Figure 6. Rocky area east of the Mokolo River along the D1882 sand road, especially the northside. The area is viewed as fairly sensitive (Dec.2010)

Figure 7. The veld south of the sand road (D1882) tends to be less rocky in areas, compared to the north, as shown here. (June 2011. South)

Figure 8. Bushveld of the study area and surrounding region. With the Dorset Substation construction site in the upper right (Dec.2010. North)

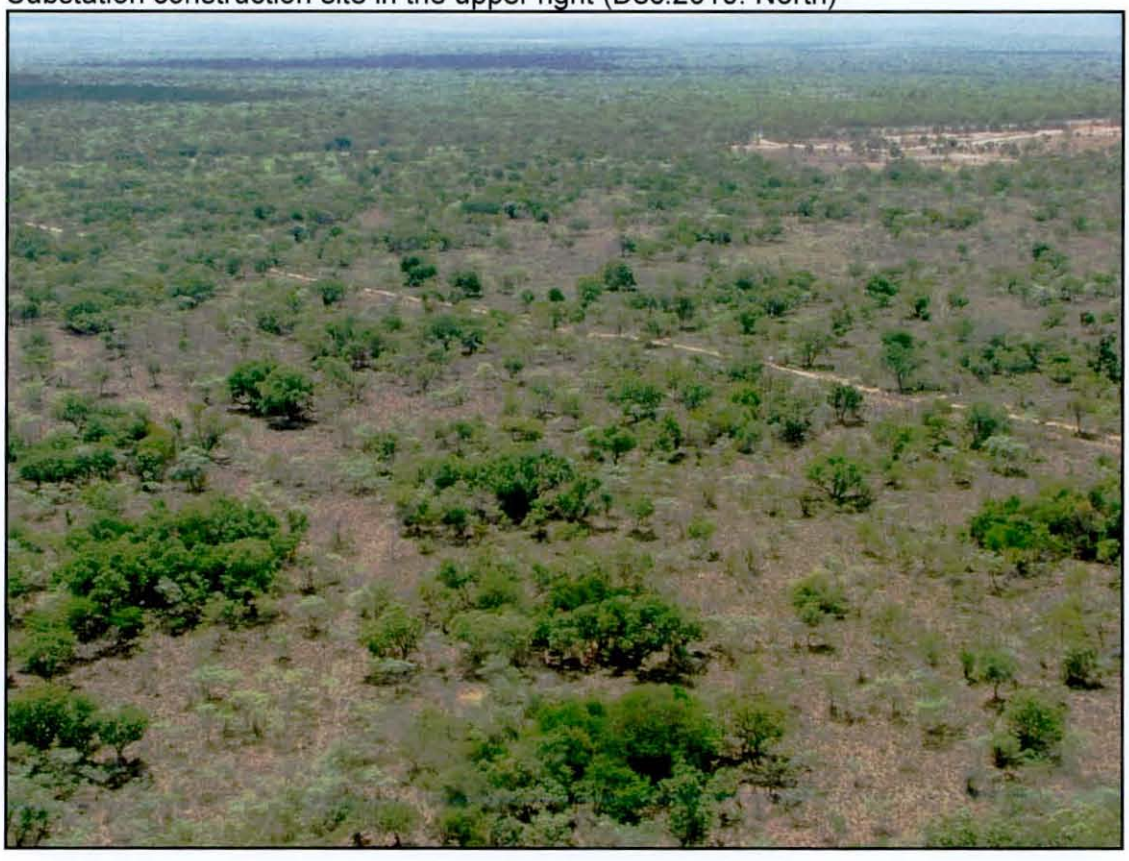

Figure 9. Dorset Substation construction site photographed from a helicopter (Dec.2010)

Figure 10. Mix of dense woodland and open areas of old farm lands typical of areas within the study site (Dec.2010)

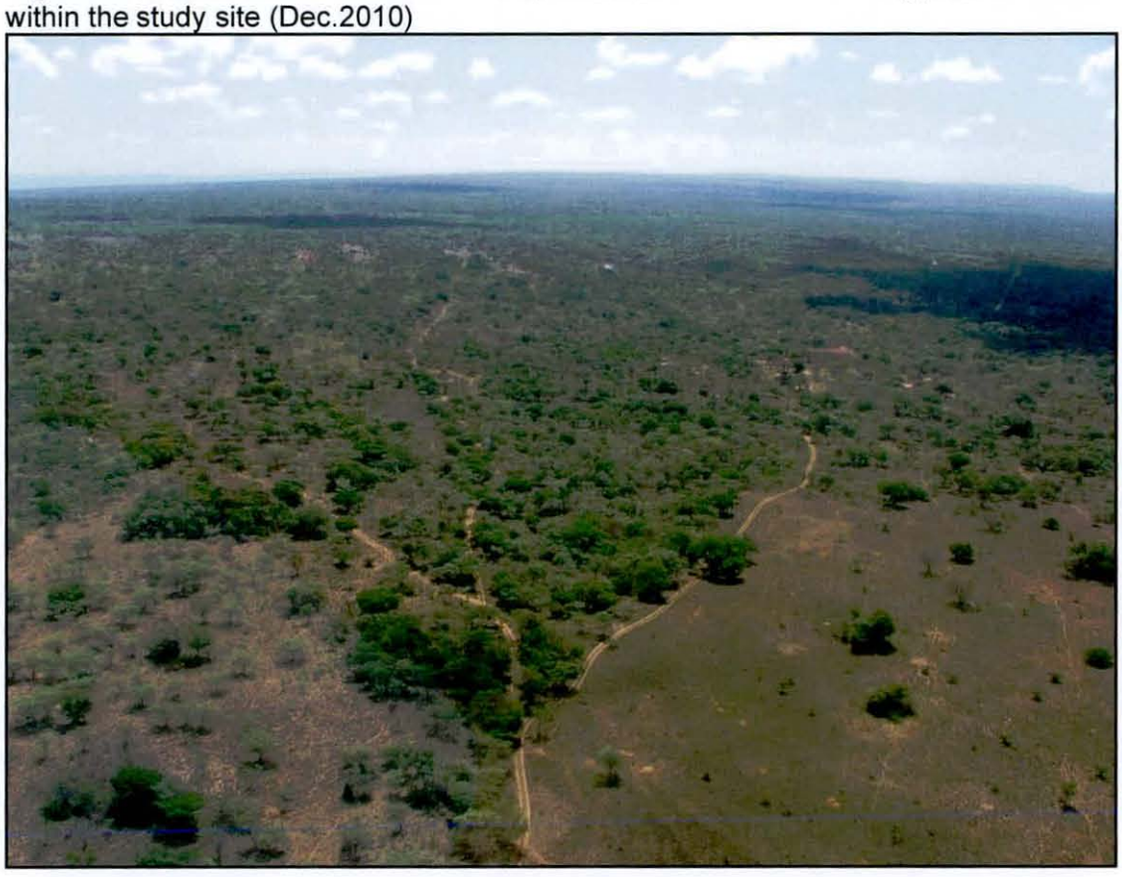

Figure 11. Dense bushveld within the study area typically found along roads (D1005 & D1162). (Dec.2010. South-west)

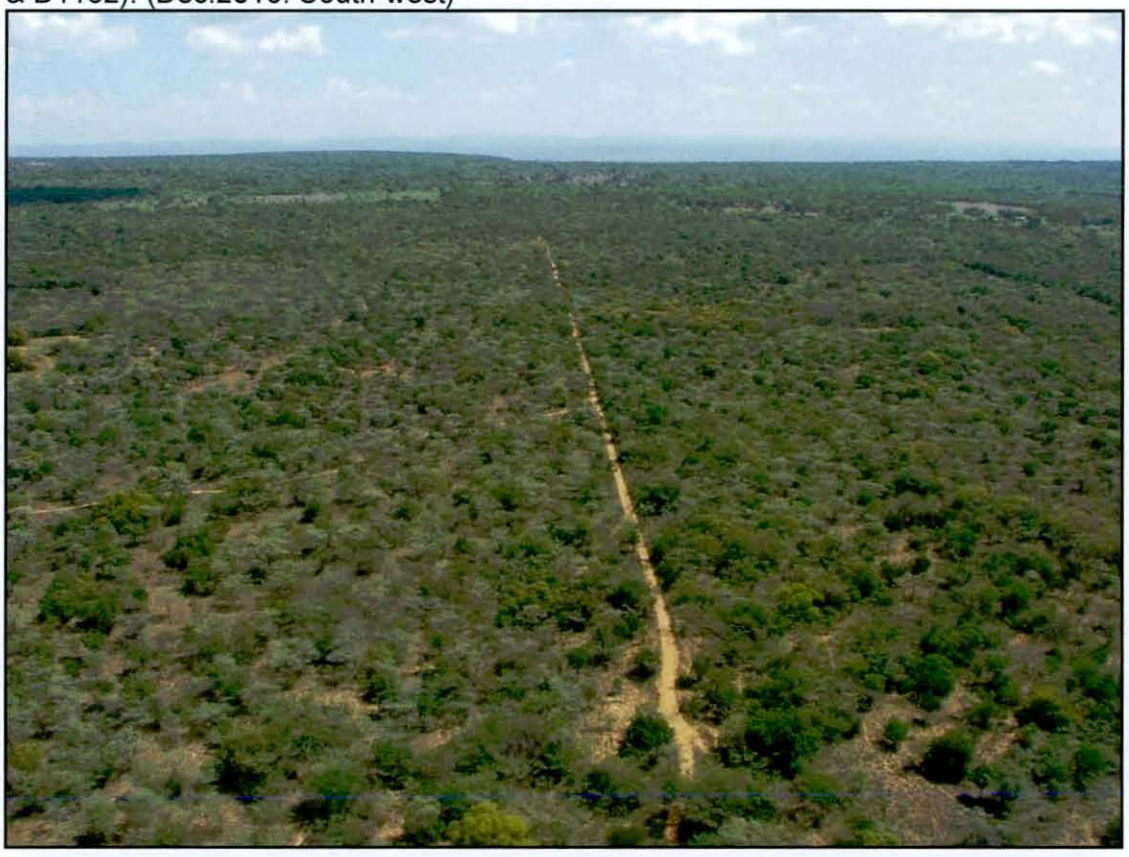

Figure 12. Large wildlife, such as impala, are common in the general region in which the study area falls due to the numerous reserves and game ranches (Dec.2010).

Figure 13. Game lodge and bushveld typical of the region in which the study area falls (Dec.2010. Lodge close to the Mokolo dam)

Figure 14. A number of cattle and other farming activities can be found in the region of the study area (Dec.2010.Farm west of Dorset Substation)

Figure 15. Bulge River shop and filling station. Just east of Bulge River Substation site (Dec.2010)

17. APPENDICES

List of plants previously recorded in the region (Tabled per grid reference)

Grid: 2327DC	
Abrus laevigatus	Exormotheca holstii
Adansonia digitata	Ficus ingens
Albizia tanganyicensis subsp. tanganyicensis	Fuirena pubescens var. pubescens
Aristida canescens subsp. canescens	Gardenia volkensii subsp. spatulifolia
Aristida congesta subsp. barbicollis	Geigeria elongata
Aristida congesta subsp. congesta	Gloriosa rigidifolia
Aristida spectabilis	Gomphocarpus tomentosus
Asparagus aggregatus	Grewia flavescens
Asparagus buchananii	Harpagophytum zeyheri subsp. zeyheri
Asparagus nelsii	Hibiscus micranthus var. micranthus
Asparagus suaveolens	Hibiscus sidiformis
Barleria lancifolia subsp. lancifolia	Hibiscus waterbergensis
Barleria saxatilis	Huernia quinta var. quinta
Bauhinia petersiana subsp. macrantha	Indigofera bainesii
Blepharis maderaspatensis	Indigofera pongolana
Bothriochloa radicans	Indigofera torulosa var. torulosa
Brachiaria nigropedata	Ipomoea gracilisepala
Brachylaena huillensis	Ipomoea holubii
Bryum argenteum	Justicia flava
Cenchrus ciliaris	Kirkia acuminata
Chamaecrista absus	Kyphocarpa angustifolia
Cleome hirta	Lobelia erinus
Cleome monophylla	Lotononis listii
Combretum hereroense	Maerua edulis
Commelina africana var. krebsiana	Mimusops zeyheri
Commelina eckloniana	Mundulea sericea subsp. sericea
Commiphora marlothii	Ochna natalitia
Commiphora mollis	Ochna pretoriensis
Crinum buphanoides	Ophioglossum polyphyllum
Crinum stuhlmannii	Ornithogalum seineri

Croton gratissimus var. gratissimus	Panicum maximum
Croton gratissimus var. subgratissimus	Pavonia transvaalensis
Croton pseudopulchellus	Peristrophe transvaalensis
Cyperus fastigiatus	Phyllanthus pentandrus
Cyperus solidus	Piriqueta capensis
Dalechampia capensis	Rhynchosia totta var. totta
Denekia capensis	Riccia okahandjana
Dicerocaryum eriocarpum	Riccia rosea
Dicoma galpinii	Senecio barbertonicus
Digitaria eriantha	Sida dregei
Dipcadi gracillimum	Sida ovata
Diplorhynchus condylocarpon	Spirostachys africana
Enneapogon scoparius	Sporobolus ioclados
Eragrostis gummiflua	Stylosanthes fruticosa
Eragrostis superba	Syzygium guineense subsp. guineense
Erythrophysa transvaalensis	Syzygium intermedium
Euclea crispa subsp. crispa	Terminalia sericea
Euphorbia transvaalensis	Tetradenia riparia
Euphorbia waterbergensis	Thunbergia neglecta
Triumfetta pentandra var. pentandra	Tylosema fassoglense
Vitex pooara	Xanthocercis zambesiaca
Vitex rehmannii	Xenostegia tridentata subsp. angustifolia
Wahlenbergia undulata	
Grid: 2327DD	
Abutilon angulatum var. angulatum	Combretum petrophilum
Acacia burkei	Combretum zeyheri
Acacia erioloba	Commelina africana var. krebsiana
Acacia erubescens	Commelina africana var. lancispatha
Acacia karroo	Commelina eckloniana
Acalypha glabrata var. pilosa	Commelina erecta
Adenia glauca	Commiphora glandulosa
Adenia gummifera var. gummifera	Corchorus kirkii
Alectra orobanchoides	Crassula lanceolata subsp. denticulata
Alistilus bechuanicus	Croton gratissimus var. subgratissimus

Andropogon schirensis	Cryptolepis cryptolepidioides
Anthocleista grandiflora	Cucumis metuliferus
Aristida spectabilis	Cyperus cyperoides subsp. cyperoides
Asparagus angusticladus	Cyperus tenuispica
Barleria affinis	Dactyloctenium giganteum
Barleria crossandriformis	Dalechampia capensis
Barleria galpinii	Dicerocaryum senecioides
Barleria lancifolia subsp. lancifolia	Dichrostachys cinerea subsp. Africana
Barleria pretoriensis	Dicoma galpinii
Barleria saxatilis	Digitaria eriantha
Barleria spinulosa	Dioscorea retusa
Bauhinia petersiana subsp. petersiana	Diospyros lycioides subsp. guerkei
Berchemia discolor	Diospyros whyteana
Blainvillea gayana	Diplorhynchus condylocarpon
Blepharis breyeri	Dolichos pratensis
Bothriochloa radicans	Dombeya rotundifolia var. rotundifolia
Brachiaria deflexa	Ekebergia capensis
Brachiaria nigropedata	Elephantorrhiza burkei
Brachiaria serrata	Elephantorrhiza goetzei subsp. goetzei
Brachylaena rotundata	Enneapogon pretoriensis
Bridelia mollis	Enteropogon macrostachyus
Burkea africana	Eragrostis rigidior
Ceratotheca triloba	Eragrostis superba
Chamaecrista absus	Eriosema psoraleoides
Chamaecrista mimosoides	Eriospermum porphyrovalve
Chloris virgata	Erythrina lysistemon
Chorisochora transvaalensis	Euclea linearis
Cleome hirta	Euclea natalensis subsp. angustifolia
Cleome maculata	Eugenia capensis
Clerodendrum glabrum	Euphorbia espinosa
Coccinia variifolia	Euphorbia neopolycnemoides
Combretum apiculatum subsp. apiculatum	Eustachys paspaloides
Combretum moggii	Evolvulus alsinoides
Combretum molle	Faurea saligna
Felicia mossamedensis	Melhania acuminata var. acuminata

Ficus ingens	Melinis repens subsp. grandiflora
Flueggea virosa subsp. virosa	Melinis repens subsp. repens
Fuirena leptostachya	Merremia pinnata
Fuirena pubescens	Mollugo nudicaulis
Gisekia africana var. africana	Monopsis decipiens
Gloriosa rigidifolia	Myrothamnus flabellifolius
Grewia bicolor var. bicolor	Nuxia congesta
Grewia flava	Ochna inermis
Grewia flavescens	Ochna natalitia
Grewia flavescens	Ochna pulchra
Grewia monticola	Ocimum gratissimum subsp. gratissimum
Grewia rogersii	Ozoroa paniculosa var. paniculosa
Grewia subspathulata	Pavonia burchellii
Gymnosporia polyacanthus	Pogonarthria squarrosa
Gymnosporia tenuispina	Polycarpaea corymbosa var. corymbosa
Harpagophytum zeyheri subsp. zeyheri	Pseudognaphalium luteo-album
Hermannia grisea	Pseudognaphalium oligandrum
Hermbstaedtia odorata var. aurantiaca	Pseudolachnostylis maprouneifolia
Heteropogon contortus	Psiadia punctulata
Heteropyxis natalensis	Pterocarpus rotundifolius
Hexalobus monopetalus var. monopetalus	Pycreus pumilus
Hibiscus calyphyllus	Rhynchosia atropurpurea
Hibiscus engleri	Rhynchosia totta
Hibiscus lunarifolius	Rotheca myricoides
Hibiscus meyeri subsp. transvaalensis	Schizachyrium sanguineum
Hibiscus micranthus var. micranthus	Schrebera alata
Hibiscus platycalyx	Sclerochiton ilicifolius
Hibiscus vitifolius subsp. vulgaris	Searsia leptodictya
Hibiscus waterbergensis	Searsia tumulicola var. tumulicola
Hypoxis angustifolia var. angustifolia	Senecio polyanthemoides
Ilex mitis var. mitis	Sesamum alatum
Indigofera pongolana	Sida pseudocordifolia
Indigofera trita subsp. subulata	Sida rhombifolia subsp. rhombifolia
Ipomoea albivenia	Sphedamnocarpus pruriens subsp. pruriens
Ipomoea holubii	Spirostachys africana

Ipomoea magnusiana	Sporobolus panicoides
Jatropha erythropoda	Sterculia rogersii
Jatropha zeyheri	Stomatostemma monteiroae
Justicia heterocarpa subsp. dinteri	Striga asiatica
Kirkia acuminata	Stylosanthes fruticosa
Kirkia wilmsii	Syzygium cordatum subsp. cordatum
Lannea discolor	Syzygium guineense subsp. guineense
Ledebouria luteola	Tephrosia longipes subsp. longipes
Leucas glabrata	Tephrosia rhodesica var. rhodesica
Limeum viscosum subsp. viscosum	Terminalia sericea
Lipocarpha rehmannii	Tinospora fragosa
Lobelia erinus	Triaspis glaucophylla
Loudetia flavida	Tricholaena monachne
Maerua parvifolia	Trochomeria macrocarpa subsp. macrocarpa
Marsdenia sylvestris	Turraea obtusifolia
Tylosema fassoglense	Xanthocercis zambesiaca
Vitex pooara	Xenostegia tridentata subsp. angustifolia
Vitex rehmannii	Ximenia caffra var. caffra
Waltheria indica	Ziziphus mucronata
Wrightia natalensis	Zornia linearis
2328CC	
Acalypha indica var. indica	Euphorbia neopolycnemoides
Acalypha villicaulis	Gnidia capitata
Acanthospermum glabratum	Grewia rogersii
Albizia tanganyicensis subsp. tanganyicensis	Gymnosporia tenuispina
Albuca abyssinica	Harpagophytum zeyheri subsp. zeyheri
Aristida congesta subsp. congesta	Hermannia boraginiflora
Aristida spectabilis	Hermannia stellulata
Aristida stipitata subsp. stipitata	Hexalobus monopetalus
Asparagus aggregatus	Hexalobus monopetalus var. monopetalus
Asparagus flavicaulis subsp. setulosus	Hibiscus waterbergensis
Asparagus racemosus	Hyparrhenia filipendula var. pilosa
Barbula eubryum	Hyperthelia dissoluta
Barleria mackenii	Ipomoea magnusiana

Barleria pretoriensis	Kalanchoe brachyloba
Bauhinia galpinii	Lantana camara
Brachymenium acuminatum	Limeum viscosum subsp. transvaalense
Bryum argenteum	Lophiocarpus tenuissimus
Bryum capillare	Melhania acuminata var. acuminata
Ceratotheca triloba	Monsonia angustifolia
Cheilanthes viridis var. glauca	Ochna inermis
Citrullus lanatus	Pavetta zeyheri subsp. zeyheri
Clerodendrum ternatum	Peristrophe transvaalensis
Combretum nelsonii	Perotis patens
Combretum zeyheri	Piriqueta capensis
Commelina africana var. lancispatha	Pogonarthria squarrosa
Coptosperma supra-axillare	Polycarpaea corymbosa var. corymbosa
Crassula swaziensis	Pseudolachnostylis maprouneifolia
Crinum stuhlmannii	Riccia atropurpurea
Crotalaria distans subsp. distans	Riccia congoana
Croton gratissimus var. gratissimus	Securidaca longepedunculata
Cyperus obtusiflorus var. obtusiflorus	Setaria lindenbergiana
Dicoma galpinii	Sporobolus conrathii
Digitaria eriantha	Striga gesnerioides
Diheteropogon amplectens var. amplectens	Tephrosia longipes subsp. longipes
Diplorhynchus condylocarpon	Terminalia sericea
Dyschoriste fischeri	Thesium resinifolium
Enneapogon pretoriensis	Trachyandra saltii var. secunda
Eragrostis chloromelas	Tylosema fassoglense
Eragrostis nindensis	Vahlia capensis subsp. vulgaris
Eragrostis pallens	Viscum combreticola
Erpodium coronatum subsp. transvaaliense	Xyris capensis Thunb.
Euclea crispa subsp. crispa	Zornia milneana
Euclea natalensis subsp. angustifolia	
Grid: 2427BA	
Acacia erubescens	Grewia bicolor var. bicolor
Acacia luederitzii var. retinens	Grewia flava
Agathisanthemum bojeri subsp. bojeri	Grewia flavescens

Alectra vogelii	Habenaria nyikana subsp. nyikana
Andropogon schirensis	Helichrysum callicomum
Anthospermum welwitschii	Helichrysum kraussii
Aristida aequiglumis	Hermannia lancifolia
Aristida congesta subsp. congesta	Hilliardiella aristata
Asparagus buchananii	Hyparrhenia filipendula var. pilosa
Bewsia biflora	Hyparrhenia newtonii var. newtonii
Brachiaria serrata	Hypericum lalandii
Bridelia mollis	Indigofera mollicoma
Buchnera reducta	Indigofera spicata var. spicata
Bulbostylis burchellii	Ipomoea albivenia
Cenchrus ciliaris	Ipomoea obscura var. obscura
Chamaecrista comosa	Ischaemum afrum
Cleome monophylla	Jamesbrittenia burkeana
Combretum apiculatum subsp. apiculatum	Justicia anagalloides
Corchorus kirkii	Kirkia wilmsii
Crassula lanceolata subsp. transvaalensis	Kohautia virgata
Cucumis humifructus	Kyllinga alba
Cynodon dactylon	Lantana rugosa
Cyperus albostriatus	Ledebouria inquinata
Cyperus cyperoides subsp. pseudoflavus	Ledebouria marginata
Cyperus obtusiflorus var. obtusiflorus	Leonotis ocymifolia var. schinzii
Cyperus sphaerospermus	Lippia wilmsii
Dianthus transvaalensis	Loudetia simplex
Dichanthium annulatum var. papillosum	Monsonia angustifolia
Dichapetalum cymosum	Mundulea sericea subsp. sericea
Dicoma galpinii	Nuxia congesta
Enneapogon cenchroides	Oldenlandia herbacea var. herbacea
Enneapogon scoparius	Oxalis latifolia
Eragrostis capensis	Oxalis obliquifolia
Eragrostis gummiflua	Panicum maximum
Eragrostis hierniana	Panicum natalense
Eragrostis pallens	Panicum stapfianum
Eragrostis racemosa	Parmotrema austrosinense
Eragrostis stapfii	Pentanisia angustifolia

Eragrostis trichophora	Perotis patens
Eriosema psoraleoides	Phyllanthus incurvus
Euclea natalensis subsp. angustifolia	Pogonarthria squarrosa
Fadogia homblei	Pollichia campestris
Felicia muricata subsp. muricata	Pycnostachys reticulata
Gazania krebsiana subsp. serrulata	Rhoicissus revoilii
Gisekia africana var. pedunculata	Schizachyrium sanguineum
Gladiolus elliotii	Schmidtia pappophoroides
Schoenoplectus muricinux	Striga asiatica
Scleria bulbifera	Tarchonanthus parvicapitulatus
Searsia leptodictya	Teramnus labialis subsp. labialis
Securidaca longepedunculata	Thunbergia atriplicifolia
Seddera suffruticosa	Trachypogon spicatus
Selago lacunosa	Trichostomum brachydontium
Senecio venosus	Triumfetta sonderi
Solanum lichtensteinii	Vernonia galpinii
Spermacoce senensis	Vernonia staehelinoides
Sphedamnocarpus pruriens	Vitex pooara
Sporobolus panicoides	Vitex rehmannii
Sporobolus pectinatus	Wahlenbergia undulata
Stachys natalensis var. galpinii	Xenostegia tridentata subsp. angustifolia
Stipagrostis uniplumis var. uniplumis	
Grid: 2427BB	
Acacia erubescens	Harpagophytum zeyheri subsp. zeyheri
Alistilus bechuanicus	Helichrysum callicomum
Andropogon chinensis	Helichrysum kraussii
Aneilema hockii	Helichrysum setosum
Aristida spectabilis	Hermannia grisea
Blepharis breyeri	Hermannia stellulata
Bryum capillare	Hibiscus engleri
Bulbostylis burchellii	Hibiscus waterbergensis
Bulbostylis hispidula subsp. pyriformis	Indigofera adenoides
Campylopus pyriformis	Indigofera melanadenia
Cenchrus ciliaris	Indigofera spicata var. spicata

Cheilanthes viridis	Indigofera vicioides var. vicioides
Chlorophytum galpinii var. galpinii	Ipomoea coptica
Chorisochora transvaalensis	Ipomoea transvaalensis
Cissus cactiformis	Isolepis costata
Combretum kraussii	Justicia minima
Commelina africana var. lancispatha	Ledebouria revoluta
Crotalaria virgultalis	Lipocarpha chinensis
Croton gratissimus var. subgratissimus	Lotononis listii
Cyperus albostriatus	Mundulea sericea subsp. sericea
Cyperus capensis	Nymphaea nouchali var. caerulea
Cyperus denudatus var. denudatus	Ocimum angustifolium
Cyperus sphaerospermus	Oxalis depressa
Cyphostemma puberulum	Pachystigma triflorum
Drimia altissima	Pearsonia uniflora
Drimiopsis burkei subsp. burkei	Pegolettia tenuifolia
Eleocharis acutangula	Phyllanthus incurvus
Eragrostis pallens	Phyllanthus pentandrus
Eriosema pauciflorum var. pauciflorum	Polygala sphenoptera var. sphenoptera
Erlangea misera	Polygala uncinata
Eulophia angolensis	Pupalia lappacea var. lappacea
Fimbristylis dichotoma subsp. dichotoma	Pycreus flavescens
Fuirena pubescens var. pubescens	Pycreus macranthus
Gladiolus elliotii	Pycreus nitidus
Grewia flavescens var. olukondae	Rhynchosia totta var. totta
Riccia congoana	Strychnos madagascariensis
Riccia okahandjana	Stylosanthes fruticosa
Schotia brachypetala	Syncolostemon canescens
Sclerochiton ilicifolius	Tephrosia longipes subsp. longipes
Selaginella dregei	Tephrosia purpurea subsp. leptostachya
Senecio inaequidens	Terminalia sericea
Sesbania bispinosa	Tribulus zeyheri subsp. zeyheri
Sida cordifolia subsp. cordifolia	Triraphis schinzii
Sida dregei	Triumfetta angolensis
Solanum catombelense	Triumfetta annua
Solanum coccineum	Vahlia capensis

Spermacoce senensis	Vernonia poskeana subsp. botswanica
Sphedamnocarpus pruriens	Xyris congensis
Stachys natalensis var. natalensis	Ziziphus zeyheriana
Strychnos cocculoides	Zornia glochidiata

2428AA	
Acacia burkei	Dichapetalum cymosum
Acacia caffra	Dicoma anomala subsp. gerrardii
Acacia karroo	Digitaria debilis
Acacia robusta subsp. robusta	Digitaria eriantha
Agathisanthemum bojeri subsp. bojeri	Diospyros lycioides subsp. guerkei
Argyrolobium transvaalense	Diplorhynchus condylocarpon
Aristida aequiglumis	Dombeya rotundifolia
Aristida canescens subsp. canescens	Dombeya rotundifolia var. rotundifolia
Aristida congesta subsp. congesta	Eragrostis chloromelas
Aristida scabrivalvis subsp. scabrivalvis	Eragrostis gummiflua
Aristida stipitata subsp. graciliflora	Eragrostis lehmanniana var. chaunantha
Asystasia schimperi	Eragrostis nindensis
Barleria rehmannii	Eragrostis rigidior
Berchemia zeyheri	Eragrostis stapfii
Blepharis maderaspatensis	Eragrostis superba
Brachiaria nigropedata	Eragrostis trichophora
Bryum capillare	Euphorbia ingens
Bulbostylis hispidula subsp. pyriformis	Euphorbia neopolycnemoides
Burkea africana	Evolvulus alsinoides
Carissa bispinosa	Faurea saligna
Ceropegia crassifolia var. crassifolia	Felicia mossamedensis
Ceropegia turricula	Ficus thonningii
Chamaecrista absus	Gloriosa rigidifolia
Chlorophytum galpinii var. norlindhii	Gnidia microcephala
Clematis oweniae	Grewia occidentalis var. occidentalis
Cleome maculata	Hyparrhenia quarrei
Clutia pulchella var. pulchella	Hypericum lalandii
Combretum molle	Hyperthelia dissoluta
Combretum nelsonii	Indigofera melanadenia

Combretum zeyheri	Ipomoea ommanneyi
Commiphora africana var. africana	Ischaemum fasciculatum
Commiphora glandulosa	Justicia betonica
Commiphora mollis	Justicia petiolaris subsp. incerta
Commiphora schimperi	Justicia protracta subsp. protracta
Crabbea hirsuta	Kalanchoe paniculata
Cussonia spicata	Kirkia acuminata
Cymbopogon pospischilii	Leucas martinicensis
Cyperus esculentus var. esculentus	Limeum fenestratum var. fenestratum
Cyperus fastigiatus	Miscanthus junceus
Cyperus rupestris var. rupestris	Myriophyllum aquaticum
Ocimum americanum var. americanum	Searsia pallens
Olea europaea subsp. africana	Searsia pyroides var. pyroides
Ozoroa paniculosa var. paniculosa	Setaria sphacelata var. torta
Panicum natalense	Sporobolus pyramidalis
Panicum repens	Striga elegans
Pavonia transvaalensis	Strychnos spinosa subsp. spinosa
Pentarrhinum insipidum	Tephrosia lupinifolia
Pittosporum viridiflorum	Themeda triandra
Plantago major	Thunbergia neglecta
Plectranthus cylindraceus	Trachypogon spicatus
Pogonarthria squarrosa	Tragia rupestris
Pollichia campestris	Trichoneura grandiglumis
Pterocarpus rotundifolius subsp. rotundifolius	Tylosema fassoglense
Pupalia lappacea var. lappacea	Urochloa brachyura
Rhoicissus tridentata subsp. cuneifolia	Vitex rehmannii
Rhynchosia totta var. totta	Wahlenbergia denticulata var. transvaalensis
Rotheca louwalbertsii	Wahlenbergia krebsii
Schmidtia pappophoroides	Xenostegia tridentata subsp. angustifolia
Schotia brachypetala	Zornia capensis subsp. capensis
Searsia leptodictya forma leptodictya	

Legislation on weeds and invasive plants in South Africa

The present legislation forms part of the Conservation of Agricultural Resources Act, 1983 (Act No 43 of 1983) (CARA). Regulations 15 and 16 under this Act, which concerns problem plants, were amended during March 2001. CARA is currently in the process of being revised[11,12,22].

Under this legislation, landowners are responsible for the control of invasive alien plants (IAP) on their properties. IAPs are divided into three categories as follows:

Category 1: Species (e.g. Triffid Weed, Lantana) which are generally the worst offenders. As declared weeds, they may not occur on any land or on any inland water surface throughout South Africa. No person may sell, advertise, exhibit, transmit, send, deliver for sale, exchange or dispose of any weed. It is also illegal to cause or permit the dispersal of any weed from one place to another.

Category 2: Species (such as pine and gum) which are also problematic, but are more commonly grown for commercial purposes or any viable and beneficial function, such as woodlots, fire belts, building material, animal fodder and soil stabilization.

Category 3: Species (such as Syringa and Morning Glory) which are generally ornamental plants and may be retained, but no new planting or trade or propagating of these plants is permitted. If weeds or invader plants occur contrary to the provisions of these regulations, the land user must control them by means of any of the control methods that are appropriate for the species concerned. Any action taken to control weeds or invader plants must be executed with caution and in a manner that will have minimal environmental impact.

18. REFERENCES

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Appendix D2: Specialist reports
Heritage Impact Assessment

Archaetnos Culture & Cultural
Resource Consultants
BK 98 09854/23

A SECOND REPORT ON A BASIC ASSESSMENT RELATING TO CULTURAL HERITAGE RESOURCES FOR THE PROPOSED CONSTRUCTION OF THE BULGE-DORSET 132Kv POWER LINE, LIMPOPO PROVINCE

For:

Texture Environmental Consultants
PO Box 36 593
Menlopark
Pretoria
0102

REPORT: **AE1160**

by:

Dr. A.C. van Vollenhoven (L.AKAD.SA.)
Accredited members of ASAPA

June 2010

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DISCLAIMER:

Although all possible care is taken to identify all sites of cultural importance during the survey of study areas, the nature of archaeological and historical sites are as such that it always is possible that hidden or subterranean sites could be overlooked during the study. Archaetnos and its personnel will not be held liable for such oversights or for costs incurred as a result thereof.

The South African Heritage Resources Agency (SAHRA) or one of its subsidiary bodies needs to comment on this report and clients are advised not to proceed with any action before receiving these. It is the responsibility of the client to submit the report to the relevant heritage authority.

SUMMARY

Archaetnos cc was appointed by Texture Environmental Consultants to conduct a basic assessment relating to cultural heritage resources for the proposed construction of the Bulge-Dorset 132kV power line. This is close to Vaalwater in the Limpopo Province. Four options for the route were surveyed.

The fieldwork undertaken revealed no sites of cultural heritage significance. The main reason for this is the inaccessibility of farms used for game farming. However the area was also surveyed via helicopter.

From a heritage point any of the four alternatives may be used. It may however be necessary to survey certain areas, especially those with a high probability of having cultural sites. The proposed development may continue bearing in mind the possibility of finding chance sites.

CONTENTS

1. INTRODUCTION

Archaetnos cc was appointed by Texture Environmental Consultants to conduct a cultural heritage impact assessment for the proposed construction of the Bulge-Dorset 132kV power line. The line starts at the proposed Bulge substation, close to the Bulge River, and runs east through Witfontein and then north-east to Dorset. The line starts to the west of the town of Vaalwater in the Limpopo Province, but ends to the north-east thereof.

Four options for the route were surveyed. The client indicated the area where the proposed development is to take place, and the survey was confined to this area.

2. TERMS OF REFERENCE

The Terms of Reference for the survey were to:

1. Identify all objects, sites, occurrences and structures of an archaeological or historical nature (cultural heritage sites) located on the property (see Appendix A).

2. Assess the significance of the cultural resources in terms of their archaeological, historical, scientific, social, religious, aesthetic and tourism value (see Appendix B).

3. Describe the possible impact of the proposed development on these cultural remains, according to a standard set of conventions.

4. Propose suitable mitigation measures to minimize possible negative impacts on the cultural resources.

5. Recommend suitable mitigation measures should there be any sites of significance that might be impacted upon by the proposed development.

6. Review applicable legislative requirements.

3. CONDITIONS & ASSUMPTIONS

The following conditions and assumptions have a direct bearing on the survey and the resulting report:

1. Cultural Resources are all non-physical and physical man-made occurrences, as well as natural occurrences associated with human activity (Appendix A). These include all sites, structure and artifacts of importance, either individually or in groups, in the history, architecture and archaeology of human (cultural) development. Graves and cemeteries are included in this.

2. The significance of the sites, structures and artifacts is determined by means of their historical, social, aesthetic, technological and scientific value in relation to their uniqueness, condition of preservation and research potential. The various aspects are

not mutually exclusive, and the evaluation of any site is done with reference to any number of these aspects.

3. Cultural significance is site-specific and relates to the content and context of the site. Sites regarded as having low cultural significance have already been recorded in full and require no further mitigation. Sites with medium cultural significance may or may not require mitigation depending on other factors such as the significance of impact on the site. Sites with a high cultural significance require further mitigation (see Appendix B).

4. The latitude and longitude of any archaeological or historical site or feature, is to be treated as sensitive information by the developer and should not be disclosed to members of the public.

5. All recommendations are made with full cognizance of the relevant legislation.

6. It has to be mentioned that it is almost impossible to locate all the cultural resources in a given area, as it will be very time consuming. Developers should however note that the report should make it clear how to handle any other finds that might occur.

7. It should be noted that in this particular case the grass cover in certain areas was very high and certain areas inaccessible due to game fences. As a result some areas could not be surveyed properly.

4. LEGISLATIVE REQUIREMENTS

Aspects concerning the conservation of cultural resources are dealt with mainly in two acts. These are the National Heritage Resources Act (Act 25 of 1999) and the National Environmental Management Act (Act 107 of 1998).

4.1 The National Heritage Resources Act

According to the above-mentioned act the following is protected as cultural heritage resources:

a. Archaeological artifacts, structures and sites older than 100 years
b. Ethnographic art objects (e.g. prehistoric rock art) and ethnography
c. Objects of decorative and visual arts
d. Military objects, structures and sites older than 75 years
e. Historical objects, structures and sites older than 60 years
f. Proclaimed heritage sites
g. Grave yards and graves older than 60 years
h. Meteorites and fossils
i. Objects, structures and sites or scientific or technological value.

The national estate (see Appendix D) includes the following:

a. Places, buildings, structures and equipment of cultural significance

b. Places to which oral traditions are attached or which are associated with living heritage
c. Historical settlements and townscapes
d. Landscapes and features of cultural significance
e. Geological sites of scientific or cultural importance
f. Archaeological and palaeontological importance
g. Graves and burial grounds
h. Sites of significance relating to the history of slavery
i. Movable objects (e.g. archaeological, palaeontological, meteorites, geological specimens, military, ethnographic, books etc.)

A Heritage Impact Assessment (HIA) is the process to be followed in order to determine whether any heritage resources are located within the area to be developed as well as the possible impact of the proposed development thereon. An Archaeological Impact Assessment only looks at archaeological resources. An HIA must be done under the following circumstances:

a. The construction of a linear development (road, wall, power line canal etc.) exceeding 300m in length
b. The construction of a bridge or similar structure exceeding 50m in length
c. Any development or other activity that will change the character of a site and exceed 5 000m^2 or involve three or more existing erven or subdivisions thereof
d. Re-zoning of a site exceeding 10 000 m^2
e. Any other category provided for in the regulations of SAHRA or a provincial heritage authority

Structures

Section 34 (1) of the mentioned act states that no person may demolish any structure or part thereof which is older than 60 years without a permit issued by the relevant provincial heritage resources authority.

A structure means any building, works, device or other facility made by people and which is fixed to land, and includes any fixtures, fittings and equipment associated therewith.

Alter means any action affecting the structure, appearance or physical properties of a place or object, whether by way of structural or other works, by painting, plastering or the decoration or any other means.

Archaeology, palaeontology and meteorites

Section 35(4) of this act deals with archaeology, palaeontology and meteorites. The act states that no person may, without a permit issued by the responsible heritage resources authority (national or provincial):

a. destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite;
b. destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite;

c. trade in, sell for private gain, export or attempt to export from the Republic any category of archaeological or palaeontological material or object, or any meteorite; or
d. bring onto or use at an archaeological or palaeontological site any excavation equipment or any equipment that assists in the detection or recovery of metals or archaeological and palaeontological material or objects, or use such equipment for the recovery of meteorites.
e. alter or demolish any structure or part of a structure which is older than 60 years as protected.

The above mentioned may only be disturbed or moved by an archaeologist, after receiving a permit from the South African Heritage Resources Agency (SAHRA). In order to demolish such a site or structure, a destruction permit from SAHRA will also be needed.

Human remains

Graves and burial grounds are divided into the following:

a. ancestral graves
b. royal graves and graves of traditional leaders
c. graves of victims of conflict
d. graves designated by the Minister
e. historical graves and cemeteries
f. human remains

In terms of Section 36(3) of the National Heritage Resources Act, no person may, without a permit issued by the relevant heritage resources authority:

a. destroy, damage, alter, exhume or remove from its original position of otherwise disturb the grave of a victim of conflict, or any burial ground or part thereof which contains such graves;
b. destroy, damage, alter, exhume or remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority; or
c. bring onto or use at a burial ground or grave referred to in paragraph (a) or (b) any excavation, or any equipment which assists in the detection or recovery of metals.

Human remains that are less than 60 years old are subject to provisions of the Human Tissue Act (Act 65 of 1983) and to local regulations. Exhumation of graves must conform to the standards set out in the **Ordinance on Excavations (Ordinance no. 12 of 1980)** (replacing the old Transvaal Ordinance no. 7 of 1925).

Permission must also be gained from the descendants (where known), the National Department of Health, Provincial Department of Health, Premier of the Province and local police. Furthermore, permission must also be gained from the various landowners (i.e. where the graves are located and where they are to be relocated) before exhumation can take place.

Human remains can only be handled by a registered undertaker or an institution declared under the **Human Tissues Act (Act 65 of 1983 as amended)**.

Unidentified/unknown graves are also handled as older than 60 until proven otherwise.

4.2 The National Environmental Management Act

This act (Act 107 of 1998) states that a survey and evaluation of cultural resources must be done in areas where development projects, that will change the face of the environment, will be undertaken. The impact of the development on these resources should be determined and proposals for the mitigation thereof are made.

Environmental management should also take the cultural and social needs of people into account. Any disturbance of landscapes and sites that constitute the nation's cultural heritage should be avoided as far as possible and where this is not possible the disturbance should be minimized and remedied.

5. METHODOLOGY

5.1 Survey of literature

A survey of literature was undertaken in order to obtain background information regarding the area. Sources consulted in this regard are indicated in the bibliography.

5.2 Field survey

The survey was conducted according to generally accepted HIA practices and was aimed at locating all possible objects, sites and features of cultural significance in the area of proposed development. If required, the location/position of any site was determined by means of a Global Positioning System (GPS), while photographs were also taken where needed.

The survey was undertaken by flying over the route with a helicopter during the summer months. This was followed by doing a physical survey via vehicle and on foot, once during the summer and once during the winter.

5.3 Oral histories

People from local communities are interviewed in order to obtain information relating to the surveyed area. It needs to be stated that this is not applicable under all circumstances. When applicable, the information is included in the text and referred to in the bibliography.

5.4 Documentation

All sites, objects features and structures identified were documented according to the general minimum standards accepted by the archaeological profession. Co-ordinates of individual localities were determined by means of the Global Positioning System (GPS).The information was added to the description in order to facilitate the identification of each locality.

5.5 Evaluation of Heritage sites

The evaluation of heritage sites is done by using the following criteria:

- The unique nature of a site
- The integrity of the archaeological deposit
- The wider historic, archaeological and geographic context of the site
- The location of the site in relation to other similar sites or features
- The depth of the archaeological deposit (when it can be determined or is known)
- The preservation condition of the site
- Uniqueness of the site and
- Potential to answer present research questions.

6. DESCRIPTION OF THE AREA

The area where the planned power line will be erected is situated to the west, north and north-west of the town of Vaalwater in the Limpopo Province (Figure 1-3). The specific farms influenced by the development are Bulgerivier 198 KQ, Mooifontein 150 KQ, Manamane 201 KQ, Bergsig 202 KQ, Malmaniesrivierdrift 199 KQ, Hermanusdoorns 600 KQ, Hermanusdoorns 205 KQ, Welgevonden 186 KQ, Welgevonden 180 KQ, Groenfontein 207 KQ, Keerom 208 KQ, Hanover 181 KQ, Grootwater 176 KQ, Kafferfontein 178 KQ, Roodekop 172 KQ, Schuinskloof 175 KQ, Witfontein 6 KR, Blaauwbank 2 KR, Blaauwbank 3 KR, Rietbokhoek 4 KR, Zeekgat 5 KR, Rietgat 8 KR, Steenbokfontein 9 KR, Vischgat 64 KR, Dwarsfontein 51 KR and Brakfontein 16 KR. The lines mostly run along the borders of these farms.

GPS co-ordinates taken are as follows:

At Bulge substation - 24°07'03,9"S; 27°40'09,4"E
At Witfontein - 24°08'57,2"S; 27°46'25,2"E
At Vischgat - 24°08'57,1"S; 27°46'25,3"E
At Dorset - 24°04'15,2"S; 28°09'24,7"E
At point where alternatives 3 and 4 deviates from alternative 1 and 2 - 24°05.820S; 27°58.829E

The environment of the area (Figure 4-9) consists of bushveld vegetation and it mostly seems undisturbed. Disturbance are limited to field used for grazing, some old agricultural fields and a few currently used agricultural fields. The topography of the area is basically flat with some hills and rock outcrops here and there. The route starts in the west at the Bulge River which flows from south to north. It crosses a number of streams and rivers on its way to the north-east. Accordingly some marshy areas are found along the route.

During the survey the veldt was extremely wet due to the good rainfall of the current season. The vegetation was quite dense in certain areas, but the biggest problem is the lack of access through game fences. However, flying over the area countered that to some extent. As a result the archaeological visibility was fair. However, one would not for instance be able to spot a Stone Age site from the air and this has to be borne in mind.

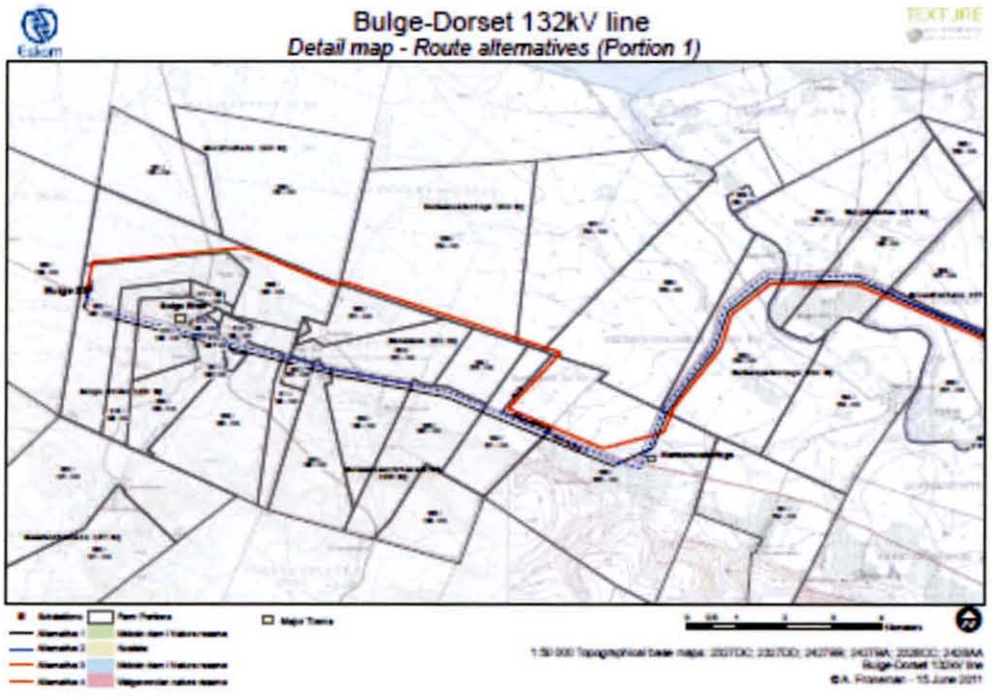

Figure 1 **Map of portion 1 of the surveyed area. The black line represents route alternative 1, the dotted blue line route alternative 2, the red line route alternative 3 and the dotted red line route alternative 4.**

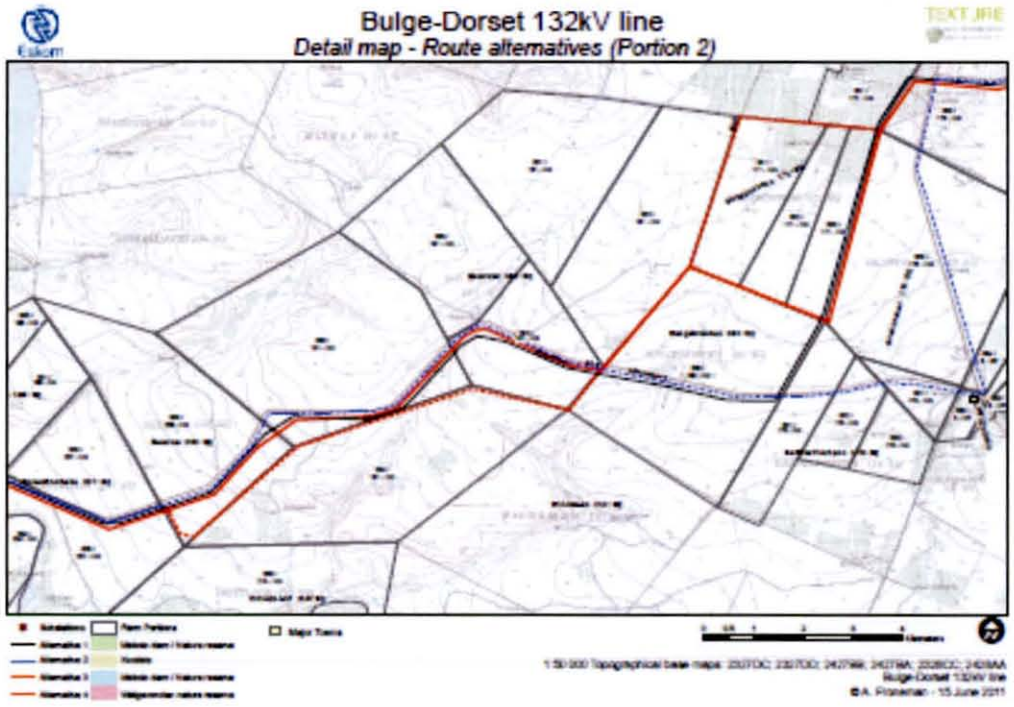

Figure 2 **Map of portion 2 of the surveyed area. The black line represents route alternative 1, the dotted blue line route alternative 2, the red line route alternative 3 and the dotted red line route alternative 4.**

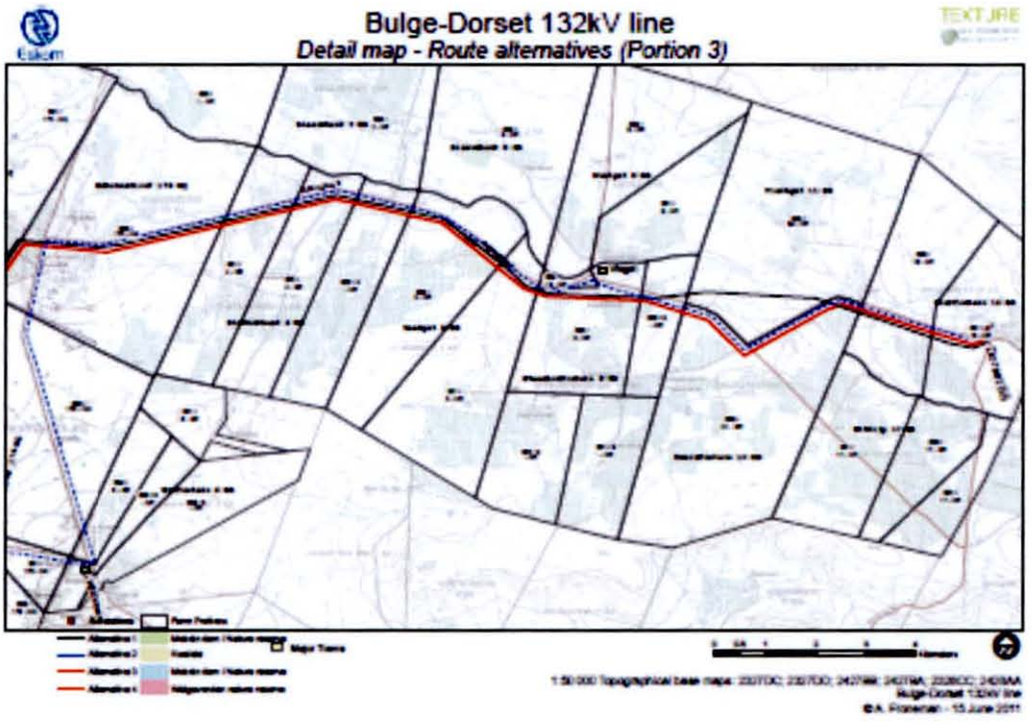

Figure 3 **Map of portion 3 of the surveyed area. The black line represents route alternative 1, the dotted blue line route alternative 2, the red line route alternative 3 and the dotted red line route alternative 4.**

Figure 4 **General view of the area showing dense vegetation.**

Figure 5 **General view of certain areas showing riverine vegetation.**

Figure 6 **View of route alternative 3 on the farm Welgevoden.**

Fiugure 7 View of route alternative 4 on the farm Keerom.

Figure 8 View of route alternative 4 on the farm Goudfontein.

Figure 9 Another view of route alternative 4 on the farm Goudfontein.

7. DISCUSSION

During the survey no site of cultural heritage significance was located in the area to be developed. Although the report is seen as ample mitigation in this regard it needs to be considered that sites may become known later and that those need to be dealt with in accordance with the legislation discussed above. In order to enable the reader to better understand possible archaeological and cultural features that may be unearthed during construction activities, it is necessary to give a background regarding the different phases of human history.

7.1 Stone Age

The Stone Age is the period in human history when lithic material was mainly used to produce tools (Coertze & Coertze 1996: 293). In South Africa the Stone Age can be divided

in three periods. It is however important to note that dates are relative and only provide a broad framework for interpretation. The division for the Stone Age according to Korsman & Meyer (1999: 93-94) is as follows:

Early Stone Age (ESA) 2 million – 150 000 years ago
Middle Stone Age (MSA) 150 000 – 30 000 years ago
Late Stone Age (LSA) 40 000 years ago – 1850 - A.D.

Not many Stone Age sites are known in the western part of Limpopo, but this probably only reflect the lack of research in the past. The nearest sites to the surveyed area are Middle and Late Stone Age sites to the east of Lephalale. Rock art sites are found in abundance in the Waterberg (Bergh 1999: 4-5). These are mostly associated with the San people of the Later Stone Age.

The surveyed area does contain rock outcrops and small hills which could have provided shelter and material for the manufacture of stone tools. The abundance of water and good vegetation would have lured game to the area and it would therefore have been the perfect hunting ground for these people. However no indication of the Stone Age was found during the survey.

7.2 Iron Age

The Iron Age is the name given to the period of human history when metal was mainly used to produce metal artifacts (Coertze & Coertze 1996: 346). In South Africa it can be divided in two separate phases according to Van der Ryst & Meyer (1999: 96-98), namely:

Early Iron Age (EIA) 200 – 1000 A.D.
Late Iron Age (LIA) 1000 – 1850 A.D.

Huffman (2007: xiii) however indicates that a Middle Iron Age should be included. His dates, which now seem to be widely accepted in archaeological circles, are:

Early Iron Age (EIA) 250 – 900 A.D.
Middle Iron Age (MIA) 900 – 1300 A.D.
Late Iron Age (LIA) 1300 – 1840 A.D.

The Early Iron Age has not been well researched. Accordingly only one site was identified close to the surveyed area. This is a site called Diamant, which lies to the west of the surveyed area (Bergh 1999: 6).

Many Late Iron Age sites were identified around the investigated area, although none are known from the specific area (Bergh 1999: 7). Again this may only indicate a lack of research. It also seems as if the known earliest trade routes did not reach this area (Bergh 1999: 9).

The type of environment in the project area definitely is suitable for human habitation. There are ample water sources, good grazing, ample fuel and building material. However the flat relief of the land may have prevented people from settling here. One would therefore expect

that Iron Age people have utilized the area. This is the same reason why white settlers later on moved into this environment.

It does seem as if this area may not have been inhabited at the beginning of the 19th century. It also seems as if the Difaquane did not really have an influence on the settlement of people here (Bergh 1999: 10-11).

Accordingly no indication of Iron Age settlement was identified during the survey.

7.3 Historical Age

The historical age started with the first recorded oral histories in the area. It includes the moving into the area of people that were able to read and write.

The first white travelers to visit these surroundings were Dr Andrew Cowan and Lieutenant Donovan in 1808. David Hume followed in 1825. Between 1830 and 1847 other travellers visited the areas surrounding Lephalale and Thabazimbi, but none seem to have entered the surveyed area (Bergh 1999: 12-13). The first white farmers only settled here during 1841-1850 (Bergh 1999: 15).

No sites dating to the historical age were found during the survey.

8. CONCLUSIONS AND RECOMMENDATIONS

In conclusion it can be stated that the assessment of the area was conducted successfully. In the surveyed area no sites of cultural significance have been found.

The final recommendations are as follows:

- From a cultural historical perspective there is no specific preference for any of the four route alternatives.

- Regardless of the option chosen it should be noted that the subterranean presence of archaeological and/or historical sites, features or artifacts are always a distinct possibility. Care should therefore be taken when development work commences that if any of these are accidentally discovered, a qualified archaeologist be called in to investigate.

- Due to constraints indicated above it may be possible that certain sites were not identified. If archaeological sites are therefore identified during construction activities, an archaeologist should also be called in to investigate.

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APPENDIX A

Definition of terms:

Site: A large place with extensive structures and related cultural objects. It can also be a large assemblage of cultural artifacts, found on a single location.

Structure: A permanent building found in isolation or which forms a site in conjunction with other structures.

Feature: A coincidental find of movable cultural objects.

Object: Artifact (cultural object).

(Also see Knudson 1978: 20).

APPENDIX B

Definition of significance:

Historic value:	Important in the community or pattern of history or has an association with the life or work of a person, group or organization of importance in history.
Aestetic value:	Important in exhibiting particular aesthetic characteristics valued by a community or cultural group.
Scientific value:	Potential to yield information that will contribute to an understanding of natural or cultural history or is important in demonstrating a high degree of creative or technical achievement of a particular period
Social value:	Have a strong or special association with a particular community or cultural group for social, cultural or spiritual reasons.
Rarity:	Does it possess uncommon, rare or endangered aspects of natural or cultural heritage.
Representivity:	Important in demonstrating the principal characteristics of a particular class of natural or cultural places or object or a range of landscapes or environments characteristic of its class or of human activities (including way of life, philosophy, custom, process, land-use, function, design or technique) in the environment of the nation, province region or locality.

APPENDIX C

Cultural significance:

- Low — A cultural object being found out of context, not being part of a site or without any related feature/structure in its surroundings.

- Medium — Any site, structure or feature being regarded less important due to a number of factors, such as date and frequency. Also any important object found out of context.

- High — Any site, structure or feature regarded as important because of its age or uniqueness. Graves are always categorized as of a high importance. Also any important object found within a specific context.

Heritage significance:

- Grade I — Heritage resources with exceptional qualities to the extent that they are of national significance

- Grade II — Heritage resources with qualities giving it provincial or regional importance although it may form part of the national estate

- Grade III — Other heritage resources of local importance and therefore worthy of conservation

APPENDIX D

Protection of heritage resources:

- Formal protection

National heritage sites and Provincial heritage sites – grade I and II
Protected areas - an area surrounding a heritage site
Provisional protection – for a maximum period of two years
Heritage registers – listing grades II and III
Heritage areas – areas with more than one heritage site included
Heritage objects – e.g. archaeological, palaeontological, meteorites, geological specimens, visual art, military, numismatic, books, etc.

- General protection

Objects protected by the laws of foreign states
Structures – older than 60 years
Archaeology, palaeontology and meteorites
Burial grounds and graves
Public monuments and memorials

Appendix D3: Specialist reports
Bird Impact Assessment

BIRD IMPACT ASSESSMENT STUDY

Eskom Distribution Northern Region

BULGE - DORSET 132kV POWER LINE

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EXECUTIVE SUMMARY

Eskom Northern Region Distribution is planning on constructing a new, 132kV Bulge-Dorset distribution power line between Bulgerivier and Visgat near Vaalwater in Limpopo. The line will run in a west-east direction between the authorised Bulgerivier Substation and the authorised Dorset Substation and will be approximately 52km long. This study deals only with the proposed power line.

The terms of reference for the bird impact assessment study are as follows:

- Describe the affected environment.
- Indicate how birdlife will be affected.
- Discuss gaps in baseline data.
- List and describe the expected impacts.
- Assess and evaluate the potential impacts.
- Recommend mitigation measures if need be.

The habitat surrounding the proposed power line comprises mostly undisturbed woodland, with limited existing impacts which consist mostly of a number of reticulation lines, fences and dirt roads. As a result it supports a number of power line sensitive species, particularly raptor species currently Red Data listed (see TABLE 2). The impact of the proposed line on the natural habitat (and therefore potentially on power line sensitive Red Data species) would be limited if it is placed next to existing linear impacts, particularly dirt roads, as is the case with alternative 1 and 2. Alternative 3 and 4 have a few sections where it deviates from existing dirt roads, which will have a bigger impact on the natural woodland vegetation. If alternative 2 is selected, the impact of the clearing of vegetation for the new line would be slightly less than if the line was partially constructed in undisturbed woodland, as would be the case with alternatives 3 and 4, and to a much lesser extent with alternative 1. The impact on smaller, non-Red Data species that are potentially breeding in the area that will be cleared for the new power line will be local in extent, in that it will not affect regional or national populations in any significant way.

The proposed construction of the new power line should have a **LOW** habitat transformation impact from an avifaunal perspective, especially if **alternative 2** is used. If **alternative 1** is used, the impact would be **MEDIUM-LOW**, as it would involve more extensive clearing of undisturbed woodland. With **alternative 3 and 4**, the impact will be **MEDIUM,** as it would require more extensive clearing of woodland than the other.

The majority of species listed in Table 2 are all vulnerable to collisions with power lines. In the case of water-associated birds such as the Black Stork, Yellow-billed Stork and African Marsh-Harrier the drainage lines, and specifically the pools in the larger rivers such as the Mokolo and Malmanies, which are in the study area, might potentially hold some attraction to these species. The new line will cross these drainage lines and might be a potential cause of collisions for these species and other, non-Red Data species such as certain species of ducks, waders and possibly Hamerkops *Scopus umbretta*. Species such as Kori Bustard and Secretarybird are known to be vulnerable to collisions with power lines, and the risk would be higher where the proposed alignments cross open habitat, especially old lands. The collision risk should therefore be regarded as **MEDIUM-HIGH** along some sections of the proposed power line alignments (see APPENDIX B).

A mono-pole steel pole will be used for the new 132kV line. Clearance between phases on the same side of the pole structure is normally around 2.2m for this type of design, and the clearance on strain structures is 1.8m. This clearance should be sufficient to prevent phase – phase electrocutions of birds on the towers. The length of the stand-off insulators is likely to be about 1.5 metres. This is relevant as birds such as vultures are able to touch both the conductor and the earthed pole simultaneously potentially resulting in a phase – earth electrocution. This is particularly likely when more than one bird sits on the same pole.

Although not recorded in large numbers, it is likely that White-backed and Cape Vultures forage in the area (Cape Vultures have been recorded in 2427BA by SABAP1, and White-backed Vulture were recorded in 2427BB by SABAP1 and during the helicopter fly-over). There are cattle and game in the area surrounding area, and should a carcass be available to the birds, they might attempt to roost on the poles. The risk of phase-earth electrocution is therefore evaluated to be **MEDIUM**. It should be mentioned that the pole design holds no inherent electrocution risk for other large **non-gregarious** species such as eagles, as they almost never perch together in large numbers next to each other.

CONCLUSIONS

The construction of the proposed 132kV Bulge-Dorset power line should pose a limited threat to the birds. The power line poses a **medium-high** collision risk, mostly to water associated species, and those species attracted to open habitats, particularly old lands. The line will pose a **medium** electrocution risk, in particular to vultures. The proposed construction of the new power line should have a **low** habitat transformation impact from an avifaunal perspective, especially if **alternative 2** is used. If **alternative 1** is used, the impact would be **medium-low**, as it would involve more extensive clearing of undisturbed woodland. With **alternative 3 and 4**, the impact will be **medium,** as it would require more extensive clearing of woodland than the other.

RECOMMENDATIONS

- Power line: The span that crosses drainage lines and old lands should be marked with Bird Flight Diverters on the earth wire of the line, five metres apart, alternating black and white (see APPENDIX B Sensitivity map for the area to be marked with Bird Flight Diverters). APPENDIX C indicates the preferred Bird Flight Diverters to be used.
- Poles: The poles should be fitted with bird perches on top of the poles to draw birds, particularly vultures, away from the potentially risky insulators (see Figure 3 below).

1. INTRODUCTION & BACKGROUND

Eskom Northern Region Distribution is planning on constructing a new, 132kV Bulge-Dorset distribution power line between Bulgerivier and Visgat near Vaalwater in Limpopo. The line will run in a west-east direction between the authorised Bulgerivier Substation and the authorised Dorset Substation and will be approximately 52km long. This study deals only with the proposed power line.

Texture Environmental Consultants was appointed by Eskom to compile the Environmental Impact Assessment (EIA) for the construction of the new power line and substation. Chris van Rooyen Consulting was appointed by Texture to assess the potential impacts of the proposed power line on birds.

Figures 1-4 below indicate where the proposed alternatives for the new power line, as well as the new Bulgerivier and Dorset Substations, will be situated.

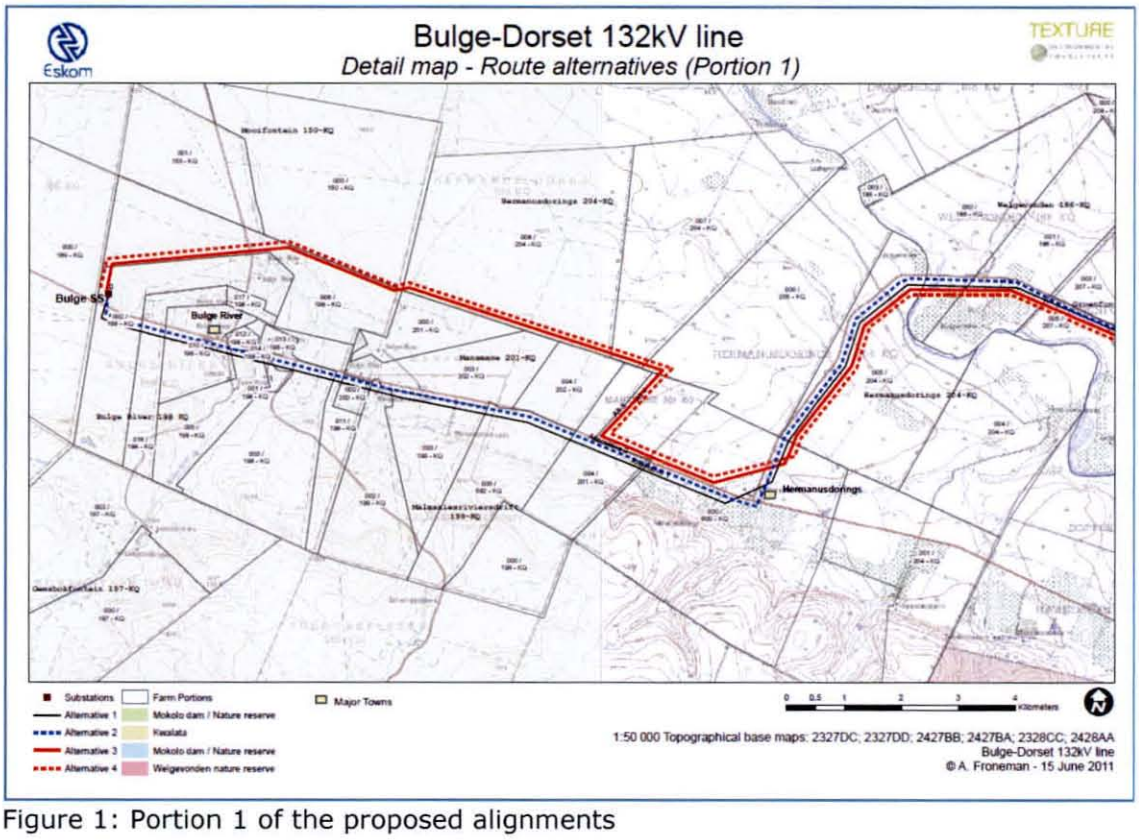

Figure 1: Portion 1 of the proposed alignments

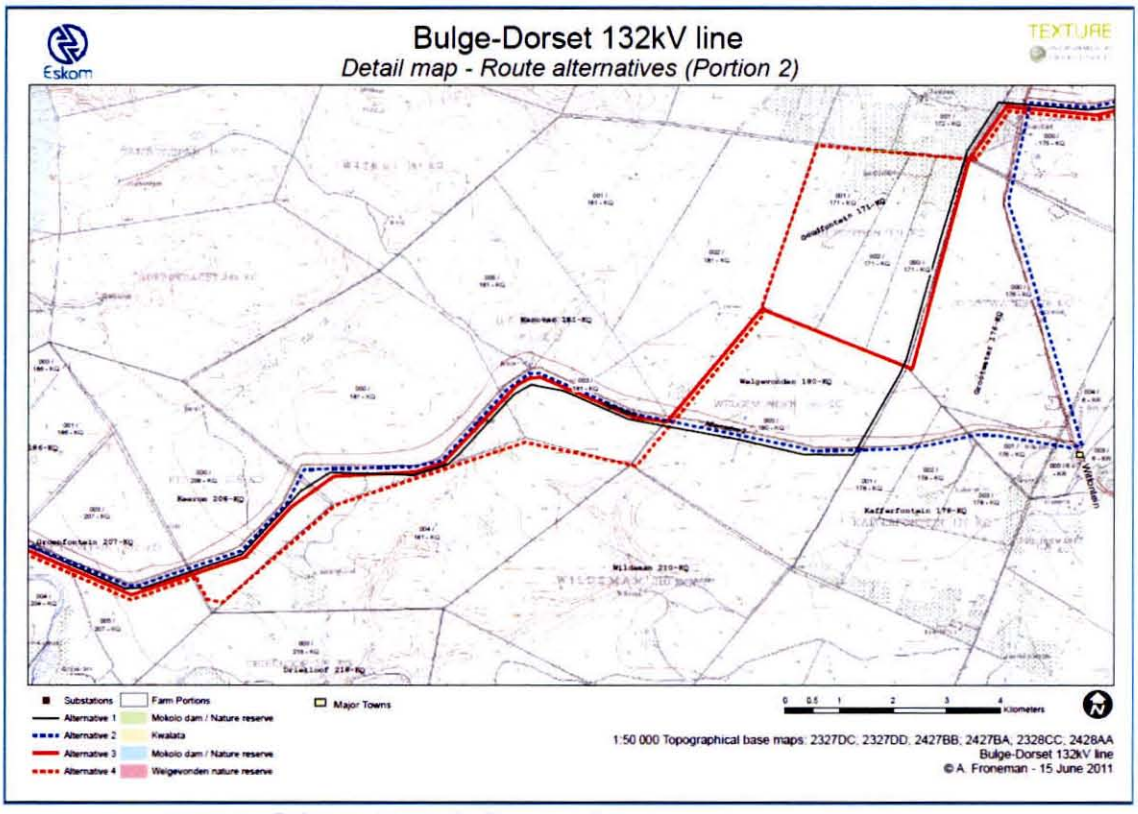

Figure 2: Portion 2 of the proposed alignments

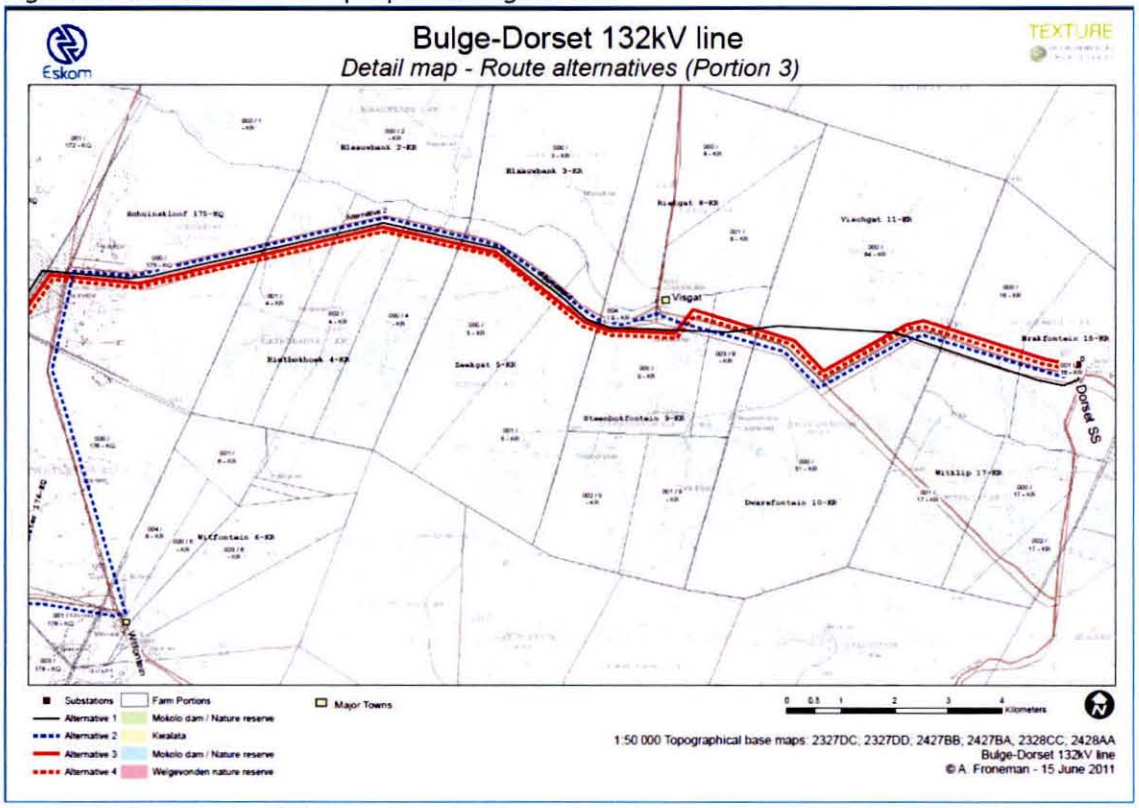

Figure 3: Portion 3 of the proposed alignments

Figure 4: Satellite map of the study area. Blue line = alternative 1. Purple line = alternative 2. Orange line = alternative 3. Green line = alternative 4.

The terms of reference for the bird impact assessment study are as follows:

- Describe the affected environment.
- Indicate how birdlife will be affected.
- Discuss gaps in baseline data.
- List and describe the expected impacts.
- Assess and evaluate the potential impacts.
- Recommend mitigation measures if need be.

1 Sources of information

The following information sources were consulted in order to conduct this study:

- Bird distribution data of the Southern African Bird Atlas Project 1 and 2 (SABAP1 and SABAP2)(http://sabap2.adu.org.za) was obtained for the quarter-degree grid cells (the equivalent of a 1:50 000 map) traversed by the proposed line, namely 2427BA, 2427BB and 2428AA. The conservation status of all species considered likely to occur in the area was determined as per the most recent iteration of the southern African Red Data list for birds (Barnes 2000), and the most recent and comprehensive summary of southern African bird biology (Hockey *et al.* 2005).
- The author has travelled and worked extensively on power line projects in the Limpopo Province since 1996. Personal observations of avifauna and bird/habitat associations have therefore also been used to supplement the data that is available from SABAP1 and 2, including sightings made during the field trip in December 2010 and June 2011.

- The power line bird mortality incident database of the Eskom - Endangered Wildlife Trust Strategic Partnership (1996 to 2007) was consulted to determine which of the species occurring in the study area are typically impacted upon by power lines and the extent to which they are impacted on.
- A classification of the vegetation types in the quarter degree square was obtained from the Southern African Bird Atlas Project 1 (SABAP1, Harrison *et al.* (1997).
- Information on the micro habitat level was obtained through visiting the area in December 2010 and June 2011 and obtaining a first-hand perspective. The site visit included a helicopter fly-over of the study area. Micro habitats were identified using a combination of ornithological and ecological experience of avifaunal/habitat associations.

1.2 Assumptions & Limitations

The following assumptions and limitations are applicable to this study:

- In this instance the 2427BA, 2427BB and 2428AA quarter degree grid cells were not particularly well covered with data being recorded on only 6, 5 and 19 SABAP2 checklists to date. In view of this, the list of Red Data species that could be encountered was supplemented with observations and general knowledge of the area by the author, by consulting species lists for adjacent quarter degree squares with similar habitat, and by consulting the Southern African Bird Atlas Project 1 (SABAP1 – Harrison *et al* 1997).
- Predictions in this study are based on experience of these and similar species in different parts of South Africa. Bird behaviour can never be entirely reduced to formulas that will hold true under all circumstances. However, power line and substation impacts can be predicted with a fair amount of certainty, based on experience gained by the author through the ongoing investigation of localities in southern Africa, since 1996, where birds have interacted with electrical infrastructure.
- It is important to note that, although the predicted impacts are mostly concerned with Red Data species, the non Red Data species will benefit as much from the proposed mitigation measures as they share the same habitat and face the same impacts as the Red Data species.

2 DESCRIPTION OF AFFECTED ENVIRONMENT

2.1 Vegetation description

It is widely accepted that vegetation structure is more critical in determining bird habitat, than the actual plant species composition (in Harrison *et al* 1997). The description of vegetation presented in this study therefore concentrates on factors relevant to the bird species present, and is not an exhaustive list of plant species present. The table below shows the vegetation composition of the two relevant quarter degree grid cells (Harrison *et al* 1997).

TABLE 1. Percentage composition of each quarter degree grid cell in terms of vegetation types along the proposed alignments (Harrison *et al* 1997).

Vegetation type	2427BA	2427BB	2428AA
Moist Woodland	100%	100%	100%