Eskoms Holdings SOC Limited
Proposed Continuous Disposal of Ash at the Tutuka Power Station

Bat Specialist Study

Mpumalanga Province

Environmental Impact Assessment Phase

July 2014

Prepared by:

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Lidwala
Specialist Solutions

SPECIALIST DECLARATION

Professional registration

The Natural Scientific Professions Act of 2003 aims to "Provide for the establishment of the South African Council of Natural Scientific Professions (SACNASP) and for the registration of professional, candidate and certified natural scientists; and to provide for matters connected therewith."

"Only a registered person may practice in a consulting capacity" – Natural Scientific Professions Act of 2003 (20(1)-pg 14)

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Qualification:	Zoology and behavioural ecology (MSc) – UCT
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Fields of Expertise:	Biological Science
Registration:	Professional Member

Declaration of Independence

The specialist investigator declares that:

- We act as independent specialists for this project.
- We consider ourselves bound by the rules and ethics of the South African Council for Natural Scientific Professions.
- We do not have any personal or financial interest in the project except for financial compensation for specialist investigations completed in a professional capacity as specified by the Environmental Impact Assessment Regulations, 2006.
- We will not be affected by the outcome of the environmental process, of which this report forms part of.
- We do not have any influence over the decisions made by the governing authorities.
- We do not object to or endorse the proposed developments, but aim to present facts and our best scientific and professional opinion with regard to the impacts of the development.
- We undertake to disclose to the relevant authorities any information that has or may have the potential to influence its decision or the objectivity of any report, plan, or document required in terms of the Environmental Impact Assessment Regulations, 2006.

Terms and Liabilities

- This report is based on a short term investigation using the available information and data related to the site to be affected. No long term investigation or monitoring was conducted.
- The Precautionary Principle has been applied throughout this investigation.
- Additional information may become known or available during a later stage of the process for which no allowance could have been made at the time of this report.

- The specialist investigator reserves the right to amend this report, recommendations and conclusions at any stage should additional information become available.
- Information, recommendations and conclusions in this report cannot be applied to any other area without proper investigation.
- This report, in its entirety or any portion thereof, may not be altered in any manner or form or for any purpose without the specific and written consent of the specialist investigator as specified above.
- Acceptance of this report, in any physical or digital form, serves to confirm acknowledgment of these terms and liabilities.

Signed on the 7th June 2013 by Kath Potgieter in her capacity as specialist investigator

EXECUTIVE SUMMARY

Lidwala Consulting Engineers (Lidwala) has been appointed by Eskom Holdings SOC Limited to undertake the Environmental Impact Assessment (EIA) and associated studies for the proposed continuous disposal of ash at the Tutuka Power Station near the town of Standerton in the Mpumapanga Province. In turn The Endangered Wildlife Trust has been appointed to conduct the bat specialist study for the project.

Tutuka Power Station is a coal fired power generation facility commissioned between 1985 – 1990. Tutuka Power Station currently disposes of ash in a dry (20% moisture content) form by means of conveyors, spreader and a stacker system from the station terrace to the ash disposal site. According to Eskom's plans, the complete ash disposal site would eventually cover an area of 2 500 hectares (ha) (Existing & Remaining ash disposal site & pollution control canals) and is located approximately 4.5 km east of the station terrace. The new facility will cater for 128 Million M3 of airspace and a footprint of 759 hectares.

Tutuka Power Station envisages the continuation of dry ash disposal over Eskom owned land, which was purchased before the commencement of environmental laws such as the Environment Conservation Act. In order to establish a new ash disposal site within close proximity to the power station and the current ash disposal site, a site selection exercise was undertaken in line with the Minimum Requirements for the Disposal of Waste by Landfill (both the 2nd Edition (1998) 1 and the Draft 3rd edition (2005) 2 were taken into account during the identification of the most feasible site alternatives, and design of the facility).

The Tutuka Power Station is situated approximately 25 km north-north-east of the town of Standerton in the Mpumalanga Province. The power station falls within the Lekwa Local Municipality, within the Gert Sibande District Municipality. The greater study area is within an 8 km radius of the centre point of the Tutuka Power Station Site and land use practices include agriculture, mining and power generation activities. Three site alternatives were identified within the greater study area. Each alternative site is briefly described below;

- Site alternative B
    - This site is located immediately north of the existing ash disposal facility and approximately 2 km north-east of the Tutuka Power Station. The total area identified is ~764.94 hectares in size. This site is comprised of parts of portions R, 2, 3, 4, 5 and 7 of the farm Dwars in die Weg 350 IS, portions R and 3 of the farm Racesbult 352 IS and portion 1 of the farm Spioenkop 375 IS.
- Site alternative C

- This site is located south-west of the existing ash disposal facility and approximately 1.3 km north-east of the Tutuka Power Station. The total area identified is ~534.41 hectares in size. This site is comprised of parts of portions 1 and 2 of the farm Spioenkop 375 IS and portions 3, 12 and 13 of the farm Pretoriusvley 374 IS.

- Site alternative A
  - This site is located immediately south and east of the existing ash disposal facility and approximately 3.5 km north-east of the Tutuka Power Station. The total area identified is ~756.89 hectares in size. This site is comprised of parts of portions R, 1 and 2 of the farm Spioenkop 375 IS, portions 1, 4, 6 and 10 of the farm Mooimeisiesfontein 376 IS, portions 1, 2, 4, 5, 22 and 25 of the farm Rouxland 348 IS and portions 3 and 6 of Dars in de Weg 350 IS.
  - An extention of site alternative A was also considered and this is discussed in detail in the attached letter *Bat Specialist Study Verification and Input for the Continuous Disposal for Ash at the TUTUKA Power Station* dated 14 April 2014.

The proposed continuous development is an ash disposal facility with the following specifications;

- Capacity of airspace of 353,1 million m^3 (Existing and remaining); and
- Ground footprint of 2 500 Ha (Existing & Remaining ash disposal facility & pollution control canals)
- Additional infrastructure
  - dirty and clean water channels flowing to settling and dirty water
  - expansion / upgrade of their existing emergency ashing area called TT02.

This report uses a desktop analysis of available references and resources to assess the potential impacts this project will have on bats during construction of the proposed ash disposal facility and combines that with a ground-truthing exercise by surveying the site. A site visit was undertaken between the 21st May and 22nd May 2013.

Of the 25 species identified as potentially occurring in the study area one is Vulnerable (*Cleotis percivali)*, four Near Threatened (*Hipposideros gigas, Miniopterus natalensis, Rhinolophus blasii* and *Rhinolophus swinnyi*) and seven Least Concern (see Table 1 for list of species). Four of the identified species are considered highly likely to occur in the study area (*Cleotis percivali, Eptesicus hottentotus, Miniopterus natalensis, Myotis tricolor, Neoromicia capensis, Rhinolophus blasii, Rhinolophus clivosus, Rhinolophus simulator, Rhinolophus swinnyi* and *Tadarida aegyptiaca*), nine considered moderately likely and six are unlikely but possible to occur.

Neomicia capensis and *Tadarida aegyptiaca* where recorded during driven transects of the study site with an EM3 call detector device. Both of these species are considered Least Concern on the IUCN's list of Red Data species. Despite no Near Threatened or Vulnerable species being recorded during the site visit two important points must be noted;

i. Near Threatened and/or Vulnerable species may still occur on the site but either were not recorded during the driven transects or are only present in the area seasonally
ii. Least Concern species are still very important to the successful functioning of an ecosystem as they provide a number of vital ecosystem services.

Any species that occurs in the area of the proposed continuous disposal of ash at the Tutuka Power Station is vulnerable to disturbance and/or displacement as a result of the construction. The uniformity of the habitat around the site, however, means that, although localized habitat destruction and disturbance would impact on bats, the habitat is not unique or important for bats and as such the surrounding habitats would be equally available to bats to utilize. The overall impact of the development on the bat population in the area is likely to be low, particularly if steps to mitigate impacts are taken.

Of the three site alternatives, alternative C would be preferred over site alternatives B and A because it is the only one that does not offer any appropriate roost sites for bats. Alternatives B and A are however still deemed "Acceptable". The proposed mitigation measures and recommendations described in Section 5 of this report should be implemented and their practicality and effectiveness researched in the greater study area. Every effort should be made to mitigate the impacts on bats during this project through a construction EMP as well as by following the recommendations in this report.

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1. INTRODUCTION

1.1. BACKGROUND TO PROJECT (information provided by Lidwala)

Lidwala Consulting Engineers (Lidwala) has been appointed by Eskom Holdings SOC Limited to undertake the Environmental Impact Assessment (EIA) and associated studies for the proposed continuous disposal of ash at the Tutuka Power Station near the town of Standerton in the Mpumapanga Province. In turn The Endangered Wildlife Trust has been appointed to conduct the bat specialist study for the project.

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- Site alternative B
    - This site is located immediately north of the existing ash disposal facility and approximately 2 km north-east of the Tutuka Power Station. The total area identified is ~764.94 hectares in size. This site is comprised of parts of portions R, 2, 3, 4, 5 and 7 of the farm Dwars in die Weg 350 IS, portions R and 3 of the farm Racesbult 352 IS and portion 1 of the farm Spioenkop 375 IS.
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The "South African Good Practice Guidelines for Surveying Bats in Wind Farm Developments", produced by the Wildlife and Energy Programme (WEP) of the Endangered Wildlife Trust (EWT), in conjunction with independent eco-consultant and trainer Sandie Sowler and Stellenbosch University postdoctoral fellow Samantha Stoffberg, and endorsed by the South African Wind Energy Association, highlights the need to assess the impact of wind farms on ecology, and the importance of bats in the South African context of the ecosystem services they provide (Sowler and Stoffberg 2012). Although specific to the impact of wind energy development on bats the suggested methods and minimum requirements in this guideline document serve as a point of departure for all bat impact studies. As such, this specialist study report uses the good practice guidelines as a guide to assess the potential impact of the proposed continued disposal of ash at the Tutuka Power Station on bat populations in the greater study area and on each of the identified potential site alternatives. A site visit was undertaken between the 21st May and 23rd May 2013.

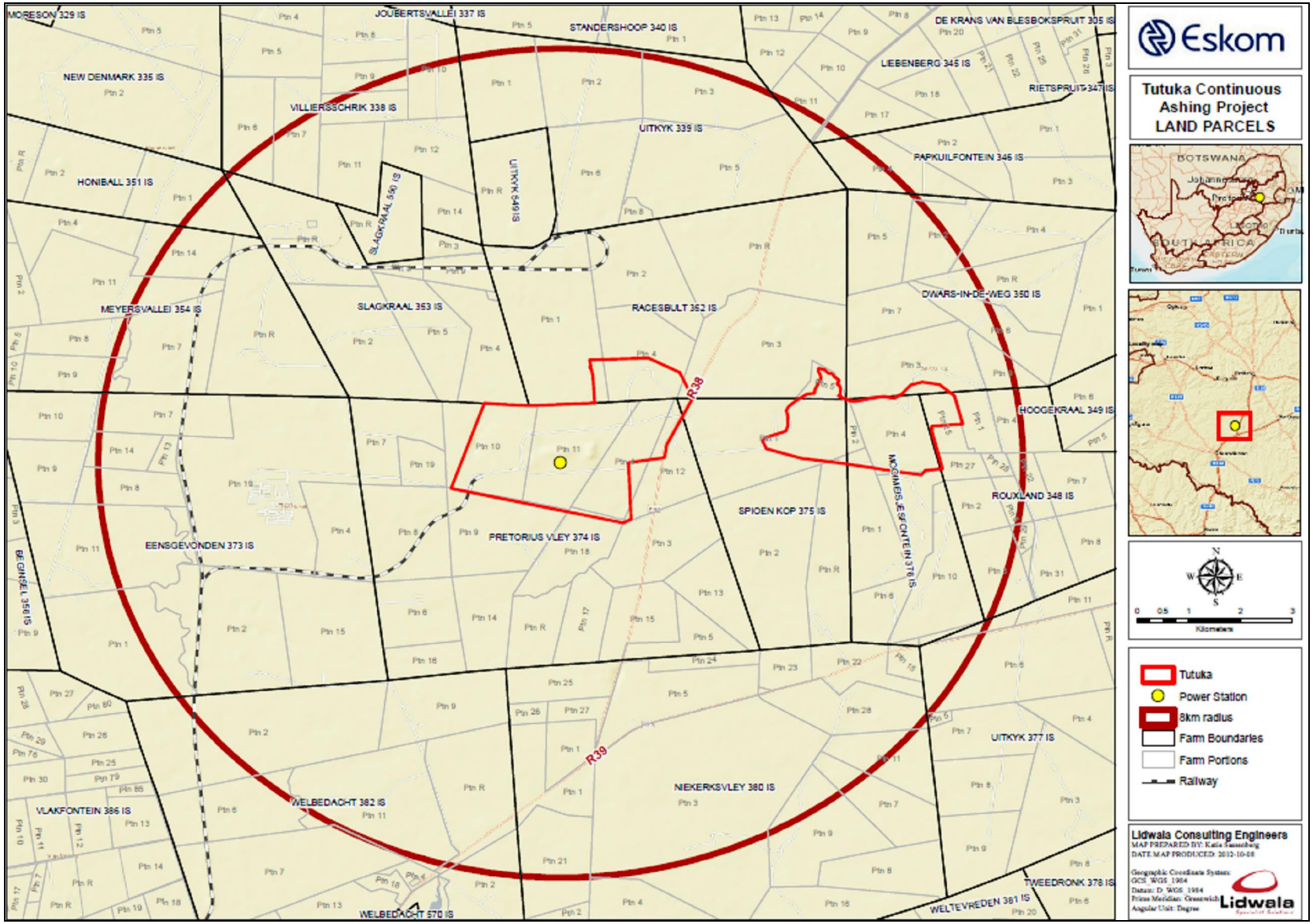

Figure 1. The greater study area for the proposed continuous disposal of ash at the Tutuka Power Station.

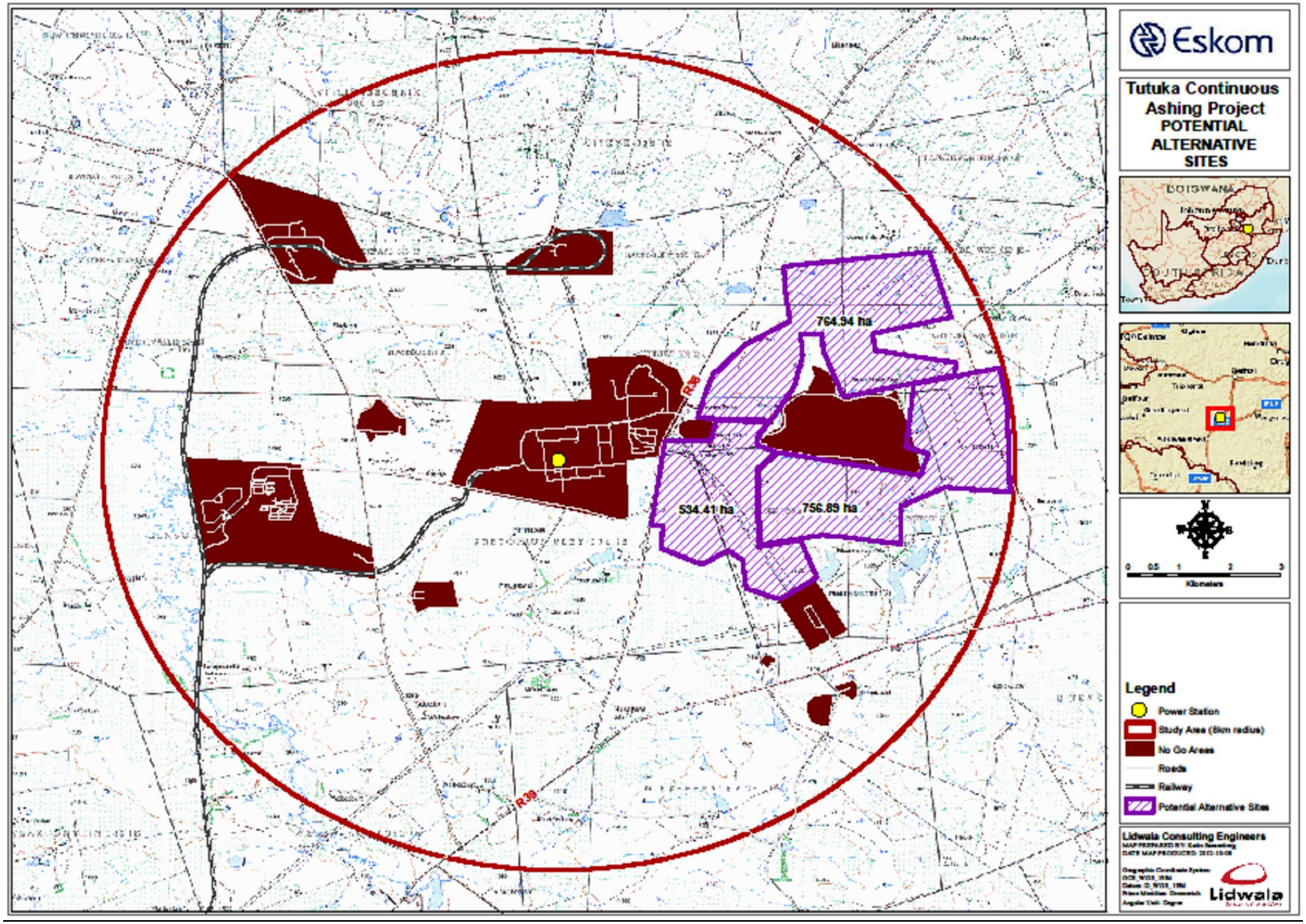

Figure 2. The three site alternatives identified for the proposed continuous disposal of ash at the Tutuka Power Station

1.2. BACKGROUND TO CHIROPTERA

1.2.1. General

Bats (Order Chiroptera) comprise one fifth of all mammalian species and are the second largest order of mammal (Simmons 2005). Bats are long-lived mammals and females often produce only one pup per year, resulting in a life-strategy characterized by slow reproduction (Barclay & Harder 2003). Because of this, bat populations are sensitive to changes in mortality rates and their populations tend to recover slowly from declines.

1.2.2. Role in ecosystems

Bats provide important ecosystem services (Kunz *et al.* 2011). They are major pollinators of fruiting trees, dispersers of seeds and controllers of insects, including agricultural pests. They have contributed substantially to medical research, to our understanding of radar and sonar, and their droppings are considered highly prized in some parts of the world as fertiliser. A single small North American Little Brown Bat (*Myotis lucifugus*) can consume up to 1,200 small insects in an hour; almost 5,000 mosquito-sized insects a night per bat (Taylor 2000). A small colony of bats can therefore consume over 200,000 insects in one night. In a study conducted in Sacramento USA, it was reported that the presence of sufficient numbers of bats reduced fruit crop damage to pears by the corn ear moth, by 55% (Long *et al*. 1998).

In South Africa, as in other parts of the world, the ecosystem services are equally important. Insectivorous bats provide essential pest control services to farmers and fruit-eating bats are agents of seed dispersal (thus aiding forest regeneration) and pollination services (important for baobab trees). The potential loss of these ecosystem services should be considered when assessing the environmental impact of developments. The possible loss of bat colonies could therefore potentially result in increased costs incurred by the need for pesticides and in reduced agricultural productivity.

Recent research suggests that the estimated value of bats to the United States agricultural industry is approximately US $22.9 billion/year and that the loss of bats in North America may lead to agricultural losses estimated at more than US $3.7 billion/year (Boyles *et al.* 2011).

1.2.3. Behaviour and echolocation

Bats are divided into two groups, fruit-eating bats and insectivorous bats. The southern African fruit bats feed on the fruits, flowers, leaves and nectar of a wide range of indigenous trees as well as commercially grown fruit. The insectivorous bats (comprising the majority of southern African bat species) feed on a variety of insects, depending on the particular species' morphology and behavior. This group uses echolocation to hunt their prey and navigate. The design of the bat's

wing, as well as structure of the echolocation call, determines the preferred prey of a particular species (Norberg and Reyner, 1987).

It is also necessary to understand bat roosting behavior, as it relates to the potential impacts a project of this nature may have. Bats roost in a variety of places during the day that can include: the foliage of trees, tree hollows or crevices, caves or rocky crevices and man-made structures, to name but a few (Monadjem *et al,* 2010). Safe roost sites are important to the continued survival of a group of bats as, without it reproductive success may be affected and the population may crash. Conservation of roost sites is, thus, important and must be searched for during any impact assessment.

Bats have the ability to emit sound pulses and analyse the returning echoes to detect, characterize and localize objects that reflect the pulse as an echo (Fenton 1990, Schnitzler and Kalko 2001). The frequencies used in echolocation are ultrasonic, i.e. above the range of human hearing. It must, however, be noted that not all bats echolocate and the fruit bats are an example of this. There are many different types of echolocation calls but what is useful is that the different groups and species have unique calls that can be used to identify them using specialized equipment that record and convert bat calls to audible (to humans) sounds. Since echolocation is unique to each bat species, recording of the ultrasonic pulses emitted by bats can be used to identify which bats are present in an area.

1.2.4. Bat migration in South Africa

Little work has been conducted in South Africa regarding the distribution and abundance of bats. Similarly the migratory habits and migration routes of South African bats are not clearly understood. Some evidence does however exist showing that some bat species do exhibit long-distance migration and seasonal movement within South Africa. *Miniopterus natalensis* (Natal Long-fingered Bat) is known to migrate up to 260km (Van der Merwe 1975) between their summer maternity caves and caves used for mating and hibernation during the winter months. *Myotis tricolor* (Temminck's Myotis) may undertake seasonal migrations similar to that of *M. natalensis* (Monadjem *et al*. 2010) although details of this are not known. One frugivorous bat species, *Rousettus aegyptiacus* (Egyptian rousette) is a gregarious cave-dweller, also thought to move distances of 50 to 500 km (Monadjem *et al*., 2010; Herselman & Norton, 1985).

1.2.5. Potential impacts of ash disposal facilities on bats

A number of factors influence the potential impacts of ash disposal facility developments on bats;

- fatality through destruction of roosts
    - if structures that are used by bats as roost sites are destroyed during the construction phase bats using those structures may be killed.

- displacement through destruction of potential roost sites
    - if structures that may potentially be used by bats as roost sites are destroyed during the construction phase bats returning to the area may be displaced as suitable roost sites are no longer available.
- loss of food source or prey-base through destruction of foraging habitat
    - if foraging habitat is destroyed during the construction phase bats may be displaced due to a loss of their prey-base
- change in behaviour through creation of dams (drinking and potential foraging sites)
    - some aspects of construction may actually attract some bat species, such as the construction of clean water dams where bats can drink.

1.3. Conservation, protection and legislative framework

In most countries in Western Europe over the past 20 years, support for the protection of bats and their roosts has increased and is enforced by stringent legislation. Bats and their roosts, even when not occupied, are fully protected by law and contravention may result in prosecution and consequent subjection to fines or even custodial sentences. This legislation has been put in place because of the decline in the European bat fauna, and the recognition that bats are a very important, even essential, part of our ecosystem. Bats are a group of mammals that we cannot afford to lose. In Europe, bats have been identified as indicators of the health of our environment and are now considered important indicators of biodiversity (Jones *et al.* 2009). The greater the number of bats in terms of individuals and diversity, the healthier our ecosystem is considered to be.

The conservation status of bats must be considered when looking at the potential impact of a development. There are 116 southern African bat species of which five are listed as Vulnerable, 17 as Near-threatened, 77 as Least Concern, 14 Data Deficient and 3 have not been evaluated (IUCN).

There are no specific permit requirements dealing with bats in South Africa but South African legislation pertaining to mammals does apply to bats. This includes the following;

- **National Environmental Management Act (NEMA): National Biodiversity Act, 2004 (Act 10 of 2004)**
    - Sections 2, 56 and 97 are of specific reference. Section 97 considers the Threatened or Protected Species (ToPs) Regulations: The Act calls for the management and conservation of all biological diversity within South Africa. Bats constitute an important component of South African biodiversity, and, as such, all species of bats receive attention and protection, not only those listed as ToPs species.
- **NEMA: Protected Areas Act, 2003 (Act 57 of 2003)**
- **Additional National Policies**

- IUCN Red data species listings (Friedman and Daly, 2004)
- National Spatial Biodiversity Assessment (NSBA)
- National Biodiversity Strategy and Action Plan (NBSAP)

1.4. METHODOLOGY

1.4.1. Desktop review

A desktop review of relevant literature and the likelihood of occurrence of specific species for the area was conducted based on the methodology set out by Natural Scientific Services. The assessment of likelihood of occurrence was directly informed by distribution maps and descriptions in Friedmann and Daly (2004) and Monadjem *et al.* (2010) and assigned as follows;

- if a species has been previously recorded in the area it was assigned a high likelihood of occurrence
- if the range of a species includes the area it was assigned moderate likelihood of occurrence
- if the study site is adjacent to an area where a species range extends, that species was assigned a low likelihood of occurrence
- If it is known that a species definitely does not occur within the study site it was not listed

1.4.2. Fieldwork

The methodology used for this study follows generally accepted principles for surveying bats and those stipulated in the good practice guidelines (Sowler and Stoffberg 2012). The field visit was used to visually assess the micro-habitats as well as to conduct surveys using a Wildlife Acoustics EM3 bat detector.

1.4.2.1. Driven transect surveys

Transects were driven to cover as much of the site as possible during the time available on site. A bat detector is a handheld ultrasonic device that can be used to determine bat activity by effectively slowing their calls down sufficiently to make it audible to the human ear while still maintaining its' unique harmonics and characteristics.

An external omni-directional microphone with an extension cable was attached to a 1.5m long pole, mounted on the cab of the vehicle and connected to the EM3 bat detector. This allows one to keep the bat detector inside the vehicle, reduces noise and improves recordings. The bat detector has a GPS attached that logs co-ordinates of any recordings made. In this way every bat call recorded has an exact position corresponding to the call. This enables a map of the recorded 'bat passes'

(recordings) to be created. Figure 3 shows the route of the driven transects. Driving speed was maintained consistently below 20 kilometres per hour at all times to avoid wind noise.

The EM3 calls were downloaded and analysed using Analook software after being converted to zero crossing files. Noise files were filtered out using Wildlife Acoustics' Kaleidoscope (Beta 0.2.0).

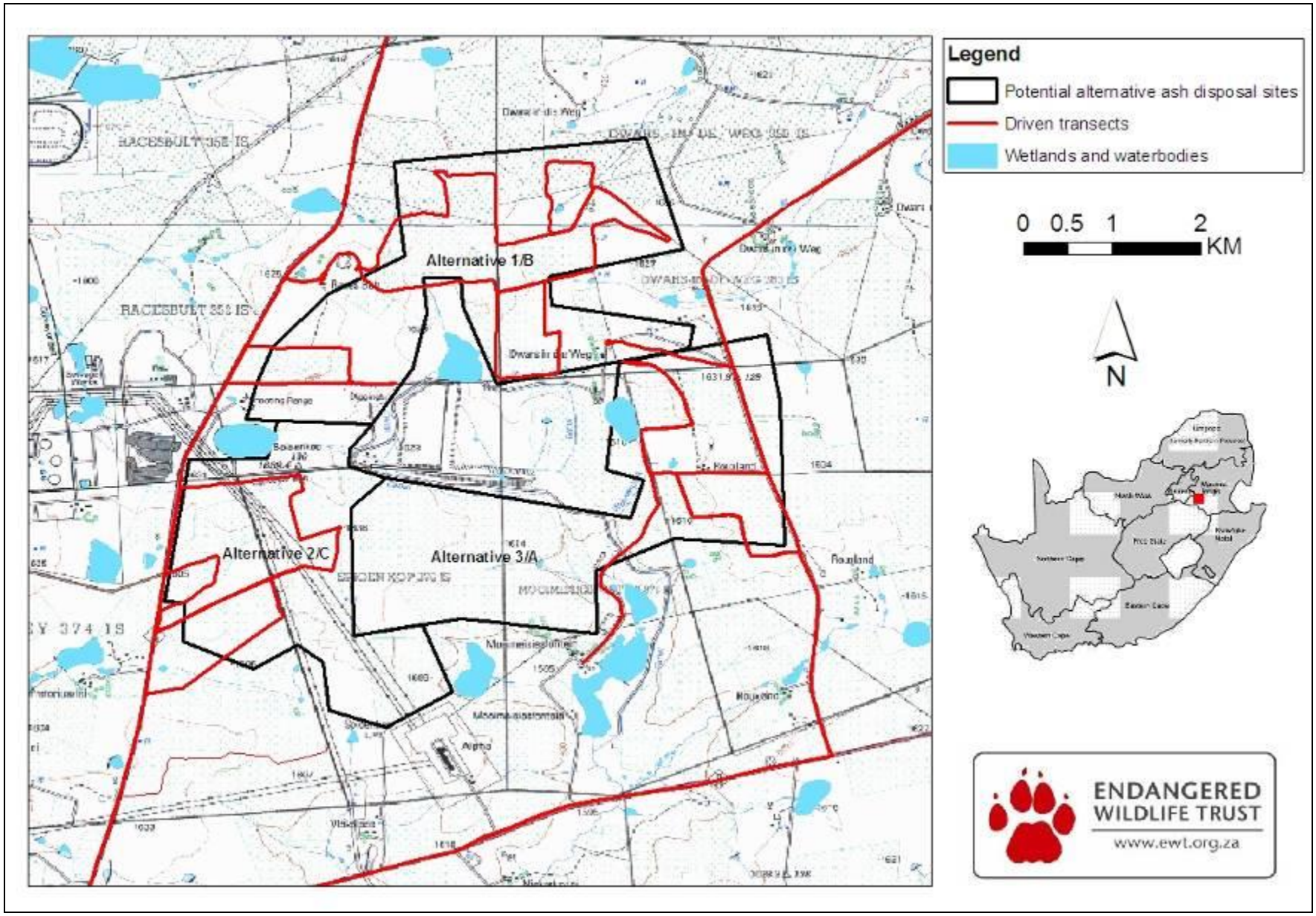

Figure 3. Driven transects on the study site

1.4.2.2. Micro-habitat and roost inspection

Each site was examined for any evidence of bat roosts or attractive micro-habitats that might attract bats to a particular site both on foot and from a vehicle. This included the inspection of many man-made structures, thickets of trees or thick vegetation, dams and pans and rocky outcrops and/or cliffs (if present).

1.5. Limitations

The impact of the proposed continuous disposal of ash at the Tutuka Power Station on bat populations may vary from one season to the next as bats migrate, breed or change foraging patterns. Twelve months of pre-construction monitoring would add great value to this study as it would give a cross-seasonal indication of bat activity in the study area.

Bats emerge from their roosts and are only active during certain times of the night, meaning that only a limited period of the night is available to collect valuable data. A fully comprehensive study of the site simply cannot be conducted in only a few nights. That said, a short-term study is far better than no study at all and, as such, a thorough and comprehensive study was conducted in the time available.

In addition, although a state-of-the-art bat detector was used, the technology has not yet been commercially developed that can identify all bat species by their echolocation calls alone (a 'bat in the hand' would provide 100% confirmation of species occurrence but live trapping was not feasible for this study). The detection range of bat detectors is limited by the absorption of ultrasound in air. At mid-range frequencies, around 50kHz, the maximum range is only approximately 25 to 30 meters in average atmospheric conditions when bats are active. This decreases with increasing frequency. In addition the usage range of bat detectors decreases with increasing humidity and in misty conditions the maximum range can be severely reduced. Recordings are, thus, easily affected by weather conditions. Fortunately weather conditions on the nights of sampling were good.

2. DESCRIPTION OF AFFECTED ENVIRONMENT

2.1. Land cover and vegetation of the study area

The area was assessed using CSIR's land cover data to determine what land cover is likely to be present at the site. Land cover is seen as more valuable to bat assessments than vegetation type as bats are mobile and the land cover data allows an assessment of the presence or absence of various land cover types that may attract bats. These are further discussed under micro habitats below but can be seen at a broader scale on the following map (Figure 4).

The vegetation of the area was also assessed and used to determine the presence or absence of suitable habitat for the bat species likely to occur in the area. Table 1 shows the preferred habitat of each species and this has been assessed using the vegetation map (Figure 5) to assist with determining the likelihood of occurrence.

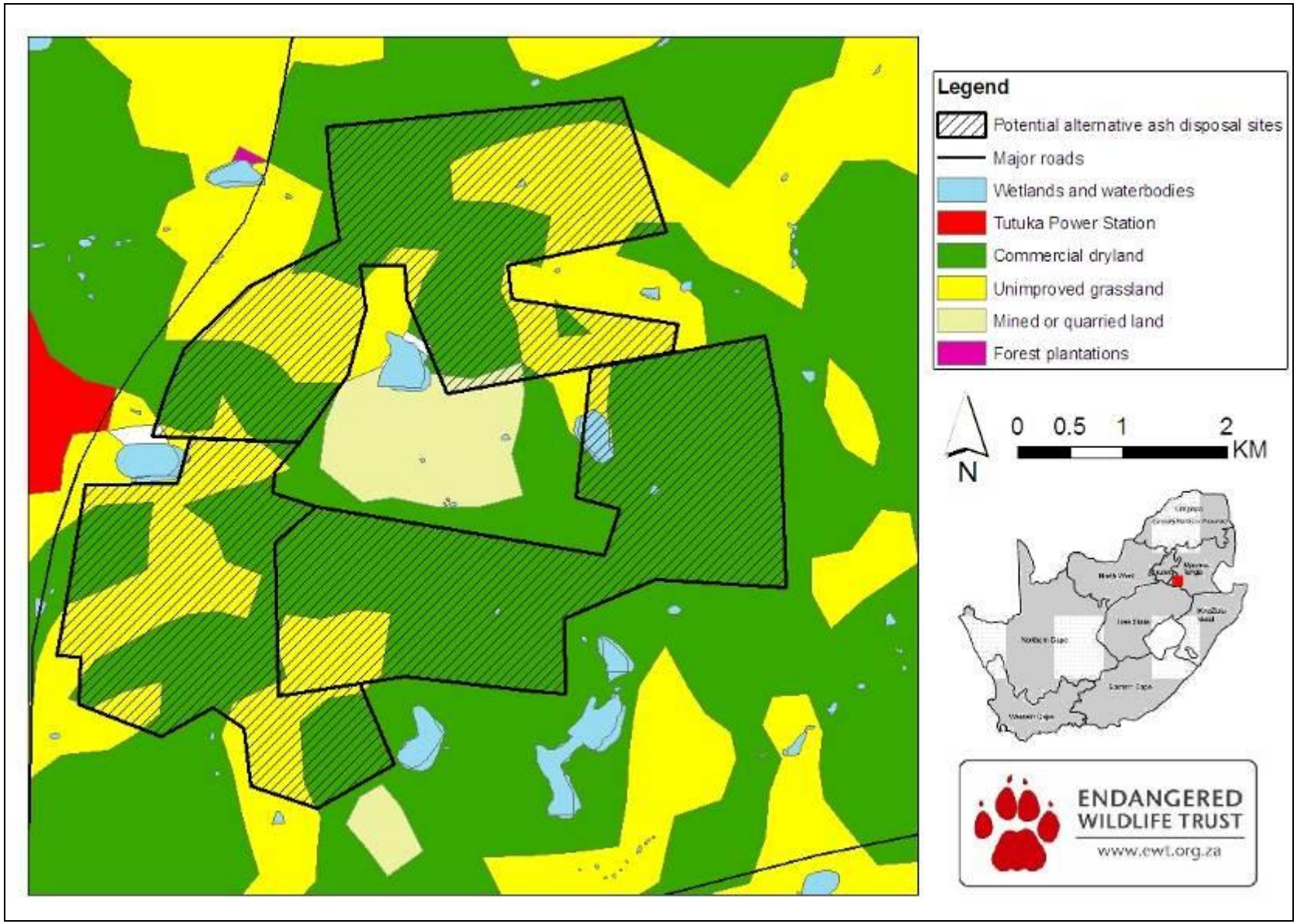

Figure 4. Land use types (CSIR) on the study site.

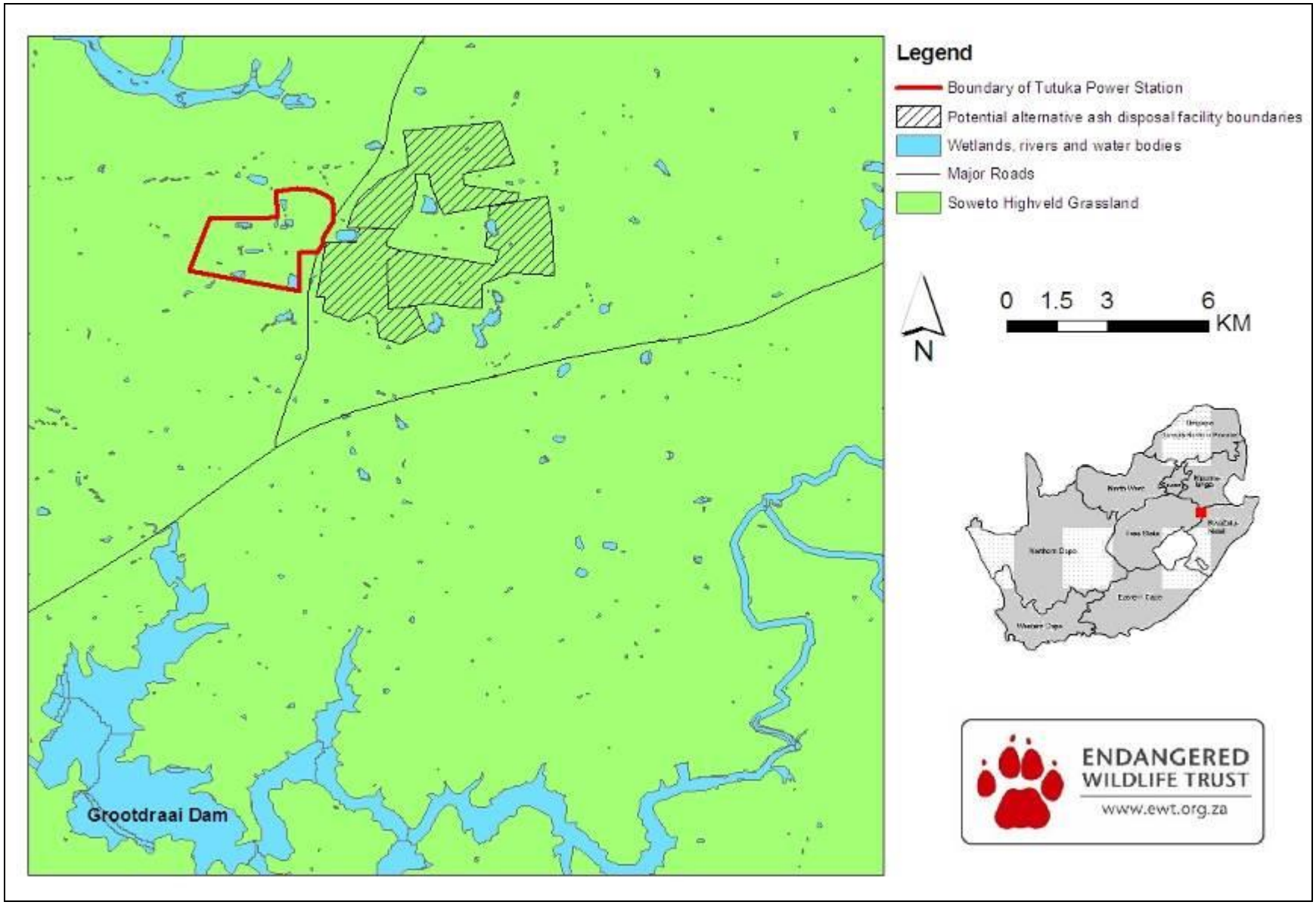

Figure 5. Vegetation types (Mucina and Rutherford 2006) on the study site.

Figure 6. Soweto Highveld Grassland vegetation typical of the study site.

The study area falls within the Grassland Biome and Mesic Highveld Grassland Bioregion. The vegetation is defined by Mucina and Rutherford (2006) as Soweto Highveld Grassland vegetation and is characterised by short to medium-high, dense, tufted grassland dominated by *Themeda triandra.* This vegetation types is considered Endangered (Mucina and Rutherford 2006), only a small extent of the targeted 24% is currently protected. Throughout the national occurrence of the vegetation approximately 47% has been transformed through cultivation, urban sprawl, mining and construction of road infrastructure. The study area consists of large areas of cultivation, predominantly maize, stands of alien trees and some small fragmented patches of natural vegetation.

2.2. Potential micro-habitats

The vegetation description partially helps to describe the species likely to occur in the study area. Specific features within the landscape will further affect which species occur there. These specifics, or "micro" habitats, are formed by a combination of factors such as vegetation, land cover and man-made structures. Micro habitats are important in identifying areas potentially important to bats. The following micro habitats were identified using a combination satellite images and ground truthing during the site visit and 'on-the-ground' investigation:

- **Wetlands:** Wetlands are characterized by slow flowing water and tall emergent vegetation. Insects such as midges and mosquitoes often breed at wetlands emerging in large numbers, creating a perfect feeding site for many bat species.
    - **Site Alternative B**
      There is one non-perennial wetland in the north-east corner of this site alternative. Although only filled with water during the rainy season it is likely that this small wetland is an important seasonal foraging site for bats in the area.
    - **Site Alternative C**
      No wetlands were identified on this site alternative.
    - **Site Alternative A**
      There is one perennial wetland in the south -central part of this site alternative. It is likely that this wetland is a foraging site for bats.

- **Dams and reservoirs:** Due to the standing nature of water in dams and reservoirs many insects use dams as breeding sites. The presence of these insects often attracts insect-eating bats. Many active reservoirs and a number of seasonal dams occur within the study site.
    - **Site Alternative B**
      There are two small dams on this site alternative. It is also important to note that there is also one large dam just south and another small dam just west of the site alternative's boundaries. These dams may attract bats to the greater study area.
    - **Site Alternative C**
      There are three small dams on this site alternative. It is also important to note that there are three additional dams west, north and east of the site alternative's boundaries. These dams may attract bats to the greater study area.
    - **Site Alternative A**
      There are two small dams on this site alternative. It is also important to note that there is a series of three large dams just south of the site alternative's boundaries. These dams may attract bats to the greater study area.

- **Thicket:** Many of the bat species listed as possibly occurring on the site are clutter and clutter-edge feeders. The presence of thicket or bush on the site may increase the

likelihood of such species being present and any alteration to this habitat may have negative effects on the presence of bats in the area, possibly even their survival. Clumped stands of eucalyptus trees occur throughout the greater study and on each of the three site alternatives.

- **Man-made structures:** Buildings are favoured by many bat species as safe, dry roost sites. They will often roost in the roofs of these structures. The farm houses, staff houses and abandoned structures in the greater study area all present suitable roosting habitat for many bat species.
    - **Site Alternative B**
      There are no buildings on this site alternative but a series of buildings just west of the site alternative's boundaries.
    - **Site Alternative C**
      There are no buildings on this site alternative but a series of Eskom owned buildings just north-east of the site alternative's boundaries.
    - **Site Alternative A**
      There is one cluster of buildings in the north-central region of this site alternative.

- **Likestock:** Concentrations of livestock, and their associated droppings, inevitably attract concentrations of insects. The presence of these insects is likely to attract insect-eating bats. Cattle are farmed throughout the greater study area.
    - **Site Alternative B**
      No livestock is farmed on this site alternative
    - **Site Alternative C**
      Small herds of cattle are farmed on this site alternative
    - **Site Alternative A**
      Small herds of cattle are farmed on this site alternative

Bats are broadly divided into two groups, insect- and fruit-eating bats. Fruit-eating bats are generally found in the warmer, eastern parts of the country where fruit trees, often of a commercial nature, are commonly found. Although some species of fruit bats have been recorded in the greater study area, due to the available habitat types, none are likely to occur in the area of or around the study site (Table 1). Insect-eating bats are found across the entire country, including the study area. Therefore, anything that attracts insects is likely to, in turn, attract bats. For example, wetlands, pans, rivers, dumping sites, and animals such as cows, sheep and horses.

3. Results

3.1. Desktop review

Based on historically recorded and modelled distributions by Friedmann and Daly 2004 and Monadjem *et al.* 2010 the number of bat species with the potential to occur in the study area numbers ten species (Table 1). Of the 25 species identified as potentially occurring in the study area one is Vulnerable (*Cleotis percivali)*, four Near Threatened (*Hipposideros gigas, Miniopterus natalensis, Rhinolophus blasii* and *Rhinolophus swinnyi*) and seven Least Concern (see Table 1 for list of species). Four of the identified species are considered highly likely to occur in the study area (*Cleotis percivali, Eptesicus hottentotus, Miniopterus natalensis, Myotis tricolor, Neoromicia capensis, Rhinolophus blasii, Rhinolophus clivosus, Rhinolophus simulator, Rhinolophus swinnyi* and *Tadarida aegyptiaca*), nine considered moderately likely and six are unlikely but possible to occur.

Table 1. Potential bat species in the study area

SPECIES	COMMON NAME	HABITAT	CONSERVATION STATUS	LIKELIHOOD OF OCCURRENCE
Cleotis percivali	Percival's Short-eared Trident Bat	Woodland	V	High
Eptesicus hottentotus	Long-tailed Serotine	Rocky outcrops/caves	LC	High
Glauconycteris variegata	Variegated Butterfly bat	Savanna/woodland	LC	Low
Hipposideros caffer	Sundevall's Leaf-nosed Bat	Savanna/woodland	LC	Moderate
Hipposideros gigas	Giant Leaf-nosed bat	Forest/savanna	NT	Moderate
Hipposideros vittatus	Spriped leaf-nosed bat	Forest/savanna	LC	Low
Hypsugo anchietae	Anchieta's Pipistrelle	Riparian forest	LC	Low
Kerivoula argentata	Damara Woolly bat	Savanna/woodland	LC	Moderate
Kerivoula lanosa	Lesser Woolly Bat	Unknown	LC	Moderate
Miniopterus fraterculus	Lesser Long-fingered bat	Montane grassland	LC	Low
Miniopterus natalensis	Natal Long-fingered Bat	Savanna/grassland	NT	High
Myotis tricolor	Temminck's Myotis	Savanna woodland/mountains	LC	High
Neoromicia capensis	Cape Serotine	Wide tolerance	LC	High
Nycteris thebaica	Egyptian Slit-faced Bat	Savanna/karoo	LC	Moderate
Pipistrellus rusticus	Rusty Pipistrelle	Savanna/woodland/wetland	LC	Moderate
Pipstrellus hesperidus	Dusky Pipistrelle	Woodland/riparian woodland	LC	Low
Rhinolophus blasii	Blasius's Horseshoe bat	Savanna/woodland	NT	High
Rhinolophus clivosus	Geoffroy's Horseshoe	Savanna/woodland	LC	High
Rhinolophus darlingi	Darling's Horseshoe Bat	Savanna/woodland	LC	Moderate
Rhinolophus simulator	Bushveld Horseshoe Bat	Savanna/woodland/drainage lines	LC	High

Rhinolophus swinnyi	Swinny's Horseshoe Bat	Forest/savanna woodland	NT	High
Rousettus aegyptiacus	Egyptian Rousette	Caves	LC	Low
Tadarida aegyptiaca	Egyptian Free-tailed Bat	Wide tolerance	LC	High
Taphozous mauritianus	Mauritian Tomb Bat	Forest/savanna	LC	Moderate
Laephotis botswanae	Botswana long-eared bat	Savanna/woodland	LC	Moderate

* V – Vulnerable, NT – Near Threatened, LC – Least Concern, DD – Data Deficient (IUCN)

3.2. Roost (and other significant site) surveys

Although fruit bats have been recorded in this area in the past the proposed site itself did not have any fruit trees that are typically found in fruit bat habitat. Although it is possible that fruit bats may traverse the site during migration and foraging forays it is unlikely that they would roost there.

No active roost sites were found on any of the site alternatives. But two of the main farm houses within the greater study area showed evidence of occupation by bats including bat smudges and droppings (Figure 7a). A number of both perennial and non-perennial dams were identified on the site (Figure 7b). A 'carcass disposal site' was identified on site alternative B (Figure 7c). The site attracts insects and the presence of bats was confirmed during the driven transect survey.



a. b. c.

Figure 7. Photographs showing; a. bat smudges showing evidence of a bat colony, b. perennial dam and c. 'carcass disposal site'.

3.3. Driven transect surveys

One transect was driven and repeated over two different nights, the 21st and 22nd of May 2013 (Figure 4). Two (2) species bat were detected by the EM3 bat detector during these transects – *Neromicia capensi* and *Tadarida aegyptiaca.* The number of bat passes recorded are shown in Table 2 and Figure 8. Please note that these results indicate diversity rather than abundance (as there is no way to know whether the same individual is being recorded repeatedly) and, in addition, highlight potentially sensitive areas.

Table 2. Bat passes recorded during driven transect surveys

Species	**Common name**	**Number of passes**
Neromicia capensis	Cape serotine	8
Tadarida aegyptiaca	Egyptian free-tailed bat	5

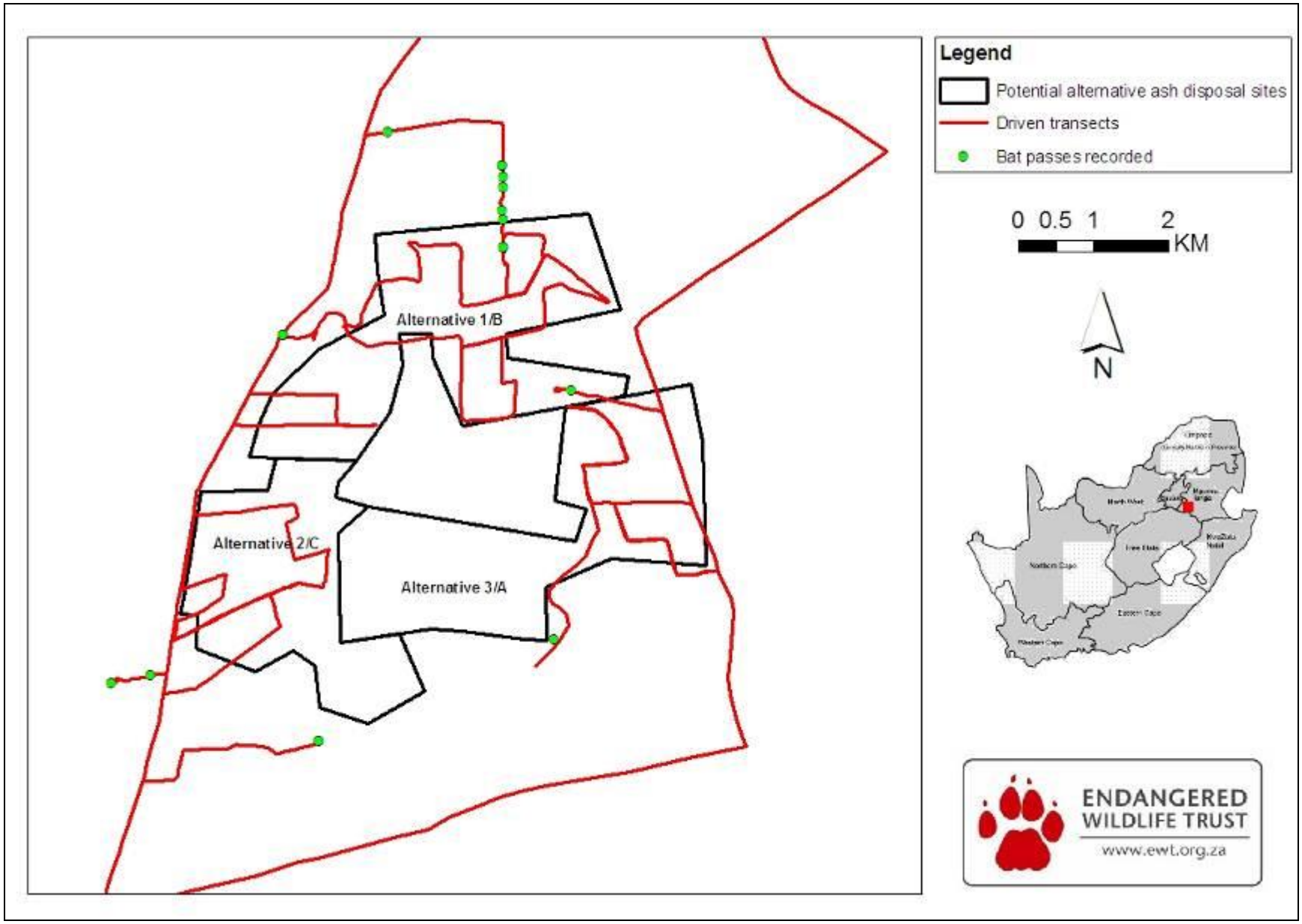

Figure 8. Results of driven transect surveys showing bat passes.

It must be noted that it is highly likely that results may differ throughout the year and that while it is possible to identify bats from calls, the only completely reliable method is to identify species in the hand from morphological features and measurements. This was not practical for this study as it would be very unlikely to catch a representative sample of bats over the total study area. Calls are therefore relied upon to give an idea of what species are in the area. It is also useful to get an idea of areas in which bats are congregating. Some species have very similar calls. Where there was doubt, the more sensitive species was used in the identification in keeping with the precautionary principle. That said these data are of sufficient quality to make an assessment on the project and the impact it will have on bat species.

Neoromicia capensis was found throughout the greater area. This was expected because this species has a wide tolerance of habitat and is quite common throughout the region. This bat is a clutter edge forager and gives birth during the wet summer months. This species of bat roosts in houses, under the bark of trees and in mine shafts. It is unlikely that construction on any of the site alternatives will destroy any *N. capensis* roosts but care should be taken not to destroy any unidentified roost sites should they be found.

Tadarida aegyptiaca is widespread and abundant throughout most of southern Africa. It roosts communally in small to medium-sized groups which may number in the dozens. They roost in buildings, caves and under the bark of trees. This species has been recorded foraging in a wide variety of habitats and does not appear to be constrained by particular vegetation types. Females give birth to their young in November or December and only once a year. It is unlikely that construction on any of the site alternatives will destroy any *T. aegyptiaca* roosts but care should be taken not to destroy any unidentified roost sites should they be found.

Areas likely to be sensitive in terms of impact on bat populations are highlighted in Figure 9.
The topography of the site, along with observations made during the site visit, were used to designate the permanent water sources, riparian valleys and their slopes and the permanent man-made structures with evidence of bat occupation (identified either by bat passes recorded or bat dropping on walls) as having High Bat Sensitivity. The areas assigned Moderate Bat Sensitivity include non-riparian slopes and smaller koppies. These areas were designated based on their higher likelihood of supporting insects, and thereby attracting bats, and higher likelihood of providing suitable roost sites. Mitchell-Jones and Carlin (2009) and Rodrigies *et al.* (2008) indicate that a minimum buffer distance of 200m from features important to bats should be maintained.

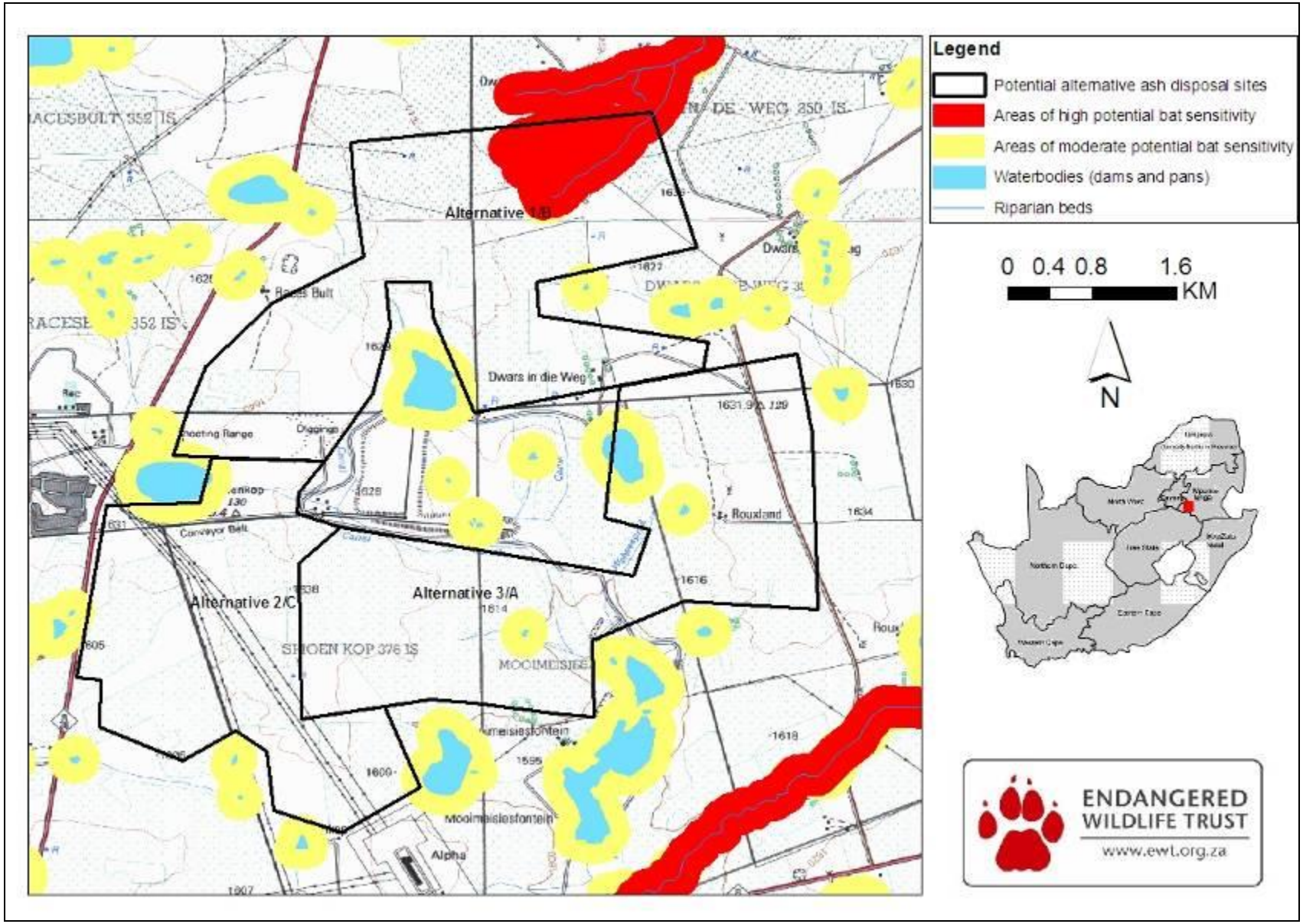

Figure 9. Potential bat sensitivity in the study area.

4. EVALUATION OF IMPACTS

The potential for impacts on bats in the study area by the proposed Continuous Disposal of Ash at the Tutuka Power Station is evaluated in terms of impacts related to the main behavioural activities of bats:

- Roosting impacts
- Foraging impacts

Lidwala provided the EWT with Assessment Impact Tables to use when compiling the section below. The Impact Tables are attached as Appendix1. Please note, since the impact on bats should become negligible after the construction phase only the impacts during construction are assessed.

The only potential impact on bats post-construction is related to the use of lighting in or around the ash disposal facility. The impact of lighting on bat behaviour can have two different results. It can either attract bats that prey on insects or it can disturb bats and act as a barrier to movement (Outen 1998). Therefore it is advisable to keep lighting to a minimum to avoid attracting certain species and to avoid disturbing others. Lighting needs of the project are carefully considered and minimal lighting be used if possible. Low pressure sodium lamps are recommended, or UV filters should be fitted to other types of light. This will decrease the attraction of insects and thus to bat species. There should be no large scale lines of lights as these can act as barriers to bat movement. It is not envisaged that this will have a very large impact but it is something to be aware of once operation begins. Should it become a large problem a suitably qualified bat specialist should be contacted to resolve the issue.

It must also be noted that the construction of certain structures may attract bats. Many houses (workshops, operation rooms etc) are used all over the world as roost sites. This can cause distress to people as these bats may soil walls and floors with their faeces. It is therefore suggested that during construction newly constructed buildings be sealed as much as possible from bats. This will help to mitigate for this impact. This is more of a business impact as bats are unlikely to be negatively affected by this unless they are physically killed by the people on site.

There is no evidence to suggest that bats are affected by power lines or linear infrastructure corridors in any way. For this reason these alternatives were not assessed as part of this study. Destruction of any naturally occurring vegetation should, however, be kept to a minimum during the construction of any of these structures.

5. MEASURES FOR INCLUSION IN THE FINAL ENVIRONMENTAL MANAGEMENT PLAN

OBJECTIVE: Bat populations foraging in, or roosting in, the development area are likely to be affected by the construction and operation of the Proposed Continuous Disposal of Ash at the Tutuka Power Station through disturbance or disruption of foraging or destruction of roosting sites. The objective should be to limit such impacts on bat populations implementing management strategies to reduce impacts.

Project component/s	Any construction or development over and above what is necessary that destroys vegetation; any lighting used during the construction and operational phases that may attract insects.
Potential Impact	The potential impact if this objective is not met is that bat populations may be disturbed or localized loss of species and reduction in biodiversity may occur if this objective is not met.
Activity/risk source	Activities which could affect achieving this objective include construction and/or development over and above what is necessary, destruction of existing roost sites and destruction of existing water-bodies.
Mitigation: Target/Objective	Mitigation measures, as recommended ensuring no existing man-made structures house bat colonies, keeping destruction of natural vegetation to a minimum and using lights that will be less likely to attract insects. A facility environmental management plan that takes cognizance of bat populations in the greater area in the event of any future extensions of any infrastructure.

Mitigation: Action/control	Responsibility	Timeframe
Disturbance and/or removal of vegetation should be kept to a minimum.	Developer	To be in place during planning phase and implemented during construction phase
Disturbance and/or destruction of existing bat roosts should be avoided	Developer	To be in place during planning phase and implemented during construction phases
Minimal lighting should be considered, alternatively low pressure sodium lamps or UV filters should be used	Developer	To be in place during planning phase and implemented during construction and operational phases

Performance Indicator	Completed mitigation measures as recommended. Inclusion of further bat impact consideration in any future extension of infrastructural elements. Immediate reporting to relevant conservation authorities of any bat related impacts experienced during any phase of development or operation of the facility.

Monitoring	Officials from relevant environmental authorities (National and Provincial) to be permitted to inspect the operation at any time in relation to the bat component of the management plan.

6. SITE PREFERENCE RANKING

Table 3. Specialist Criteria for Site Preference Ratings

Site preference Rating	Criteria
Preferred (4)	Little to no impact on bat population in the area
Acceptable (3)	Minimal impact on bat populations through disturbance through loss of foraging habitat
Not Preferred (2)	Impact on bat populations through excessive disturbance through loss of foraging habitat and loss of potential roost sites
No-Go (1)	Impact on bat populations through destruction of known roost sites resulting in displacement or mortalities

Table 4**.** Final Site Ranking Matrix

Study	Alt B	Alt C	Alt A
Proposed Continuous Disposal of Ash at the Tutuka Power Station	3	4	3

7. CONCLUSIONS

Any species that occurs in the area of the proposed continuous disposal of ash at the Tutuka Power Station is vulnerable to disturbance and/or displacement as a result of the construction. At least one of the bat species identified as potentially occurring in the area of the study site is Vulnerable (*Cleotis percivali)*, four Near Threatened (*Hipposideros gigas, Miniopterus natalensis, Rhinolophus blasii* and *Rhinolophus swinnyi*) and seven Least Concern. Acoustic recording confirmed that at least two of the bats occurring in the area were present on the site (*Neomicia capensis* and*Tadarida aegyptiaca)*. The uniformity of the habitat around the site also means that localized habitat destruction and disturbance would impact on bats but the habitat is not unique or important for bats and as such the surrounding habitats would be equally available to bats to utilize. The overall impact of the development on the bat population in the area is likely to be low, particularly if steps to mitigate impacts are taken.

Of the three site alternatives, alternative C would be preferred over site alternatives A and B because it is the only one that does not offer any appropriate roost sites for bats. Alternatives A and B are considered "Acceptable". The proposed mitigation measures and recommendations described in Section 5 of this report should be implemented and their practicality and effectiveness

researched in the greater study area. Every effort should be made to mitigate the impacts on bats during this project through a construction EMP as well as by following the recommendations in this report.

This report is to be read in conjunction with the attached letter *Bat Specialist Study Verification and Input for the Continuous Disposal for Ash at the TUTUKA Power Station* dated 14 April 2014.

8. REFERENCES

BARCLAY, R.M.R., AND HARDER, L.D. (2003). Life histories of bats: life in the slow lane. *In* Kunz T.H. and Fenton M.B. (eds) *Bat Ecology*. University of Chicago Press.

BOYLES, J.G., CRYAN, P.M., MCCRACKEN G.F. AND KUNZ, T.H. (2011). Economic importance of bats in agriculture. *Science* 332:**41**-42

FENTON, M.B. (1990). The foraging ecology of animal eating bats. *Canadian J. Zoology* **68**:411-422

FRIEDMANN, Y. & DALY, B. (eds.) (2004). *Red data book of the mammals of South Africa: A conservation assessment.* CBSG Southern Africa, Conservation Breeding Specialist Group (SSC/IUCN). Endangered Wildlife Trust, Johannesburg.

HERSELMAN, J.C. & NORTON, P.M. (1985). The distribution and status of bats (Mammalia: Chiroptera) in the Cape Province. *Annals of the Cape Province Museum (Natural History)* **16**: 73-126

JONES, G., JACOBS, D.S., KUNZ, T.H., WILLIG, M.R., AND RACEY, P.A. (2009). Carpe noctem: the importance of bats as bioindicators. *Endangered Species Research* **8**:93–115

KUNZ, T.H., DE TORREZ, E.B., BAUER, D., LOBOVA, T. AND FLEMMING, T.H. (2011). Ecosystem services provided by bats. *Annals of the New York Academy of Sciences* **1233**: 1-38

LONG, R., SIMPSON, T., DING, J., HEYDON, S. AND REILL, R. (1998). Bats feed on crop pests in Sacramento Valley. *California Agriculture* **52**: 8-10

MITCHELL-JONES, T. AND CARLIN, C. 2009. *Bats and onshore wind turbines.* Interim guidance. Natural England Technical Infirmation Note TIN051. 9pp. Accessed from http://www.naturalengland.org.za.

MONADJEM, A., TAYLOR P.J, COTTERILL F.P.D AND SCHOEMAN M.C. (2010). Bats of Southern and Central Africa: A Biogeographic and Taxonomic Synthesis.Wits University Press

MUCINA, L. AND RUTHERFORD, M.C. (eds) 2006. The Vegetation of South Africa, Lesotho and Swaziland (Digital). In Mucina, L. & Rutherford, M.C. (eds) 2006. The Vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19: Compact Disk. South African National Biodiversity Institute, Pretoria.

NORBERG, U.M. AND REYNER, J.M.V. (1987). Ecological morphology and flight in bats (Mammalia: Chiroptera): wing adaptions, flight performance, foraging strategy and echolocation. *Phil. Trans. R.Soc. Lond. B* **316**: 335-427

OUTEN, A.R. (1998). *The possible ecological implications of artificial lighting*. Hertfordshire Biological Records Centre

RODRIGUES, LL., BACH, M.J., DUBONG-SAVAGE, GOODWIN, J. AND HARBURSCH, C. 2008. *Guidelines for consideration of bats in wind farm projects.* EUROBATS. Publication Series No. 3 (English version). UNEP/EUROBATS. Secretariat, Bonn, Germany, 51pp.

SCHNITZLER, H.U. KALKO, E.K.B. (2001). Echolocation by insect eating bats. *BioScience* **51**:557-569.

SIMMONS, N.B. (2005). Order Chiroptera. *In* Wilson D.E. and Reeder D.M. (eds) *Mammal Species of the World*, vol. 1, 3rd edition. John Hopkins University Press.

SOWLER, S. & STOFFBERG, S. (2012). *The South African Good Practice Guidelines for Surveying Bats in Wind Farm Developments*. A guideline document distributed by and produced in cooperation with the Wildlife & Energy Programme of the Endangered Wildlife Trust.

TAYLOR P.J. 2000. *Bats of Southern Africa*. University of Natal Press, Pietermaritzburg

VAN DER MERWE M. (1973). Aspects of social behaviour of the Natal Clinging bat, *Miniopterus schreibersi natalensis* (A. Smith, 1934). *Mammalia* **37**: 380-389.