# Basic Assessment for the Proposed Construction of an Eskom Powerline (2.5kms) and Associated Substation (66KV) in Plettenberg Bay

# Estuarine Ecological Specialist Study

**-DRAFT 3-**

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ANCHOR environmental

**SiVEST Environmental Division**

**Unit 12 Wentworth Building**

**Somerset Links, De Beers Avenue**

**Somerset West7130**

**South Africa**

**Prepared by**

Sean Porter & Barry Clark

8 Steenberg House
Silverwood Close
Tokai 7945
Tel: (021) 7013420
Fax: (086) 542 8711
www.anchorenvironmental.co.za

# Executive Summary

Eskom Holdings SOC (Pty) Ltd. is proposing the construction of a 66KV substation and power lines on Farm 305/16, adjacent to the Keurbooms-Bitou River, Plettenberg Bay, Western Cape. Part of the footprint of the substation as well as a pylon (B16) will lie within the Estuarine Functional Zone below the 5-m contour. A power line will also cross the estuary from the substation and run parallel to the N2 bridge. The likely impacts of these developments on the estuary are documented in this report along with recommended mitigation measures.

The site was visited in March 2013 to evaluate estuarine biodiversity and its conservation importance and sensitivity in the area potentially affected by the development. Desktop analyses were also conducted using GIS data and information contained in the Garden Route Biodiversity Sector Plan and area-specific literature on other important biodiversity features such as Coordinated Water Bird Counts for the Bitou Estuary. The development footprint of the proposed substation was found to contain no significant estuarine or estuarine-associated biodiversity and was infested with alien vegetation. However, the adjacent Keurbooms-Bitou Estuary, where the proposed power line would cross, is particularly sensitive and supports important biodiversity and Red Data-Listed fishes and birds.

Potential impacts associated with the development of the proposed electrical substation within the Estuarine Functional Zone include habitat destruction, pollution, erosion and alien vegetation. The same impacts are predicted for the pylon except with the added impact of potential electrocution of birds. Impacts of the substation were all assessed to be of l*ow negative* significance and status respectively, prior to mitigation. If essential mitigation measures are implemented, the status of each impact is likely to be *neutral* with *insignificant* or *low* significance. The impacts of the pylon (B16) were all assessed to be of *low* to *insignificant negative* status except for the impact of bird electrocutions which was adjudged to be of *medium* significance and *negative* status prior to mitigation. After mitigation the impact significance of electrocutions is considered to be of *low* significance. Similarly, the impact of the proposed power line, which would cross the estuary, is considered to be of *medium* significance and *negative* status due to the high probability of mortality that are likely to result from waterbirds colliding with the powerline prior to mitigation. Of particular concern is that many waterbirds are night-time flyers and move up and down the estuary in darkness, and consequently any overhead lines would be largely invisible to them. It is essential, therefore, that the likely impact of the power line is mitigated further by the placement of bird diverters which *must be effective at night,* such as AfterGlows or FireFlys. To be effective, these bird diverters would need to be replaced every 3-5 years for the duration of the development. Depending on the success of the night-time bird diverters, the impact of the power line should be reduced to one of *low* significance. Should the proposed development go ahead, post-construction monitoring would be essential in evaluating the success of such bird diverters as the technology is relatively new.

# Contents

# 1. Introduction

Eskom Holdings SOC (Pty) Ltd is proposing the construction of a 66KV substation and powerlines on Farm 305/16, adjacent to the Keurbooms-Bitou River, Plettenberg Bay, Western Cape. Portions of these developments will lie below the 5-m contour and hence within the Estuarine Functional Zone of the Keurbooms-Bitou Estuary as defined in the National Biodiversity Assessment: Estuary Component (van Niekerk & Turpie 2011).

The location of the proposed substation will lie adjacent to the T-junction of the Main Road 390 (R340) and the National Road N2/8 (

Figure 1). High-voltage powerlines supported by several pylons will connect the substation to the national grid, and will cross the Keurbooms-Bitou Estuary (Figure 2 & Figure 3). One of the pylons (B16)will be installed below the 5-m contour within the estuarine functional zone of the Keurbooms estuary, situated on the 3-m contour approximately 20 m from the High water Mark (Figure 3). The footprint of the pylon will be approximately 5.30 x 2.65 m.

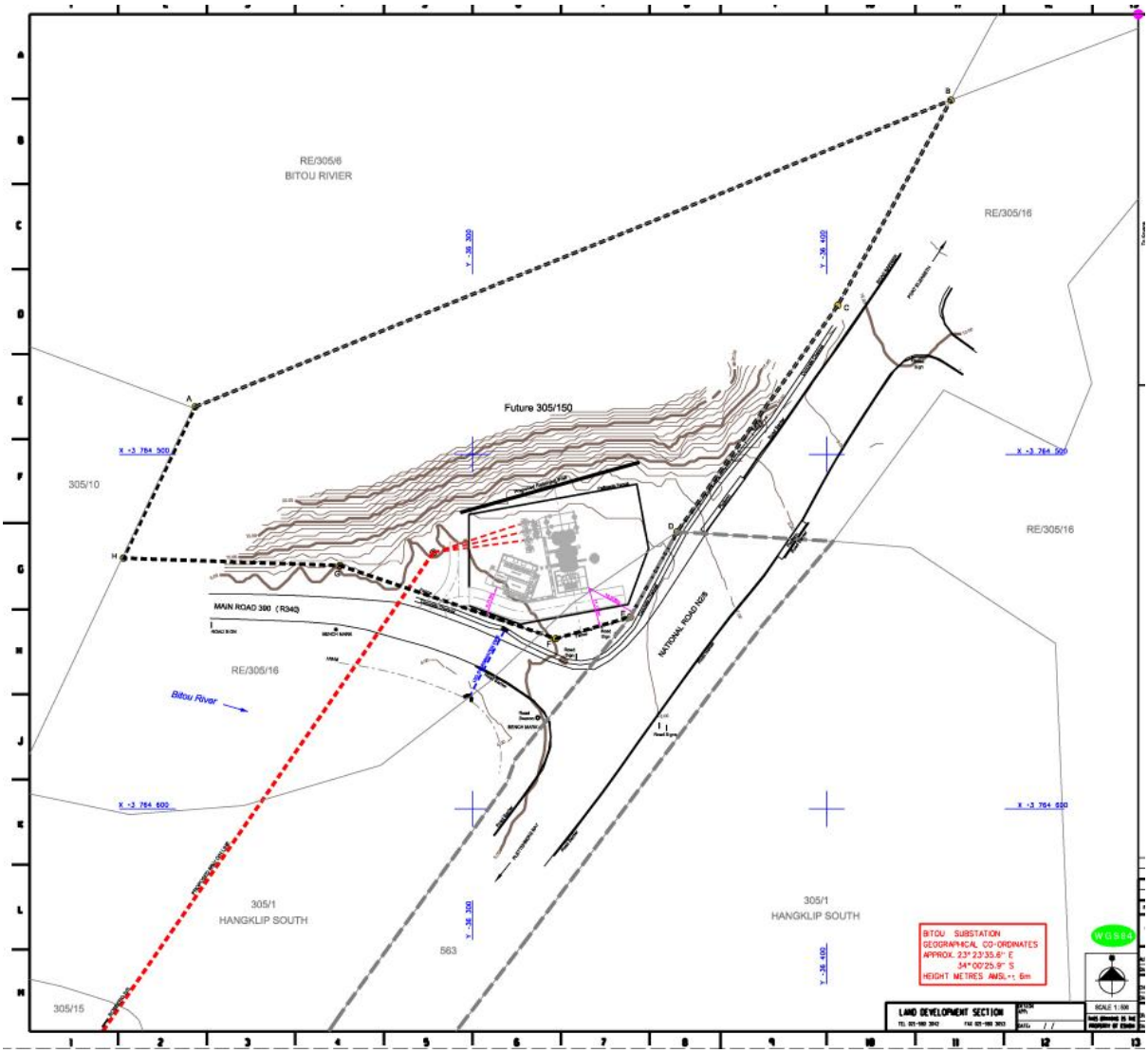

**Figure 1. Site plan for the proposed development. Red dashed lines indicate the proposed power line. (Source: Eskom).**

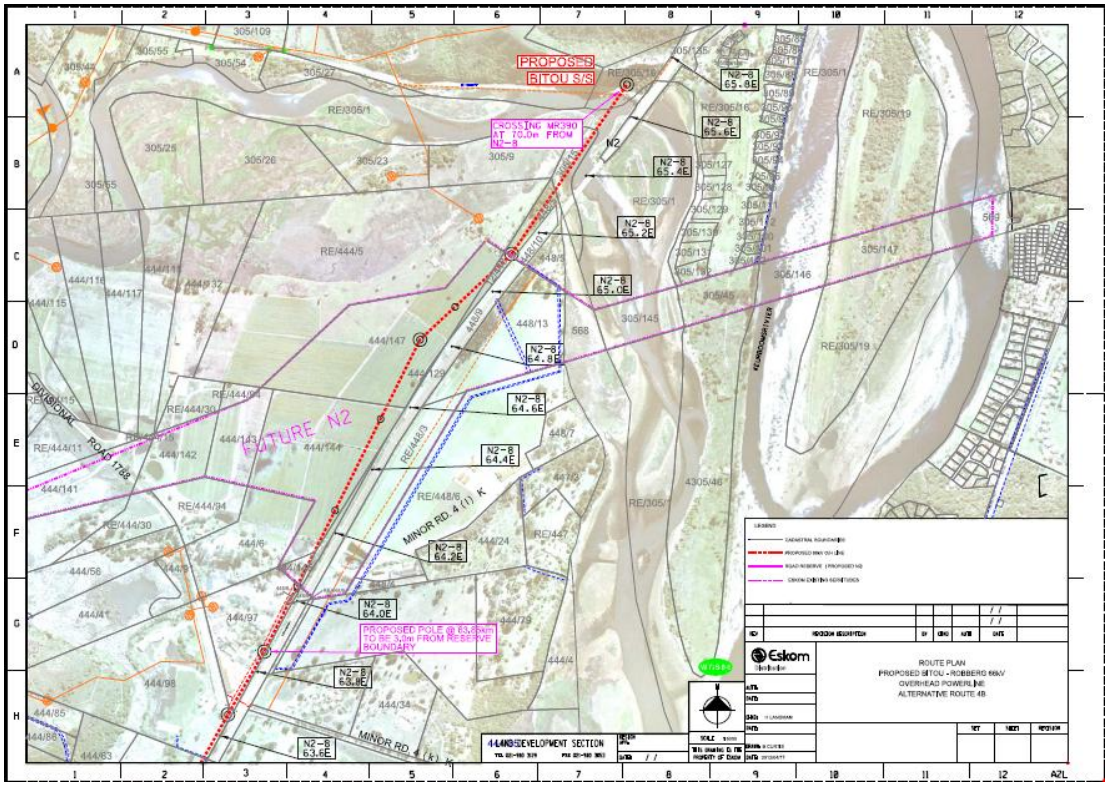


**Figure 2.** **Site plan showing the wider area and the direction of the proposed power lines (dotted red line) and supportive pylons (concentric black rings).**


**Figure 3.** **Close-up view of the pylon (B15, B16 & Term) positions in the receiving environment.**

A specialist estuarine ecological assessment was therefore commissioned as part of the Basic Assessment process associated with the proposed development.

This report includes the following components relating to the proposed development and its potential impact in the Estuarine Functional Zone:

1. A description of the affected estuarine habitats, including their sensitivity and significance;

2. Identification and assessment of impacts to the marine and coastal environment in accordance with standard methodology; and

3. Specialist mitigation measures with comprehensive method statements.

# 2. Methods of Assessment

The site for the proposed development was visited on 18 and 19 March 2013. A qualitative biodiversity survey was conducted of the area within the development footprint, with particular focus on plants and estuarine associated organisms, including birds, within the portion of the proposed development footprint that is situated in the Estuarine Functional Zone. In addition, the adjacent Keurbooms-Bitou Estuary was studied with attention given to how the proposed development may impact it, including potential impacts of the power lines emanating from the substation.

Dominant species were recorded and particular attention was given to the identifying species and habitats of conservation concern. Only diurnal observations were conducted, which apart from direct observations of species, also included signs of their presence such as footprints, scat and borrows etc.

A desktop study was also undertaken to evaluate the vegetation type of the area based on the broad-scale classification (1: 1 000 000) of Mucina & Rutherford (2006) and the fine-scale classification of vegetation units derived from the Garden Route Initiative Fine-Scale Biodiversity Planning (GRFBP) project (SANParks & C.A.P.E 2010a), the areas biodiversity and transformation status in terms of the GRFBP project (SANParks & Garden Route Initiative 2010a, 2010b), and birds recorded in the pentad covering the affected area at large SABAP2 (2013) and according to Coordinated Waterbird Counts specifically of the lower reaches of the Bitou River (Taylor *et al.* 1999).

# 3. Results

## 3.1. Desktop assessment of transformation and conservation status of the development footprint and adjacent estuary

At a landscape level, most of the area surrounding the proposed substation is natural and untransformed (Figure 4). Other nearby areas have been transformed to urban, farmland or degraded status. The conservation status of the proposed site of the substation is considered part of a Critical Biodiversity Area according to the fine-scale (1:10 000) GRFBP project (SANParks & Garden Route Initiative 2010a) (Figure 5). The proposed power lines will also run through the Estuarine Functional Zone of the Keurbooms estuary which is also a Critical Biodiversity Area .

The Bitou River feeds the Keurbooms Estuary, and together the Bitou-Keurbooms estuarine system is ranked as the 18$^{th}$ most important of the 256 functioning estuaries in South Africa, in terms of conservation value (Turpie 2004). Its importance is well recognised by the Garden Route Biodiversity Sector Plan 2010 for the George, Knysna and Bitou Municipalities (Vromans 2010).


**Figure 4. Land transformation in the vicinity of the proposed substation. = Natural, = Urban, = Farms, =Degraded, = Alien invaded.**

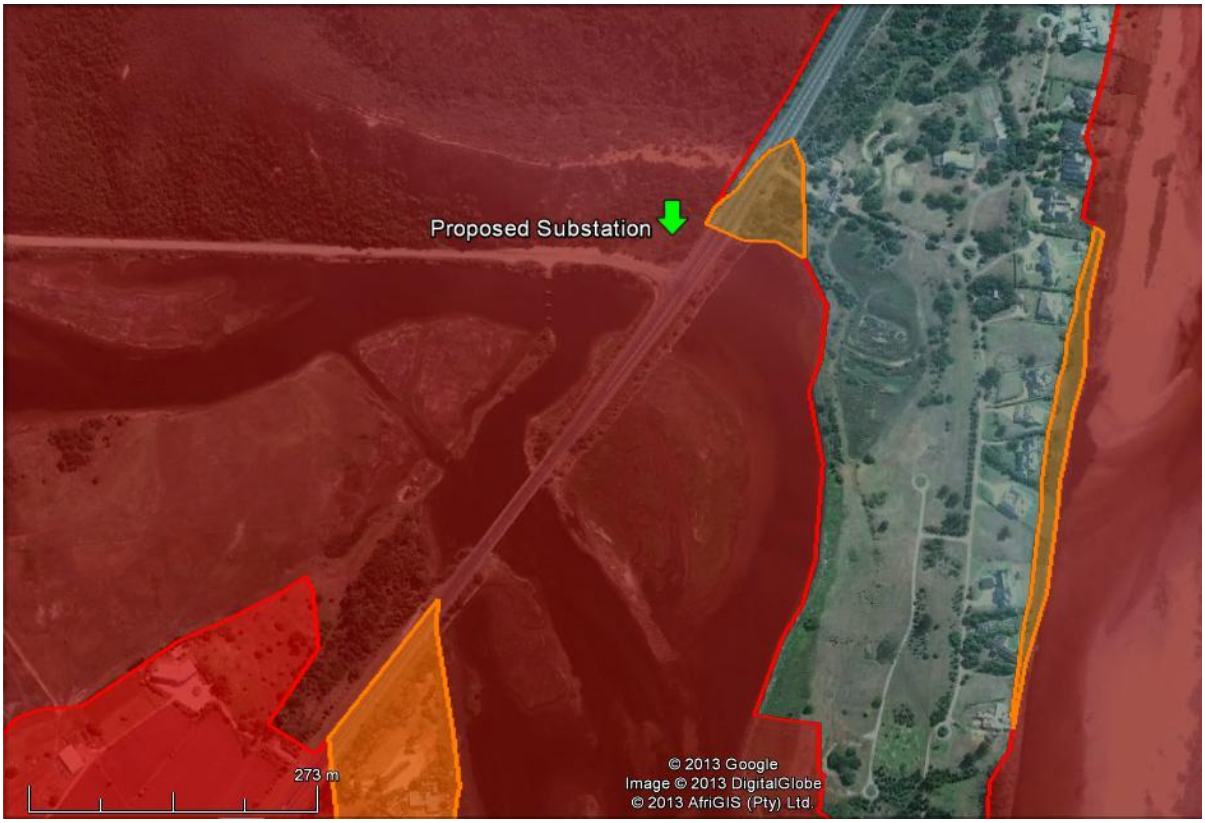


**Figure 5. Biodiversity status in the vicinity of the proposed substation. = Critical Biodiversity Area, = Ecological Support Area.**

## 3.2. On-site assessment of affected habitats and species

### 3.2.1. Substation

The development footprint of the substation, including that which resides within the Estuarine Functional Zone (i.e. below the 5-m contour) is classified as Keurbooms Thicket-Forest according to the 1:10 000-scale mapping of the GRFBP project (SANParks & C.A.P.E 2010a) based on the work of Vlok *et al*. (2008). However, site inspection found that most of the vegetation within the substation footprint is highly degraded with pristine Keurbooms Thicket-Forest restricted to the base and slopes of the cliffs at the northern edge of the proposed development footprint only. The Thicket-Forest at the base and on the cliffs is in good condition, of high conservation value (Critical Biodiversity Area), and comprises Protected white milkwood *Sideroxylon inerme* (one particular specimen is ancient) (Figure 6). Care should be taken not to disturb any of this habitat during development.

The remaining flat area (that which is not thicket-forest), between the road and base of the cliffs (including part of the Estuarine Functional Zone), however, has been severely degraded by road construction activities, has little conservation value and was dominated by the alien black wattle *Acacia mearnsii*. This area is therefore not considered to be a Critical Biodiversity Area based on *on-site* evaluations.

**Figure 6. A particularly large and ancient milkwood *Sideroxylon inerme,* situated directly adjacent to the Estuarine Functional Zone at the base of the cliffs.**

The Estuarine Functional Zone of the degraded flat area within the proposed development footprint of the substation was similarly dominated by wattle *Acacia mearnsii*. Indigenous species, however, were present, in particular *Chloris gayana*, *Helichrysom cymosoi* and *Erica hispidula*. A list of plant species recorded within the Estuarine Functional Zone of the development footprint is given in Table 1. No Red-Listed plant species were found. Furthermore, no estuarine or estuarine associated plant species were found. Plants recorded were all intolerant of saline conditions and saturated/inundated soils and hence cannot really be considered to be estuarine associated species.

**Table 1. Plant species recorded specifically within the Estuarine Functional Zone of the development footprint.**

| Scientific name | Common name |
|---|---|
| *Acacia mearnsii* | Wattle |
| *Briza maxima* | Large quaking grass |
| *Buddleja saligna* | Olive buddleja |
| *Chloris gayana* | Rhodes grass |
| *Cortaderia selloana* | Pampus grass |
| *Eragrostis curvula* | Weeping love grass |
| *Erica hispidula* | Erica |
| *Helichrysom cymosom* | Helichrysom |
| *Hypoxis* sp. | African potato |
| *Osteospermum moniliferum* | Tickberry |

| Scientific name | Common name |
|---|---|
| *Panicum maximum* | Guinea grass |
| *Paspalum dilatatum* | Dallis grass |
| *Pennisetum clandestinum* | Kikuyu grass |
| *Putterlickia pyracantha* | Bastard spike-thorn |
| *Rhus chirindensis* | Red current rhus |
| *Rhus* c.f. *lucida* | Shiny-leaved rhus |
| *Tarchonanthus camphoratus* | Wild camphor bush |
| *Trimeria grandifolia* | Mulberry-leaf trimeria |

Thirty-two animal species were recorded in and adjacent to the proposed substation over the two days on site (Table 2). The most abundant group were insects followed by birds. In general, the development footprint was depauperate in fauna, with very few signs of animal life. Two species' of birds of conservation concern, the Cape cormorant and Lanner falcon, both of which are listed as Near-threatened, were recorded adjacent to and flying over the development footprint respectively (Barnes 2000). The iconic African fish-eagle was also recorded over the estuary.

### 3.2.2. Pylon B16

Besides the substation, the only other component of the proposed development that is situated on the ground (i.e. besides power lines) within the Estuarine Functional Zone is Pylon B16 at the 3-m contour line (Figure 3). The vegetation within the development footprint of this pylon is classified as Garden Route Shale Fynbos (Mucina & Rutherford, 2006), which is listed as Endangered. However, this area has also been well mapped by the GRFBP project (SANParks & Garden Route Initiative 2010b), and is classified as Degraded (Figure 4). The on-site evaluation of the area indicated that the vegetation type is not estuarine in nature, and is certainly not Cape Estuarine Salt Marsh which is the vegetation type associated with areas of the Bitou Estuary closer to the High Water Mark. The vegetation is decidedly terrestrial and most closely conforms to Garden Route Shale Fynbos albeit in a degraded state due to current land use practices. Common plants were various species of *Rhus* spp., *Chrysanthemoides monilifera* and *Buddleia saliana,* as well as several alien pine trees *Pinus* sp. The area is of little conservation value, and is highly isolated and fragmented by the N2 and adjacent farmland.

### 3.2.3. Adjacent Keurbooms-Bitou Estuary

The adjacent section of the Keurbooms-Bitou Estuary below the High Water Mark was dominated by open water with a steep (±30°), narrow, rocky shoreline that separated it from the road and remaining Estuarine Functional Zone (Figure 7). Intertidal and shallow subtidal sandbanks with eelgrass *Zosterra capensis* occur on the far side of the open water area where several species of fish and bird were recorded (Figure 8 & Table 2).

Although altered, this area is in a reasonable condition, includes some rare habitat and important biodiversity, in particular waterbirds and the Endangered Knysna seahorse *Hippocampus capensi*. According to SABAP2, 246 bird species have been recorded within the pentad (3400_2320) that covers the proposed development site and adjacent areas (SABAP2 2013). More specific to the lower

reaches of the Bitou River, the Coordinated Water Bird Count has recorded a total of 75 waterbird species frequenting the area (see Appendix 1; Taylor *et al*. 1999). Most important is the high prevalence of Yellow-billed Duck, South African Shellduck, Cape and Red-billed Teal, Pied Avocet and Black-winged Stilt.

The proposed development should be undertaken in a manner that minimises and mitigates any impact on this adjacent area and the airspace above it. Two potential aspects of concern regarding the proposed development relate to i) the presence of a storm water drain that exudes water from the road as well as the area encompassing the proposed development footprint into the Keurbooms-Bitou Estuary, and ii) the power lines that would emanate from the proposed substation.

The storm-water drain is a potential source of pollution from the substation, particularly during construction. Care should therefore be taken to ensure that soil and all sources of pollution (such as paint, chemicals & construction waste etc) do not enter the estuary via the storm-water drain. In addition, once the substation has been constructed, it should not be a site for erosion.

The most significant negative impact associated with the proposed development, however, is likely to come from waterbirds colliding with power lines as the power lines will run from the proposed substation directly across the estuary parallel to the N2 bridge. Collisions are the biggest single threat posed by power lines to birds in southern Africa (van Rooyen, 2004). Rivers and estuaries are habitats that act as movement corridors for many species, and the Bitou River is recognised as an important ecological corridor in this regard (Vromans, 2010). Waterbirds in particular, are known to move up and down estuaries between foraging and roosting areas, especially during low light periods at dawn and dusk and during the night (Shewell, 1959; Rowan, 1963; Halsa 1985; Deng & Frederick 2001; Sanzenbacher & Haig 2002; Link *et al.* 2011). Essential mitigation measures therefore need to be put in place to minimise the risk of waterbirds colliding with these power lines.

**Table 2. Animal species recorded within the Estuarine Functional Zone of the proposed development footprint.**

| Common name | Scientific name | Comment |
|---|---|---|
| **Insects** | | |
| **Common thorntail dragonfly** | ***Ceratogomphus pictus*** | |
| **Painted sprite damselfly** | ***Pseudagrion hageni*** | |
| **Cotton-stainer assassins** | ***Phonoctonus* sp.** | |
| **Antlion** | **Myrmeleontidae** | |
| **Copper-tailed blowfly** | ***Chrysoma chloropyga*** | |
| **Grasshopper 1** | **Orthoptera 1** | |
| **Grasshopper 2** | **Orthoptera 2** | |
| **Green-banded swallowtail** | ***Papilio nireus*** | |
| **Common bush brown** | ***Bicyclus safitza*** | |
| **Brown vapourer** | ***Bracharoa dregei*** | |
| **African migrant** | ***Catopsilia florella*** | |
| **Hornet** | **Vespidae** | |
| **Reptiles** | | |
| **Cape skink** | ***Mabuya capensis*** | |
| **Birds** | | |
| **Sombre greenbul** | ***Andropadus importunis*** | |
| **African dusky flycatcher** | ***Muscicapa adusta*** | |
| **Yellow-billed kite** | ***Milvus aegyptius*** | **Fly over** |
| **Lanner falcon** | ***Falco biarmicus*** | **Fly over** |
| **Swee waxbill** | ***Coccopygia melanotis*** | |

| Common name | Scientific name | Comment |
|---|---|---|
| Cape white-eye | *Zosterops virens* | |
| Cape robin-chat | *Cossypha caffra* | Adjacent to substation |
| Little egret | *Egretta garzetta* | Adjacent to substation |
| White-breasted cormorant | *Phalacrocorax lucidus* | Adjacent to substation |
| Cape cormorant | *Phalacrocorax capensis* | Adjacent to substation |
| Fish eagle | *Haliaeetus vocifer* | Adjacent to substation |
| Grey heron | *Ardea cinerea* | Adjacent to substation |
| Blacksmith lapwing | *Vanellus armatus* | Adjacent to substation |
| Cape wagtail | *Motacilla capensis* | Adjacent to substation |
| Speckled pigeon | *Columba guinea* | Adjacent to substation |
| Pied kingfisher | *Ceryle rudis* | Adjacent to substation |
| Kelp gull | *Larus dominicanus* | Adjacent to substation |
| Sacred ibis | *Threskionis aethiopicus* | Adjacent to substation |
| Mammals | | |
| Striped mouse | *Rhabdomys pumilio* | |

**Figure 7.** **Narrow and steep rocky shoreline on the edge of the Keurbooms-Bitou estuary adjacent to the proposed development site.**

**Figure 8.** **Looking towards the proposed development site: *Zosterra capensis* growing on shallow sandbanks in the foreground with an open water area, estuary banks and the proposed development area in the background.**

## 3.3. Use of the Estuarine Functional Zone within the development footprint by estuarine and estuarine-associated species and its ecological support role to the Keurbooms-Bitou Estuary

Overall, the portion of the proposed development footprint of the substation that intersects with the Estuarine Functional Zone of the Keurbooms-Bitou estuary appears to play no significant support role to estuarine and estuarine-associated species. There is no suitable habitat of significance to act as perches or roosting sites for estuarine birds, the road is likely to act as a significant disturbance factor and the lush alien vegetation dominating this site would also make it unfavourable for use by estuarine birds.

No evidence was found that suggests that the area is being used by estuarine-associated mammals such as Water mongoose and Cape clawless otter. The confined space and small size of the site (between cliffs and a busy road), as well as its position in the landscape (i.e. unsuitable as an ecological corridor between terrestrial and aquatic environments), all contribute to making the area unfavourable.

That said, however, the area may still serve as a source of freshwater runoff to the adjacent estuary and as such would assist with the maintenance of salinity regimes and also in channelling water downstream. During extreme flood events this area may scour out and provide sediments to downstream habitats such as salt marshes and sandbanks, thereby maintaining estuarine habitats.

## 3.4. Sensitivity of the Estuarine Functional Zone within the proposed development footprint of the substation, pylon B16, and the adjacent Keurbooms-Bitou Estuary

Due to the degraded nature of the portion of the proposed development footprint of the substation within the Estuarine Functional Zone, it can be considered to be of *low sensitivity*. Similarly, due to the somewhat degraded and terrestrial nature of the footprint of pylon B16, it too is of *low sensitivity*. However, the adjacent Keurbooms-Bitou Estuary (i.e. below the High Water Mark) is considered to be of *high sensitivity* due to its aquatic nature, reasonable condition and the important biodiversity it supports. Any potential direct or indirect impacts should therefore be avoided and or mitigated. Direct impacts and first-order indirect impacts are provided in Section 4 Impact assessment.

## 3.5. Potential impacts of climate change

Climate change models predict that stormflows (based on medians) are likely to increase from west to east across South Africa for typical years, with the west coast and hinterland showing clear reductions into the intermediate (2046-2065) and distant future (2081-2100) (Schulze & Kunz 2012). However, there is an abrupt shift to a band of marked projected increases in stormflows in the area which is transitional between the winter and summer rainfall (Schulze & Kunz 2012). This would include the Bitou Estuary.

Streamflow (Mean Annual Runoff or MAR) is also expected to increase in the region of the Bitou Estuary and its catchment by approximately 20%, similar to the majority of the country, in both the intermediate (2046-2065) and distant future (2081-2100) (Schulze & Kunz 2011).

Historically (1950-1999), the Bitou Estuary catchment had a 100-250 $m^3.S^{-1}$ one day design peak discharge for a 20 year return period, which is typical of most of the country except for many areas of the Northern Cape (Knoesen & Schulze 2011). For a 2 year return period, it historically had a one day design peak discharge of less than 25 $m^3.S^{-1}$ which is similar to the south-western cape. However, models of the one day design peak discharge show that for a 2 year return period it will increase by approximately 20% for the intermediate future (2046-2065) and distant future (2081-2100), with highest projected increases in peak discharge appearing in the transitional areas between winter and summer rainfall regions such as in the Bitou catchment. However, for the 10 year and 20 year return periods, one day design peak discharge is actually expected to decrease for the intermediate (2046-2065) and distant future (2081-2100).

From an engineering perspective, the most important variables to consider are the short and long duration day design rainfalls. Engineering structures such as dams, bridges, culverts and stormwater systems need to be designed to accommodate peak floods of a certain magnitude in order to function safely at a given level of risk (Schulze *et al*. 2011). Climate change, likely to be manifest as alterations to temperature and rainfall regimes as well as increases in rainfall variability, may lead to increases in the intensity and frequency of extreme rainfall events and associated flooding (Schulze *et al.* 2011), which could affect the proposed infrastructure for this project due to its proximity to the high water mark. In terms of short duration (10 min - 24 h) design rainfall changes, no

discernable change from the present is predicted in intermediate and distant future scenarios for all return periods for much of the country including the Bitou (Knoesen *et al.* 2011a).

For long duration (one to seven days) design rainfalls, the overall picture for South Africa is that of a 10 to 20% increase (Knoesen *et al.* 2011b). For the study area, ten percent increases are predicted especially for the 7 day duration design rainfalls (for 2 year and 20 year return periods) but also (albeit by less than a 10 % increase) for the one-day 2-year return period and for the one-day 20-year return period (see Knoesen *et al.* 2011b).

The impact of climate change on flows is not likely to impact on water levels and flood events much more so than under current levels. Indications are that a 1 in 100 year flood may now have an occurrence internal of 1 in 90 years for at least the next 100 years. In terms of design rainfalls, which are constrained by the fact that predictions can only be made up to the 20 year return period, short term rainfalls are not likely to change in the next 100 years on site. Thus, according to these models, climate change will have very little influence on the development based on this variable. For long term design rainfalls, a small increase (≈10%) is predicted for 20 year return periods. Climate change influences on the hydrodynamics of the Bitou Estuary are therefore highly unlikely to need further consideration than what is already encompassed in standard 1 in 100 year flood lines already considered by engineers.

In terms of sea level change, predictions are that global sea levels will rise between 28 and 43 cm by the end of the 21$^{st}$ century (relative to 1980-1999, Meehl *et al*. 2007). Impacts on coastal systems resulting from a rise in sea level include an increase in inundation, flood and storm damage, erosion, saltwater intrusion, rising water tables/impeded drainage as well as the loss of wetland habitat.

Linear and nonlinear sea-level changes at Durban, South Africa have been studied by Andrew Mather (Coastal and Catchment Policy, Co-ordination and Management, eThekwini Municipality), in which the tide records between 1970 and 2003 for Durban, South Africa, have been analysed to determine the extent of recent linear and nonlinear sea-level trends. The linear trends of monthly mean sea-level revealed a sea level rise of 2.7 ± 0.05 mm/y and the yearly mean sea-level trend revealed a rise of 2.4 ± 0.29 mm/y. Nonlinear trends varied between –1 mm and +8 mm / yr. Based on the yearly mean sea-level trend in Durban, an increase of approximately 24 cm can be expected in the mean sea-level off the Keurbooms-Biotu estuary mouth in 100 years time. As the proposed development is approximately 2.5 km inland from the sea, it is highly unlikely that the site will be affected by erosion as a result of sea-level rise in the next 100 years and certainly not likely to inundate either the proposed substation or pylon B16.

# 4. Impact assessment

## 4.1. Construction phase

### 4.1.1. Habitat destruction

Due the nature of the substation development, the site will have to be cleared of vegetation and levelled. As the Estuarine Functional Zone component of the proposed site for the substation is highly degraded and dominated by alien species, probably from construction of the N2 highway, the significance of *habitat destruction* is *considered low* (Table 3). However, there is potential for labourers to wander across the road and outside of the development footprint of the substation and potentially trample and destroy adjacent estuarine vegetation which should be prevented. In addition, the adjacent indigenous forest vegetation, which lie outside of the Estuarine Functional Zone, should not be disturbed as this would indirectly affect the Estuarine Functional Zone. Impacts of the proposed development on this area should be guided by a terrestrial botanist/ecologist.

**Table 3. Impact 1: Habitat destruction within the Estuarine Functional Zone for the substation footprint.**

| | ***Extent*** | ***Intensity*** | ***Duration*** | ***Consequence*** | ***Probability*** | ***Significance*** | ***Cumulative impact*** | ***Status*** | ***Confidence*** |
|---|---|---|---|---|---|---|---|---|---|
| Without mitigation | Local **1** | Low **1** | Long-term **3 (Irreversible)** | **Low 5** | Definite | **LOW** | **Low** | **– ve** | High |
| | Essential mitigation measures:<br>• No workers allowed between the Main Road 390 (R340) and water level of the estuary or between the N2 and water level of the estuary. I.e. no access to or below the High Water Mark of the estuary.<br>• These areas should be appropriately demarcated/fenced off for the duration of the construction period and all demarcation removed entirely after completion of the project.<br>• No water abstraction of any kindto be permitted from the estuary<br>• All cleared alien vegetation from the footprint of the substation to be removed from the site to a suitable landfill area. Any alien species seeds should not be allowed to enter the culvert.<br>• No use of any herbicides within 32 m of the High Water Mark or near culverts or storm water drains. | | | | | | | | |
| With mitigation | Local 1 | Low 1 | Long-term **3 (Irreversible)** | Low 5 | Definite | LOW | Low | -ve | High |

Similarly, the development of pylon B16 will also result in a patch of vegetation of at least 14.05 $m^{2}$ in extent being cleared along with an access track to this site for construction purposes. This area itself is of low sensitivity but lies adjacent to sensitive estuarine habitats and therefore several essential mitigation measures are required (Table 4).

Finally, the stringing of the overhead power lines from the pylon at the substation to pylon B16 may also have an impact on the Estuarine Functional Zone it traverses if not done appropriately.

According to the engineers, they can do this without driving in the Estuarine Functional Zone and use a pulley which will prevent any cables from touching the ground. No significant impacts are likely to result from this method of stringing the pylons as long as these methods are adhered to (Table 5).

**Table 4. Impact 2: Habitat destruction within the Estuarine Functional Zone for pylon B16.**

| | ***Extent*** | ***Intensity*** | ***Duration*** | ***Consequence*** | ***Probability*** | ***Significance*** | ***Cumulative impact*** | ***Status*** | ***Confidence*** |
|---|---|---|---|---|---|---|---|---|---|
| Without mitigation | Local **1** | Low **1** | Medium-term **2 (Reversible)** | **Very low 4** | Definite | **VERY LOW** | **Low** | **– ve** | High |
| | Essential mitigation measures:<br>• No workers allowed between the footprint of B16 and the Bitou Estuary. I.e. No access to or below the High Water Mark of the estuary.<br>• These areas should be appropriately demarcated/fenced off for the duration of the construction period and all demarcation removed entirely after completion of the project.<br>• No water abstraction of any kind to be permitted from the estuary.<br>• Access to the footprint should be via a strip track where vegetation is simply cut and no road should be graded to the footprint. i.e no disturbance to the top soil<br>• The access track must emanate from the N2, be as short as practicably possible, and use the road verge as far as possible to achieve an appropriate gradient to the track and thereby minimise habitat destruction of adjacent vegetation outside of the road verge (see Figure 9).<br>• Any alien vegetation cleared from the footprint of the track and pylon to be removed from the site and placed at a suitable landfill area. Seeds from alien species should not be spread to adjacent sites.<br>• The footprint of the pylon and the construction track must be rehabilitated with vegetation that is indigenous to the area, as directed by a rehabilitation specialist. Alien vegetation must be removed from the disturbed areas for a period of at least ten years post construction until the area has been suitably rehabilitated.<br>• All top soil (from the top 40 cm) excavated from within the pylon footprint should be stored carefully offsite for later use in rehabilitation and not be mixed with any other materials.<br>• The surrounding area should not be used for construction or storage of materials and disturbance must be limited to the construction track and pylon footprint.<br>• No use of any herbicides within 32 m of the High Water Mark. | | | | | | | | |
| With mitigation | Local 1 | Low 1 | Medium-term **2 (Reversible)** | Very low 4 | Definite | VERY LOW | Low | -ve | High |


**Figure 9. Proposed route of construction track to pylon B16 that should be followed to minimise habitat destruction.**

**Table 5. Impact 3: Habitat destruction of the Estuarine Functional Zone while stringing the overhead cables using the method described above.**

| | ***Extent*** | ***Intensity*** | ***Duration*** | ***Consequence*** | ***Probability*** | ***Significance*** | ***Cumulative impact*** | ***Status*** | ***Confidence*** |
|---|---|---|---|---|---|---|---|---|---|
| Without mitigation | Local **1** | Low **1** | Short-term **1 (Reversible)** | **Very low 3** | Improbable | **INSIGNIFICANT** | **Low** | **– ve** | High |
| | Essential mitigation measures:<br>• Not required although the proposed method for stringing the cables between pylons must be strictly adhered to. | | | | | | | | |
| With mitigation | **Not applicable** | | | | | | | | |

### 4.1.2. Pollution & runoff

The construction phase of most developments increases the chance of pollution. In this case, the effect on the adjacent Keurbooms-Bitou Estuary would be exacerbated by the presence of a culvert that is situated between the proposed site of the substation and existing roads, which drains into the estuary via a storm-water outlet. Potential sources of pollution include soil runoff (during earth moving operations) which may lead to excessive turbidity and siltation of the estuary, but more serious could be chemical pollution such as from paints and solvents that are likely to be used during construction. This is easily preventable and should be mitigated such that potential impacts can be neutralised (Table 6). The culvert should either be temporarily covered and or construction workers strictly supervised at all times to ensure that no foreign material enters the culvert and estuary. This includes plastics and all other forms of general litter e.g. packets, cartons, tins.

Similarly, the construction of Pylon B16 could have similar impacts in terms of soil runoff, chemicals and other pollutants. Although there is no culvert to escalate this risk, essential mitigation measures similar to those made for the substation need to be undertaken (Table 7).

**Table 6. Impact 4: Pollution, including soil runoff and other foreign materials associated with the proposed substation entering the estuary via the existing storm-water drain.**

| | ***Extent*** | ***Intensity*** | ***Duration*** | ***Consequence*** | ***Probability*** | ***Significance*** | ***Cumulative impact*** | ***Status*** | ***Confidence*** |
|---|---|---|---|---|---|---|---|---|---|
| Without mitigation | Local **1** | Medium **2** | Medium-term **2 (Reversible)** | **Low 5** | Probable | **LOW** | **Medium** | **– ve** | Medium |
| | Essential mitigation measures:<br>• No soil or other foreign material (paint, cement powder, chemicals and any other materials associated with construction) should be put either deliberately or accidentally in the culvert bordering the site so that is can wash into the estuary. Close supervision required to ensure this does not happen and or culvert should be covered until construction is finished.<br>• No workers allowed between the Main Road 390 (R340) and water level of the estuary or between the N2 and water level of the estuary to prevent erosion. I.e. No access to or below the High Water Mark of the estuary.<br>• All chemicals should be responsibly contained and used, and no chemicals should be stored within 32 m of the High Water Mark.<br>• No storage of building materials within 32 m of the High Water Mark.<br>• Cement & concrete mixing not to be done within 32 m of the High Water Mark or near the culvert and not to be done on permeable surfaces. Only to be undertaken at authorised sites determined suitable by botanist/terrestrial ecologist to ensure that this does not get into storm water,<br>• All vehicles & machinery should be checked daily for oil and chemical leaks. No leaking machines to be allowed on site.<br>• No washing of vehicles and machinery within 32 m of the High Water Mark or close to storm water drains and only at designated areas defined by botanist/terrestrial ecologist.<br>• Chemical toilet to be provided for all workers which should be located at least 32 m from the High Water Mark. No other areas may be used for toilet facilities.<br>• No littering or waste disposal except in dustbins. Dustbins for workers should be placed at least 32 m from the High Water Mark and have lids to ensure no material blows out.<br>• No burning of waste or fires on site or within 32 m of High Water Mark.<br>• No depositing of soil within 32 m of the High Water Mark, & only at authorised areas at least 32 m from the High Water Mark as guided by a terrestrial botanist/ecologist.<br>• All building rubble, construction material and litter to be removed during and once construction is finished.<br>• Contractor in association with the Project Coordinator to ensure compliance of workers with good environmental practices and general conduct as per their environmental awareness induction training. | | | | | | | | |
| With mitigation | Local 1 | Low 1 | Medium-term 2 (Reversible) | **Very Low 4** | Possible | **INSIGNIFICANT** | Very low | Neutral | Medium |

**Table 7. Impact 5: Pollution, including soil runoff and other foreign materials associated with Pylon B16 during construction.**

| | ***Extent*** | ***Intensity*** | ***Duration*** | ***Consequence*** | ***Probability*** | ***Significance*** | ***Cumulative impact*** | ***Status*** | ***Confidence*** |
|---|---|---|---|---|---|---|---|---|---|
| Without mitigation | Local **1** | Medium **2** | Medium-term **2 (Reversible)** | **Low 5** | Probable | **LOW** | **Low** | **– ve** | Medium |
| | Essential mitigation measures:<br>• All chemicals should be responsibly contained and used, and no chemicals should be stored within 32 m of the High Water Mark.<br>• No storage of building materials within 32 m of the High Water Mark.<br>• Cement & concrete mixing not to be done within 32 m of the High Water Mark and not to be done on permeable surfaces. Only to be undertaken at authorised sites determined suitable by botanist/terrestrial ecologist to ensure that this does not get into storm water,<br>• All vehicles & machinery should be checked daily for oil and chemical leaks. No leaking machines to be allowed on site.<br>• No washing of vehicles and machinery within 32 m of the High Water Mark or close to storm water drains and only at designated areas defined by botanist/terrestrial ecologist.<br>• Chemical toilet to be provided for all workers which should be located at least 32 m from the High Water Mark. No other areas may be used for toilet facilities.<br>• No littering or waste disposal except in dustbins. Dustbins for workers should be placed at least 32 m from the High Water Mark and have lids to ensure no material blows out.<br>• No burning of waste or fires on site or within 32 m of High Water Mark.<br>• No depositing of soil within 32 m of the High Water Mark, & only at authorised areas at least 32 m from the High Water Mark as guided by a terrestrial botanist/ecologist.<br>• All building rubble, construction material and litter to be removed during and once construction is finished.<br>• Contractor in association with the Project Coordinator to ensure compliance of workers with good environmental practices and general conduct as per their environmental awareness induction training. | | | | | | | | |
| With mitigation | Local 1 | Low 1 | Medium-term 2 (Reversible) | **Very Low 4** | Possible | **INSIGNIFICANT** | Very low | Neutral | Medium |

## 4.2. Operational phase

### 4.2.1. Site for erosion

Due to the nature of the development, all vegetation within the Estuarine Functional Zone of the development footprint of the substation will be removed and therefore the area may be a potential site for erosion and a source of siltation and turbidity. This would possibly be the case if any bare ground areas are left exposed and would result in a *negative* status for this potential impact (Table 8). This impact can easily be mitigated by covering any bare ground areas with a suitable ground cover such as gravel or indigenous turf forming grass such as *Cynodon dactylon* to minimise soil erosion. In addition, it should also be noted that removal of indigenous vegetation at the foot of or on the sides of the adjacent cliff area (i.e. outside of the Estuarine Functional Zones) is likely to result in significant erosion which would impact negatively on the estuary.

**Table 8. Impact 6: The development footprint of the substation becoming a site of erosion and thus contributing to siltation of the estuary.**

| | ***Extent*** | ***Intensity*** | ***Duration*** | ***Consequence*** | ***Probability*** | ***Significance*** | ***Cumulative impact*** | ***Status*** | ***Confidence*** |
|---|---|---|---|---|---|---|---|---|---|
| Without mitigation | Local **1** | Medium **2** | Long-term **3 (Reversible)** | **Medium 6** | Possible | **LOW** | **Low** | **– ve** | Medium |
| | Essential mitigation measures:<br>• Any bare ground areas of the substation that do not have hard infrastructure should be covered by suitable groundcover such as gravel or indigenous turf forming grass such as *Cynodon dactylon* to minimise soil erosion. | | | | | | | | |
| With mitigation | Local 1 | Medium 2 | Long-term 3 | **Medium 6** | Improbable | **LOW** | **Very low** | **Neutral** | Medium |

In addition, the footprint of Pylon B16 and the probable construction track that would need to be built is also likely to induce erosion. Essential mitigation measures are therefore recommended in the form of rehabilitation of the footprint and track to back to natural vegetation indigenous to the area (Table 9).

**Table 9. Impact 7: The development footprint of pylon B16 and associated construction track becoming a site of erosion.**

| | ***Extent*** | ***Intensity*** | ***Duration*** | ***Consequence*** | ***Probability*** | ***Significance*** | ***Cumulative impact*** | ***Status*** | ***Confidence*** |
|---|---|---|---|---|---|---|---|---|---|
| Without mitigation | Local **1** | Medium **2** | Long-term **3 (Reversible)** | **Medium 6** | Possible | **LOW** | **Low** | **– ve** | Medium |
| | Essential mitigation measures:<br>• Rehabilitation of the pylon footprint and track (see Table 4 for details). | | | | | | | | |
| With mitigation | Local 1 | Medium 2 | Medium-term 2 | **Low 5** | Improbable | **VERY LOW** | **Very low** | **Neutral** | Medium |

### 4.2.2. Site for alien vegetation

Any disturbance, such as the development of a substation or the construction of pylons, increases the likelihood of alien plant infestations which can then become a source of aliens for other non-affected areas of the estuary. The impact of this can and should be mitigated by periodic removal of alien species at least once a year from within and directly adjacent to the development site of the substation (Table 10) and pylon (Table 11).

**Table 10. Impact 8: The development footprint of the substation becoming colonised by alien vegetation.**

| | ***Extent*** | ***Intensity*** | ***Duration*** | ***Consequence*** | ***Probability*** | ***Significance*** | ***Cumulative impact*** | ***Status*** | ***Confidence*** |
|---|---|---|---|---|---|---|---|---|---|
| Without mitigation | Local **1** | Low **1** | Long-term **3 (Reversible)** | **Low 5** | Probable | **LOW** | **Medium** | **– ve** | High |
| | Essential mitigation measures:<br>• All alien vegetation to be removed periodically, at least once a year.<br>• No use of any herbicides for the control of alien plant species within 32 m of the High Water Mark or adjacent to any culverts of storm water drainsErosion control (see above) | | | | | | | | |
| With mitigation | Local 1 | Low 1 | Short-term 2 | **Very Low 4** | Improbable | **INSIGNIFICANT** | **Very low** | **Neutral** | High |

**Table 11. Impact 9: The development footprint of the pylon and construction track becoming colonised by alien vegetation.**

| | ***Extent*** | ***Intensity*** | ***Duration*** | ***Consequence*** | ***Probability*** | ***Significance*** | ***Cumulative impact*** | ***Status*** | ***Confidence*** |
|---|---|---|---|---|---|---|---|---|---|
| Without mitigation | Local **1** | Low **1** | Long-term **3 (Reversible)** | **Low 5** | Probable | **LOW** | **Medium** | **– ve** | High |
| | Essential mitigation measures:<br>• All alien vegetation to be removed periodically, at least once a year from rehabilitated areas within the pylon footprint and track.<br>• No use of any herbicides during the control of alien plant species within 32 m of the High Water Mark.<br>• Erosion control (see above) | | | | | | | | |
| With mitigation | Local 1 | Low 1 | Short-term 2 | **Very Low 4** | Improbable | **INSIGNIFICANT** | **Very low** | **Neutral** | High |

### 4.2.3. Collisions between birds and power lines

It is well recognised that collisions are the biggest single threat posed by power lines to birds in southern Africa (van Rooyen, 2004). In this particular case, the problem is exacerbated because the transmission lines will cross an estuary with an important waterbird population. Many waterbirds, particularly duck, geese, egrets and herons are known to fly especially during low light levels at dawn and dusk or during the night (Shewell, 1959; Rowan, 1963; Brown *et al*. 1982; Halsa 1985; Deng & Frederick 2001; Sanzenbacher & Haig 2002; Louw 2005; Wanless 2005; Link *et al.* 2011). The significance of this impact is likely to be *medium* (Table 12). This impact must be mitigated, with special attention given to waterbirds and the prevention of collisions during both daylight and nigh-time.

It is recommended that bird diversion devices that function during the day and night be placed at suitable intervals along the lines (approximately every 4.5 m). FireFlys™ or After Glows (P&R Technologies, 2013) are recommended for this purpose (Figure 10 & Figure 11). The use of FireFlys™ has been shown to be highly effective, although studies are lacking on the successfulness of After Glows (see review by APLIC 2012). Both devices are “clip-on” and consist of highly reflective tape and photo-reactive coatings that allow them to glow for up to 10-12 hrs after sunset according to the manufacturers. The use of night-time bird diverters is likely to be a cost-effective and successful mitigation measure which is expected to result in the overall impact being of *low* significance and is considered essential. These night-time bird diverters would need to be replaced routinely every 3-5 years to maintain their effectiveness.

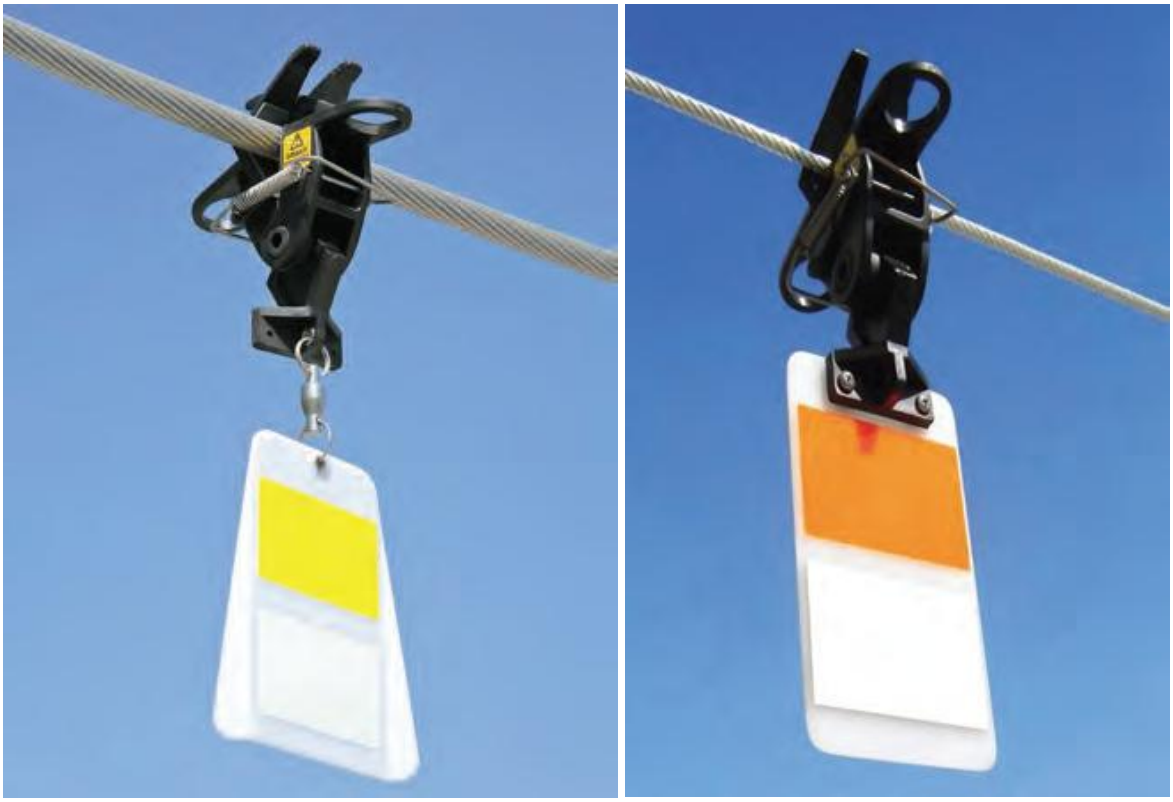

**Figure 10.** **Examples of FireFlys™ for areas with light (left) and heavy sustained (right) winds made by P&R Technologies.**

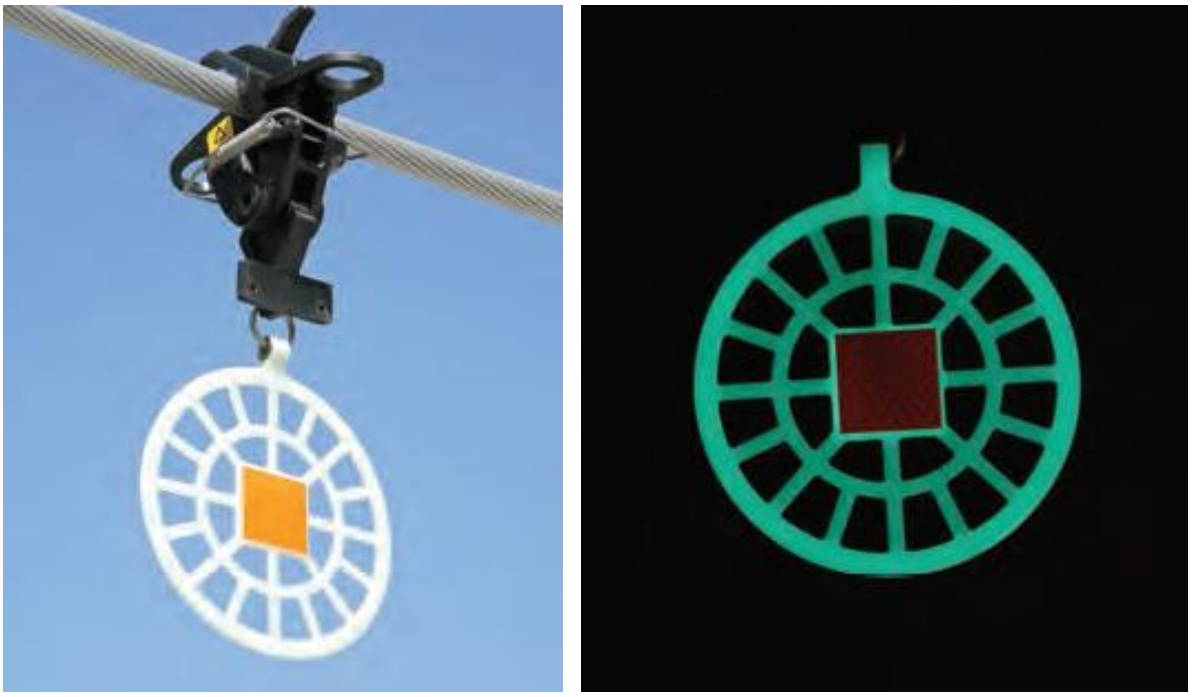

**Figure 11.** **The BirdMark BM-AG After Glow in daylight (left) and darkness (night), manufactured by P&R Technologies.**

**Table 12. Impact 10: Mortality to waterbirds due to collisions with power lines across the Estuarine Functional Zone.**

| | ***Extent*** | ***Intensity*** | ***Duration*** | ***Consequence*** | ***Probability*** | ***Significance*** | ***Cumulative impact*** | ***Status*** | ***Confidence*** |
|---|---|---|---|---|---|---|---|---|---|
| Without mitigation | Local **1** | Medium **2** | Long-term **3 (Irreversible)** | **Medium 6** | Definite | **MEDIUM** | **High** | **– ve** | Medium |
| | Essential mitigation measures:<br>• Power lines over Estuarine Functional Zone should be fitted with FireFlys or After Glows and not bird flappers or other bird diversion devices which work during daylight only. The precise placement of the After Glows/Fireflys on the power line to be done under the guidance of an ornithologist.<br>• Impaired/old After Glows & FireFlys to be replaced periodically (3-5 yrs) as and when required for the lifetime of the project. | | | | | | | | |
| With mitigation | Local 1 | Medium 2 | Long-term 3 | **Medium 6** | Possible | **LOW** | **Medium** | **– ve** | Medium |

### 4.2.4. Electrocutions of birds sitting on pylon B16

The risk of electrocution of birds perching on the pylon structure is most significant for large birds which are capable of spanning the air-gaps between the conductors, and for species which habitually perch on elevated structures (Kruger 1999, Van Rooyen 2000) (Table 13). In this case, the proximity of pylon B16 to the estuary and the lack of other vantage points in the Estuarine Functional Zone make it a particularly attractive spot for the iconic African Fish-eagle to perch, which was recorded on site and known to occur regularly in the area. Its large wing-span makes this species particularly at risk of electrocutions. This is expected to have a *Medium* level of significance prior to mitigation.

**Table 13. Impact 11: Mortality of birds due to electrocution.**

| | ***Extent*** | ***Intensity*** | ***Duration*** | ***Consequence*** | ***Probability*** | ***Significance*** | ***Cumulative impact*** | ***Status*** | ***Confidence*** |
|---|---|---|---|---|---|---|---|---|---|
| Without mitigation | Local **1** | Medium **2** | Long-term **3 (Irreversible)** | **Medium 6** | Definite | **MEDIUM** | **High** | **– ve** | Medium |
| | Essential mitigation measures:<br>• The pylon must be bird-friendly, with sufficiently large gaps between the conducting elements and the metalwork, and with perching surfaces spaced sufficiently far away from the conductors to prevent even large birds such as the African Fish Eagle from bridging these gaps. Note that the distance between grounded metal and conductors would need to be at least 80 cm, based on a fish eagle being 68 cm in length and with a wing span 148 cm.<br>• Bird-guards should be fitted where birds might perch above the conductors to reduce bird-streamer related shorting.<br>• Bird-guards to be replaced as and when required for the duration of the project. | | | | | | | | |
| With mitigation | Local 1 | Medium 2 | Long-term 3 (Irreversible) | **Medium 6** | Improbable | **LOW** | **Low** | **– ve** | Medium |

## 5.1. Impact summary

## 5.2. Potential impacts

Most impacts are considered to be of *low* significance before mitigation with a *negative* status, but after mitigation measures have been implemented for these impacts their status is likely to be neutral. The impact due to collisions between birds and power lines across the Estuarine Functional Zone, however, is considered to be of *medium* significance. Nevertheless, the residual impact after appropriate mitigation measures have been implemented is expected to be reduced to a *low* significance level with a *medium* level of confidence.

**Table 14. Summary of impacts and the significance of each before and after mitigation.**

| Phase | Impact | *Consequence* | *Probability* | Significance | *Cumulative impact* | *Status* | *Confidence* |
|---|---|---|---|---|---|---|---|
| Construction | **Impact 1**: Habitat destruction (substation) | Low | Definite | **LOW** | Low | -ve | High |
| | With Mitigation | Low | Definite | LOW | Low | -ve | High |
| | **Impact 2**: Habitat destruction (pylon B16) | **Very low** | Definite | **VERY LOW** | **Low** | **– ve** | High |
| | With Mitigation | Very low 4 | Definite | VERY LOW | Low | -ve | High |
| | **Impact 3**: Habitat destruction while stringing the overhead cables using the method described above. | **Very low** | Improbable | **INSIGNIFICANT** | **Low** | **– ve** | High |
| | With Mitigation | Not required except the proposed method of stringing the cables must be strictly adhered to. | | | | | |
| | **Impact 4**: Pollution & runoff (substation) | Low | Probable | **LOW** | **Medium** | – ve | Medium |
| | With Mitigation: | Very Low | Possible | **INSIGNIFICANT** | Very low | Neutral | Medium |
| | **Impact 5**: Pollution & runoff (Pylon B16) | **Low** | Probable | **LOW** | **Low** | **– ve** | Medium |

| **Phase** | **Impact** | ***Consequence*** | ***Probability*** | **Significance** | ***Cumulative impact*** | ***Status*** | ***Confidence*** |
|---|---|---|---|---|---|---|---|
| | With Mitigation | **Very Low** | Possible | **INSIGNIFICANT** | Very low | Neutral | Medium |
| Operational | **Impact 6**: Site for erosion (substation) | Medium | Possible | **LOW** | **Low** | – ve | Medium |
| | With Mitigation: | Medium | Improbable | **LOW** | Very low | Neutral | Medium |
| | **Impact 7**: Site for erosion (pylon B16) | **Medium** | Possible | **LOW** | **Low** | **– ve** | Medium |
| | With Mitigation | **Low** | Improbable | **VERY LOW** | **Very low** | **Neutral** | Medium |
| | **Impact 8**: Site for alien vegetation (substation) | Low | Probable | **LOW** | **Medium** | – ve | High |
| | With Mitigation: | Very Low | Improbable | **INSIGNIFICANT** | Very low | Neutral | High |
| | **Impact 9**: Site for alien vegetation (Pylon B16) | **Low** | Probable | **LOW** | **Medium** | **– ve** | High |
| | With Mitigation: | **Very Low** | Improbable | **INSIGNIFICANT** | **Very low** | **Neutral** | High |
| | **Impact 10**: Collision mortality between birds & power lines | Medium | Definite | **MEDIUM** | **High** | – ve | Medium |
| | With Mitigation: | Medium | Possible | **LOW** | Medium | – ve | Medium |
| | **Impact 11**: Mortality caused by electrocutions (Pylon B16) | **Medium** | Definite | **MEDIUM** | **High** | **– ve** | Medium |
| | With Mitigation | **Medium** | Improbable | **LOW** | **Low** | **– ve** | Medium |

## 5.3. Impact mitigation

The following are a list of *essential* mitigation measures pertaining to the substation:

- No workers allowed between the Main Road 390 (R340) and water level of the estuary or between the N2 and water level of the estuary. I.e. No access to or below the High Water Mark of the estuary.
- No-go areas should be appropriately demarcated/fenced off for the duration of the construction period and all demarcation removed entirely after completion of the project.
- No water abstraction of any kindfrom the estuary
- All cleared alien vegetation from the footprint of the substation to be removed offsite and placed at a suitable landfill area. Any alien species seeds should not be allowed to enter the culvert.
- No use of any herbicides within 32 m of the High Water Mark or near culverts or storm water drains
- No soil or other foreign material (paint, cement powder, chemicals and any other materials associated with construction) should be put either deliberately or accidentally in the culvert bordering the site so that is can wash into the estuary. Close supervision required to ensure this does not happen and or culvert should be covered until construction is finished.
- No workers allowed between the Main Road 390 (R340) and water level of the estuary or between the N2 and water level of the estuary to prevent erosion. I.e. No access to or below the High Water Mark of the estuary.
- All chemicals should be responsibly contained and used, and no chemicals should be stored within 32 m of the High Water Mark.
- No storage of building materials within 32 m of the High Water Mark.
- Cement & concrete mixing not to be done within 32 m of the High Water Mark or near the culvert and not to be done on permeable surfaces. Only to be undertaken at authorised sites determined suitable by botanist/terrestrial ecologist to ensure that this does not get into storm water,
- All vehicles & machinery should be checked daily for oil and chemical leaks. Leaking machines not to be used.
- No washing of vehicles and machinery within 32 m of the High Water Mark or close to storm water drains and only at designated areas defined by botanist/terrestrial ecologist.
- Chemical toilet to be provided for all workers which should be located at least 32 m from the High Water Mark. No other areas may be used for toilet facilities.
- No littering or waste disposal except in dustbins. Dustbins for workers should be placed at least 32 m from the High Water Mark and have lids to ensure no material blows out.
- No burning of waste or fires on site or within 32 m of High Water Mark.
- No depositing of soil within 32 m of the High Water Mark, & only at authorised areas at least 32 m from the High Water Mark as guided by a terrestrial botanist/ecologist.
- All building rubble, construction material and litter to be removed during and once construction is finished.
- Contractor in association with the Project Coordinator to ensure compliance of workers with good environmental practices and general conduct as per their environmental awareness induction training.
- Any bare ground areas of the substation that do not have hard infrastructure should be covered by suitable groundcover such as gravel or indigenous turf forming grass such as *Cynodon dactylon* to minimise soil erosion.
- All alien vegetation to be removed periodically, at least once a year.
- No use of any herbicides during the control of alien plant species within 32 m of the High Water Mark or adjacent to any culverts of storm water drains

- Power lines over Estuarine Functional Zone should be fitted with FireFlys or After Glows and not bird flappers or other bird diversion devices which work during daylight only. The precise placement of the After Glows/Fireflys on the power line to be done under the guidance of an ornithologist.
- Impaired/old After Glows & FireFlys to be replaced periodically (3-5 yrs) as and when required for the lifetime of the project.

The following are a list of essential mitigation measures pertaining to pylon B16 and the stringing of overhead cables:

- No workers allowed between the footprint of B16 and the Bitou Estuary. I.e. No access to or below the High Water Mark of the estuary.
- These areas should be appropriately demarcated/fenced off for the duration of the construction period and all demarcation removed entirely after completion of the project.
- No water abstraction of any kind from the estuary.
- Access to the footprint should be via a strip track where vegetation is simply cut and no road should be graded to the footprint. i.e. No disturbance to the top soil
- The access track must emanate from the N2, be as short as practicably possible, and use the road verge as far as possible to achieve an appropriate gradient to the track and thereby minimise habitat destruction of adjacent vegetation outside of the road verge (see Figure 9).
- Any cleared alien vegetation from the footprint of the track and pylon to be removed offsite and placed at a suitable landfill area. Any alien species seeds should not be allowed to enter the culvert.
- The footprint of the pylon and the construction track must be suitably rehabilitated with indigenous vegetation (to the area), and this should be guided by a rehabilitation specialist. Alien vegetation must be removed from the disturbed areas for a period of at least ten years post construction until the area has been suitably rehabilitated.
- All top soil (from the top 40 cm) excavated from within the pylon footprint should be stored carefully offsite for later use in rehabilitation and not be mixed with any other materials.
- The surrounding area should not be used for construction or storage of materials and disturbance must be limited to the construction track and pylon footprint.
- No use of any herbicides within 32 m of the High Water Mark.
- Proposed method for stringing the cables between pylons must be strictly adhered to.
- All chemicals should be responsibly contained and used, and no chemicals should be stored within 32 m of the High Water Mark.
- No storage of building materials within 32 m of the High Water Mark.
- Cement & concrete mixing not to be done within 32 m of the High Water Mark and not to be done on permeable surfaces. Only to be undertaken at authorised sites determined suitable by botanist/terrestrial ecologist to ensure that this does not get into storm water,
- All vehicles & machinery should be checked daily for oil and chemical leaks. Leaking machines not to be used.
- No washing of vehicles and machinery within 32 m of the High Water Mark or close to storm water drains and only at designated areas defined by botanist/terrestrial ecologist.
- Chemical toilet to be provided for all workers which should be located at least 32 m from the High Water Mark. No other areas may be used for toilet facilities.
- No littering or waste disposal except in dustbins. Dustbins for workers should be placed at least 32 m from the High Water Mark and have lids to ensure no material blows out.
- No burning of waste or fires on site or within 32 m of High Water Mark.
- No depositing of soil within 32 m of the High Water Mark, & only at authorised areas at least 32 m from the High Water Mark as guided by a terrestrial botanist/ecologist.

- All building rubble, construction material and litter to be removed during and once construction is finished.
- Contractor in association with the Project Coordinator to ensure compliance of workers with good environmental practices and general conduct as per their environmental awareness induction training.
- All alien vegetation to be removed periodically, at least once a year from rehabilitated areas within the pylon footprint and track.
- No use of any herbicides during the control of alien plant species within 32 m of the High Water Mark.
- Erosion control (see above)
- The pylon must be bird-friendly, with sufficiently large gaps between the conducting elements and the metalwork, and with perching surfaces spaced adequately away from the conductors to prevent even large birds such as the African Fish- Eagle from bridging these gaps.
- Bird-guards should be fitted where birds might perch above the conductors to reduce bird-streamer related shorting.
- Bird-guards to be replaced as and when required for the duration of the project.

# 6. References

APLIC. 2012. Avian power line interaction committee. Reducing avian collisions with power lines: The state of the art in 2012. Edison Electric Institute and APLIC. Washington, DC. http://www.aplic.org/uploads/files/11218/Reducing_Avian_Collisions_2012watermarkLR.pdf

Barnes, K.N. (ed.). 2000. The Eskom red data book of birds of South Africa, Lesotho and Swaziland. Birdlife South Africa, Johannesburg.

Brown, L.H., Urban, E.K. & Newman, K. 1982. The birds of Africa. Vol. 1. Academic Press, London.

Deng, J. & Frederick, P. 2001. Nocturnal flight behaviour of waterbirds in close proximity to a transmission powerline in the Florida Everglades. *Waterbirds* 24: 419-424.

Halsa, S.A. 1985. Activity budgets of Spurwinged and Egyptian geese at Barberspan during winter. *Ostrich* 56: 104-110.

Knoesen, D.M. and Schulze, R.E. 2011. Climate Change and Peak Discharge: A 2011 Perspective. *In:* Schulze, R.E. 2011. *A 2011 Perspective on Climate Change and the South African Water Sector*. Water Research Commission, Pretoria, RSA, WRC Report TT 518/12, Chapter 5.6, 163-167.

Knoesen, D.M., Schulze, R.E. and Smithers, J.C. 2011a. Climate Change and Short Duration Day Design Rainfall: A 2011 Perspective. *In:* Schulze, R.E. 2011. *A 2011 Perspective on Climate Change and the South African Water Sector*. Water Research Commission, Pretoria, RSA, WRC Report TT 518/12, Chapter 7.1, 199-205.

Schulze, R.E., Knoesen, D.M. and Smithers, J.C. 2011b. Climate Change and Long Duration Design Rainfall: A 2011 Perspective. *In:* Schulze, R.E. 2011. *A 2011 Perspective on Climate Change and the South African Water Sector*. Water Research Commission, Pretoria, RSA, WRC Report TT 518/12, Chapter 7.2, 207-211.

Kruger, R. 1999. Towards solving raptor electrocutions on Eskom distribution structures in South Africa. M. Phil. Mini-thesis. University of the Orange Free State, Bloemfontein.

Link, P.T., Afton, A.D., Cox, R.R. & Davis, B.E. 2011. Daily movements of female mallards wintering in southwestern Louisiana. *Waterbirds* 34: 422-428.

Louw, K. 2005. Little egret *Egretta garzetta*. In: Hockey, P.A.R., Dean, W.R.J. & Ryan, P.G. (Eds.). Roberts Birds of Southern Africa. VII Edition. John Voelcker Bird Book Fund.

Meehl, G.A., T.F. Stocker, W. Collins, P. Friedlingstein, A. Gaye, J. Gregory, A. Kitoh, R. Knutti and Co-authors, 2007: Global climate projections. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, S. Solomon, D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller, Eds., Cambridge University Press, Cambridge, 747-846.

Mucina, L. & Rutherford, M.C. (eds.). 2006. The vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria.

Rowan, M.K. 1963. The yellow-bill duck *Anus* [sic] *undulata* Dubois in Southern Africa. *Ostrich Supplement* 5: 1-56.

P&R Technologies. 2013. http://www.pr-tech.com/

SANParks & C.A.PE. 2010. Garden Route vegetation GIS layer. GR_Vegetation_Layer.shp

SANParks & Garden Route Initiative 2010a. Critical biodiversity areas and ecological support areas GIS layer. GR_Critical_Biodiversity_Areas_and_Ecological_Support_Areas.shp

SANParks & Garden Route Initiative 2010b. Transformation of landcover GIS layer. GR_Transformation_Layer.shp

SABAP2. 2013. South African Bird Atlas Project 2. Animal Demography Unit, Zoology Department, University of Cape Town.

Sanzenbacher, P.M. & Haig, S.M. 2002. Regional fidelity and movement patterns on wintering killdeer in an agricultural landscape. *Waterbirds* 25: 16-25.

Schulze, R.E. and Kunz, R.P. 2011. Climate Change and Annual Streamflow Statistics: A 2011 Perspective. *In:* Schulze, R.E. 2011. *A 2011 Perspective on Climate Change and the South African Water Sector*. Water Research Commission, Pretoria, RSA, WRC Report TT 518/12, Chapter 5.4, 153-157.

Schulze, R.E. & Kunz, R.P. 2012. Climate change and stormflows: a 2011 perspective. In: R.E. Schulze (Ed.). A 2011 perspective of climate change and the South African water sector. Water Research Commission, report no. TT 518/12.

Shewell, AL. 1959. The waterfowl of Barberspan. *Ostrich Supplement* 3: 160-179.

Taylor, P.B., Navarro, R.A., Wren-Sargent, M., Harrison, J.A. & Kieswetter, S.L.. 1999. Coordinated waterbird Counts in South Africa, 1992-1997. Avian Demography Unit, Cape Town.

Turpie, J.K. 2004. South African national spatial biodiversity assessment 2004: Technical report. Volume 3: Estuary component. Pretoria, South African National Biodiversity Institute.

Van Niekerk, L. & Turpie, J.K. (eds). 2012. *National Biodiversity Assessment 2011: Technical Report. Volume 3: Estuary Component*. CSIR Report Number CSIR/NRE/ECOS/ER/2011/0045/B. Council for Scientific and Industrial Research, Stellenbosch.

Van Rooyen, C.S. 2000. An overview of the Eskom-EWT Strategic Partnership in South Africa. EPRI Workshop on avian interactions with utility structures, 2-3 December 1999, Charleston, South Carolina.

Van Rooyen, C.S. 2004. The management of wildlife interactions with overhead lines. In the fundamentals and practice of overhead line maintenance (132kV and above). Eskom technology, service international, Johannesburg. Pp. 217-245.

Vlok, J.H.J., Euston-Brown D.I.W. & Wolf, T. 2008. A vegetation map for the Garden Route Initiative. Unpublished 1:50 000 maps and report supported by CAPE FSP task team.

Vromans, D.C., Maree, K.S., Holness, S., Job, N. & Brown, A.E. 2010. The Garden Route Biodiversity Sector Plan for the George, Knysna and Bitou Municipalities. Supporting land-use planning and decision making in Critical Biodiversity Areas and Ecological Support Areas for sustainable development. Garden Route Initiative. South African National Parks. Knysna.

Wanless, R.M. 2005. Grey heron *Ardea cinerea*. In: Hockey, P.A.R., Dean, W.R.J. & Ryan, P.G. (Eds.). Roberts Birds of Southern Africa. VII Edition. John Voelcker Bird Book Fund.

# 7. Appendices

**Appendix 1: Coordinated waterbird counts for the lower Bitou River ranked according to abundance (after Taylor *et al*. 1999).**

| Common name | Ave. | Max |
|---|---|---|
| Egret, Cattle | 73.21 | 209 |
| Duck, Yellow-billed | 54.72 | 363 |
| Sandpiper, Curlew | 47.88 | 150 |
| Avocet, Pied | 39 | 171 |
| Ibis, African Sacred | 37.55 | 438 |
| Stilt, Black-winged | 36.21 | 101 |
| Cormorant, Reed | 31.23 | 120 |
| Shoveler, Cape | 28.96 | 89 |
| Tern, Swift | 24.5 | 48 |
| Tern, Whiskered | 24.5 | 33 |
| Goose, Egyptian | 24.41 | 95 |
| Lapwing, Blacksmith | 23.97 | 67 |
| Teal, Red-billed | 22 | 77 |
| Gull, Kelp | 19.57 | 82 |
| Plover, Kittlitz's | 19.33 | 60 |
| Shelduck, South African | 18.6 | 51 |
| Teal, Cape | 16.54 | 65 |
| Ibis, Hadeda | 15 | 48 |
| Moorhen, Common | 14.03 | 78 |
| Ruff, Ruff | 12 | 36 |
| Coot, Red-knobbed | 11.83 | 100 |
| Grebe, Little | 10.28 | 22 |
| Plover, Common Ringed | 9.4 | 40 |
| Sandpiper, Wood | 8.09 | 36 |
| Egret, Little | 6.48 | 29 |
| Goose, Spur-winged | 5.9 | 11 |
| Wagtail, Cape | 5.76 | 17 |
| Duck, White-backed | 5.67 | 10 |
| Whimbrel, Common | 5.53 | 16 |
| Greenshank, Common | 5.48 | 26 |
| Cormorant, White-breasted | 5.36 | 15 |
| Duck, White-faced | 5.33 | 9 |
| Plover, Grey | 5.17 | 11 |
| Plover, Three-banded | 5.09 | 30 |
| Night-Heron, Black-crowned | 5 | 10 |
| Heron, Grey | 4.79 | 13 |
| Oystercatcher, African Black | 4.57 | 10 |
| Teal, Hottentot | 4.56 | 11 |
| Kingfisher, Pied | 4.26 | 12 |
| Heron, Black-headed | 4.15 | 27 |

| Common name | Ave. | Max |
|---|---|---|
| Spoonbill, African | 4 | 8 |
| Sandpiper, Marsh | 3.6 | 7 |
| Sandpiper, Common | 3.57 | 11 |
| Duck, Mallard | 3.33 | 6 |
| Pochard, Southern | 3.14 | 10 |
| Crane, Blue | 3 | 4 |
| Stint, Little | 3 | 3 |
| Cormorant, Cape | 3 | 5 |
| Duck, Maccoa | 2.33 | 7 |
| Goose, Domestic | 2.25 | 3 |
| Crake, Black | 2.25 | 4 |
| Darter, African | 2.23 | 10 |
| Flamingo, Greater | 2.2 | 6 |
| Duck, Domestic | 2 | 2 |
| Snipe, African | 2 | 4 |
| Redshank, Common | 2 | 2 |
| Curlew, Eurasian | 2 | 2 |
| Thick-knee, Water | 2 | 2 |
| Tern, Caspian | 2 | 3 |
| Heron, Purple | 1.83 | 6 |
| Marsh-Harrier, African | 1.56 | 3 |
| Hamerkop, Hamerkop | 1.5 | 2 |
| Kingfisher, Giant | 1.4 | 2 |
| Osprey, Osprey | 1.33 | 2 |
| Fish-Eagle, African | 1.21 | 2 |
| Rail, African | 1 | 1 |
| Swamphen, African Purple | 1 | 1 |
| Jacana, African | 1 | 1 |
| Plover, White-fronted | 1 | 1 |
| Kingfisher, Half-collared | 1 | 1 |
| Kingfisher, Malachite | 1 | 1 |
| Martin, Brown-throated | 1 | 1 |
| Egret, Yellow-billed | 1 | 1 |
| Bittern, Little | 1 | 1 |
| Ibis, Glossy | 1 | 1 |

**Appendix 2: Impact rating methodology employed in this study**

The significance of all potential impacts that would result from the proposed project is determined in order to assist decision-makers. The significance rating of impacts is considered by decision-makers, as shown below.

- **INSIGNIFICANT**: the potential impact is negligible and **will not** have an influence on the decision regarding the proposed activity.
- **VERY LOW**: the potential impact is very small and **should not** have any meaningful influence on the decision regarding the proposed activity.
- **LOW**: the potential impact **may not** have any meaningful influence on the decision regarding the proposed activity.
- **MEDIUM**: the potential impact **should** influence the decision regarding the proposed activity.
- **HIGH**: the potential impact **will** affect a decision regarding the proposed activity.
- **VERY HIGH**: The proposed activity should only be approved under special circumstances.

The **significance** of an impact is defined as a combination of the **consequence** of the impact occurring and the **probability** that the impact will occur. The significance of each identified impact[1] was thus rated according to the methodology set out below:

**Step 1 –** Determine the **consequence** rating for the impact by determining the score for each of the three criteria (A-C) listed below and then **adding** them. The rationale for assigning a specific rating, and comments on the degree to which the impact may cause irreplaceable loss of resources and be irreversible, must be included in the narrative accompanying the impact rating:

| Rating | Definition of Rating | Score |
|---|---|---|
| **A. *Extent*** – *the area over which the impact will be experienced* | | |
| Local | Confined to project or study area or part thereof (e.g. limits of the concession area) | 1 |
| Regional | The region (e.g. the whole of Namaqualand coast) | 2 |
| (Inter) national | Significantly beyond Saldanha Bay and adjacent land areas | 3 |
| **B**. ***Intensity*** – *the magnitude of the impact in relation to the sensitivity of the receiving environment, taking into account the degree to which the impact may cause irreplaceable loss of resources* | | |
| Low | Site-specific and wider natural and/or social functions and processes are negligibly altered | 1 |
| Medium | Site-specific and wider natural and/or social functions and processes continue albeit in a modified way | 2 |
| High | Site-specific and wider natural and/or social functions or processes are severely altered | 3 |
| **C**. ***Duration*** – *the time frame for which the impact will be experienced and its reversibility* | | |
| Short-term | Up to 2 years | 1 |
| Medium-term | 2 to 15 years | 2 |
| Long-term | More than 15 years (state whether impact is irreversible) | 3 |

The combined score of these three criteria corresponds to a **Consequence Rating**, as follows:

| ***Combined Score* (A+B+C)** | 3 – 4 | 5 | 6 | 7 | 8 – 9 |
|---|---|---|---|---|---|
| ***Consequence Rating*** | Very low | Low | Medium | High | Very high |

**Example 1:**

| ***Extent*** | ***Intensity*** | ***Duration*** | ***Consequence*** |
|---|---|---|---|

[1] This does not apply to minor impacts which can be logically grouped into a single assessment.

| | | | |
|---|---|---|---|
| Regional<br>**2** | Medium<br>**2** | Long-term<br>**3** | **High**<br>**7** |

**Step 2 –** Assess the **probability** of the impact occurring according to the following definitions:

| ***Probability*** *– the likelihood of the impact occurring* | |
|---|---|
| Improbable | < 40% chance of occurring |
| Possible | 40% - 70% chance of occurring |
| Probable | > 70% - 90% chance of occurring |
| Definite | > 90% chance of occurring |

**Example 2:**

| ***Extent*** | ***Intensity*** | ***Duration*** | ***Consequence*** | ***Probability*** |
|---|---|---|---|---|
| Regional<br>**2** | Medium<br>**2** | Long-term<br>**3** | **High**<br>**7** | Probable |

**Step 3 –** Determine the overall **significance** of the impact as a combination of the **consequence** and **probability** ratings, as set out below:

| | | **Probability** | | | |
|---|---|---|---|---|---|
| | | Improbable | Possible | Probable | Definite |
| **Consequence** | Very Low | **INSIGNIFICANT** | **INSIGNIFICANT** | **VERY LOW** | **VERY LOW** |
| | Low | **VERY LOW** | **VERY LOW** | **LOW** | **LOW** |
| | Medium | **LOW** | **LOW** | **MEDIUM** | **MEDIUM** |
| | High | **MEDIUM** | **MEDIUM** | **HIGH** | **HIGH** |
| | Very High | **HIGH** | **HIGH** | **VERY HIGH** | **VERY HIGH** |

**Example 3:**

| ***Extent*** | ***Intensity*** | ***Duration*** | ***Consequence*** | ***Probability*** | ***Significance*** |
|---|---|---|---|---|---|
| Regional<br>**2** | Medium<br>**2** | Long-term<br>**3** | **High**<br>**7** | Probable | **HIGH** |

**Step 4 –** Note the **status** of the impact (i.e. will the effect of the impact be negative or positive?)

**Example 4:**

| ***Extent*** | ***Intensity*** | ***Duration*** | ***Consequence*** | ***Probability*** | ***Significance*** | ***Status*** |
|---|---|---|---|---|---|---|
| Regional<br>**2** | Medium<br>**2** | Long-term<br>**3** | **High**<br>**7** | Probable | **HIGH** | **– ve** |

**Step 5 –** State the level of **confidence** in the assessment of the impact (high, medium or low).

Depending on the data available, a higher level of confidence may be attached to the assessment of some impacts than others. For example, if the assessment is based on extrapolated data, this may reduce the confidence level to low, noting that further groundtruthing is required to improve this.

**Example 5:**

| *Extent* | *Intensity* | *Duration* | *Consequence* | *Probability* | *Significance* | *Status* | *Confidence* |
|---|---|---|---|---|---|---|---|
| Regional<br>**2** | Medium<br>**2** | Long-term<br>**3** | **High**<br>**7** | Probable | **HIGH** | **– ve** | High |

**Step 6 –** Identify and describe practical **mitigation** and **optimisation** measures that can be implemented effectively to reduce or enhance the significance of the impact. Mitigation and optimisation measures must be described as either:

- **Essential**: must be implemented and are non-negotiable; and
- **Optional**: must be shown to have been considered and sound reasons provided by the proponent if not implemented.

Essential mitigation and optimisation measures must be inserted into the completed impact assessment table. The impact should be re-assessed with mitigation, by following Steps 1-5 again to demonstrate how the extent, intensity, duration and/or probability change after implementation of the proposed mitigation measures.

**Example 6: A completed impact assessment table**

| | *Extent* | *Intensity* | *Duration* | *Consequence* | *Probability* | *Significance* | *Status* | *Confidence* |
|---|---|---|---|---|---|---|---|---|
| Without mitigation | Regional<br>**2** | Medium<br>**2** | Long-term<br>**3** | **High**<br>**7** | Probable | **HIGH** | **– ve** | High |
| Essential mitigation measures:<br>• xxxxx<br>• xxxxx | | | | | | | | |
| With mitigation | Local<br>1 | Low<br>1 | Long-term<br>3 | **Low**<br>**5** | Improbable | **VERY LOW** | **– ve** | High |

**Step 7 – Prepare a summary table of** all impact significance ratings as follows:

| **Impact** | ***Consequence*** | ***Probability*** | **Significance** | ***Status*** | ***Confidence*** |
|---|---|---|---|---|---|
| Impact 1: XXXX | Medium | Improbable | **LOW** | –ve | High |
| With Mitigation | Low | Improbable | **VERY LOW** | | High |
| Impact 2: XXXX | Very Low | Definite | **VERY LOW** | –ve | Medium |
| With Mitigation: | *Not applicable* | | | | |

Indicate whether the proposed development alternatives are environmentally suitable or unsuitable in terms of the respective impacts assessed by the relevant specialist and the environmentally preferred alternative.