ASSESSMENT OF VERTEBRATE SPECIES AND THEIR HABITATS FOR ESKOM'S PROPOSED NEW TAUNUS-DIEPKLOOF POWERLINE AND TWO SUBSTATIONS, SOWETO, GAUTENG PROVINCE

by

I.L. Rautenbach Ph.D., Pr.Nat.Sci.
A.C. Kemp Ph.D., Pr.Nat.Sci.
J.C.P. van Wyk M.Sc., Pr.Nat.Sci.

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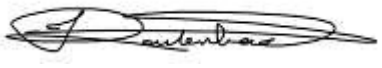
Declaration of Independence

We (Ignatius Lourens Rautenbach Id 4212015012005, Alan Charles Kemp Id 4405075033081 and Jacobus Casparus Petrus van Wyk Id 6808045041084) declare that we

- Are suitably qualified and are registered as per prerequisites of the Natural Scientific Professions Act No. 27 of 2003, and this project is our own work from its inception, reflects exclusively our observations and unbiased scientific interpretations, and was executed to the best of our ability
- Abide by the Code of Ethics of the S.A. Council for Natural Scientific Profession;
- Act as independent specialist consultants respectively in the fields of mammalogy, ecology and ornithology, and herpetology;
- Are assigned as specialist consultants by Dimela Eco Consultants for Envirolution Consulting for the proposed project "**Assessment of vertebrate species and their habitats for Eskom's proposed new Taunus-Diepkloof Powerline and two Substations, Soweto, Gauteng Province**" as described in this report;
- Do not have or will not have any financial interest in the undertaking of the activity other than remuneration for work performed;
- Have or will not have any vested interest in the proposed activity proceeding;
- Have no and will not engage in conflicting interests in the undertaking of the activity;
- Undertake to disclose to the client and the competent authority any material information that have or may have the potential to influence the decision of the competent authority required in terms of the Environmental Impact Assessment Regulations 2014;
- Will provide the client and competent authority with access to all information at our disposal, regarding this project, whether favourable or not.



I. L. Rautenbach

A. C. Kemp

JCP van Wyk

Disclaimer

Even though every care is taken to ensure the accuracy of this report, faunal and environmental assessment studies are limited in scope, time and budget. Discussions and proposed mitigations are made, to some extent, on reasonable and informed assumptions built on *bona fide* information sources, as well as deductive reasoning. A more factual report, based on field collecting and observations, can only be derived over several years and seasons of research, to account for fluctuating environmental conditions and animal migrations. Since environmental impact studies deal with dynamic natural systems, additional information may come to light at a later stage. The vertebrate team can therefore not accept responsibility for conclusions and mitigation measures, made in good faith, based on own databases, and on the information provided at the time of the directive. Although the authors exercised due care and diligence in rendering services and preparing documents, they accept no liability and the client, by accepting this document, indemnifies the authors against all actions, claims, demands, losses, liabilities, costs, damages and expenses that arise from or in connection with services rendered, directly or indirectly, by the authors and use of this document. This report should therefore be viewed and acted upon with these limitations in mind.

EXECUTIVE SUMMARY

Proposals by Eskom for a route along which to construct a new 132 kV powerline, between their Taunus Substation on the western edge of current housing developments for Soweto and their eastern Diepkloof Substation within the Soweto CBD, were assessed for their potential impact on vertebrate habitats, species and populations. Deviation 1 and Deviation 2 of the route along the way were also proposed for assessment as alternatives, along with sites for two new 100x100-m substations, one with an alternative site. From west to east, the route passes through grass- and croplands, over the N2 motorway, alongside alien-wooded smallholdings, down the north side of the main Klip River valley and finally turns north back over the rocky ridges and N2 into the residential, industrial and finally business districts of central Soweto. Most of the natural habitats along the way are degraded by burning, grazing, trampling and disturbance and so support only a subset of their historical fauna, while only the transformed wooded habitats attracting a novel suite of vertebrate species. Networks of roads, railway lines, and utility supplies, together with past excavations, tracks, dumps, rubble and litter, add to the degradation in many areas. Except for the reed-filled Klip River watercourse, none of the habitats is of the quantity or quality that they can be expected to support health populations of any but the most resilient and common species. An Endangered adult African Marsh Harrier was encountered above the reed beds on the eastern edge of Lenasia, where Deviation 2 is proposed to pass, and is suspected to be breeding there. Other threatened riparian and wetland species may also occur along this linear watercourse, in addition to its ecological importance as a corridor for dispersal movements of wetland species.

Our assessment included the sites and servitudes themselves, as well as surroundings areas within at least 500 m. The main preferred powerline route was proposed as having the least impact on the vertebrate habitats and populations involved. Deviation 1 was rejected because it passed over a large area of near-natural Carletonville Dolomite Grassland, and Deviation 2 because it passed back and forth over the Klip River, including at the point where the African Marsh Harrier was observed, and in-between ran along its southern floodplain. We approved of the preferred sites for Substation 1 and Substation 2, rejecting the alternative Substation 2a site for the extra logistics involved.

Overall, we classified none of the habitats on site as of more than Low to Moderate Ecological Significance for this development, with only the Klip River drainage line rating a High impact. No threatened vertebrate species are expected to be significantly impacted by this development, provided that our recommended route and substation sites are adopted.

1. INTRODUCTION

We were engaged by Dimela Eco Consulting, for Envirolution Consulting (NEC) and on behalf of Eskom's Taunus-Diepkloof Project, to document the vertebrates and their habitats in and around Soweto, City of Johannesburg Metropolitan Municipality, Gauteng Province (Fig.1). The proposed new 132 kV powerline is to start at the existing Taunus Substation west of Soweto, head west then south on the Farm Zuurbekom 297 IQ, pass through the western edge of the West Rand Garden Agricultural Holdings, cross the N12 motorway, and then turn east across the Farms Zuurbekom 297 IQ and then Olifantsvlei 316 IQ to the south of the N12. Thereafter, it will cross the Klip River and continue south of the N12, and Nancefield Industrial Area, until it turns north over the N12 just west of the N1, then over the R553 road and Chris Hani Road in Soweto before connecting to the existing Diepkloof Substation northwest of the Soweto CBD. Along the way, a site has been selected for a new 100 x 100 m substation about 2 km west of the Taunus Substation, and a second one south of the N12 and just west of where the R558 crosses the N12 – here the preferred site Substation 2a is south and the alternative site Substation 2b north of the railway. Two Deviations of the line were also considered as alternatives, one west of and just before the second substation, along the northern boundary of the Farm Syferfontein 290 IQ, and the second east of and just after the second substation, where the powerline crosses and then runs parallel with the railway along the Klip River to its crossing of the M10 motorway after which it re-crosses the Klip River to re-join the preferred route (Fig. 1).

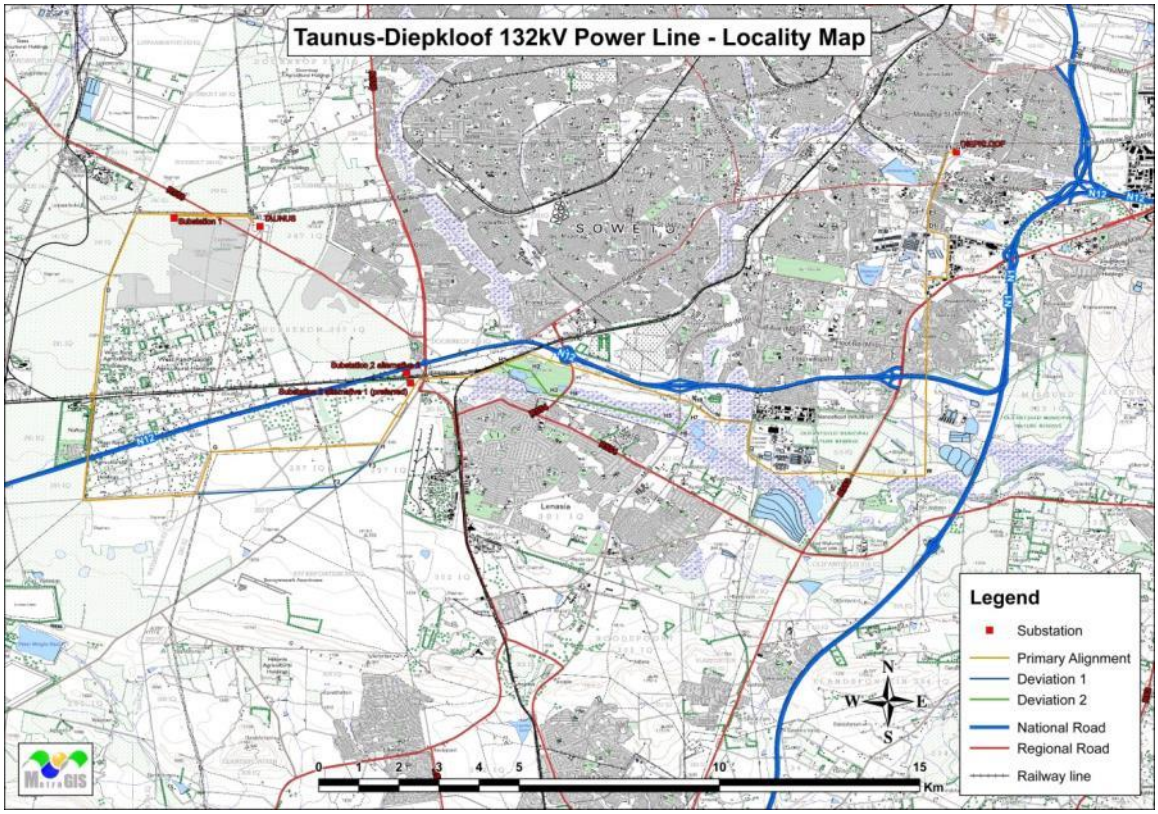


Figure 1: Topographical map showing the locations and routes of the proposed Taunus-Diepkloof powerline developments around Soweto, Gauteng.

The development was subjected to an earlier desktop vegetation survey (Hoare, 2011), which we consulted and where necessary incorporated into aspects of this report so expanding our understanding of the site. A second on-site vegetation study was done at the same time as our ornithologist visited the site, and our mammalogist and herpetologist used the information from this site visit to draft their own desktop assessments. A wetland assessment will also be done and should be consulted for further details of these aspects of the site.

2. ASSIGNMENT – Protocol

This assignment is in accordance with the 2014 Environmental Impact Assessment (EIA) Regulations No. R. 982 (Department of Environmental Affairs and Tourism, 18 June 2010) emanating from Chapter 5 of the National Environmental Management Act, 2004 (Act No. 10 of 2004).

The assignment is interpreted as follows: Compile a scholarly report of the vertebrate fauna and habitats of the site, with emphasis on Red Data species and any critical ecosystems that may occur on the site. In order to compile this information, we had to define the extent and conservation condition of the major habitat types, and to test the environmental feasibility of these locations:

2.1 Initial preparations:

Obtain all relevant maps and information on the natural and disturbed environments of the area under scrutiny, including on Red Data vertebrate species that may occur within the area to be affected.

2.2 Faunal assessment

- Compile lists of the vertebrates that can be expected in the area and highlight Red Data species.
- Assess the quantitative and qualitative condition of suitable habitat for the Red-listed vertebrates that may occur in the area.
- Express an opinion pertaining to the conservation status of the Red Data species and their habitats.

2.3 General

- Identify and describe particular ecologically sensitive areas.
- Identify problem areas in need of special treatment or management, e.g. areas with bush encroachment, erosion, water pollution, degradation or reclamation.
- Make recommendations on aspects that should be monitored during development.
- Calculate and comment on significance ratings for the proposed development.

3. RATIONALE

Environmental conservation is no longer the prerogative of vocal left-wing 1960s-style green activist NGOs. Instead it is now universally appreciated that a rapidly-growing

and more demanding human population continues to place exponential stress on the earth's resources, with irredeemable costs to ecosystems. It is also recognized that ecosystems are in fact nature's 'engine room' to manufacture fundamental live-support products for plants, animals and humans. Environmental degradation ranges from mega-problems, such as global warming, demand for power and land-use practices, to indiscriminate use of household chemicals.

The new conservation awareness is settling at all levels, ranging from consumers, school curricula and communities to governments. This new consciousness is typified by vigorous debate and empathy, and sometimes by decisiveness (viz. new legislation).

In South Africa, a number of acts (viz. the Environmental Conservation Act [Act 73 of 1989], the National Water Act [Act No 36 of 1998], The National Heritage Resources Act [No. 25 of 1999], The Constitution of the Republic of South Africa Act [No 108 of 1996], the National Environmental Management Act [NEMA] [Act 107 of 1998 as amended in 2010], The National Environmental Management Biodiversity Act, [Act 10 of 2004], the National Environmental Management: Waste Act [NEMWA] [Act 59 of 2008], and the Environmental Impact Assessment Regulations: GN R. 543-546 of 18 June 2010, as amended (Gazette No 33306 – Regulation 547)) call on developers (and by implication consumers), the scientific community and conservation agencies to minimise environmental impact. The conduct of natural scientists is directed by The Natural Scientific Professions Act (Act 27 of 2003). Nowadays, a developmental prerogative is to precede new constructions by a multidisciplinary environmental investigation that assesses the conservation costs. This is to ensure that the best conservation practices are applied during the planning, construction, operational and decommissioning phases of new developments.

This development of expanded substations and improved carrying capacity of transmission lines is obviously beneficial for the residents and enterprises operating in the general area. If the development can proceed without any significant addition to the environmental impacts in what is partly a well-developed area, then it offers important additional supply potential for the local municipality.

4. SCOPE AND OBJECTIVES OF THE STUDY

- To define and describe vertebrate habitat types identified on the site;
- To qualitatively and quantitatively assess the significance of vertebrate habitat components and their current general conservation status;
- To identify and comment on ecologically sensitive areas;
- To comment on connectivity;
- To provide a list of mammals, birds, reptiles and frogs that occur or might occur on site, and to identify species of conservation importance (Red Data species);
- To highlight potential impacts of the proposed development on the vertebrate species richness of the study site, and
- To provide management recommendations that mitigate negative and enhance positive impacts, should the proposed development be approved.

- Calculate and comment on significance ratings for the proposed development.

5. STUDY AREA

The site starts on the southwest edge of urban developments around the Witwatersrand, in particular west of the sprawling townships of Soweto, but then enters the ancillary townships of Lenasia and ends up at the Diepkloof substation right in the heart of and close to the CBD of Soweto (Figs. 1-4). From the Taunus Substation, currently on the western edge of Soweto's expanding townships, it passes initially through various agricultural areas, from large croplands to small holdings, with patches of natural grassland in between. It then enters and runs along the Klip River valley as it drains away to the east, and finally it turns north to ascend rocky ridges though ancillary urban service and dense housing developments, on its way into the industrial and business centre of Soweto.

Figure 2: Satellite image of the general area around the proposed powerline developments (red line) southwest of Johannesburg, from the Magaliesberg range in the north to the Vaal Dam in the south and across the bushveld-grassland interface (cf. Fig. 1).

Figure 3: Satellite image of the site (red, purple and green lines) in relation to the main housing and road developments in the area (cf. Figs. 1 & 2).

The undulating plains in the west of the site leading down to the Klip River have deep red to yellow soils (Figs. 7 & 11) overlying the dolomite of the Malmani Subgroup of the Transvaal Supergroup, but with little of the dolomite rocks on the surface unless exposed by cultivation or erosion along the drainage lines (Mucina & Rutherford 2006). The soils along and around the river exhibit much more clay, especially once the line turns north towards the hills and basalts of the Klipriviersberg Group of the Ventersdorp Supergroup where the substrate becomes rocky with shallow clay soils and boulders at the peaks (Figs. 25, 40 & 41). The area has long been exposed to human impacts, with cultivation and housing the most extensive, and pedestrian and vehicle tracks, and communal livestock, now widespread across any undeveloped areas.

Climatically, the elevated location in the interior of the continent produces extreme diurnal and seasonal fluctuations in temperature, from 0^{o}C with frost at dawn on a mean of 41 days in the austral winter to mean summer temperatures in the upper 20s^{o}C. Mean annual rainfall of about 662 mm falls in summer, with 28% annual variation and a high 72% evaporation rate.

At 11541-1647 meters above sea level (m a.s.l., measured on Google Earth), the site starts high up on the western plains and descends slowly as it drops down into and along the Klip River drainage line (Figs. 4 & 5). Where it turns north, it rises sharply to a rocky peak on the ridge above before its final slight descent into the more undulating heart of Soweto. All drainage off the site ends up in the perennial Klip River, which flows south as part of the greater Vaal River catchment area.

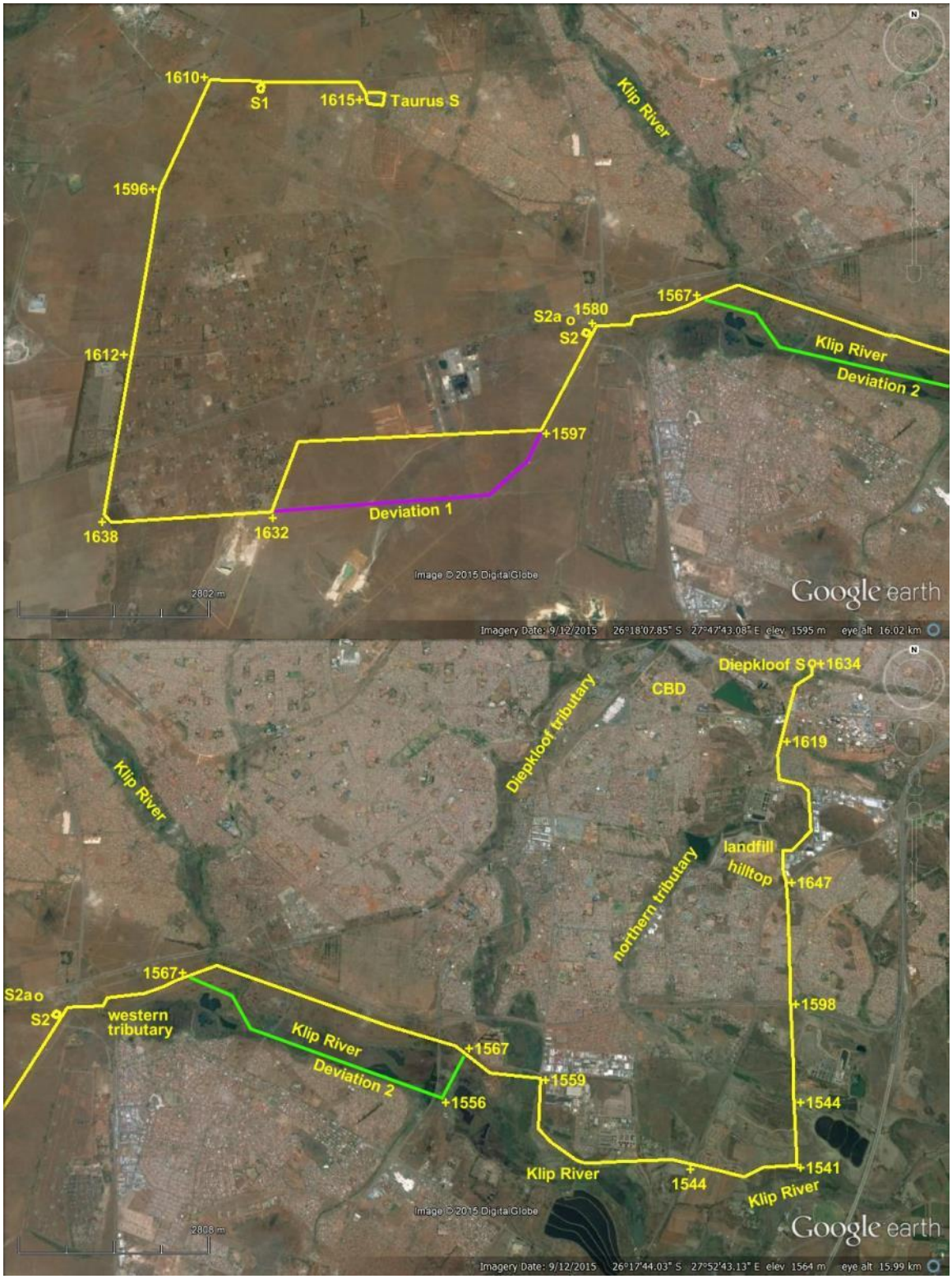


Figure 4: Satellite image of the western (top) and eastern (bottom) halves of the site, annotated in yellow with some of the main features and estimated altitudes (in m a.s.l.) at points (+) along the proposed Taunus-Diepkloof powerline (yellow, purple and green lines). Deviation 1 (purple line) and Deviation 2 (green line); S = new Substations, with the numbers 1, 2 and 2a for the first and second preferred sites, and 2a for the second alternative site.

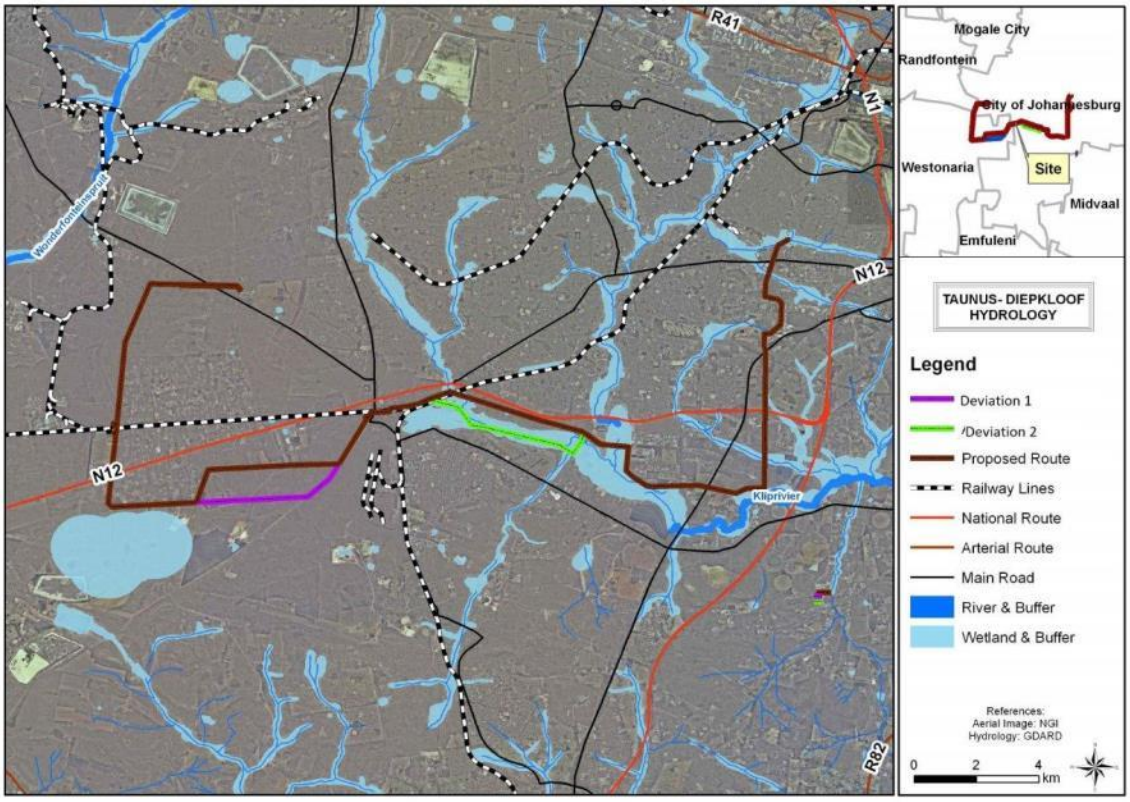


Figure 5: Hydrology of the study site, with buffers indicated around ecologically significant sections.

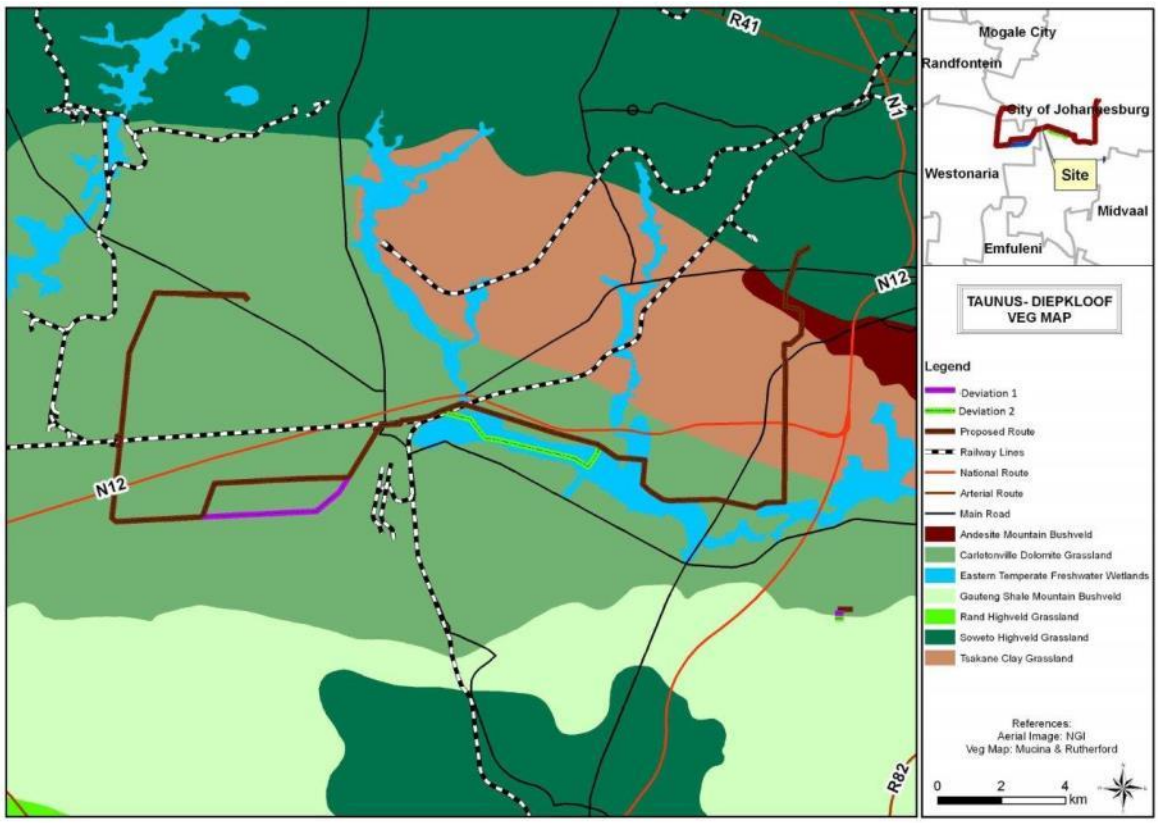


Figure 6: The main vegetation units recognised for the study site.

Land use in the general area has previously been mainly for agriculture and housing, with more mining to the north and west (Fig. 2). The Carletonville Dolomite Grassland has been classified as Vulnerable and the Tsakane Clay and Soweto Highveld Grasslands as Endangered, while the Eastern Temperate Freshwater Wetlands and Andesite Mountain Bushveld are considered as only Least Threatened (Mucina & Rutherford 2006). For the Vulnerable and Endangered vegetation units, as much as half of their area has been transformed by mining, cultivation, urbanisation and infrastructure for industry and transportation and little has been officially conserved. The Krugersdorp and Suikerbosrand Nature Reserves are the distant but closest large conservation areas as potential sources of vertebrates (Fig. 1). In the immediate vicinity of the site, the Klip River basin to the south and adjacent Olifantsvlei Municipal Nature Reserve form the most promising neighbouring ecological systems for the source of vertebrates to support conservation on the site (Fig. 7). Most of the site is not on ecologically significant habitats, except for a few Ecological Support Areas in the south and east but most significantly the Important Area along the Klip River and other small riparian crossings (Fig. 7; GDARD 2014a & b).

With respect to the four main forms of vertebrate habitat on the site, namely terrestrial, wetland, arboreal and rupicolous, the terrestrial habitat is by far the most extensive but also the most transformed by agriculture and housing or, where patches or areas of natural habitat remain, degraded through burning and heavy grazing by communal livestock (cattle, sheep, goats) and/or localised dumping of waste, rubble and litter.

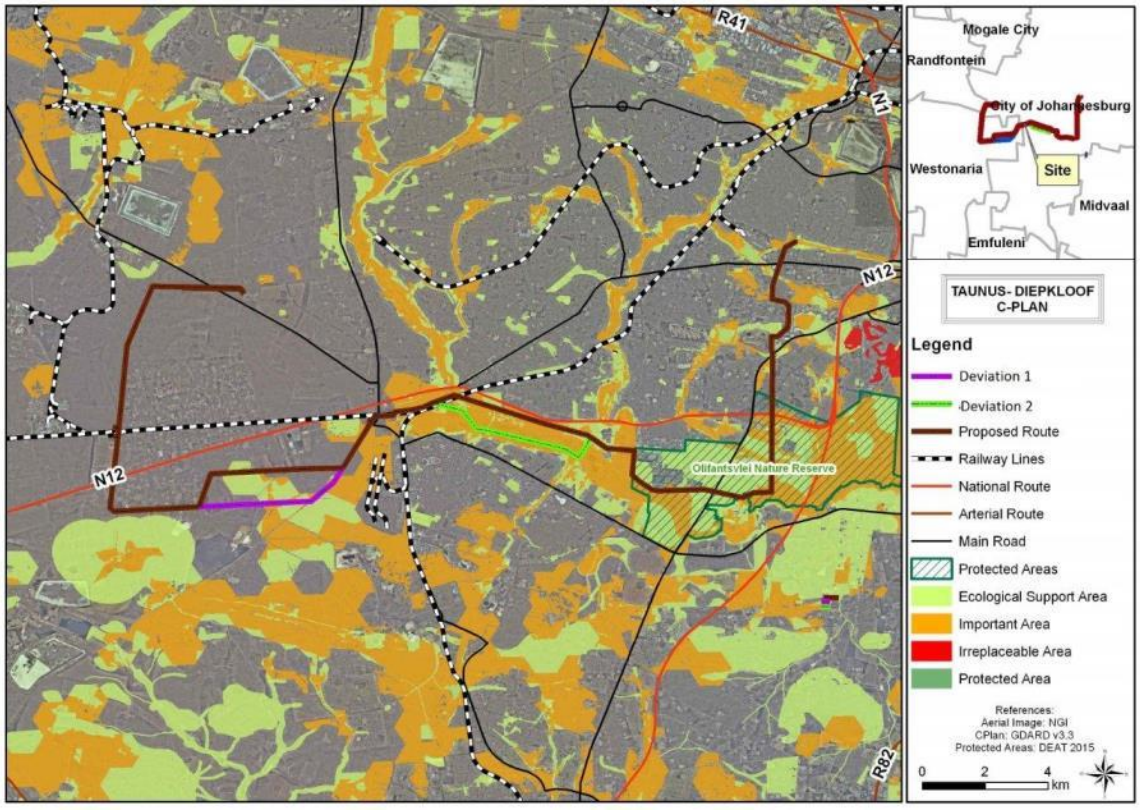


Figure 7: Ecological significance of habitats on and around the site from Gauteng's Directorate of Nature Conservation's C-Plan Version 3.3 (2014a).

Semi-natural grassland is most obvious along the southwest edge of the site, with some recovering grassland at various stages within the fallow croplands, the most recent still infested with weeds. Active termite mounds and molerat mounds are the best indicators of near-natural grasslands or the stage of recovery of fallow croplands, while the disturbed and homogenised soils of the active croplands supported notably high densities of gerbil burrows. Bankrotbos *Seriphium plumosum* was evident only in a few over-utilized areas.

The Klip River and its tributaries are prominent and significant riparian and wetland features, even between the dense housing where their drainage lines have been left largely undeveloped. The bed of the rivers where there is perennial water have been choked by tall dense beds of *Phragmites* reeds, which provide safe shelter for species that do not require open water, of which there is very little in the beds themselves although available in artificial dams and ponds in and adjacent to the rivers. Due to heavy burning and grazing pressure on any temporarily flooded alluvial plains alongside the river, most moisture-loving grasses and sedges have been all but eliminated and, in many places, replaced by lawns of alien *Pennisetum* kikuyu grass with very little indigenous coarse *Imperata* cotton grass patches remaining. Generally, development does not intrude on these flood plains, although it has occurred locally, but they are often used for illegal dumping due to their proximity to dwellings and industries.

The arboreal habitat on site is largely limited to the many varieties of alien trees introduced to gardens, farmyards and small holdings, with eucalypts the most prominent and weeping willows obvious along the rivers. Some of these trees and other plants are also scattered across the habitat where they have been dumped as garden waste or seeded by frugivorous birds. A small suite of indigenous trees remain as isolated patches on the rocky ridges within the developed part of Soweto, and some others remain or have been planted, of which sweet thorn *Vachellia karroo* is the most obvious. The whole area is crisscrossed by a variety of utility lines with their poles and pylons, and these form artificial refuges and perches for aerial species and elevated hunting posts for predators where trees were previously absent.

There is very little natural rupicolous habitat along the pylon route, almost all confined to the northeast arm of the route where the powerline ascend the basalts above the Klip River and then crosses the rocky andesite ridges within Soweto. However, there are plenty of artificial surrogates for rupicolous habitat, such as the many buildings and other cliff-like structures across the area, the dumps of rubble arising from their construction, and the scattered piles of small rocks exposed and removed during cultivation. The whole area has also been subjected to many forms of excavation, from earth, gravel and sand pits to trenches for pipelines and servitudes for roads and railways, and many of these diggings form rocky banks and/or beds. Evidence of erosion is low, probably due to the generally flat topography and elsewhere to designs and structures to control runoff, while the dense reed beds along the Klip River curb flooding and secure the substrate.

5.1 Images of the proposed powerline routes and substation sites (west to east).

Taunus to Substation 1:

Figure 8: View south of the Taunus Substation, from where the proposed new 132 kV powerline will depart to the west (right). Note the disturbed, degraded, littered, short and secondary grassland.

Figure 9: View north from the same position as Fig. 9, showing the same degraded grassland and a clump of mixed indigenous and alien trees around the ruin of an old farmhouse.

Figure 10: View west from the same position as Fig. 9 and looking along the existing powerline, south (left) of which the new line would pass. Note the expanding housing developments.

Figure 11: View west along the same existing powerline as in Fig. 11, taken across the R559 road. Note more expanding housing developments, at the corner of which is the site of the proposed new Substation 1.

Substation 1:

Figure 12: View northwest from the corner of the housing developments in Fig. 12, showing the site in front of the existing pylon where it is proposed to construct the 100 x 100-m Substation1.

Substation 1 to start of Deviation 1:

Figure 13: View south from the base of the existing pylon at the point where the proposed new powerline will turn 90^{o} to the south, to run along the western (left) side of the poles of the smaller powerline.

Figure 14: View southwest further along the west side of the poles of the same small powerline as in Fig. 14, showing the density of gerbil burrows and, further away, the dark bands of stands of tall weeds. The area was being widely used by burrow-nesting birds at the time of the site visit

Figure 15: View north from the same position as Fig. 15, showing a patch of degraded but natural primary grassland, complete with termite mounds and molerat heaps and, in the distance, two alien trees.

Figure 16: View further south than Figs. 15 & 16, where the proposed powerline will run alongside the wooded smallholdings to the east (right) and eventually enter the east side of the plantation on the horizon. In the foreground is a slight depression, surrounded by ploughed croplands but probably too wet in summer for tilling, which supports some of the best grassland along this section of the route even if heavily grazed.

Figure 17: View south of where the proposed powerline will cross the railway line (cf. Fig. 1) and then pass through the gap in the plantations of alien trees. Note another area of relatively good quality although degraded natural grassland in the foreground, although the powerline would pass over the secondary fallow grassland to the west (right) of the poles.

Figure 18: View south from just over the railway line in Fig. 18, where the proposed powerline will pass through the gap in the plantation and west (right) of the security fence, presumably replacing the rusty old existing powerline.

Figure 19: View north from where the proposed powerline would turn 90^{o} to the east, looking back over fallow croplands to where the powerline would emerge from the plantation of alien trees on the horizon. The N12 motorway passes just in front of the plantation. Note the scattered alien trees introduced into the landscape on smallholdings to the east (right).

Figure 20: View east from where the proposed powerline turns eastwards, with smallholdings to the north (left) and an opencast lime mine in the distance to the south (right). Note the highly degraded secondary fallow grassland, with a scattering of small calcrete rocks ploughed up from the dolomite below.

Preferred route/Deviation 1 start to Substation 2:

Figure 21: View west from where the proposed powerline again turns 90^{o} north (right), showing the lime mine to the south (left), the end of the smallholdings and an informal settlement to the north, and similar degraded fallow grassland on either side. Deviation 1 begins at the settlement and continues east alongside the road in the foreground.

Figure 22: View north from the same position as Fig. 22, looking down an existing powerline alongside which the proposed powerline will pass to the west (left). Note the edge of smallholdings to the west, the distant line of trees where the proposed line again turns eastwards and the degraded but natural grassland with termite mounds to the east (right). Deviation 1 will continue to the east (right).

Figure 23: View east from the same position as Fig. 23, looking in the direction that Deviation 1 would take if selected, across extensive sparse and degraded natural grassland, under the pylons in the distance and turning northeast (left) just before the trees on the near horizon and then alongside the southwest-ward extension of the R558 road.

Figure 24: View southwest (top) and east (bottom) from near the corner where the existing powerline again turns 90°, this time from north to east, alongside which the proposed powerline will also pass. Note the edge of the wooded smallholdings above and, in both images, the sparse, degraded, primary natural grassland on either side.

Figure 25: View northwest across the extensive plain of sparse and degraded natural grassland, with the preferred site for Substation 2 in the east (left) foreground and looking in the directions where the preferred powerline route would arrive from the west (right) or Deviation 1 from the south (straight ahead, alongside the trees and R558 extension).

Substation 2 preferred and 2a alternative sites:

Figure 26: Another view, eastwards, over the 100x100-m preferred site for Substation 2, a disturbed area of degraded secondary grassland alongside the railway line to the north (left) that then passes under the bridge and between the embankments over the R558 road.

Figure 27: View northeast from the opposite side of the railway in Fig. 27, looking over the site for the Substation 2a alternative, slightly further east where a few railway buildings end and a degraded vacant storage area remains between the railway (left) and the N12 motorway (at the end of the tarred side road).

Substation 2 to Preferred route/Deviation 2 end:

Figure 28: View west (top) and east (bottom), looking from just south (left) of and over where the M68 (Chris Hani Road) crosses the N12 motorway (cf. Figs. 1 & 4). The preferred powerline route arrives from alongside the railway and then the south side of the N12 (above) having crossed the Klip River as it flows in from the north. Deviation 2 starts from where the preferred route is still alongside the railway, crosses the shallow valley of the western tributary to the Klip River and then runs south of the Klip River along its alluvial plain. From this point, the preferred line continues east (bottom) alongside an existing powerline and south of the N12. Access to these sections of the powerline routes was not feasible during the site visit. Both can be seen and viewed on satellite images to cross similar degraded habitats with mainly alien trees (e.g. Fig. 4).

Deviation 2 versus Preferred route to east of the M10 motorway

Figure 29: View west from the M66 where the proposed route for Deviation2 arrives at the reed-filled Klip River and passes along its southern (left) bank on the alluvial plain. Note the degraded and littered state of the plain.

Figure 30: View west (left) and east (right) of the alluvial plain along the southern bank of the reed-filled Klip River, taken from the edge of Lenasia township about midway along the proposed route for Deviation 2. Note the sparse, burnt, cut, grazed, littered and degraded grassland, and lack of any marginal wetland vegetation, even though summer floods probably reaches these plains.

Figure 31: View west (left) and east (right) along the Klip River, taken from the embankment of the M10 motorway where the proposed route for Deviation 2 will arrive from the west (top) and then turn 90^{O} south (bottom) alongside an existing powerline. Note the solid impenetrable bed of reeds across the entire river bed.

East of M10 motorway to ascent into central Soweto:

Figure 32: View south looking down the M10 motorway and its crossing of the Klip River, with Lenasia township in the right background, taken from where the preferred powerline route will cross the M10 and Deviation 2 will re-join it from the south just to the east (left). Note the rare patch of open water among the reeds west (right) of the motorway, near where an Endangered African Marsh Harrier was seen.

Figure 33: View west (left) and east (right), taken from the same position as Fig. 33 on the M10 motorway of where the proposed powerline will cross the road, with a continuation of the transformed and/or degraded habitat infested with woody alien plants that extends along the south side of the N12 motorway passing to the north.

Figure 34: View west (left) and south (right) where the proposed powerline crosses the confluence of the Diepkloof tributary into the Klip River and then turns 90^{o} south to pass around the fence of the Nancefield Industrial Area. Note the degradation and litter around the junction, and the reed-filled beds of the river and its tributary.

Figure 35: View west (left) and east (right) from east of the R553 Golden Highway, about midway along the south section of the wall around the new Olifantsvlei Cemetery (cf. Figs. 1 & 5) The Klip river alluvial plain is immediately south of the wall.

Figure 36: View west from where the proposed powerline and the cemetery wall turn 90^{o} north (right) towards central Soweto, with the reed-filled Klip River and its degraded alluvial plain south (left) of the wall.

Figure 37: View east along the alluvial plain of the reed-filled Klip River at the point where the proposed powerline leaves the riverbank to head north into central Soweto, showing the sparse grass cover and degraded condition of the marginal wetland vegetation due to heavy grazing pressure from communal livestock.

Figure 38: View east towards the confluence of this incised northern tributary of the Klip River that drains south from Soweto, showing limited marginal vegetation, where it is inaccessible to livestock under the banks, and the grazed kikuyu 'lawns' on the alluvial plains. Willow trees occur at intervals along the banks.

Klip River to Diepkloof Substation in central Soweto:

Figure 39: View north from the bank of the northern tributary of the Klip River, showing the wide alluvial plain with the cemetery wall and preferred powerline route alongside it to the west (left) and a large earth quarry to the east (right) at the base of the ridge that rises into Soweto.

Figure 40: View south from the base of the ridge in Fig. 40, looking south over the valley of the Klip River (top), and from further north (back) to show the eastern line of the Olifantsvlei Cemetery wall and road where the proposed route will pass (bottom). Note the willow trees along the drainage line of the northern tributary with its large dams, further away the line of trees along the Klip River itself (top), and in the foreground the start of the wooded indigenous thickets where the rocky basalt ridge begins alongside the new and currently empty cemetery (bottom).

Figure 41: View north where the proposed route will ascend the rocky basalt ridge through indigenous thicket. Note the white pillar indicating the servitude for a gas pipeline that parallels the powerline route.

Figure 42: View south (top) and north (bottom) from where the gas pipeline servitude crosses the centre of a fallow, weed-filled cropland, with the indigenous woody thickets of Fig. 42 (top) reappearing to the north (bottom) beyond the N12 motorway at the base of the townships of Soweto. Note the tree-covered ridge on the near horizon where the powerline would pass and the relatively undeveloped valley up which it would ascend.

Figure 43: View south (left) and north (right) along the remains of the wooded and rocky drainage line up which the powerline would ascend.

Figure 44: View south from the top of the rocky hilltop ridge (cf. Fig. 43) at about where the powerline would ascend above the houses.

Figure 45: View north from the same hilltop as Fig. 44, looking over the intersection along the R553 Golden Highway across which the powerline would pass, with the iconic twin cooling towers near where the line will end on the horizon. Note the litter blown in from the huge landfill site to the northwest (left).

Figure 46: View of the wooded indigenous habitat that remains on the rocky hilltop opposite where Fig. 46 was taken of the Andesite Mountain Bushveld.

Figure 47: View south (top) and north (bottom) where the power line will loop to the east round the border of the extensive Rand Water property, looking over industrial areas and the bare landfill 'mountain' with the wooded hilltop alongside it to the east (top left), and (bottom) towards further industrial buildings and the twin towers near the CBD. Note the degraded and or transformed habitats.

Figure 48: View west (left) and north (right) where the powerline would come round the side of the Rand Water property, down the south side of the tarred road (top) and then turn 90^{o} north to head down into the valley alongside the existing powerlines (right). Note the degraded and littered habitats.

Figure 49: View east up the head of the valley of the northern tributary that the powerline would cross after it left the north bank of the Klip River, showing part of the open, mown servitude for several existing powerlines, some of which are visible. Note the bulrushes, sedges and alien trees along the watercourse to the north (left).

Figure 50: View into the valley of Diepkloof, the next tributary to the north, taken from the edge of transformed industrial sites looking into the wetland below with the Diepkloof Substation on the far side.

Figure 51: View south from above the Diepkloof Substation, looking back towards the wooded hilltop on the left horizon with the twin towers on the right. Note the completely transformed and degraded habitat except for the green reeds, bulrushes and grasses along the Diepkloof tributary.

6. METHODS

Three criteria were used to gauge the probability of occurrences of vertebrate species on the study site. These include known distribution ranges, habitat preferences and the qualitative and quantitative presence and extent of suitable habitats on site:

- *High* probability would be applicable to a species with a distributional range overlying the study site as well as the presence of prime habitat occurring on the study site. Another consideration for inclusion in this category is the inclination of a species to be common, i.e. normally occurring at high population densities.
- *Medium* probability pertains to a species with its distributional range peripherally overlapping the study site, or required habitat on the site being sub-optimal. The size of the site as it relates to its likelihood to sustain a viable breeding population, as well as its geographical isolation is also taken into consideration. Species categorized as *medium* normally do not occur at high population numbers, but cannot be deemed as rare.
- *Low* probability of occurrence will mean that the species' distributional range is peripheral to the study site and habitat is sub-optimal. Furthermore, some mammals categorized as *low* are generally deemed to be rare.

6.1 Field Survey

During the site visit, mammals, birds, reptiles and frogs were identified by visual sightings through random transect walks and patrolling with a vehicle. No trapping or mist netting was conducted as the terms of reference did not require such intensive work. In addition, mammals were also identified by means of spoor, droppings, burrows or roosting sites, birds by their calls, old nests, moulted feathers, spoor, droppings and food remains, and herpetofauna by their calls.

6.2 Desktop Survey

As many mammals and herpetofauna are either secretive, nocturnal, hibernators and/or seasonal, and whereas some birds are seasonal migrators, distributional ranges and the presence of suitable habitats were used to deduce the presence or absence of such species based on authoritative tomes, scientific literature, field guides, atlases and data bases. This can be done with a high level of confidence irrespective of season.

6.3 Taxon-specific Requirements

Mammals: During the visit the site was surveyed and assessed for the potential occurrence of Red Data and/or wetland-associated species such as Juliana's golden mole (*Neamblosomus juliana*), Highveld golden mole (*Amblysomus septentrionalis*), Rough-haired golden mole (*Chrysospalax villosus*), African marsh rat (*Dasymys incomtus*), Angoni vlei rat (*Otomys angoniensis*), Vlei rat (*Otomys irroratus*), White-tailed rat (*Mystromys albicaudatus*), a member of shrews such as the Forest shrew (*Myosorex varius*), Southern African hedgehog *(Atelerix frontalis), a number of bats such as the* Short-eared trident bat (*Cloeotis percivali*), African clawless otter (*Aonyx capensis*), Spotted-necked otter (*Lutra maculicollis*), Marsh mongoose (*Atilax paludinosus*), Brown hyena (*Parahyaena brunnea*), etc.

Birds: To identify Red Data species likely to occur on the site and to express an opinion regarding their probable occurrence, based on specific habitat requirements and guided by the existing lists compiled for such species within the relevant quarter-degree grid and pentad cells by regional and national bird atlases. The primary data for this assessment came from the distribution and status information collected for southern African birds during the SABAP1 atlas project, comparison with the incoming data for the on-going SABAP2 atlas project, and is therefore only as accurate and reliable as the limitations and assumptions described for those exercises (Harrison *et al*. 1997; www.sabap2.org.za; Bonnevie 2011, Retief 2013), augmented with information from earlier atlas studies of the old Transvaal (Tarboton *et al*. 1987) and Gauteng (Marais & Peacock 2008).

Herpetofauna: During the visit, the site was surveyed and assessed for the potential occurrence of South African Red Data species in Gauteng (Minter, *et al*, 2004; Alexander & Marais, 2007; Du Preez & Carruthers, 2009 & Bates, *et al*, 2014), such as: Giant Bullfrogs (*Pyxicephalus adspersus*); Coppery Grass Lizard (Chamaesaura aenea); Striped Harlequin Snake (*Homoroselaps dorsalis*); Nile Crocodile (*Crocodylus niloticus*) and Southern African Python (*Python natalensis*).

6.4 Impact Assessment Criteria

In order to quantitatively express the projected impact of a development, somewhat subjective weighted values of 0-5 are deployed, as tabulated below. This technique is a useful tool to compare impacts on locations under consideration for development. The environmental significance of a development is then calculated using the following formula, which allows the development to be assessed more objectively:

Significance (Consequence) = (Magnitude + Reversibility + Extent + Duration) X Probability.

Significance values depicting reigning environmental conditions at proposed development sites.

SIGNIFICANCE RANKING MATRIX

RANKING	MAGNITUDE	REVERSIBILITY	EXTENT	DURATION	PROBABILITY
5	Very high/ don't know	Irreversible	International	Permanent	Certain/inevitable
4	High		National	Long term (impact ceases after operational life of asset	Almost certain
3	Moderate	Reversibility with human intervention	Provincial	Medium term (6-15 years)	Can occur
2	Low		Local	Short term (0 - 5 years)	Unusual but possible
1	Minor	Completely reversible	Site bound	Immediate	Extremely remote
0	None		None		None

- The **Magnitude** of the impact: This will be quantified as either:
  - Low: Will cause a low impact on the environment;
  - Moderate: Will result in the process continuing but in a controllable manner;
  - High: Will alter processes to the extent that they temporarily cease; and
  - Very High: Will result in complete destruction and permanent cessation of processes.
- **Reversibility/ Replaceability:** The degree at which the impact can be **reversible** or **the lost resource replaced.**
- **The Extent of the impact**: This criterion expresses the spatial impact of the impact.
- **The Duration (or Exposure)**: wherein it will be indicated whether:
  - The impact will be immediate;
  - The impact will be of a short tem (Between 0-5 years);
  - The impact will be of medium term (between 5-15 years);
  - The impact will be long term (15 and more years); and
  - The impact will be permanent.
- **The Probability:** which shall describe the likelihood of impact occurring and will be rated as follows:
  - Extremely remote: Which indicates that the impact will probably not happen;
  - Unusual but Possible: Distinct possibility of occurrence;
  - Can Occur: there is a possibility of occurrence;
  - Almost Certain: Most likely to occur; and
  - Certain/ Inevitable: Impact will occur despite any preventative measures put in place.

Derived values are then translated as being in the significance range of from Very High to Minor.

RANKING	65-100	64-36	35-16	15-5	1-4
SIGNIFICANCE	Very High	High	Moderate	Low	Minor

- Very high environmental significance 65-100 points
- High environmental significance 64-36 points
- Moderate environmental significance 35-16 points
- Low environmental significance 15-5 points
- Minor environmental significance 4-1 points

Depending on the nature of the proposed development, significance rankings may be calculated Without Mitigation Measures (WOMM) and With Mitigation Measures (WMM) to illustrate the predicted effectiveness of proposed mitigation measures.

7. RESULTS

A site visit by an ornithologist and botanist was conducted on 20-21 October 2015 from 09:30-18:00 hrs and 09:00-16:00 hrs. Based on their findings, a mammalogist and herpetologist compiled their parts of this report as a desktop study.

7.1 MAMMALS

Acocks (1988), Mucina and Rutherford (2006), Low & Rebelo (1996), Knobel and Bredenkamp (2006), SANBI & DEAT (2009) in broad terms discuss the distinguishing plant assemblages of the study area. It should be acknowledged that botanical geographers have made immense strides in defining plant associations (particularly assemblages denoted as vegetation units or veld types), whereas this cannot be said of zoologists. The reason is that vertebrate distributions are not very dependent on the minutiae of plant associations *pace* the quality and quantity of cover against predation and nourishment. Rautenbach (1978 & 1982) found that mammal assemblages can at best be correlated with botanically defined biomes, such as those by Low and Rebelo (1996 & 1998), and latterly by Mucina and Rutherford (2006) as well Knobel and Bredenkamp (2006). Hence, although the former's work has been superseded by the work of the latter two, the definitions of biomes are similar and both remain valid for mammals and are therefore recognized as a reasonable determinant of mammal distribution.

The local occurrences of mammals are, on the other hand, closely dependent on broadly defined habitat types, in particular terrestrial, arboreal (tree-living), rupicolous (rock-dwelling) and wetland-associated vegetation cover. It is thus possible to deduce the presence or absence of mammal species by evaluating the habitat types within the context of global distribution ranges.

7.1.1 Mammal Habitat Assessment

The study is of a new development that will be located along the south-western areas of the Johannesburg Metropole. As such, the to-be-affected study site comprising the route and its deviations for the ESKOM power line will traverse through vegetation units (defined by Mucina and Rutherford, 2006 and detailed in Section 5) that have been either transformed or, at best, heavily disturbed.

All four of the main habitat types are recognized within the servitude and the 500-meter buffer on each side of the servitude. Terrestrial habitat in the form of grassland of the rolling Highveld plains predominates, whereas wetland/aquatic habitat occurs wherever the proposed route will be near or across the Klip River and smaller tributary drainage lines (Figs. 32, 45, 38-40 & 50-51). Rupicolous habitat offering nooks and crannies for rock-dwelling mammals is rare and poorly developed (Figs. 45-46). Arboreal habitat is represented, although it consists of scattered trees, of which a large proportion is exotic and thus also alien to local arboreal mammals (Figs. 10, 17-20, 29, 42 & 47). See Section 5 for the vegetation units having been compromised by intensive land-use practices.

The servitude (ideally with 500-meter buffers on each side) on the various routes under consideration is either entirely transformed by housing or is severely disturbed by regular fires (Fig. 9), heavy grazing (Figs. 11-14 & 25-27), crop growing (Fig. 20), dumping of rubbish (Figs. 10, 49 & 52), as well of littering (Figs. 35 & 46). No pristine terrestrial habitat (grassland) remained. Less disturbed grassland is often characterised by the presence of termitaria (Figs. 16-17), and that indeed is the condition along the proposed route and within the 500 meters of adjoining property.

The species richness and population densities of mammals are correlated to the qualitative and quantitative conservation condition of their preferred habitats. In this instance the conservation of the site (or subcomponents thereof) is rated as poor, and concomitantly mammals are limited to common species with wide ecological tolerances.

The lighter red-coloured soil (Figs. 11, 13 & 15) on the Highveld plains is of a softer texture allowing the construction of termitaria. Alluvial clay is present near the water sources.

No caves answering to the requirements of colonies of cave-dwelling bats are absent (dark, moist and secure). Smaller colonies may have invaded manmade structures

7.1.2 Observed and Expected Mammal Species Richness

The to-be-affected terrain has never been considered for nature conservation, which is fundamental to its species richness decline. Initially the district has been used for the grazing of livestock and later tilling. Gradually the pastoral landscape was transformed by urbanization. At the same time biological dynamics were increasingly compromised, such as habitat quality, dispersal opportunities and species richness. Altering the district for human interests forced mammal species richness into an irreversible spiral of decline

All charismatic mammals (like elephants, buffaloes, black wildebeests, red hartebeests, white rhinos, lions, leopards, hyenas) were the first to be extirpated for sport, later to favour cattle and sheep farming, crop growing, subsequently mining and ultimately suburbanization. Latterly, medium-sized mammals were displaced, in particular aardvark, baboons, monkeys, warthogs, bush pigs, porcupines, black-backed jackal, duiker and the ubiquitous steenbok. Reticent but widespread species such as caracal, the wild cat and aardwolf have also succumbed to encroachment by civilization, in this instance the extent and intensity of the destructive forces of housing. The presence of termitaria has been recorded since some small mammal species such as dwarf shews and pygmy mice use moribund termitaria as refuges. As a precautionary measure, these species are thus included in Table 2 as possible residents, but other Red Data species such as hedgehogs and white-tailed rats are excluded as a consequence of the poor ecological health of the site.

It is concluded that only 29 species of mammals are still part of the present-day mammal species assemblage. The occurrence of three was confirmed (Table 3).

Less discerning arboreal species (viz. woodland dormouse) and rupicolous species (viz. elephant shrews and Namaqua rock rats) have, under the precautionary principle, have been included in the list of residents (Table 2). In both instances the habitat is weakly developed, apart from being isolated beyond the scope of dispersal.

Species occurrences are more probable in areas where cover against predation and nourishment are available, and secondarily a measure of connectivity to support gene-flow via migration. As such, ecological services are substandard and patchy. Most of the species of the diversity (Table 2) along the routes under consideration are common and widespread (viz. scrub hares, multimammate mice, pygmy mice, genets, mongooses and others). In any ecosystem they are robust generalists with wide ecological tolerances. The reason for their survival success is predominantly seated in their remarkable reproduction potential (viz. multimammate mice species capable of producing ca. 12 pups per litter at intervals of three weeks), and to a lesser extent their reticent and cryptic nature (scrub hares, genets and mongooses). It should, however, be emphasized that the species diversity (species richness super-imposed on population numbers) is low as result of the constraining effect of a plethora of destructive forms of land-use, and wherever natural veld has not been transformed conservation was nevertheless not a priority. Dwarf shrews are listed since they have a penchant to take refuge in moribund termitaria, whereas the musk shrew is in fact a hardy insectivore occurring widely in grasslands, although rank and moist vegetation in riparian zones carry higher densities of its invertebrate prey.

It is likely that the seasonally luxuriant semi-aquatic vegetation along the Klip River and its may harbour herbivorous small mammals such as vlei rats and forest shrew. However, it is concluded that the presence of otters is no longer a possibility and they are hence omitted from the species list.

The listed free-tailed bat and the three vespertilionid bats showed remarkable adaptability by expanding their distributional ranges and population numbers significantly, capitalizing on the roosting opportunities offered by manmade structures on the Highveld; in this instance in the houses and sheds in the vicinity. Versper bats are more tolerant towards roost opportunities and it is more than likely that small colonies found roosts in the roofs of buildings near the study site. Free-tailed bats are likewise partial to narrow-entrance roosts provided by buildings; in some instances roost occupation could reach epidemic proportions. The study site offers no caves or suitable structures answering to the exacting roosting requirements of cave-dwelling bats (Hipposideridae, Rhinolophidae, Nycteridae), but it is likely that they have roosts elsewhere and at times commute to the site to hawk for invertebrates rising over the river and wetland area during summer sunsets. However, the likelihood of their occurrence is so remote that they are not listed as potential vagrants. The nearby open water of dubious quality suggests that insect swarming may not take place during summer sunsets, as such not forming sought-after feeding patches for hawking bats. But individual bats will undoubtedly overfly the study site in search for prey.

The species richness is very low for such an extensive area and has been in a downwards cycle for a considerable time. This comes as no surprise given the scale of environmental destruction along the proposed routes. The overall quality of conservation is ranked as abysmal. Visually, connectivity appears to be good to the south, but this ecological service is hampered by intermediate transformed areas that are ecologically sterile deserts.

Table 1: Mammal diversity. The species observed or deduced to occupy the site. (Systematics and taxonomy as proposed by Bronner et.al [2003] and Skinner and Chimimba [2005]).

	SCIENTIFIC NAME	ENGLISH NAME
?	*Elephantulus myurus*	Eastern rock elephant shrew
√	*Lepus saxatilis*	Scrub hare
√	*Cryptomys hottentotus*	African mole rat
?	*Thryonomys swinderianus*	Greater cane rat
?	*Graphiurus murinus*	Woodland dormouse
*	*Rhabdomys pumilio*	Four-striped grass mouse
*	*Mus minutoides*	Pygmy mouse
*	*Mastomys natalensis*	Natal multimammate mouse
*	*Mastomys coucha*	Southern multimammate mouse
*	*Aethomys ineptus*	Tete veld rat
?	*Aethomys namaquensis*	Namaqua rock mouse
?	*Otomys angoniensis*	Angoni vlei rat
?	*Otomys irroratus*	Vlei rat
√	*Gerbilliscus brantsii*	Highveld gerbil
?	*Dendromus melanotis*	Grey pygmy climbing mouse
?	*Dendromus mesomelas*	Brants' climbing mouse
?	*Dendromus mystacalis*	Chestnut climbing mouse
DD	*Myosorex varius*	Forest shrew
DD*	*Suncus lixus*	Greater dwarf shrew
DD*	*Suncus infinitesimus*	Least dwarf shrew
DD*	*Crocidura cyanea*	Reddish-grey musk shrew
*	*Tadarida aegyptiaca*	Egyptian free-tailed bat
*	*Neoromicia capensis*	Cape serotine bat
*	*Scotophilus dinganii*	African yellow house bat
*	*Scotophilus viridis*	Greenish yellow house bat
*	*Genetta genetta*	Small-spotted genet
*	*Genetta tigrina*	SA large-spotted genet
√	*Cynictis penicillata*	Yellow mongoose
*	*Galerella sanguinea*	Slender mongoose

√ Definitely present or have a *high* probability to occur;

***** *Medium* probability to occur based on ecological and distributional parameters;

? *Low* probability to occur based on ecological and distributional parameters.

Red Data species rankings as defined in Friedmann and Daly's S.A. Red Data Book / IUCN (World Conservation Union) (2004) are indicated in the first column: CR= Critically Endangered, En = Endangered, Vu = Vulnerable, LR/cd = Lower risk conservation dependent, LR/nt = Lower Risk near threatened, DD = Data Deficient. All other species are deemed of Least Concern.

Table 2: Mammal species positively confirmed from the study site, observed indicators and habitat.

SCIENTIFIC NAME	ENGLISH NAME	OBSERVATION INDICATOR	HABITAT
L. saxatilis	Scrub hare	Faecal pellets	Short grass
C. hottentotus	African mole rat	Tunnel systems	Universal
G. brantsii	Highveld gerbil	Burrows	Soft sand

Scrub hares, rodent moles and Highveld gerbils are widespread and common. Thanks to their particular lifestyles, they are often found in proximity of human habitation or activities such as cultivation. Hares escape attention by their nocturnal lifestyle and reticent behaviour by day when they lay up in forms. Rodent moles have a permanent subterranean lifestyle, whereas gerbils spend the day underground and forage at night.

7.1.3 Red Listed Mammal Species Identified:

-By the Scientific Community

The three shrew species cited as 'DD' in Table 2 are not necessarily endangered. These small mammals have not been adequately studied to provide quantitative field data for accurately assigning a conservation ranking. As a precaution, they are thus considered as 'Data Deficient'. Shrews exist at the apex of the food pyramid, which means that their population numbers are inevitably significantly lower than that of similar-sized herbivorous mammals and especially of their smaller prey species. Because of the diet of these ferocious little insectivores, they are furthermore not readily trapped with conventional bait or traps, which may mean that their numbers are under-estimated. Good capture results obtained with drift fences and pitfalls support the latter statement.

No other Red Data or sensitive species are deemed present on the site, either since the site is too disturbed, falls outside the distributional ranges of some species, or does not offer suitable habitat(s).

-By the Biodiversity Act No 10 of 2004

Nil.

- Mpumalanga Nature Conservation closely follows Friedman and Daly (1998)

Nil.

7.2 BIRDS

7.2.1 Bird Habitat Assessment

The habitats at the site, as identified for bird community distributions, occur within the Mixed Grassland biome (Allan *et al*. in Harrison *et al*. 1997) and more specifically the

drier Carltonville Dolomite Grassland (Gh 15) and the moister Tsakane Clay Grassland (Gm 9) and Soweto Highveld Grassland (Gm 8) vegetation units of the Dry and Mesic Highveld Grassland, with only small intrusion Andesite Mountain Bushveld (SVcb 11) of the Central Bushveld (Mucina *&* Rutherford 2006).

The aerial mobility of birds also demands attention to the principal habitats surrounding the study site and their conservation status, not just those along the immediate borders but also more distant habitats that might provide sources for species visiting the site and sinks for those breeding on site. In this context, any patches of natural grassland, wetland and open water surrounding the site will offer an important mosaic of connections to the site, especially the on-site Olifantsvlei Municipal Nature Reserve and the more distant Krugersdorp Game Reserve, with the Magaliesberg, Suikerbosrand and Blesbokspruit (Important Bird Areas (IBAs) SA025, SA0022 & SA0021) of more distant importance.

The broader habitats adjacent to the study site are mainly extensions of those present on site, or mentioned specifically in the habitat types described below. Generally, I did not assign aerial-feeding species, such as swifts, martins and swallows, to a specific habitat on site, except for those habitats that offered potential nesting habitats, since they feed wherever aerial wind-borne 'plankton' is available. Four principal habitat types distinguished were distinguished on and/or adjacent to the site, and considered most relevant to bird ecology and community structure.

1) **Natural Grass- and Croplands (Figs. 9-18, 20-27, 29, 43, 47-49).** This habitat, however much degraded, was most similar to what was the predominant habitat before development, open, flat and with low vegetation cover, and so whatever can be preserved has some conservation value. Croplands are included here with grassland as so much of the area appears to be fallow, with grasses and herbs recolonizing although also many weeds. The presence of termite mounds, rodent burrows and molerat mounds, signs of better quality grasslands, attest to the potential of some areas for recovery. In many other areas grassland of a type is only present as small patches among other habitats, especially between transformed and derelict infrastructure although here too often infested with herbaceous weeds.
2) **Drainage Lines and Wetlands (Figs. 30-33, 35-40, 50-51).** The major natural drainage feature was the wide shallow valley of the Klip River along the southern border of the site, with lesser links along at least three tributaries entering from the north. Various dams had been constructed in or near these drainage lines, small ones along the tributaries but larger ones along the lower Klip River. While the dams provided open water bodies, the Klip River and its confluences were so choked with tall stands of reeds that little open water was observed. The alluvial plains of the Klip River were wide and probably flood in summer, but they had been so heavily grazed as to be virtually devoid of wetland plants and so are probably of poor wetland quality.
3) **Rocky Bushveld (Figs. 42, 44-45, 49, 52).** The extent of this habitat is small and the quality poor, but there are enough indigenous trees present to create sufficient cover and food for some bushveld species. The habitat probably was extensive on the eastern ridges and hills north of the Klip River, but much of this

is now transformed by the housing and business development of central Soweto. The best habitat remains on the hilltop along the route, with fragments in varying condition along the drainage lines lower down.

4) **Transformed habitats and structures (Figs. 10-12, 19-23, 25, 28-29, 34, 40, 43-49, 52).** This classification specifically excludes land transformed for cultivation, included with grassland in 1) above due to its approximation to that habitat when fallow and/or growing drops. Transformation here refers to habitat removed for roads, railway lines, landfills or residential and commercial buildings, many of which feature especially in the eastern sector of the site. Structures within these transformations, such as culverts, bridges, eaves and cliff-like excavations or buildings, offer particular safe and secluded sites to various bird species, while the vegetation around them is often artificially watered or weedy and is in itself attractive.

Table 3: Rating of recognised on-site avian habitats (site + 500 m buffer) on and around the proposed new Taunus-Diepkloof powerline and substations around Soweto, Gauteng Province (2627BB, BC, BD).

Avian Habitats	Conservation Priority					Sensitivity	
	High	Medium -high	Medium	Medium -low	Low	High	Low
1. Grassland					X		X
2. Transformed					X		X
3. Drainage Lines & Wetlands				X			X

7.2.2 Observed and Expected Bird Species Richness

For the national bird atlas projects, the site falls within three of SABAP1's quarter-degree grid cells (QDGCs), namely 2627BB (Roodepoort), BC (Westonaria) and BD (Grasmere), and in seven of SABAP2's pentads 2610_2755, 2615_2740, 2615_2745, 2615_2750, 2615_2755, 2620_2740 and 2620_2745 (Harrison et al. 1997, www.sabap2.org.za). Out of the 350+-323+ bird species recorded respectively during the SABAP2 and SABAP1 national bird atlas projects for these three QDGCs, only 242 are expected to occur on and around the study site in its present form (Table 4). Of these, 144 (60%) species are expected to have a high probability of occurrence, with 64 (26%) a medium probability and only 34 (14%) a low probability, which indicates the variety of the habitats even if their quality is mediocre. Of those expected, 64 (26%) species were reported during the site visit (all of high probability).

The four different habitat types that I distinguished are expected to support somewhat different species of birds (Table 4). Thirteen generalist species (5%) are expected to use all four habitat types, augmented by the 18 species (7%) classed as aerial feeders and expected to range across all habitats when feeding for a generalist total of 31 (13%) species, while of the remainder only 12 species (5%) are expected to prefer three habitat types, 50 species (21%) two habitat types, but a significant majority of 144 species (60%) only a single habitat type. Based on this total of 416 assessments of predicted habitat preference, the riparian and wetland habitats of the Klip River system were potentially the richest and most distinctive habitat, predicted to be used by 151

(36%) of the expected species, compared to 96 (23%) and 92 (22%) for the transformed and grass-/cropland habitats respectively, and 76 (18%) for the limited rocky bushveld habitats. The 18 aerial-feeding species are included within the above analysis, not only for all the habitats they range across when feeding, but also if there are terrestrial habitats that some might use for breeding. Apart from the well-developed Klip River and associated wetlands, all other habitats were expected to be utilised by similar numbers of species, their somewhat different characteristics and extents determining which ones are chosen, with overlap of the grass-/cropland species into the adjacent transformed habitats that add the more three-dimensional arboreal and quasi-rupicolous habitats, together with the separate suites of species they attract. The drainage lines and wetlands habitats would then support over a third of the expected species, a notably greater proportion than their relative extent, while the degraded drier grasslands and the transformed habitats they surround would each support less than a quarter of the species and the rocky bushveld even less than that.

Table 4: Bird species diversity observed and expected on and around the proposed new Taunus-Diepkloof powerline and substations around Soweto, Gauteng Province (2627BB, BC, BD). Based on the national list and annotations of Birdlife South Africa (2014), sorted in the order of 'Roberts VII' (Hockey *et al*. 2005), with probability of occurrence and habitat preferences assessed after a site visit on 9 June 2015 and comparison with lists from SABAP 1 & 2 (Harrison *et al*., 1997; www.sabap2.org). Species in bold font were detected on the site visit.

Common English Name	Scientific Name	Status Codes (see below)			Probability of occurrence (see 5.4 above)			Preferred Habitats (see 6.2 above)
		RD	S	E	High	Medium	Low	
Orange River francolin	***Scleroptila levaillantoides***				**H**			**1**
Swainson's Spurfowl	***Pternistis swainsonii***				**H**			**1**
Common Quail	*Coturnix coturnix*		**NBM**				L	1
Helmeted Guineafowl	***Numida meleagris***				**H**			**1**
White-faced Duck	*Dendrocygna viduata*					M		2
Egyptian Goose	*Alopochen aegyptiaca*				H			2
Spur-winged Goose	*Plectropterus gambensis*				H			2
African Black Duck	*Anas sparsa*				H			2
Yellow-billed Duck	*Anas undulata*				H			2
Cape Shoveler	*Anas smithii*						L	2
Red-billed Teal	*Anas erythrorhyncha*					M		2
Southern Pochard	*Netta erythrophthalma*					M		2

Kurrichane Buttonquail	*Turnix sylvaticus*				H			1
Greater Honeyguide	***Indicator indicator***				**H**			**4**
Lesser Honeyguide	*Indicator minor*				H			4
Brown-backed Honeybird	*Prodotiscus regulus*					M		2,4
Red-throated Wryneck	*Jynx ruficollis*				H			1,4
Cardinal Woodpecker	*Dendropicos fuscescens*					M		3
Acacia Pied Barbet	*Tricholaema leucomelas*					M		3
Black-collared Barbet	*Lybius torquatus*				H			3,4
Crested Barbet	***Trachyphonus vaillantii***				**H**			**3,4**
African Grey Hornbill	*Tockus nasutus*						L	3,4
African Hoopoe	***Upupa africana***				**H**			**1,3,4**
Green Wood-hoopoe	***Phoeniculus purpureus***				**H**			**3,4**
Malachite Kingfisher	*Alcedo cristata*				H			2
Brown-hooded Kingfisher	*Halcyon albiventris*					M		3,4
Giant Kingfisher	*Megaceryle maxima*				H			2
Pied Kingfisher	*Ceryle rudis*				H			2
White-fronted Bee-eater	*Merops bullockoides*				H			2,3
European Bee-eater	*Merops apiaster*		**B/NB M**		H			1,2,3,4
White-backed Mousebird	*Colius colius*						L	4
Speckled Mousebird	*Colius striatus*					M		3,4
Red-faced Mousebird	***Urocolius indicus***				**H**			**3,4**
Jacobin Cuckoo	*Clamator jacobinus*		**BM**			M		4
Red-chested Cuckoo	*Cuculus solitarius*		**BM**		H			3,4
Diderick Cuckoo	*Chrysococcyx caprius*		**BM**		H			1,2,3,4
Burchell's Coucal	*Centropus burchellii*				H			2
African Palm-Swift	*Cypsiurus parvus*				H			Aerial
Alpine Swift	*Tachymarptis melba*		**BM**		H			Aerial
African Black Swift	*Apus barbatus*				H			Aerial
Little Swift	*Apus affinis*				H			Aerial,4
Horus Swift	*Apus horus*					M		Aerial,3

White-rumped Swift	*Apus caffer*		**BM**		H			Aerial,4
Barn Owl	*Tyto alba*				H			1,2,3,4
African Grass-Owl	*Tyto capensis*	**VU,LC**					L	2
Spotted Eagle-Owl	*Bubo africanus*				H			1,2,3,4
Marsh Owl	*Asio capensis*					M		2
Fiery-necked Nightjar	*Caprimulgus pectoralis*					M		1,2,3
Rufous-cheeked Nightjar	*Caprimulgus rufigena*		**BM**			M		1,2,3
Rock Dove	***Columba livia***				**H**			**4**
Speckled Pigeon	***Columba guinea***				**H**			**1,4**
Laughing Dove	***Streptopelia senegalensis***				**H**			**1,2,3,4**
Cape Turtle-Dove	***Streptopelia capicola***				**H**			**1,2,3**
Red-eyed Dove	***Streptopelia semitorquata***				**H**			**1,2,4**
Namaqua Dove	*Oena capensis*				H			1
African Green-Pigeon	*Treron calvus*					M		4
Northern Black Korhaan	***Afrotis afraoides***				**H**			**1**
White-bellied Korhaan	*Eupodotis senegalensis*	**VU,LC**					L	1
Blue Crane	*Anthropoides paradiseus*	**NT,VU**					L	1,2
Red-chested Flufftail	*Sarothrura rufa*				H			2
African Rail	*Rallus caerulescens*				H			2
African Crake	*Crecopsis egregia*		**BM**		H			2
Black Crake	***Amaurornis flavirostra***				**H**			**2**
Baillon's Crake	*Porzana pusilla*					M		2
African Purple Swamphen	*Porphyrio madagascariensis*					M		2
Common Moorhen	***Gallinula chloropus***				**H**			**2**
Red-knobbed coot	*Fulica cristata*					M		2
African Snipe	*Gallinago nigripennis*				H			2
Marsh Sandpiper	*Tringa stagnatilis*		**NBM**		H			2
Common Greenshank	*Tringa nebularia*		**NBM**		H			2
Wood Sandpiper	*Tringa glareola*		**NBM**		H			2
Common Sandpiper	*Actitis hypoleucos*		**NBM**		H			2

Little Stint	*Calidris minuta*		**NB**		H			2
Ruff	*Philomachus pugnax*		**NBM**		H			2
Greater Painted-snipe	*Rostratula benghalensis*	**VU,NT**					L	2
Spotted Thick-knee	***Burhinus capensis***				**H**			**1,2,3,4**
Black-winged Stilt	*Himantopus himantopus*					M		2
Pied Avocet	*Recurvirostra avosetta*					M		2
Kittlitz's Plover	*Charadrius pecuarius*				H			2
Three-banded Plover	*Charadrius tricollaris*				H			2
Blacksmith Lapwing	***Vanellus armatus***				**H**			**2**
African Wattled Lapwing	***Vanellus senegallus***				**H**			**2**
Crowned Lapwing	***Vanellus coronatus***				**H**			**1**
Temminck's Courser	*Cursorius temminckii*					M		1
Black-winged Pratincole	*Glareola nordmanni*	**NT,NT**	**NBM**				L	Aerial
Grey-headed Gull	*Chroicocephalus cirrocephalus*				H			2
Caspian Tern	*Sterna caspia*	**VU,LC**					L	2
Whiskered Tern	*Chlidonias hybrida*					M		2
White-winged Tern	*Chlidonias leucopterus*		**NBM**			M		2
Black-shouldered Kite	***Elanus caeruleus***				**H**			**1,2,3,4**
Yellow-billed Kite	*Milvus aegyptius*		**BM**			M		1,2
African Fish-Eagle	*Haliaeetus vocifer*						L	2
Cape Vulture	*Gyps coprotheres*	**EN,VU**					L	1,2
Black-chested Snake-Eagle	*Circaetus pectoralis*					M		1
African Marsh-Harrier	***Circus ranivorus***	**EN,LC**			**H**			**2**
Black Harrier	*Circus maurus*	**EN,VU**		**(*)**			L	1
Pallid Harrier	*Circus macrourus*	**NT,NT**	**NBM**				L	1,2
Little Sparrowhawk	*Accipiter minullus*						L	4
Ovambo Sparrowhawk	*Accipiter ovampensis*					M		4
Black Sparrowhawk	*Accipiter melanoleucus*					M		4
Steppe Buzzard	*Buteo buteo*		**NBM**		H			1,2
Jackal Buzzard	*Buteo rufofuscus*			**(*)**		M		2,3

Verreauxs' Eagle	*Aquila verreauxii*	VU,LC					L	3
Martial Eagle	*Polemaetus bellicosus*	EN,VU					L	1,2
Long-crested Eagle	*Lophaetus occipitalis*					M		2
Secretarybird	*Sagittarius serpentarius*	VU,VU				M		1
Lesser Kestrel	*Falco naumanni*		NBM		H			1
Rock Kestrel	*Falco rupicolus*					M		1,3
Greater Kestrel	*Falco rupicoloides*					M		1
Amur Falcon	*Falco amurensis*		NBM		H			1
Lanner Falcon	*Falco biarmicus*	VU,LC			H			1,2,3,4
Little Grebe	*Tachybaptus ruficollis*				H			2
African Darter	*Anhinga rufa*					M		2
Reed Cormorant	***Phalacrocorax africanus***				**H**			**2**
White-breasted Cormorant	***Phalacrocorax lucidus***				**H**			**2**
Black Heron	*Egretta ardesiaca*					M		2
Little Egret	*Egretta garzetta*				H			2
Yellow-billed Egret	*Egretta intermedia*				H			2
Great Egret	*Egretta alba*					M		2
Grey Heron	***Ardea cinerea***				**H**			**2**
Black-headed Heron	*Ardea melanocephala*				H			2
Goliath Heron	*Ardea goliath*						L	2
Purple Heron	*Ardea purpurea*				H			2
Cattle Egret	***Bubulcus ibis***				**H**			**1,2**
Squacco Heron	*Ardeola ralloides*					M		2
Green-backed Heron	*Butorides striata*					M		2
Black-crowned Night-Heron	*Nycticorax nycticorax*					M		2
Little Bittern	*Ixobrychus minutus*				H			2
Hamerkop	*Scopus umbretta*					M		2,4
Greater Flamingo	*Phoenicopterus roseus*	NT,LC					L	2
Lesser Flamingo	*Phoeniconaias minor*	NT,NT					L	2
Glossy Ibis	***Plegadis falcinellus***				**H**			**2**

Hadeda Ibis	***Bostrychia hagedash***				**H**			**2,4**
African Sacred Ibis	***Threskiornis aethiopicus***				**H**			**2,4**
African Spoonbill	*Platalea alba*					M		2
Pink-backed Pelican	*Pelecanus rufescens*	**VU,LC**					L	2
Yellow-billed Stork	*Mycteria ibis*	**EN,LC**					L	2
Abdim's Stork	*Ciconia abdimii*	**NT,LC**	**NBM**			M		1,2
White Stork	*Ciconia ciconia*		**NBM**		H			1,2
Black-headed Oriole	*Oriolus larvatus*						L	4
Fork-tailed Drongo	*Dicrurus adsimilis*						L	4
African Paradise-Flycatcher	*Terpsiphone viridis*						L	4
Brown-crowned Tchagra	*Tchagra australis*						L	4
Southern Boubou	*Laniarius ferrugineus*					M		2,3,4
Bokmakierie	***Telophorus zeylonus***				**H**			**1,2**
Pied crow	***Corvus albus***				**H**			**1,2,3,4**
Red-backed Shrike	*Lanius collurio*		**NBM**		H			1,2
Lesser Grey Shrike	*Lanius minor*		**NBM**			M		1
Common Fiscal	***Lanius collaris***				**H**			**1,2,3,4**
Brown-throated Martin	***Riparia paludicola***				**H**			Aerial**,2**
Banded Martin	***Riparia cincta***				**H**			Aerial**,1**
Barn Swallow	***Hirundo rustica***		**NBM**		**H**			Aerial
White-throated Swallow	***Hirundo albigularis***		**BM**		**H**			Aerial,2
Pearl-breasted Swallow	*Hirundo dimidiata*				H			Aerial,1
Greater Striped Swallow	***Cecropis cucullata***		**BM**		**H**			Aerial,4
Lesser Striped Swallow	*Cecropis abyssinica*		**BM**			M		Aerial,4
Red-breasted Swallow	*Cecropis semirufa*				H			Aerial,4
South African cliff-Swallow	*Petrochelidon spilodera*			**B(*)**	H			Aerial,4
Rock Martin	*Hirundo fuligula*					M		Aerial,4
Common House-Martin	*Delichon urbicum*		**NBM**			M		Aerial
Dark-capped Bulbul	*Pycnonotus tricolor*				H			3,4

Fairy Flycatcher	*Stenostira scita*			**(*)**	H			3
Little Rush-Warbler	*Bradypterus baboecala*				H			2
Sedge Warbler	*Acrocephalus schoenobaenus*		**NBM**			M		2
African Reed-Warbler	*Acrocephalus baeticatus*		**BM**		H			2
Great Reed-Warbler	*Acrocephalus arundinaceus*		**NBM**		H			2
Lesser Swamp-Warbler	***Acrocephalus gracilirostris***				**H**			**2**
Icterine Warbler	*Hippolais icterina*		**NBM**			M		4
Willow Warbler	*Phylloscopus trochilus*		**NBM**		H			4
Chestnut-vented Tit-Babbler	*Sylvia subcaerulea*						L	3
Garden Warbler	*Sylvia borin*		**NBM**			M		4
Cape White-eye	*Zosterops capensis*			**(*)**	H			2,3,4
Levaillant's Cisticola	***Cisticola tinniens***				**H**			**2**
Neddicky	***Cisticola fulvicapilla***				**H**			**2,3**
Zitting Cisticola	***Cisticola juncidis***				**H**			**1**
Desert Cisticola	***Cisticola aridulus***				**H**			**1**
Cloud Cisticola	*Cisticola textrix*			**(*)**	H			1
Wing-snapping Cisticola	***Cisticola ayresii***				**H**			**1**
Tawny-flanked Prinia	***Prinia subflava***				**H**			**2**
Black-chested Prinia	***Prinia flavicans***				**H**			**1,3,4**
Bar-throated Apalis	*Apalis thoracica*					M		3
Melodious Lark	*Mirafra cheniana*	**LC,NT**		**(*)**		M		1
Rufous-naped Lark	***Mirafra africana***				**H**			**1,2**
Eastern clapper Lark	*Mirafra fasciolata*					M		1
Spike-heeled Lark	*Chersomanes albofasciata*				H			1
Eastern Long-billed Lark	*Certhilauda semitorquata*			**(*)**			L	3
Chestnut-backed Sparrowlark	*Eremopterix leucotis*				H			1
Red-capped Lark	*Calandrella cinerea*				H			1
Pink-billed Lark	*Spizocorys conirostris*					M		1
Cape Rock-Thrush	*Monticola rupestris*			**(*)**			L	3
Sentinel Rock-Thrush	*Monticola explorator*			**(*)**			L	3

Groundscraper Thrush	*Psophocichla litsitsirupa*						L	4
Karoo Thrush	*Turdus smithi*			**(*)**		M		4
Fiscal Flycatcher	*Sigelus silens*			**(*)**	H			3,4
Spotted flycatcher	*Muscicapa striata*		**NBM**		H			2,3,4
Cape Robin-Chat	***Cossypha caffra***				**H**			**3,4**
African StoneChat	***Saxicola torquatus***				**H**			**2**
Mountain Wheatear	***Oenanthe monticola***				**H**			**3,4**
Capped Wheatear	***Oenanthe pileata***				**H**			**1**
Familiar Chat	*Cercomela familiaris*				H			2,3,4
Ant-eating Chat	***Myrmecocichla formicivora***				**H**			**1**
Mocking cliff-Chat	*Thamnolaea cinnamomeiventris*					M		3,4
Red-winged Starling	*Onychognathus morio*					M		3,4
Cape Glossy Starling	*Lamprotornis nitens*					M		3,4
Pied Starling	***Lamprotornis bicolor***			**(*)**	**H**			**1,4**
Wattled Starling	*Creatophora cinerea*				H			1,2
Common Myna	***Acridotheres tristis***		**I**		**H**			**1,2,3,4**
Amethyst Sunbird	*Chalcomitra amethystina*						L	3,4
White-bellied Sunbird	*Cinnyris talatala*					M		2,3,4
White-browed Sparrow-Weaver	***Plocepasser mahali***				**H**			**4**
Cape Weaver	*Ploceus capensis*			**(*)**		M		2
Southern Masked-Weaver	***Ploceus velatus***				**H**			**1,2,3,4**
Red-billed Quelea	***Quelea quelea***				**H**			**1,2**
Yellow-crowned Bishop	***Euplectes afer***				**H**			**2**
Southern Red Bishop	***Euplectes orix***				**H**			**1,2**
White-winged Widowbird	*Euplectes albonotatus*				H			1,2
Red-collared Widowbird	*Euplectes ardens*					M		2
Long-tailed Widowbird	***Euplectes progne***				**H**			**1,2**
Thick-billed Weaver	*Amblyospiza albifrons*					M		2
Orange-breasted Waxbill	*Amandava subflava*				H			2

African Quailfinch	*Ortygospiza fuscocrissa*				H			1
Red-headed Finch	*Amadina erythrocephala*				H			3,4
Common Waxbill	*Estrilda astrild*				H			2,4
Bronze Mannikin	*Spermestes cucullata*					M		2,4
Pin-tailed Whydah	***Vidua macroura***				**H**			**1,2,3,4**
Cuckoo Finch	*Anomalospiza imberbis*					M		1
House Sparrow	***Passer domesticus***		**I**		**H**			**4**
Cape Sparrow	***Passer melanurus***				**H**			**3,4**
Southern Grey-headed Sparrow	*Passer diffusus*				H			4
Cape Wagtail	*Motacilla capensis*				H			2
Cape Longclaw	***Macronyx capensis***				**H**			**1,2**
African Pipit	***Anthus cinnamomeus***				**H**			**1,2**
Plain-backed Pipit	*Anthus leucophrys*				H			1,2
Buffy Pipit	*Anthus vaalensis*					M		1
Long-billed Pipit	*Anthus similis*						L	3
Yellow-fronted Canary	*Crithagra mozambica*					M		3,4
Black-throated Canary	*Crithagra atrogularis*				H			1,2,3
Yellow Canary	*Crithagra flaviventris*						L	1
Streaky-headed Seedeater	*Crithagra gularis*				H			3,4
Cinnamon-breasted Bunting	*Emberiza tahapisi*				H			3

Red Status	Status in south Africa (S)	Endemism in South Africa (E)
NA = Not Assessed	BM = breeding migrant	Endemism in South Africa (E) (not southern Africa as in field guides)
LC = Least Concern	NBM = non-breeding migrant	
NT = Near-Threatened	V = vagrant	* = endemic
VU = Vulnerable	I = introduced	
EN = Endangered	R = rare	(*) = near endemic (i.e. ~70% or more of population in RSA)
CR = Critically Endangered	PRB = probable rare breeder	B* = breeding endemic
EX = Extinct Regionally	RB = rare breeder	B(*) = breeding near endemic

NR = Not Recognised	RV = rare visitor	W* = winter endemic
Red Status is from *The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland,* Taylor (2015).		

7.2.3 Threatened and Red-Listed Bird Species

-By the Scientific Community

Based on the most recent assessment of the threatened status of South Africa's avifauna (Taylor 2015), a total of 20 Red Data avifaunal species are expected possibly to use the site and its surroundings given the habitats available (Table 2). During the period of the ongoing Southern African bird atlas project started in 2007 (SABAP2; www.adu.org.za), only six of these species (White-bellied Korhaan, African Marsh Harrier, Verreauxs' Eagle, Greater Flamingo, Secretarybird and Melodious Lark) have already been reported for 1-4 of the pentads on which the site falls, although another 5 have not yet been found within the 2627BB, BC & BD QDGCs that surround the site, despite being recorded there up to 1992 by SABAP 1 (except for Pallid Harrier and Caspian Tern included only on the Precautionary Principle).

Most of these threatened species fall into a few obvious categories by habitat preference (Table 5) and their likelihood of occurrence on site (Table 6); especially once one appreciates what habitats are useful and available to them on site (Table 7).

Table 5: List of threatened species that will possibly make use of the habitats on and around the proposed new Taunus-Diepkloof powerline and substations around Soweto, Gauteng Province (2627BB, BC, BD). Note one species may have more than one habitat preference. [1+2] indicates species reported previously for site's grid cell(s) in SABAP1 up to 1992 and/or SABAP2 from 2007.

Threatened Status	Species	Preferred Habitat Type(s)			
		Klip River system	Grass- and cropland	Rocky ridges	Transformed
Least Concern	1+2 Melodious Lark		X		
Near Threatened	1+2 Blue Crane	X	X		
	1 Black-winged Pratincole	X	X		
	Pallid Harrier		X		
	1+2 Greater Flamingo	X			
	1+2 Lesser Flamingo	X			
	1+2 Abdim's Stork	X	X		
Vulnerable	1+2 African Grass-Owl	X			
	1+2 White-bellied Korhaan		X		
	1 Greater Painted-Snipe	X			
	Caspian Tern	X			
	1+2 Verreauxs' Eagle			X	
	1+2 Secretarybird	X	X		
	1+2 Lanner Falcon	X	X	X	X

	1	Pink-backed Pelican	X			
Endangered	1	Cape Vulture		X		
	1+2	African Marsh Harrier	X	X		
	1	Black Harrier		X		
	1	Martial Eagle	X	X		
	1+2	Yellow-billed Stork	X			
TOTALS	**20**		**14**	**12**	**2**	**1**

Table 6: The expected frequency of occurrence of threatened bird species on and around the proposed new Taunus-Diepkloof powerline and substations around Soweto, Gauteng Province (2627BB, BC, BD), based on the quantity and quality of habitats available. [1+2] indicates species reported previously for site's grid cell(s) in SABAP1 up to 1992 and/or SABAP2 from 2007.

Threatened Status	Species		Expected frequency of occurrence on site			
			Regular resident	Frequent visitor	Erratic visitor	Infrequent vagrant
Least Concern	1+2	Melodious Lark			X	
Near Threatened	1+2	Blue Crane				X
	1	Black-winged Pratincole				X
		Pallid Harrier				X
	1+2	Greater Flamingo				X
	1+2	Lesser Flamingo				X
	1+2	Abdim's Stork			X	
Vulnerable	1+2	African Grass-Owl		X		
	1+2	White-bellied Korhaan			X	
	1	Greater Painted-Snipe				X
		Caspian Tern				X
	1+2	Verreauxs' Eagle			X	
	1+2	Secretarybird		X		
	1+2	Lanner Falcon			X	
	1	Pink-backed Pelican				X
Endangered	1	Cape Vulture				X
	1+2	African Marsh Harrier	X			
	1	Black Harrier				X
	1	Martial Eagle				X
	1+2	Yellow-billed Stork				X
TOTALS	**20**		**1**	**2**	**5**	**12**

Table 7: Estimated suitability of favoured habitats to support requirements of threatened bird species on and around the proposed new Taunus-Diepkloof powerline and substations around Soweto, Gauteng Province (2627BB, BC, BD), based on the quantity and quality of habitats available and assessed as Good (G), Mediocre (M), Poor (P), Absent (A) or Not Applicable (NA). [1+2] indicates species reported previously for site's grid cell(s) in SABAP1 up to 1992 and/or SABAP2 from 2007.

Threatened Status	Species	Potential support for:

		Movement	Feeding	Roosting	Breeding
Least Concern	1+2 Melodious Lark	M	P	P	P
Near Threatened	1+2 Blue Crane	M	P	P	P
	1 Black-winged Pratincole	P	P	A	NA
	Pallid Harrier	P	P	P	NA
	1+2 Greater Flamingo	P	P	P	NA
	1+2 Lesser Flamingo	P	P	P	NA
	1+2 Abdim's Stork	M	P	M	NA
Vulnerable	1+2 African Grass-Owl	M	P	P	NA
	1+2 White-bellied Korhaan	P	P	P	P
	1 Greater Painted-Snipe	P	M	P	P
	Caspian Tern	P	P	P	A
	1+2 Verreauxs' Eagle	P	P	A	A
	1+2 Secretarybird	M	M	P	P
	1+2 Lanner Falcon	M	M	M	P
	1 Pink-backed Pelican	P	P	P	A
Endangered	1 Cape Vulture	P	P	A	A
	1+2 African Marsh Harrier	G	M	G	G
	1 Black Harrier	P	P	P	A
	1 Martial Eagle	P	P	P	P
	1+2 Yellow-billed Stork	P	P	P	A
TOTALS	**20**	**G1;M6;P10**	**M4;P16**	**G1;M2;P14;A3**	**G1;P7;A6;NA6**

These analyses indicate that by far the most important habitat to conserve on site for nationally threatened bird species are riparian and wetland habitats along the Klip River system and its tributaries, even though this extent is relatively small (Table 5). Not only is it an important corridor for all forms of wetland bird, aerially and for the skulking species through the dense reed beds, but it also has the potential to support several threatened species, most obviously the African Marsh Harrier with an adult present in the peak of its breeding season. Natural grassland would also be worth conservation, but throughout it is all degraded, at best, and comprises the drier Carletonville Dolomite Grassland that is at present only classified as Vulnerable. The rocky ridges are small in extent compared to and totally transformed habitats, but both support distinctive suites of species that are different to the drainage line and grassland habitats. The transformed woody habitats are only relevant to indigenous avifauna for the prey they support, which might attract a few threatened predatory species.

Only the Endangered African **Marsh Harrier is** expected to be regular resident (based on a single sighting of an adult in mid-breeding-season) (Table 6). Only two other species are expected as frequent visitors, **African Grass-Owl** because it is widespread locally in surrounding wetlands will at least pass through this wetland system (even if it does not look ideal for residence and breeding), and the Secretarybird because it is already reported from 4/7 of the site's pentads since 2007 and the grass- and cropland habitats should be at least seasonally attractive (depending on crop, burning, grazing and disturbance cycles). All the other 17 species are expected at best as erratic visitors (**Melodious Lark, White-bellied Korhaan, Abdim's Stork, Verreauxs' Eagle, Lanner Falcon**), the remaining 12 species as only infrequent vagrants. Notably, the former five have been reported for the site's QDGCs during both the SABAP 1 & 2 bird atlas

projects, the latter 12 only until 1992 during the SABAP 1 data collection period (Table 6).

With the exception of the suitable quality of the Klip River system of dense reed beds and open surrounding alluvial plains for the **African Marsh Harrier**, none of the habitats on site are considered as of better quality than Mediocre for any of the specific requirements of the other 19 threatened species. This applies even for the least demanding phases of the life cycle, movements and feeding, and most are poor to absent for the most important habit roles of roosting and especially breeding (Table 7). Of these 19 species, only the **Melodious Lark, Greater Flamingo, White-bellied Korhaan, Verreauxs' Eagle, Secretarybird** and **African Marsh Harrier** have been reported from the site's pentads since 2007.

-By the Biodiversity Act No 10 of 2004

The following species expected on and around the site are listed under Government Notice 2007 of the NEMBA 2004 Act:

Endangered: Blue Crane, Cape Vulture, Pink-backed Pelican.

Vulnerable: African-Grass-Owl, Lesser Kestrel, Martial Eagle.

Protected: African Marsh Harrier

These species were presumably selected from the 2000 Red Data book for South African birds (Barnes 2000), but have been superseded by the latest 2015 revision (Taylor 2015).

The species selected for special conservation as Threatened or Protected Species (ToPS, 2015) are:

Protected: Blue Crane

Endangered: Cape Vulture, Martial Eagle***.***

-By the Gauteng Guidelines for Biodiversity Assessments, 2014

Red List priority species anticipated on the site: African Grass-Owl, White-bellied Korhaan, Blue Crane, Cape Vulture, African Marsh Harrier, Martial Eagle, Secretarybird, Lesser Kestrel, Greater Flamingo, Lesser Flamingo.

These species were presumably selected from the 2000 Red Data book for South African birds (Barnes 2000) but have been superseded by the latest 2015 revision (Taylor 2015).

7.3 HERPETOFAUNA

The local occurrences of reptiles and amphibians are closely dependent on broadly defined habitat types, in particular terrestrial, arboreal (tree-living), rupicolous (rock-dwelling) and wetland-associated vegetation cover. It is thus possible to deduce the presence or absence of reptile and amphibian species by evaluating the habitat types within the context of global distribution ranges.

7.3.1 Herpetofauna Habitat Assessment

From a herpetological habitat perspective, it was established that three of the four major habitats are naturally present on the study site, namely terrestrial, rupicolous and wetlands.

The terrestrial habitat is by far the most extensive but also the most degraded and/or transformed by agriculture and housing or, where patches or areas of natural habitat remain, degraded through burning and heavy grazing by communal livestock (cattle, sheep, goats) and/or localised dumping of waste and rubble.

Semi-natural grassland is most obvious along the southwest edge of the site, with some recovering grassland at various stages within the fallow croplands, but with the most recent still infested with weeds. Active termite mounds are the best indicators of near-natural grasslands or the stage of recovery of fallow croplands.

Noticeable absentees from the study site are indigenous trees, with only a few small and isolated ones occurring in some areas. These are too few and too small to accommodate arboreal reptiles, apart from being a considerable distance outside their distributional ranges. Arboreal habitat is therefore absent in a functional sense. Due to the absence of natural arboreal habitat, some species such as tree agamas and flap-neck chameleons were omitted from the species list in Table 8. Most of the scattered trees present on the study site are exotics such as *Eucalyptus* and weeping willows. Due to the low number of trees on the study site and the collection of firewood, there are almost no dead logs which could have provided shelter and food for some herpetofauna.

There is very little natural rupicolous habitat along the pylon route, almost all confined to the northeast arm of the route where the powerline ascend the basalts above the Klip River and then crosses the rocky andesite ridges within Soweto. However, there are plenty of artificial surrogates for rupicolous habitat, such as the many buildings and other cliff-like structures across the area, the dumps of rubble arising from their construction, and the scattered piles of small rocks exposed and removed during cultivation. The whole area has also been subjected to many forms of excavation, from earth, gravel and sand pits to trenches for pipelines and servitudes for roads and railways, and many of these diggings form rocky banks and/or beds. Evidence of erosion is low, probably due to the generally flat topography and elsewhere to designs and structures to control runoff, while the dense reed beds along the Klip River curb flooding and secure the substrate.

The Klip River and its tributaries are prominent and significant wetland features, even between the dense housing where their drainage lines have been left largely undeveloped. The bed of the rivers where there is perennial water have been choked by tall dense beds of *Phragmites* reeds, which provide safe shelter for species that do not require open water, of which there is very little in the beds themselves although available in artificial dams and ponds in and adjacent to the rivers. Although some wetlands are artificial, these are functional with wetland plant species, and also wetland fauna. As a consequence, habitat is available for common water- and moisture-reliant herpetofauna.

All rivers, streams and wetlands are protected in Gauteng and are regarded as being sensitive.

7.3.2 Observed and Expected Herpetofauna Species Richness

Of the 44 reptile species that may occur on the study site (Table 8), none was confirmed during the site visit and of the possible 13 amphibian species which may occur on the study site (Table 8); none was confirmed during the site visit.

These 57 herpetofauna species are recorded as potential occupants of the study site. Most of these herpetofauna species are robust generalists with the ability to capitalise on disturbed environments. It should be noted that potential occurrence is interpreted as being possible over a period of time, as a result of expansions and contractions of population densities and ranges, which stimulate migration.

The American red-eared terrapin (*Trachemys scripta elegans*) and the Brahminy blind snake (*Ramphotyphlops braminus*) are the only two feral reptile or amphibian species known to occur in South Africa (De Moor and Bruton, 1988; Picker and Griffiths, 2011), but with only a few populations they are not expected to occur on this particular site.

The species assemblage is typical of what can be expected in extensive natural areas with sufficient habitat to sustain populations. Most of the species of the resident diversity (Table 8) are fairly common and widespread (viz. brown house snake, mole snake, common egg eater, rinkhals, speckled rock skink, common platanna, common river frog, Boettger's caco, bubbling kassina, guttural toad and red toad).

Table 8: Reptile and Amphibian diversity. The species observed or deduced to occupy the site. Systematic arrangement and nomenclature according to Branch (1998), Minter, *et.al* (2004), Alexander & Marais (2007), Du Preez & Carruthers (2009) and Bates *et.al* (2014)

	SCIENTIFIC NAME	ENGLISH NAME
	CLASS: REPTILIA	REPTILES
	Order: TESTUDINES	TORTOISES & TERRAPINS
	Family: Pelomedusidae	Side-necked Terrapins
√	*Pelomedusa subrufa*	Marsh Terrapin
	Order: SQUAMATA	SCALE-BEARING REPTILES
	Suborder:LACERTILIA	LIZARDS
	Family: Gekkonidae	Geckos
√	*Lygodactylus capensis capensis*	Common Dwarf Gecko
*	*Pachydactylus affinis*	Transvaal Gecko
√	*Pachydactylus capensis*	Cape Gecko
	Family: Lacertidae	Old World Lizards or Lacertids
*	*Nucras holubi*	Holub's Sandveld Lizard
?	*Pedioplanis lineoocellata lineooellata*	Spotted Sand Lizard
	Family: Cordyidae	
*?**NT***	*Chamaesaura aenea*	Coppery Grass Lizard

	SCIENTIFIC NAME	ENGLISH NAME
?	*Cordylus vittifer*	Common Girdled Lizard
	Family: Gerrhosauridae	Plated Lizards
√	*Gerhosaurus flavigularis*	Yellow-throated Plated Lizard
	Family: Scincidae	Skinks
√	*Trachylepis capensis*	Cape Skink
√	*Trachylepis punctatissima*	Speckled Rock Skink
√	*Trachylepis varia*	Variable Skink
√	*Afroablepharus wahlbergii*	Wahlberg's Snake-eyed Skink
?	*Acontias gracilicauda*	Thin-tailed Leggless Skink
	Family: Agamidae	Agamas
√	*Agama aculeate distanti*	Eastern Ground Agama
?	*Agama atra*	Southern Rock Agama
	Family: Varanidae	Monitors
√	*Varanus niloticus*	Water Monitor
	Suborder: SERPENTES	SNAKES
	Family: Typhlopidae	Blind Snakes
?	*Afrotyphlops bibronii*	Bibron's Blind Snake
*	*Rhinotyphlops lalandei*	Delalande's Beaked Blind Snake
	Family: Leptotyphlopidae	Thread Snakes
?	*Leptotyphlops distanti*	Distant's Thread Snake
*	*Leptotyphlops scutifrons*	Peter's Thread Snake
	Family: Viperidae	Adders
*	*Bitis arietans arietans*	Puff Adder
√	*Causus rhombeatus*	Rhombic Night Adder
	Family: Lamprophiidae	
*	*Aparallactus capensis*	Black-headed Centipede Eater
?	*Atractaspis bibronii*	Bibron's Stiletto Snake
? ***NT***	*Homoroselaps dorsalis*	Striped Harlequin Snake
?	*Homoroselaps lacteus*	Spotted Harlequin Snake
√	*Boaedon capensis*	Common House Snake
*	*Lamprophis aurora*	Aurora Snake
?	*Lycodonomorphus inornatus*	Olive Ground Snake
√	*Lycodonomorphus rufulus*	Brown Water Snake
√	*Lycophidion capense capense*	Cape Wolf Snake
√	*Psammophis brevirostris*	Short-snouted Grass Snake
√	*Psammophis crucifer*	Cross-Marked Grass Snake
?	*Psammophis trinasalis*	Fork-Marked Sand Snake
√	*Psammophylax rhombeatus*	Spotted Grass Snake
?	*Psammophylax tritaeniatus*	Striped Grass Snake
?	*Duberria lutrix lutrix*	South African Slug-Eater
?	*Prosymna sundevallii*	Sundevall's Shovel-Snout
√	*Pseudaspis cana*	Mole Snake
	Family: Elapidae	Cobras, Mambas and Others

	SCIENTIFIC NAME	ENGLISH NAME
√	*Hemachatus haemachatus*	Rinkhals
?	*Elapsoidea sundevallii*	Sundevall's Garter Snake
	Family: Colubridae	
√	*Crotaphopeltis hotamboeia*	Red-Lipped Snake
√	*Dasypeltis scabra*	Rhombic Egg Eater
	CLASS: AMPHIBIA	AMPHIBIANS
	Order: ANURA	FROGS
	Family: Pipidae	Clawed Frogs
√	*Xenopus laevis*	Common Platanna
	Family: Bufonidae	Toads
√	*Amietaophrynus gutturalis*	Guttural Toad
*	*Amietaophrynus rangeri*	Raucous Toad
√	*Schismaderma carens*	Red Toad
	Family: Hyperoliidae	Reed Frogs
√	*Kassina senegalesis*	Bubbling Kassina
	Family Phrynobatrachidae	Puddle Frog
?	*Phrynobatrachus natalensis*	Snoring Puddle Frog
	Family: Pyxicephalidae	
√	*Amietia angolensis*	Common River Frog
?	*Amietia fuscigula*	Cape River Frog
?	*Strongylopus fasciatus*	Striped Stream Frog
√	*Cocosternum boettgeri*	Boettger's Caco or Common Caco
? ***NT***	*Pyxicephalus adspersus*	Giant Bullfrog
√	*Tomopterna cryptotis*	Tremolo Sand Frog
√	*Tomopterna natalensis*	Natal Sand Frog

√ Definitely there or have a *high* probability of occurring;
* *Medium* probability of occurring based on ecological and distributional parameters;
? *Low* probability of occurring based on ecological and distributional parameters.

Red Data species rankings as defined in Branch, The Conservation Status of South Africa's threatened Reptiles': 89 – 103..In:- G.H.Verdoorn & J. le Roux (editors), 'The State of Southern Africa's Species (2002) and Minter, *et.al*, Atlas and Red Data Book of the Frogs of South Africa, Lesotho and Swaziland (2004) are indicated in the first column: CR= Critically Endangered, En = Endangered, Vu = Vulnerable, NT = Near Threatened, DD = Data Deficient. All other species are deemed of Least Concern.

7.3.3 Red Data Listed Herpetofauna identified

-By the Scientific Community

The study site falls outside the natural range of the Southern African python and the Nile crocodile. Both these species should not occur on the study site.

The striped harlequin snake has not been recorded on this quarter degree square (Transvaal Museum or Ditsong Museum of Natural History Records). It is very difficult to

confirm whether this cryptic snake is present on any study site, but this species could occur on the study site.

A small part of the study site consisted of pristine grassveld. The coppery grass lizard might occur on the study site.

Potential breeding sites for the giant bullfrog are present on the study site. These breeding sites are temporary, which bullfrogs prefer in order to avoid predation from fish. They also need water bodies of which at least one side has a very gentle slope. A gentle slope allows for shallow water (less than 10cm deep), which enables the female bullfrog to stand when she lays her eggs outside the water for the male to fertilise. Bullfrog tadpoles swim in schools and stay in the warm shallow water during the day for rapid development (Van Wyk *et al*., 1992).

Many parts of the study site consist of sandy soil and are very suitable as a dispersal area, which combines feeding and aestivation. It is essential that the soil be suitable for burrowing on a daily basis during the short activity period at the beginning of the rainy season and for deeper retreats during the resting periods.

It is important to note that in the latest literature (Measey (ed.) 2011 and Carruthers & Du Preez, 2011); the giant bullfrog's status has changed officially from Near Threatened (Minter *et al*, 2004) to Least Concern in South Africa.

8. ENVIRONMENTAL IMPACT ASSESSMENT

8.1. The ecological importance of the study site

The study site is in effect a long thin line through various habitats that might seem suitable for a variety of species – open grass- and croplands, a broad reed-choked watercourse with wide alluvial plains, and rocky ridges – with, scattered amongst them, wooded smallholdings, densely populated townships, industrial areas and a network of road, railway and utility lines and servitudes. In area, the extensive open western plains predominate as the least occupied, all on a drier calcrete-based form of grassland, but much cultivated or fallow with only small areas of heavily grazed, degraded natural grassland. The Klip River is by definition a much narrower and linear habitat, while most of the rocky ridges and hills are covered in buildings, with only small patches of natural bushveld poking through. On closer examination, all habitats across the site have been widely degraded and/or transformed and their quality is generally low or compromised. Most of the remaining grassland is secondary, after cultivation, and/or severely degraded through overgrazing or colonisation by alien trees and weeds. The rocky areas carry little soil, generally lack supporting vegetation and include various forms of rubble and litter. The water bodies and wetlands, although large and perennial, have water quality that appears low, reed 'infestations' and almost no marginal vegetation. Some adaptable species thrive throughout the site, such as gerbils, wheatears or skinks, but the overall impression is that while species diversity is potentially quite high, due to the wide range of human densities and variety of habitat types, the population numbers for any remaining species are low and reflect the poor quality of the habitats.

The site does have a potential role in support of the vertebrate ecology in the least occupied part to the west of suburbia, but this role will not be realised unless these areas have their habitats protected from veld fires, grazing livestock and human disturbance. Only with this protection will indigenous animal populations grow to the point where they can stabilize the local ecology, an outcome which seems unlikely given the expanding housing developments and current random use of these habitats. Only the core of the Klip River offers some immunity from these pressures, its dense wide bed of reeds, impenetrable by people, creating a refuge for smaller marsh-dwelling species, and its valley floor an important corridor for terrestrial and aerial movements that link different populations. The southeast sector of the line, just north of the Klip River, is indicated to pass through the edge of the Olifantsvlei Municipal Nature Reserve but much of the reserve appears to be walled into the as yet unused Olifantsvlei Cemetery (presumably to augment the existing extensive cemeteries north of the N2), and so its role in augmenting vertebrate populations is currently unclear.

8.2 General impacts on vertebrates associated with transmission line construction and substation development.

- **Effects of lines and associated structures** – Lines and their supporting poles/pylons intrude into previously open space but have a small terrestrial footprint. The poles and lines have two new consequences for aerial species like birds and bats along their route. First they increase the risk of aerial collisions, and second they provide potential perch/hunting/roost/nest sites. The collision risks depend on a variety of factors, the biology and senses of species in the area, the location of the lines in relation to normal flight paths, and the prominence and detectability by day/night of the structures relative to their surroundings. Use of the structures has the potential for positive and negative consequences, positive in providing new perch/hunting/roost/nest sites safe from human and other disturbance or negative in increasing the predation pressure on other animal prey species living below. All these effects are most intense for the novelty that new lines introduce into flat open treeless habitats, such as the grasslands.

  There is also a risk of electrocution if animals land/perch/take-off in such a way that they touch live and earth lines, or if their moist droppings compromise insulator efficiency. This risk exists regardless of the voltage of the lines, but many/most modern line and pole/pylon designs by the Eskom-EWT partnership have reduced this risk to a minimum, since short circuits not only kill birds but also cause expensive power breaks/outages.

  Effects from the proposed developments for this site involve introducing a long new line through the area, novel in some areas and additional to existing powerlines in others, and erection of two new substations. Both preferred substation sites (1 & 2; Fig. 4 top) are assessed to have the least ecological impacts on vertebrate populations, and neither of the deviations proposed for the powerline are recommended. Deviation 1 crosses the middle of the largest area of natural grassland along the route, which should continue to be conserved as such despite the heavy grazing that it is subjected to and its resulting low quality. In contrast, the preferred line in this sector passes alongside smallholdings and an existing powerline for most of its length (Fig. 4 top). Deviation 2 is definitely not to be considered on the grounds of vertebrate ecology, running as it does for much of its

length along the southern flood plain of the Klip River, and then crossing the river east of the R558 (Fig. 4 bottom), at exactly the least disturbed section of the river where an adult Endangered African Marsh Harrier was seen and is suspected of breeding.

- **Loss and degradation of natural habitat** – The general effect of the construction of transmission lines on the habitats they traverse is low due to the small areas involved, basically the footprint at the base of each support pylon. However, for safety purposes, such lines require a wide servitude, an access track normally runs along this servitude for construction and subsequent maintenance, and vegetation has to be kept short (mown and/or cut) to avoid damage from fires. These disturbances usually only occur at long intervals during the year. Negative effects of electromagnetic radiation immediately below the lines on flora and fauna have also been proposed, but seem to be generally discounted or ignored. Effects of lines on habitats, negative or positive, are mainly due to their prominence as perches and/or obstructions above sensitive habitats where high densities and/or diversities of birds concentrate, such as along updrafts on ridgelines or across narrow linear ecosystems like rivers and wetlands.

  The effect of this development will cause minimal reduction of what little natural habitat exists within the confines of the site (assuming rejection of the southern loops of Deviations 1 and 2). The degraded nature of most of the habitats along the route also means that the impact of the development will be effectively reduced, especially for the 31-m wide servitude below the powerline that will not make much of an alteration to the already short ground cover of the grass- and croplands, although it might reduce further the already small areas of the remaining rocky bushveld.
- **Loss of conservation-significant taxa and/or changes in community structure** - The small overall footprint of powerline on the landscape, in particular from its support pylons, is unlikely to cause direct and widespread loss of threatened taxa or change in community structure. Positive effects, for the species concerned, may arise from provision of new perch/roost/nest sites. Negative effects may result from the addition of elevated hunting perches, most likely in unoccupied areas of open grass- and croplands, or aerial obstructions across the area, which may be less than expected if the species present are already used to all the existing powerlines that crisscross the area, especially if the new line is placed wherever possible alongside an existing line. Rejection of Deviations 1 and 2 helps to reduce and/or eliminate these potential negative impacts.
- **Increased habitat fragmentation & loss of connectivity** – Lines and their poles/pylons are unlikely to cause habitat fragmentation and or connectivity loss, except where they are so numerous and/or prominent that they deflect birds from their normal flight paths. The access track along the servitude may affect habitat connectivity, such as across rivers/wetlands, but the track does not normally require any special construction and sensitive habitats can be avoided.

  There are restricted habitats to be crossed by the proposed developments, over the upper reaches of the Klip River just east of the R554 crossing and over the confluence of the Diepkloof tributary. Both occur on the north, most developed side of the river, the former alongside an existing power- and the railway line, and the latter also alongside an existing powerline and at the western edge of the Nancefield Industrial Area.

- **Increased anthropogenic encroachment** – Lines and their pylons do extend anthropogenic effects, often over long distances and across otherwise pristine habitats. Particularly sensitive habitats can usually be avoided, but the power they conduct has extensive anthropogenic effects at source (power and distribution (sub)stations) and termination (industrial, residential and urban developments). The proposed developments are expected to extend the already extensive anthropogenic encroachment into the open western areas, but would probably have no noticeable additional effect along the rest of the preferred route or at its two new substations. The effect of the extended western encroachment must be seen against the wide transformations and/or degradations that have already taken place in the habitats and vertebrate populations most likely to be affected.

Table 9: **Impacts expected to occur on and around the proposed and preferred new Taunus-Diepkloof powerline and substations around Soweto, Gauteng Province (2627BB, BC, BD).**

Activity	Nature of Impact	Severity* 0 (low) – 10 (high) +ve or -ve	Likelihood** High/Medium/Low	Potential Mitigation
Construction impacts				
Substations	Loss of grassland habitat	-4	High	Unavoidable within substation footprint.
	Construction activities	-5	Low	Low if all activities confined to within development footprint.
Access track along lines	Loss of grassland habitat	a) -3 b) -5	a) Low b) Medium	Use existing tracks where possible, restrict vehicles to track. Use existing river crossings. Follow/replace existing line(s).
	Protection of natural resources	-2	Low	Minimise disturbance during pylon construction / line erection. Especially careful on grass- / wetlands.
Pole/line erection	Loss of habitat	-5	Low	Minimise disturbance. Work within pylon footprint.
Operational impacts				
Substations	Light pollution	-3	Low	Direct light away from

				surrounding, use 'yellow' lights.
	Storm water control	-3	Low	Flat area with absorbent soils, minimise solid surfaces.
Servitude maintenance	Loss of habitat	-3	Low	Mow to sustain grasslands, reduce weeds, eliminate aliens. Sustain short-grass areas.
	Disturbance	-2	Low	Control workforce and ablutions. Install temporary facilities.
	Alien plant increase	-2	Low	Monitor and control during annual clearance operations. Mow, and spray woody invasive aliens.
Line collisions	Increased bird/bat mortality	a) -1 b) -3	a) Low b) Medium	Use Eskom-EWT scaring protocols. Unlikely given site structures, but monitor during servitude maintenance to detect danger zones.
Pole electrocutions	Increased bird mortality	-2	Low	Assume safe new pylon designs. Monitor under pylons during servitude maintenance.

* Positive (+) or negative (-) in the absence of mitigation. Severity score: 0-10, where 0 = no discernible impact and 10 = extremely severe impact extending well beyond the immediate area of the proposed development.

** Probability (low, medium, high) of a negative impact occurring.

9. IMPACT ASSESSMENT DERIVED VALUES

The numerical impact values for vertebrates yield the following totals for the habitats on site, given the projected impacts of the development and as per the assessment criteria discussed in Section 6.4 above. Development on or close to the drainage line is not considered as an option where it can be avoided, but its impact assessment is calculated to serve as a benchmark against which the others can be evaluated.

Habitat	Magnitude	Reversibility	Extent	Duration	Probability	Significance	Confidence
Grass- and cropland	1	2	1	2	4	24	Moderate
Riparian and wetland	3	3	1	3	4	44	High

Rocky bushveld	2	1	1	3	3	21	Moderate
Transformed manmade habitats and structures	1	1	1	2	3	15	Low

Significance values are expressed as

RANKING	65-100	64-36	35-16	15-5	1-4
SIGNIFICANCE	Very High	High	Moderate	Low	Minor

The numerical significance values for the habitats at the site fall in the Moderate to Low Environmental Significance classes, except for the riparian and wetland habitats along the Klip River and the confluence of its tributaries which is assessed as of High Environmental Significance. Of note is that the drainage line habitat has the highest value (44), but the other habitats are rated lower because the nature of the development is has a small footprint, is easily reversed, will have a limited life in terms of its immediate impact on vertebrates and only a moderate to low probability of occurrence.

9.1 Overall Impact Impressions

Species richness: Species diversity and numbers were low throughout, even on the least transformed habit of the western grasslands and Klip River drainage lines. The proposed development will definitely add to these degrading pressures, but its impact can be reduced most obviously by not selecting the southern sectors of Deviations 1 and 2 that would pass across a tract of degraded but natural grassland or alongside and across the Klip River, respectively. Reduction of impacts along the drainage line will also enhance connectivity across the site. A few individual animals will undoubtedly be displaced to adjoining areas, but no species will be seriously eliminated.

Threatened species: No threatened species are expected to be fatally impacted by the proposed development, assuming that Deviation 2 is rejected and the presumed nesting habitat of the Endangered African Marsh Harrier is no further disturbed.

Sensitive areas: The conservation condition of the drainage line habitat, despite being widely degraded, is the best on site, and it is proposed that the line and as much of a buffer as feasible be conserved so that they can continue to supply an effective ecological connectivity service across the area.

Habitat(s) quality and extent: Conservation and preservation is generally low to non-existent, especially in the extensive areas of manmade development, with only the degraded western grassland and Klip River drainage line offering any redeeming features. Much of what was the The southeast sector of the line, just north of the Klip River, is indicated to pass through the edge of the Olifantsvlei Municipal Nature Reserve but much of the reserve appears to be walled into the as yet unused Olifantsvlei Cemetery. Its role in augmenting vertebrate populations is currently unclear therefore, but there is no reason why a horticulturally well-managed cemetery, with its low disturbance levels and extra protection, cannot match or even exceed the currently degraded habitats.

Impact on species richness and conservation: The development of the powerlines and substation, once complete, will be a relatively small addition to the various other impacts on the site, including various other powerlines. One can expect most impacts to wane as

the vertebrates become used to the power line's presence in the environment, although it will endure for a long time and can only be offset initially by avoiding mismanagement of the drainage line and adjacent grassland.
Connectivity: Connectivity will be compromised to some extent, most severely if development extends to the drainage line any more than necessary.
Management recommendations: Control of grazing, burning and woody alien invasion in the drainage lines, and to a lesser extent into remaining areas of natural grassland, would make the greatest positive impression on ecological condition.
General: Nil.

10. LIMITATIONS, ASSUMPTIONS, GAPS IN INFORMATION AND INDEMNITY

The vertebrate team has sufficient experience and ample access to information sources to confidently compile lists of biota such as presented herein to support conclusions and suggested mitigation measures based on site visits. In instances where doubt exists, a species is assumed to be a possible occupant (viz. Red rock rabbits, pythons and bull frogs); -this approach renders the conclusions to be robust. In instances where the possible occurrence has significant ecological implications, an intensive survey is recommended. In view of the latter, it is highly unlikely whether an intensive survey to augment this site visit will add significantly to the data base, and the additional costs are unlikely to warrant the effort.

11. CONCLUSION

Proposals by Eskom for a route along which to construct a new 132 kV powerline, between their Taunus Substation on the western edge of current housing developments for Soweto and their eastern Diepkloof Substation within the Soweto CBD, were assessed for their potential impact on vertebrate habitats, species and populations. Deviation 1 and Deviation 2 of the route along the way were also proposed for assessment as alternatives, along with sites for two new 100x100-m substations, one with an alternative site. From west to east, the route passes through grass- and croplands, over the N2 motorway, alongside alien-wooded smallholdings, down the north side of the main Klip River valley and finally turns north back over the rocky ridges and N2 into the residential, industrial and finally business districts of central Soweto. Most of the natural habitats along the way are degraded by burning, grazing, trampling and disturbance and so support only a subset of their historical fauna, while only the transformed wooded habitats attracting a novel suite of vertebrate species. Networks of roads, railway lines, and utility supplies, together with past excavations, tracks, dumps, rubble and litter, add to the degradation in many areas. Except for the reed-filled Klip River watercourse, none of the habitats is of the quantity or quality that they can be expected to support health populations of any but the most resilient and common species. An Endangered adult African Marsh Harrier was encountered above the reed

beds on the eastern edge of Lenasia, where Deviation 2 is proposed to pass, and is suspected to be breeding there. Other threatened riparian and wetland species may also occur along this linear watercourse, in addition to its ecological importance as a corridor for dispersal movements of wetland species.

Our assessment included the sites and servitudes themselves, as well as surroundings areas within at least 500 m. The main preferred powerline route was proposed as having the least impact on the vertebrate habitats and populations involved. Deviation 1 was rejected because it passed over a large area of near-natural Carletonville Dolomite Grassland, and Deviation 2 because it passed back and forth over the Klip River, including at the point where the African Marsh Harrier was observed, and in-between ran along its southern floodplain. We approved of the preferred sites for Substation 1 and Substation 2, rejecting the alternative Substation 2a site for the extra logistics involved.

Overall, we classified none of the habitats on site as of more than Low to Moderate Ecological Significance for this development, with only the Klip River drainage line rating a High impact. No threatened vertebrate species are expected to be significantly impacted by this development, provided that our recommended route and substation sites are adopted.

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13. CURRICULA VITAE

IGNATIUS LOURENS RAUTENBACH

Ph.D., Prof. Nat. Sci.

Independent Environmental Consultant – MAMMALOGY.

Identity Number	421201 5012 00 5
Gender Male	
Date of Birth	1 December 1942
Nationality	South African
Home Languages	Bilingual (English & Afrikaans)
Postal Address	45 Helgaard Street, Kilner Park, Pretoria, RSA 0186. Tel no +27 12 3334112, Cell +27 082 3351288. E-mail naasrauten@mweb.co.za
Former Position	Retired Director: Planning, Northern Flagship Institute
Present Position	Consultant – Specialist, Environmental Impact Assessments (Applied research), Photographing microstock for four agencies
Qualifications	**B.Sc**. (UP), **T.H.E.D** (Pta TTC), **M.Sc.** (UP), **Ph.D**. (Un. Natal)
Professional Honours	1. Professional Natural Scientist (Zoology) – S.A Council for Natural Scientific Professions, Registration # 400300/05 2. Fellow of the Photographic Society of South Africa 3. Master photographer at club level 4. Honorary life member of the S.A. Wildlife Management Association.
Notable Research Contribution	In-depth survey of the Mammals of the Transvaal. 1982. 211pp. Ecoplan Monograph 1.
Notable Literary Contribution	Rautenbach, Naas & Annalene Rautenbach. 2008. *Photography for Focused Beginners.* 302pp with 250 images. Green Door Studio, Pretoria.
Formal Courses Attended	Computer Literacy, Project Management, Contract Design, Senior Management

Employment history

May 2001 - Present Self-employed, collaborator with Eco-Agent CC Ecological Consultants as well as Galago Environmental [environmental impact assessments], technical writing, and photography

April 1999 - August 2001 Director: Planning, Northern Flagship Institution

Jan 1991 - April 1999 Executive Director, Transvaal Museum

July 1967 - Dec 1990 Curator (in charge) of the Division of Mammalogy, Transvaal Museum. Promoted to Principal Scientist rank as of June 1985
March - June 1967 Research student at the Mammal Research Institute of the Zoology Department, University of Pretoria
July 1966, Nov l966 - Febr 1967 Member of the Smithsonian Institution's field teams collectively partaking in the 'African Mammal Project'
1966: Part-time research assistant to Prof. J. Meester, University of Pretoria
1962 - 1965 Temporary assistant during University holidays in the Nematology laboratories, Agricultural Technical Services
1991 - 2002 Founder member and non-executive director of the Board of Trustees of
1993 - 2001 Founder member and Trustee of the privatised Museums Pension Fund
1997 - 2001 Non-executive director of the Tswaing Section 21 Company

Professional Achievements

Managed a research institute of 125 members of staff. Solicited numerous grants totalling ≥ R1 000 000. Initiated and overseen building programmes of R30 million at the Transvaal Museum. Conceptualised and managed 12 display programmes.

Research: Author and co-author of 85 scientific publications re mammalogy in peer reviewed subject journals, 18 popular articles, 10 books, and >400 contractual EIA research reports. Extensive field work and laboratory experience in Africa, Europe, USA, Alaska, Brazil and Mexico. B -rated by FRD as scientist of international status 1983 – 1995.

Students: Additional to museum manager duties, **c**o-supervised 5 B.Sc. (Hons.), 2 M.Sc. and 2 Ph.D. students.

Public Recognition:

Public speaking *inter alia* Enrichment Lecturer on board the 6* *SS Silver Wind*, radio talks, TV appearances.

Hobbies

Technical writing, photography, field logistics, biological observations, wood working, cooking, designs.

Personal Evaluation

I am goal-orientated, expecting fellow workers and associates to share this trait. I am an extrovert, sensitive to amicable interpersonal relations. I have a wide interest span ranging from zoological consulting, photography, cooking, sport, news, gardening and out of necessity, DIY. To compensate for my less than perfect memory, I lead a structured and organised life to deal with the detail of a variety of interests. Often to the chagrin to people close to me, I have an inclination to “Think Out of the Box”.

ALAN CHARLES KEMP

Born: 7 May 1944 in Gweru, Zimbabwe
Citizenship: South African, British
Marital status: Married, 1 daughter, 1 son

Present work address

Naturalists & Nomads, 8 Boekenhout Street, Navors, Pretoria, 0184, South Africa
Tel: (27)(12)804-7637 Fax: (27)(12)804-7637
E-Mail: leadbeateri@gmail.com

or

Naturalists & Nomads, Postnet Suite #38, Private Bag X19, Menlo Park, 0102, South Africa

Qualifications:

1965 B.Sc. Rhodes University, Zoology and Entomology as majors
1966 B.Sc. Hons. Rhodes University, Zoology
1973 Ph.D. Rhodes University, Zoology of Pretoria

Thesis: (Ph.D.) on ecology, behaviour and systematics of hornbills in Kruger National Park

Professional titles:

• Pr.Sci.Nat. South African Council for Natural Scientific Professions (Zoological & Ecological Sciences) **Registration Number 400059/09**

Professional career:

- Field Research Assistant to Prof. Tom J. Cade, Section of Ecology and Systematics, Cornell University, in Kruger National Park, South Africa, Nov 1966 - Apr 1969.
- Department of Birds, Transvaal Museum, Pretoria, June 1969 – August 1999, Head of Department from 1971, rising to Senior Scientist and then Head Curator by 1974.
- Elected Manager, Transvaal Museum, September 1999 – July 2001, until voluntary early retirement.
- Edward Grey Institute of Ornithology, Oxford, December 2001 – April 2002, drafting specialist bird texts for Gale Publishing, USA and Andromeda Press,

Oxford, UK.

- Berg ‘n Dal & Pretoria, April 2002 - February 2003, presenting paper and later editorial assistant for book from the Mammal Research Institute, University of Pretoria, *The Kruger Experience: ecology and management of savanna heterogeneity.*
- Bangkok, March – June 2003, drafting research papers for colleague at Mahidol University; touring Laos.
- Pretoria, August-December 2003, editorial assistant for book from the Mammal Research Institute, University of Pretoria, a revision of *The Mammals of Southern Africa.*
- Hala-Bala Wildlife Reserve, January – December 2004, a one-year rainforest study of hornbills, raptors and owls in southern Thailand for their National Center for Genetic Engineering and Biotechnology (BIOTEC).
- Pretoria, January 2005 – July 2007, organizing 4th International Hornbill Conference at Mabula Game Lodge and editing and publishing CD-ROM proceedings, and consulting on ground hornbills to Mabula, University of Cape Town and Endangered Wildlife Trust.
- Bangkok, India, Singapore, Sarawak, September 2006 – April 2008. Assisted colleagues at Mahidol University, Bankok, with compilation of research paper on molecular systematics of hornbills, and travelled to see other Asian habitats and meet with other colleagues.
- Bangkok, December 2011 – April 2012. Assisted colleagues at Mahidol University, Bangkok, with compilation of research papers and co-editing/writing three hornbill books together with colleagues in Singapore.

Academic career:

• Students:

- Completed post graduate students: M.Sc. 14; Ph.D. 5.

• Author of:

- 53 scientific papers or notes in refereed journals
- 48 papers at national and international congresses
- 6 scientific (unpublished) reports on environment and natural resources
- 74 popular scientific papers.
- 18 contributions in books

• Editorial Roles

- Ostrich, African Journal of Ornithology (editor 1973-75).
- Bird Conservation (International (editorial committee 1995-present)

• FRD evaluation category: C2 (Avian Biology and Systematics)

- Associate positions:
  - University of the Witwatersrand, Honourary lecturer, Department of Zoology (1988-2001)
  - Percy FitzPatrick Institute of African Ornithology, University of Cape Town, research associate (2001 – present).
  - Transvaal Museum, Honourary curator (2004-present)
  - Wildlife Conservation Society, New York, wildlife conservation associate (1996-present).

Membership:

- American Ornithologist's Union, Corresponding Fellow (1986- present)
- Birdlife South Africa (previously South African Ornithological Society), Ordinary Member (1969-present), President (1975-1993) of Northern Transvaal (Pretoria) Branch, Honourary Life Member of Pretoria Bird Club (2000 – present).

Special committees:

- International Ornithological Committee of 100, elected member (1989-present).
- Raptor Research Foundation, Grants assessor, Leslie Brown Memorial Fund (1985- present).

Merit awards and research grants:

- 1969-86. Annual research grants from South African Council for Scientific and Industrial Research (CSIR).
- 1974. Chapman Fund Award, American Museum of Natural History, for field research in Borneo and India.
- 1986-98. Annual research award from South African Foundation for Research Development (FRD) as "C"-graded national scientist.
- 1989-95. Team member of FRD Special Programme in Conservation Biology.
- 1989-95. Team member of FRD Special Programme in Molecular Systematics.
- 1991-95. Various private sector sponsorships.
- 1992, 1994. FRD merit award to museum scientists.
- 2000. Special NRF Science Liaison award to attend 10th Pan-African Ornithological Congress, Kampala, Uganda.
- 2001. Special NRF Science Liaison award to attend 3rd International Hornbill Workshop, Phuket, Thailand.
- 2004. One year's support from Thailand's National Center for Genetic

Engineering and Biotechnology (BIOTEC) for rainforest survey research.
- 2007-2008. Six month's funding to enable specialist assistance at Department of Microbiology, Mahidol University, Thailand.

Consultant

- Sept-Oct 1994 – Kruger National Park, specialist consultant on ground hornbills to BBC Natural History Unit for filming of Wildife on One programme, 6 weeks.
- Oct-Nov 1996. Kruger National Park, specialist consultant on various birds to David Attenborough for BBC series Life of Birds, 3 weeks.
- Sep-Oct 1998. Kruger National Park, specialist hornbill consultant to National Geographic magazine team, 4 weeks.
- October 2001 – Mala Mala, specialist consulting on ground hornbills for National Geographic film unit, 1 week.
- 2004-present - >15 specialist birding and nature tours as a National South African Tourist Guide, registration number GP0770.
- 2005-present – >30 Biodiversity assessments for a Ramsar wetland proposal, Important Bird Area proposal, and general scoping, G20 and specialist avifaunal EIAs.

JACOBUS CASPARUS PETRUS (JACO) VAN WYK

Identity number 680804 5041 08 4
Gender Male
Date of birth 4 August 1968
Nationality South African
Home languages Afrikaans, fluent in English
Postal address P.O. Box 25085, Monument Park, Pretoria, 0105.
Tel no +27 12 347 6502, Cell +27 82 410 8871
E-mail **jcpvanwyk@absamail.co.za**
Present position Co-Department Head, Environmental Education & Life Sciences, Hoërskool Waterkloof
Consultant Specialist Environmental Assessments, EIAs, writing, photo-recording

Qualifications **B.Sc**. (U.F.S.) **B.Sc. (Hon.)** (U.F.S.), **H.E.D** (U.F.S.), **M.Sc.** (U.F.S.)
Honours Foundation of Research Development bursary holder
Professional Natural Scientist (Zoology) – S.A Council for Natural Scientific Professions, Registration # 400062/09
Notable Research Contribution In-depth field study of the giant bullfrog

Formal Courses Attended Outcomes Based Education, University of the South Africa (2002)
Introductory Evolution, University of the Witwatersrand (2008)
OBE, GET & FET training, 2002-2008, Education Department

Employment history

2000 – Present Co-Department Head for Environmental Education & Life Sciences, Hoërskool Waterkloof, Pretoria.

1995 - 1999 Teaching Biology (Grades 8 – 12) and Physics / Chemistry (Grades 8 – 9) at the Wilgerivier High School, Free State. Duties included teaching, mid-level management and administration.

July 1994 – Dec 1994 Teaching Botany practical tutorials to 1st year students at the Botany & Zoology Department of the Qwa-Qwa campus of the University of Free State, plant collecting, amphibian research

1993 - 1994 Mammal Research Institute (University of Pretoria) research associate on the Prince Edward Islands: topics field biology and population dynamics of invasive alien rodents, three indigenous seals, invertebrate assemblages, censussing king penguin chicks and lesser sheathbills, and marine pollution

1991 - 1993 Laboratory demonstrator for Zoological and Entomological practical tutorials, and caring for live research material, University of the Free State

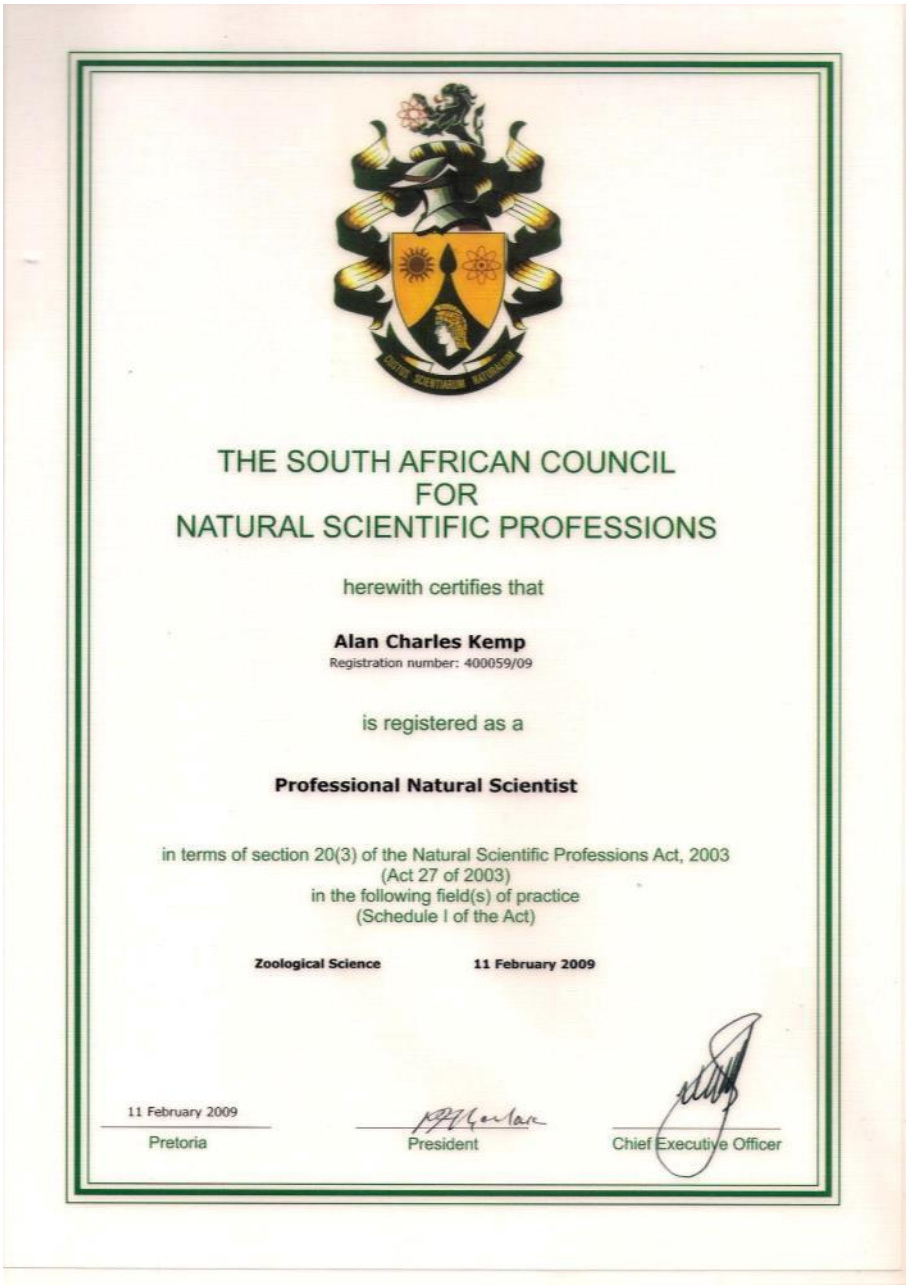
1986 - 1990 Wildlife management and eco-guiding, Mt. Everest Game Farm, Harrismith

Professional Achievement **Research:** Author and co-author of 52 scientific publications in peer-reviewed and popular subject journals, and >150 contractual EIA research reports. Extensive field work and laboratory experience in Africa

Public Recognition: Public speaking *inter alia* radio talks, TV appearances

Hobbies: Popular writing, travel, marathon running, climbing (viz Kilimanjaro), photography, biological observations, public speaking.

SACNASP Registrations:



THE SOUTH AFRICAN COUNCIL
FOR
NATURAL SCIENTIFIC PROFESSIONS

herewith certifies that

Alan Charles Kemp
Registration number: 400059/09

is registered as a

Professional Natural Scientist

in terms of section 20(3) of the Natural Scientific Professions Act, 2003
(Act 27 of 2003)
in the following field(s) of practice
(Schedule I of the Act)

Zoological Science **11 February 2009**

11 February 2009
Pretoria

President

Chief Executive Officer

The South African Council for Natural Scientific Professions certifies in terms of section 20(3)(a) of the Natural Scientific Professions Act, 2003 (Act 27 of 2003), that

Dr A C Kemp

is registered as a Professional Natural Scientist, Reg. no

400059/09

in the following field(s) of practice:

Ecological Science
Zoological Science

Expiry Date: 31 MAY 2015

SACNASP