially form an appropriate natural biological corridor; connecting the sensitive habitats along the Nseleni River with similar habitats and should conserve the majority of suitable habitat for faunal species likely to occur in the immediate surrounding area. It is important that all activities within the highly sensitive Nseleni River and riparian zone are adequately managed and construction activities restricted to the bridge and road servitude.

The proposed replacement of the steel truss Nseleni River bridge will most likely result in a **medium-low**, **short, medium** and **long-term negative** impact on the affected environment if construction activities are restricted to the 8-10m servitude. Impacts on the site will depend on restricting construction activities to the road/bridge servitude as well as adequate rehabilitation (macro-channel bank stabilization) to the adjacent riparian zone along the Nseleni River. Should the project be approved, it is therefore recommended that the following mitigation measures be implemented:

During the construction phase of the proposed replacement of the Nseleni River bridge, some habitat destruction and alteration inevitably takes place. This happens with the clearing of the bridge servitude. As the majority of the proposed P425 road re-alignment occurs within completely transformed habitats extremely limited vegetation clearance will be required during the construction and operational phase of the project. Vegetation clearance will be required for the bridge alignment with the removal of several large riparian species including two large *Acacia robusta* subsp. *clavigera,* two large *Ficus sycomorus* subsp. *sycomorus,* dense stands of *Pavetta lanceolata,* a single *Cussonia zuluensis*, a large *Trichilia dregeana,* a single *Scutia myrtina,* a single *Tarrena pavettoides, Gymnosporia sp.* and several *Grewia occidentalis*. These activities will have an impact on the associated fauna; especially

ground living and fossorial species as well as arboreal species occurring within or in close proximity of the servitude, both through modification of habitat and disturbance caused by human activity. The proposed impact will be of **medium to high; short-long term impact** on remaining (albeit) limited faunal species.

MITIGATION AND RECOMMENDATIONS

The following general recommendations are made to minimise the impacts of proposed replacement Nseleni River bridge construction activities on the immediate environment and remaining fauna:

- Close site supervision must be maintained during construction of the three span continuous in-situ box girder deck bridge.
- During the **CONSTRUCTION** phase workers must be limited to areas under construction within the bridge servitude and access to the undeveloped areas, especially the surrounding wooded riparian zones must be strictly regulated ("no-go" areas during construction as well as operational activities).
- No removal of adjacent riparian vegetation and the appropriate rehabilitation of the macro-channel banks after the completion of construction activities.
- Provision of adequate toilet facilities must be implemented to prevent the possible contamination of ground (borehole) and surface water in the area. Mobile toilets must be provided in order to minimize un-authorised traffic of construction workers outside of the designated areas.
- All temporary stockpile areas including litter and dumped material and rubble must be removed on completion of construction. All alien invasive plant should be removed from the bridge servitude to prevent further invasion.
- Firearms or any other hunting weapons must be prohibited on site.
- Contract employees must be educated about the value of wild animals and the importance of their conservation.
- Severe contractual fines must be imposed and immediate dismissal on any contract employee who is found attempting to snare or otherwise harm remaining faunal species.
- No animals should be intentionally killed or destroyed and poaching and hunting should not be permitted on the site.

The following mitigation measures for the Nseleni River bridge crossing are provided as a guideline:

- Construction activities of the three span continuous in-situ box girder deck bridge should ideally be scheduled to take place during low flow periods (winter months); when as little of the construction area and exposed sediment is in contact with the flow as possible. However, due to timeframes associated with environmental authorisation and tendering processes, it is recognised that activities may have to be scheduled out of the ideal period. Extra precautions and measures will have to be taken to limit erosion and sedimentation impacts.

- The original geometry, topography and geomorphology in both cross-sectional and longitudinal profile should be reinstated, above and below the Nseleni River crossing.
- Appropriate mitigatory measures for controlling sediment input into the river/valley bottom wetlands will be required during the construction phase. The use of hay bales packed in rows across diversions and active flow areas during construction may be one way of limiting sediment inputs. They also help to buffer the pH. The bales will need to be removed and disposed of after construction. Other alternative methods of controlling sediment should also be considered such as sediment fences etc.
- All coffer dams, causeway and construction materials should be removed from the rivers immediately after construction at the site is completed.
- The river valley was characterised by a slightly steeper valley wall on the south western side than on the north eastern side. Consulting the surveyor's drawing the two macro-channel banks of the Nseleni River were 11 m high. While the south western bank had an average gradient between 33.1 % and 40.56 %, the north eastern bank's average gradient was calculated as 32.6 %.
- Where necessary and according to risks in terms of bank erosion, gabions or storm water control structures should be used to disperse storm water flows and prevent further bank erosion. Appropriate gabion baskets or gabion mattresses should be installed to prevent further bank erosion. This is especially pertinent to the south-western bank which has clear signs of bank erosion evident.
- Where necessary and according to slope and risks in terms of bank erosion, disturbed areas should be re-vegetated using either a specified seed mix and/or appropriate indigenous vegetation (see attached species list).
- Where appropriate, large individual indigenous riparian tree species should be avoided during construction and should be clearly marked on site (danger tape etc.).
- The environmental management plan, should be audited during construction, and monitored for a period thereafter, until full rehabilitation is assured and stability demonstrated.

6.2 CONSTRUCTION PHASE

General

- All construction activities should be strictly limited to the Nseleni bridge construction servitude area. Vegetation clearance should be restricted to the actual bridge servitude within the highly sensitive wooded riparian zone of the Nseleni River.

- Sufficient chemical toilets and waste bins must be provided in all areas where construction is taking place. These toilets and bins must furthermore be emptied regularly.
- Sanitation facilities shall be located within 100m from any point of work, but not closer than 50 m from the Nseleni River.
- It is recommended that the construction programme preferably commence during the dry winter months, when the Nseleni River base flow is lower and the risk of soil and bank erosion is lowest. All earthworks shall be undertaken in such a manner so as to minimize the extent of any impacts. Additional mitigation should be provided and implemented as per EMPr should authorisation and tendering process preclude construction within the ideal timeframe.
- All vehicles associated with the construction activities should be in a serviced condition to prevent oil leaks etc and the possible contamination of the non-perennial drainage lines.

6.3 SOIL EROSION

Sheet erosion occurs when run-off surface water carries away successive thin layers of soil over large patches of bare earth. This type of erosion is most severe on sloping soils, which are weakly structured with low infiltration, which promotes rapid run-off. It occurs on the site where vegetation has been destroyed. Continual erosion in sheet-eroded slopes is a common cause of gully erosion. Gully erosion results from increased flow along a drainage line, especially where protective vegetation has been removed and soils are readily transported. A gully has steep, bare sides and is often narrow and deep. Once formed, a gully usually spreads upstream through continual slumping of soil at the gully head. Gully erosion can be associated with salting as the saline sub-soils are readily eroded.

- Soil removed from the riparian zone or macro-channel banks is to be appropriately stored for later use in back-filling. Sub-soil and topsoil (the top +/- 30-50 cm of the soil) should be stored separately.
- Soil stockpiles are to be protected from possible erosion, e.g. through covering of the stockpiles with tarpaulin, and limiting the height and angle of the stockpile. Soil stockpiles should not exceed 1 m in height.
- Soil stockpiling areas must be sufficiently situated away from the drainage areas towards the Nseleni River.
- Any erosion channels developed during the construction period or during the vegetation establishment period should be backfilled and compacted, and the areas restored to a proper condition. The Contractor should ensure that cleared areas are effectively stabilised to prevent and control erosion.

5.4. REHABILITATION

The traditional definition of rehabilitation aims at returning the land in a given area to some degree of its former state after a particular process has resulted in its damage.

Mitigation Measures

Only seed specified in this specification shall be used for vegetation establishment on the Nseleni River embankments. The seed shall be certified, fresh and of good quality. The method of establishing grass on the bank slopes shall be hydro seeding. In flat areas the sub-contractor shall have the option of using mechanical means (tractor –planter) of distributing the seed. The sub-contractor shall be responsible for the quality of the established vegetation independent of which method of establishment is used.

- Exposed areas should be rehabilitated with a grass mix that blends in with the surrounding vegetation. The grass mix should consist of indigenous grasses, shrubs and trees adapted to the local environmental conditions.
- The use of the exotic invader Kikuyu Grass (*Pennisetum clandestinum*) is not recommended and should be prohibited. Kikuyu require extensive maintenance as well as large amounts of water. The use of an indigenous (to the area) seed mix appropriate for the area is recommended; as the species occur naturally in the area as well as being non-invasive and requiring less water than exotic species.
- The grass mix should consist of a mix of quick covering grasses (pioneer species), mat-forming grasses (e.g. *Digitaria eriantha, Cynodon dactylon, Chloris gayana*) and tufted grasses (e.g. *Eragrostis curvula, Themeda triandra*) to ensure prompt and adequate coverage of the exposed soil while long term stability of the grass sward is also achieved. Re-vegetated areas should be monitored every 3 months for the first 12 months and twice a year thereafter.
- Re-vegetated areas showing inadequate surface coverage (less than 30% within 9 months after re-vegetation) should be prepared and re-vegetated from scratch.
- Damage to re-vegetated areas should be repaired promptly.
- Shaping of remaining and exposed soil profile to blend in with the gradients of the surrounding landscape.
- Exotic weeds and invaders that might establish on the re-vegetated areas should be controlled to allow the grasses to properly establish.
- Disturbed areas around the bridge site should be re-vegetated using a specified seed mix and/or appropriate indigenous grasses, forbs, shrubs or small trees (<10m).

For cuts and fills the following is recommended:

- Cut slopes will not have slopes steeper than 1 vertical: 3 horizontal. If slopes are steeper than 1:3 the slopes must be benched or designed for proper vegetation establishment.
- Fill slopes should be designed to a slope of 1 vertical: 2 horizontal. Special measures must be designed to ensure vegetation establishment on slopes steeper than 1:2.
- For flat areas and slopes up to 1:3 normal hydro seeding and grass seed mixtures as per the specification below should be used.
- For slopes between 1:3 and 1:1.5 hydro seeding with additional establishment requirements is to be used.
- For slopes steeper than 1:1.5 a design needs to be provided for erosion prevention which could also include an element of vegetation establishment.

Hydro seeding

The types and mixtures of seed to be used shall be as specified in these vegetation specifications and detailed below. Cellulose pulp (Voermol) should be added to the hydro seeding mixture at a rate of 25kg of pulp per kiloliter of water used. Hydro seeding shall be carried out with an approved hydro seeding machine at a rate of application of not less that the specified seed mixture weight per hectare.

Seed mixtures

Two different specifications shall apply for flat areas (P425 servitude) and for sloped areas (Nseleni River Bridge).

Flat Areas

The seed mixture to be used on the flat platforms, temporary deviations and slopes with an angle of up to 1:3 shall be:

Aristida congesta	2kg/ha
Chloris gayana	4kg/ha
Cynodon dactylon	6kg/ha
Digitaria eriantha	5kg/ha
Eragrostis curvula	2kg/ha
Melinis repens	2kg/ha
Panicum maximum	3kg/ha
Themeda triandra	5kg/ha
Total:	29 kg/ha

Sloped Areas

The seed mixture to be used on cut and fill slopes with an angle steeper than 1:3 shall be:

Aristida junciformis subsp. galpinii	2kg/ha
Chloris gayana	3kg/ha
Cynodon dactylon	6kg/ha
Digitaria eriantha	5kg/ha
Eragrostis curvula	2kg/ha
Imperata cylindrica	3kg/ha
Panicum maximum	3kg/ha
Themeda triandra	5kg/ha
Total:	29kg/ha

Certain cuts and fills are difficult to vegetate with normal hydro seeding practices. Before hydro seeding is undertaken the following preparation work would have to be completed:

- Manure would be spread by hand at a rate of 4 tones per hectare,
- Sandbags would be prepared by filling the bags with a mixture of topsoil, fertilizer and seed.
- The sandbags would be pegged with 50 mm Wood pegs onto the slopes in horizontal lines, three meters apart. The sandbags would form a catwalk on the slopes.
- Fertilizer, as previously specified would be spread by hand onto the slopes.
- Mulching with locally harvested grass cuttings (if available) would be done directly onto the slope. The rate of application would be 1.5 tones per hectare.
- A hessian net would be fixed onto the slopes between the sandbags. The net would be 20% shade.
- Hydro seeding would be done over the nets onto the slope with the previously specified seed mixture (see above for species list).
- The nets would be removed approximately 6 weeks after seeding or as determined by the Environmental Manager.

For slopes between 1:3 and 1:1.5 the seed mixture specified for sloped areas should be used during hydro seeding. In addition to the hydro seeding one of the following or a combination of the following methods should be implemented to ensure sustainable vegetation growth. For slopes steeper than 1:1.5 a design method of erosion protection and stabilization needs to be provided. For these slopes (steeper than 1:1.5) the vegetation establishment provides an aesthetic purpose and not a functional one.

Topsoil filled geo membrane tube/sausages

A geo membrane tube with a diameter of 15cm and length of 150 or 300cm is filled with topsoil. Prior to filling the tube the topsoil is mixed with seed and fertilizer as specified in 2.3.4.1. The tube is tied and sealed placed onto sloped or eroded areas and 1 meter intervals. The tubes are fixed with wooden/steel pegs into the ground to prevent it from washing away.

Grass bales

In eroded areas, gullies and slopes grass bales would be placed to reduce the flow speed of water and to retain siltation. The bales would be secured by means of wooden/steel pegs that would be driven through the bales into the ground.

Rehabilitation methods are detailed in Table 6 below.

Table 6: Recommended rehabilitation measures.

Step	1.1.1 Method	1.1.2 Equipment
1	Remove all construction material from the area where construction has been completed.	To be undertaken by hand.
2	Topsoil that has been stockpiled during construction must be applied to the area to undergo rehabilitation. The depth of the topsoil layer to be applied depends on the natural depth of topsoil in the area, and the amount of topsoil that may have been lost during construction.	Topsoil must be applied from the topsoil stockpiled during construction.
3	The naked ground should be seeded with a stabilising grass mix, suited to the conditions. The quantity of seed used will depend on the slope, with a steeper slope requiring a heavier application of seed. For slopes: • >15º: 25-50 kg/ha • <15º: 15-25 kg/ha The natural seed bank in the topsoil will supplement the seed mix applied	The seed mix should consist of pioneer grass species of the area, and will also depend on what species are commercially available during the season required. A standard seed mix would consist of the following species (in decreasing order of proportion constituting the seed mix)*: • *Themeda triandra* • *Andropogon chinensis* • *Aristida congesta* • *Cynodon dactylon* • *Cymbopogon plurinodes* • *Eragrostis curvula* • *Eragrostis gummiflua* • *Setaria spp.*

* see attached species list

Step	1.1.1 Method	1.1.2 Equipment
		• *Imperata cylindrica* • *Sporobolus fimbriatus* and sedges such as *Schoenoplectus* spp. and *Juncus spp.* should be used
4	The areas which have been seeded must be regularly watered directly after seeding until the grass cover becomes established. Watering is to be done in a manner that ensures that no erosion of the topsoil and seed mix takes place.	A hosepipe must be available on site.
5	If the grasses have not established after a period of two months after seeding, the areas should be reseeded. If necessary, another dressing of topsoil should be applied prior to seeding.	As above.
6	Slope stabilisation measures may be necessary in places where grass has not been able to establish and there is an erosion risk. The measures implemented depend on the situation, and can be varied as necessary.	Various slope stabilisation measures are available and vary in effectiveness according to the situation including • Logs/bark held in place with pegs • Rows of *Cynodon dactylon*, *Panicum maximum*, *Imperata cylindrica*, *Hyparrhenia hirta* held in place with pegs.
7	All alien vegetation is to be appropriately removed and disposed of. Alien species that have been encountered along the proposed Nseleni River bridge included Syringa *Melia azedarach,* Brazilian Glory Pea *or* Red Sesbania *Sesbania punicea*, Castor-Oil Plant (*Ricinus communis*), Lantana (*Lantana camara*), Bugweed (*Solanum mauritianum*), Peanut Butter Cassia (*Senna diymobotrya*), Morning Glory (*Ipomoea purpurea*), Paraffin Bush (*Chromolaena odorata*), Yellow Oleander (*Thevetia peruviana*), Montanoa (*Montanoa hibiscifolia*), *Ageratum conyzoides*, *Caesalpinia decapetala*, *Leucaena leucocephala*, *Psidium guajava*, *Mimosa pigra, Tithonia diversifolia*.	Removal will to a large extent be done by hand. Saws may be necessary in certain cases and specific herbicides may be required (if used, the use of these must be strictly controlled)

Step	1.1.1 Method	1.1.2 Equipment
8	The P425 road and Nseleni River Bridge servitude must be regularly inspected during the operational phase and alien vegetation that had re-emerged; must be removed and follow-up treatment applied.	On-going alien vegetation removal programme (beyond the scope of the project)

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8. APPENDIX

Table7. Grass species list (ideally grass species endemic to the area should be used for the re-vegetation)

Alloteropsis semialata ssp. eckloniana
Alloteropsis semialata ssp. semialata
Andropogon appendiculatus
Andropogon chinensis
Anthephora pubescens
Aristida adscensionis
Aristida canescens ssp. canescens
Aristida congesta ssp. Congesta
Aristida diffusa ssp. Burkei
Aristida scabrivalvis ssp. scabrivalvis
Aristida transvaalensis
Arundinella nepalensis
Avena sp.
Bewsia biflora
Brachiaria brizantha
Brachiaria eruciformis
Brachiaria serrata
Bromus leptoclados
Bromus sp.
Cenchrus ciliaris
Cymbopogon caesius
Cymbopogon pospischilii
Cyperus esculentus
Digitaria debilis
Digitaria diagonalis var. diagonalis
Digitaria eriantha
Digitaria monodactyla
Digitaria sp.
Digitaria ternate

Digitaria tricholaenoides
Diheteropogon amplectens var. amplectens
Ehrharta erecta var. erecta
Elionurus muticus
Enneapogon cenchroides
Enneapogon scoparius
Eragrostis chloromelas
Eragrostis curvula
Eragrostis planiculmis
Eragrostis racemosa
Eragrostis sp.
Eustachys paspaloides
Helictotrichon turgidulum (Stapf) Schweick.
Hemarthria altissima
Heteropogon contortus.
Hyparrhenia anamesa
Hyparrhenia cymbaria
Hyparrhenia filipendula var. pilosa
Hyparrhenia hirta
Hyparrhenia quarrei
Hyparrhenia tamba
Imperata cylindrical.
Koeleria capensis
Leersia hexandra
Lolium multiflorum
Lolium temulentum
Loudetia simplex
Melinis nerviglumis
Melinis repens* ssp. *repens
Monocymbium ceresiiforme
Panicum maximum
Panicum miliaceum

Panicum natalense.
Paspalum dilatatum
Paspalum notatum
Paspalum scrobiculatum
Pennisetum thunbergii
Pennisetum villosum
Perotis sp.
Poa annua
Poa pratensis
Pogonarthria sp.
Potamogeton pusillus
Schizachyrium sanguineum
Setaria lindenbergiana
Setaria megaphylla
Setaria nigrirostris
Setaria sp.
Setaria sphacelata var. sphacelata
Setaria sphacelata var. torta
Sorghum bicolor ssp. arundinaceum
Sorghum halepense
Sorghum versicolor
Sporobolus africanus
Sporobolus discosporus
Sporobolus fimbriatus
Sporobolus natalensis
Sporobolus nitens
Sporobolus sp.
Sporobolus stapfianus
Stipagrostis uniplumis var. neesii
Stipagrostis zeyheri ssp. sericans
Themeda triandra Forssk.
Trachypogon spicatus

Tragus berteronianus
Triraphis andropogonoides
Tristachya rehmannii
Typha capensis
Urelytrum agropyroides
Urochloa mosambicensis
Urochloa panicoides P.Beauv.

Table8. Suggested indigenous trees for riparian rehabilitation (species indigenous to the area are indicated with (☺). It is strongly recommended that only these are planted as far as possible)

Botanical Name	**Common Name**
☺ *Acacia robusta*	Robust Thorn
Acacia caffra	Common Hook Thorn
☺ *Acacia natalitia*	
☺ *Acacia tortilis*	Umbrella Thorn
Acacia sieberiana var. *woodii*	Paper Bark
☺ *Albizia adianthifolia*	Flatcrown
☺ *Apodytes dimidiata*	White Pear
☺ *Barringtonia racemosa*	Powder-Puff Tree
☺ *Bridelia micrantha*	Mitzeeri
☺ *Calodendron capense*	Cape Chestnut
Cassia abbreviata	Long-tailed cassia
☺*Celtis africana*	White stinkwood
☺*Combretum erythrophylum*	River Bushwillow
☺*Cussonia spicata*	Natal cabbage
☺*Diospyros lycoides*	Blue bush
☺*Dombeya rotundifolia*	Wild pear
☺ *Ekenbergia capensis*	Cape ash
☺***Erythrina caffra***	**Coastal Corral Tree**
☺ *Ficus natalensis*	Natal Fig
☺ *Ficus sur*	Cluster Fig
☺***Ficus sycomorus***	**Sycamore fig**
☺***Grewia occidentalis***	**Cross berry**
☺ *Gymnosporia buxifolia*	Common Spikw-Thorn
☺*Halleria lucida*	Tree fuschia
☺*Harpephyllum caffrum*	Wild plum
Kiggelaria africana	Wild peach
☺*Leucosidea serricea*	Ouhout

Olea europaea subsp. africana	Wild olive
Pappea capenis	Jacket plum
☺*Pittosporum viridiflorum*	Cheesewood
Podocarpus henkelli	Henkell's yellowwood
Pterocarpus rotundifolius	Round leaved kiaat
☺*Searsia/Rhus chiridensis*	Red Currant
Searsia/Rhus prunoides	Dogwood
☺*Searsia/Rhus leptodictya*	Mountain karee
☺ *Searsia/Rhus lancea*	Karee
☺ *Searsia/Rhus pyroides*	Common wild currant
Salix mucronata	Safsaf willow
☺ *Schotia brachypetala*	Weeping boer-bean
☺ *Syzigium cordata*	Water berry
☺*Trichilia emetica*	Natal mahogany
☺***Trichilia dregeana***	**Natal Forest Mahogany**
☺ *Vepris lanceolata*	White ironwood
☺*Ziziphus mucronata*	Buffalo thorn

Table9. Indigenous shrub species marked with ☺ should be used for re-vegetation beneath the Nseleni River.

Botanical Name	**Common Name**
☺*Aloe arborescens*	
☺*Aloe greatheadii*	
☺ *Aloe marlothii*	
☺ *Bauhinia natalensis*	Dainty Bauhinia
Buddleja salinga	False olive
☺*Buddleja salvifolia*	Sagewood
Burchellia bubaline	Wild pomegranate
☺*Carissa macrocarpa*	Bird num-num
☺***Dietes grandiflora***	Wild iris
☺*Dovyalis caffra*	Kei apple
☺*Ehretia rigida*	Puzzle bush
Erica species	Heaths
Euryops species	Golden daisies
Felicia species	Wild daisy
☺***Grewia occidentalis***	**Wild currant**
☺*Helichrysum kraussii*	Everlastings
☺*Leonotis leonorus*	Wild dagga
Leucospernum species	Pincushions
☺***Mackaya bella***	**Forest bell bush**
☺ ***Pavetta lanceolata***	**Forest's pride bush**

☺*Plectranthus species*	Spur flowers
☺*Plumbago auriculata*	Cape leadwort
Protea caffra	Sugarbush
Psychotria capensis	Black birdberry
☺*Rhamnus prinoides*	Dogwood
☺*Strelitzia nicolai*	Natal Wild Banana
Strilitzea reginae	Crane flower
☺*Tecoma capensis*	Cape honeysuckle
☺*Thunbergia natalensis*	Natal bluebell

Table 10. Frog species recorded from the 2831 CD QDGC

Family	Genus	Species	Red list category	Atlas region endemic
Arthroleptidae	*Arthroleptis*	*wahlbergi*	Least Concern	0
Arthroleptidae	*Leptopelis*	*natalensis*	Least Concern	0
Brevicepitidae	*Breviceps*	*adspersus*	Least Concern	0
Brevicepitidae	*Breviceps*	*mossambicus*	Least Concern	0
Brevicepitidae	*Breviceps*	*verrucosus*	Least Concern	0
Bufonidae	*Amietophrynus*	*gutturalis*	Least Concern	0
Bufonidae	*Amietophrynus*	*rangeri*	Least Concern	0
Bufonidae	*Schismaderma*	*carens*	Least Concern	0
Heleophrynidae	*Hadromophryne*	*natalensis*	Least Concern	0
Hyperoliidae	*Afrixalus*	*aureus*	Least Concern	0
Hyperoliidae	*Afrixalus*	*fornasinii*	Least Concern	0
Hyperoliidae	*Afrixalus*	*spinifrons*	Near Threatened	0
Hyperoliidae	*Hyperolius*	*marmoratus*	Least Concern	0
Hyperoliidae	*Hyperolius*	*pusillus*	Least Concern	0
Hyperoliidae	*Hyperolius*	*semidiscus*	Least Concern	0
Hyperoliidae	*Hyperolius*	*tuberilinguis*	Least	0

			Concern	
Hyperoliidae	*Kassina*	*senegalensis*	Least Concern	0
Microhylidae	*Phrynomantis*	*bifasciatus*	Least Concern	0
Phrynobatrachidae	*Phrynobatrachus*	*mababiensis*	Least Concern	0
Phrynobatrachidae	*Phrynobatrachus*	*natalensis*	Least Concern	0
Pipidae	*Xenopus*	*laevis*	Least Concern	0
Ptychadenidae	*Ptychadena*	*porosissima*	Least Concern	0
Pyxicephalidae	*Amietia*	*angolensis*	Least Concern	0
Pyxicephalidae	*Natalobatrachus*	*bonebergi*	Endangered	1
Pyxicephalidae	*Strongylopus*	*fasciatus*	Least Concern	0
Pyxicephalidae	*Strongylopus*	*grayii*	Least Concern	0
Pyxicephalidae	*Strongylopus*	*wageri*	Least Concern	0
Pyxicephalidae	*Tomopterna*	*natalensis*	Least Concern	0
Rhacophoridae	*Chiromantis*	*xerampelina*	Least Concern	0

Red listing source: Minter LR, Burger M, Harrison JA, Braack HH, Bishop PJ & Kloepfer D (eds). 2004. Atlas and Red Data book of the frogs of South Africa, Lesotho and Swaziland. SI/MAB Series no. 9. Smithsonian Institution, Washington, D.C.

Table11. Reptiles species found for locus = 2831CD.

Family	Genus	Species	Subspecies	Common name	Red list category	Atlas region endemic
Agamidae	*Acanthocercus*	*atricollis*	*atricollis*	Southern Tree Agama	Not Evaluated	0
Agamidae	*Agama*	*aculeata*	*distanti*	Distant's Ground Agama	Not Evaluated	1
Atractaspididae	*Aparallactus*	*capensis*		Black-headed Centipede-eater	Not Evaluated	0
Atractaspididae	*Atractaspis*	*bibronii*		Bibron's Stiletto Snake	Not Evaluated	0
Atractaspididae	*Homoroselaps*	*dorsalis*		Striped Harlequin Snake	Lower Risk: Near Threatened	1
Atractaspididae	*Macrelaps*	*microlepidotus*		Natal Black Snake	Not Evaluated	1
Boidae	*Python*	*natalensis*		Southern African Python	Not Evaluated	0
Chamaeleonidae	*Bradypodion*	*caeruleogula*		uMlalazi Dwarf Chameleon	Not Evaluated	1
Chamaeleonidae	*Chamaeleo*	*dilepis*	*dilepis*	Common Flap-neck Chameleon	Not Evaluated	0
Colubridae	*Boaedon*	*capensis*		Brown House Snake	Not Evaluated	0
Colubridae	*Crotaphopeltis*	*hotamboeia*		Red-lipped Snake	Not Evaluated	0
Colubridae	*Dasypeltis*	*inornata*		Southern Brown Egg-eater	Not Evaluated	1
Colubridae	*Dispholidus*	*typus*	*typus*	Boomslang	Not Evaluated	0
Colubridae	*Duberria*	*lutrix*	*lutrix*	South African Slug-eater	Not Evaluated	1
Colubridae	*Gonionotophis*	*capensis*	*capensis*	Common File Snake	Not Evaluated	0
Colubridae	*Lamprophis*	*aurora*		Aurora House Snake	Not Evaluated	1

Colubridae	*Lycodonomorphus*	*inornatus*		Olive House Snake	Not Evaluated	1
Colubridae	*Lycodonomorphus*	*rufulus*		Brown Water Snake	Not Evaluated	0
Colubridae	*Lycophidion*	*capense*	*capense*	Cape Wolf Snake	Not Evaluated	0
Colubridae	*Philothamnus*	*hoplogaster*		South Eastern Green Snake	Not Evaluated	0
Colubridae	*Philothamnus*	*natalensis*	*natalensis*	Eastern Natal Green Snake	Not Evaluated	0
Colubridae	*Philothamnus*	*semivariegatus*		Spotted Bush Snake	Not Evaluated	0
Colubridae	*Psammophylax*	*rhombeatus*	*rhombeatus*	Spotted Grass Snake	Not Evaluated	0
Colubridae	*Pseudaspis*	*cana*		Mole Snake	Not Evaluated	0
Colubridae	*Thelotornis*	*capensis*	*capensis*	Southern Twig Snake	Not Evaluated	0
Cordylidae	*Chamaesaura*	*anguina*	*anguina*	Cape Grass Lizard	Not Evaluated	1
Cordylidae	*Chamaesaura*	*macrolepis*		Large-scaled Grass Lizard	Not Evaluated	0
Elapidae	*Dendroaspis*	*polylepis*		Black Mamba	Not Evaluated	0
Gekkonidae	*Hemidactylus*	*mabouia*		Common Tropical House Gecko	Not Evaluated	0
Gekkonidae	*Lygodactylus*	*capensis*	*capensis*	Common Dwarf Gecko	Not Evaluated	0
Gekkonidae	*Pachydactylus*	*vansoni*		Van Son's Gecko	Not Evaluated	0
Gerrhosauridae	*Gerrhosaurus*	*flavigularis*		Yellow-throated Plated Lizard	Not Evaluated	0
Gerrhosauridae	*Tetradactylus*	*africanus*		Eastern	Not	1

				Long-tailed Seps	Evaluated	
Leptotyphlopidae	*Leptotyphlops*	*scutifrons*	*scutifrons*	Peters' Thread Snake	Not listed	0
Leptotyphlopidae	*Leptotyphlops*	*sylvicolus*		Forest Thread Snake	Not Evaluated	1
Pelomedusidae	*Pelomedusa*	*subrufa*		Marsh Terrapin	Not Evaluated	0
Scincidae	*Afroablepharus*	*wahlbergii*		Wahlberg's Snake-eyed Skink	Not Evaluated	0
Scincidae	*Trachylepis*	*striata*		Striped Skink	Not Evaluated	0
Scincidae	*Trachylepis*	*varia*		Variable Skink	Not Evaluated	0
Viperidae	*Bitis*	*arietans*	*arietans*	Puff Adder	Not Evaluated	0
Viperidae	*Causus*	*rhombeatus*		Rhombic Night Adder	Not Evaluated	0

Red listing source: 1996 IUCN global listing