DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT

FOR THE PROPOSED UMSINDE EMOYENI WIND ENERGY FACILITY GRID CONNECTION

PHASE 2

WESTERN AND NORTHERN CAPE PROVINCES

DEA REF: 14/12/16/3/3/2/685

On behalf of

Emoyeni Wind Farm Project Proprietary Limited

JANUARY 2016

BEDRYFSOPSOMMING Agtergrond van projek

Emoyeni Wind Farm Project Proprietary Limited (EWFP) stel die ontwikkeling voor van die Umsinde Emoyeni-windkragfasiliteit (WEF) en gepaardgaande infrastruktuur, insluitende netwerkaansluitingsinfrastruktuur, naby die dorp Murraysburg in die Wes-Kaap en Noord-Kaap (die 'voorgestelde ontwikkeling'). Die Umsinde Emoyeni WEF bestaan uit twee ontwikkelingsfases, elk met tot 98 voorgestelde windturbines, waar elke turbine 'n geïnstalleerde opwekkingsvermoë van tussen 1,5 en 4,5 megawatt (MW) het. Let asseblief daarop dat dit onwaarskynlik is dat die projek turbines met 'n vermoë van minder as 2 MW sal gebruik; dit sal dus 'n projek van 70 turbines (140 MW / 2) beteken. Die totaal van 98 is 'n "ergste geval"-scenario en daar word nie verwag dat hierdie maksimum nodig sal wees nie.

Umsinde Emoyeni WEF bestaan uit vier komponente wat twee ontwikkelingsfases verteenwoordig, waarvan almal onder afsonderlike omgewingsaansoeke gehanteer word.

- Elektriesenetwerkverbinding en gepaardgaande infrastruktuur vir Umsinde Emoyeni WEF Fase 1 (14/12/16/3/3/2/684);
- Umsinde Emoyeni WEF: Fase 1; (14/12/16/3/3/2/686);
- Umsinde Emoyeni WEF: Fase 2 (14/12/16/3/3/2/687); en
- **Elektriesenetwerkverbinding en gepaardgaande infrastruktuur vir Umsinde Emoyeni WEF Fase 2 (die 'voorgestelde netwerkverbinding') (14/12/16/3/3/2/685).**

Hierdie verslag hou verband met die voorstel deur EWFP om omgewingsmagtiging (OM) van die Departement van Omgewingsake ("DvO") te verkry vir die elektriesenetwerkverbinding en gepaardgaande infrastruktuur vir Umsinde Emoyeni WEF Fase 2 (die 'voorgestelde netwerkverbinding') (DvO verw.-nr. 14/12/16/3/3/2/685). As 'n OM vir die voorgestelde netwerkverbindingsinfrastruktuur toegestaan word, kan dit ná konstruksie heeltemal of gedeeltelik van EWFP na Eskom Holdings SOC Limited (Eskom) soos toepaslik oorgedra word.

Die ligging van die voorgestelde netwerkverbinding en gepaardgaande infrastruktuurterrein (die 'netwerkterrein') word op Figuur 1.1 getoon. Dit bestaan uit die Umsinde Emoyeni WEF-terreingrens (Fase 1 & 2) en dieselfde stukke grond as die naburige Ishwati Emoyeni WEF en netwerkterreingrens (EA: 12/12/20/2351, tans onder appèl). Figuur 1.2 toon die koördinate van die netwerkterreingrens. Die serwituut van die netwerkverbinding vir Umsinde Emoyeni WEF Fase 2 sal strek van die substasie wat binne die terreingrens van die Umsinde Emoyeni WEF (Fase 2) gebou gaan word tot óf by die bestaande Gamma-substasie, óf, as die naburige Ishwati Emoyeni WEF gebou gaan word, tot by die voorgestelde Ishwati Emoyeni-substasie. As Umsinde Emoyeni WEF Fase 1 eerste gebou word, sal die voorgestelde netwerkverbinding aan die Umsinde Emoyeni WEF-netwerkverbinding Fase 1 wees. Die lengte van die voorgestelde netwerkverbinding sal dan minder as 3 km wees. Weens hierdie verskillende moontlike scenario's, moet daarop gelet word dat die spesialiste voorsien is van die netwerkterreingrens vir hulle assesserings en dat die voetspoor van die voorgestelde netwerkverbinding net 'n klein deel van die grond binne hierdie netwerkverbindingsterreingrens sal dek. Die resultate van hierdie assesserings moet dus as "ergste geval"-scenario's beskou word.

Arcus Consulting Services Ltd (Arcus) is aangestel om die omgewingsimpakassessering- (OIA) proses uit te voer, wat die omvangbepaling- sowel as die OIA-fase insluit, vir die Umsinde Emoyeni WEF, insluitende die voorgestelde netwerkverbinding. Die omvangbepalingsproses is uitgevoer deur 'n gekombineerde oefening vir al vier komponente van die Umsinde Emoyeni WEF, waar elke komponent onderhewig was aan 'n afsonderlike aansoek om omgewingsmagtiging by die DvO. Een konsep-omvangbepalingsverslag (KOV) is in Junie 2014 vir al vier komponente van die Umsinde Emoyeni WEF voorberei en het sedertdien deur openbare konsultasie gegaan. 'n Finale omvangbepalingsverslag (FOV) en studieplan vir die OIA (PSEIA) wat kommentaar in ag neem wat gedurende die konsultasieperiode ontvang is, is in Desember 2014 opgestel.

Gedurende die omvangbepalingsproses vir Umsinde Emoyeni WEF is sensitiewe gebiede en beperkings binne die WEF-terreingrens deur die spesialiste geïdentifiseer. Dit het resultate ingesluit van 12 maande lange voël- en vlermuismoniteringsprogramme. Beperkingskaarte is by EWFP ingedien en dit is in ag geneem in die ontwikkeling van die voorgestelde turbine-uitleg en netwerkverbindings. Gevolglik neem die voorgestelde ligging van die turbines en substasies en transmissielyne binne die WEF-terrein hierdie geïdentifiseerde beperkings in ag en is dit buite uiters sensitiewe gebiede.

Opsomming van bevindinge

Gedurende die OIA-proses is impakte op die biofisiese sowel as die sosio-ekonomiese omgewing geassesseer. Daar is opdrag gegee dat die volgende spesialistestudies gedoen moet word, op grond van die sensitiwiteite van die terrein en die potensiële impakte van die voorgestelde ontwikkeling:

- Visueel;
- Grondekologie (flora en fauna);
- Vlermuise
- Vleilande en vars water;
- Voëls;
- Grondtipes, grondgebruik en landboupotensiaal;
- Erfenis en paleontologie;
- Geraas; en
- Sosio-ekonomies.

Uit die assessering blyk dit dat die konstruksie en die bedryf van die WEF en netwerkverbindings maatskaplik sowel as vir die omgewing negatiewe impakte sal hê, maar wanneer gepaste versagtingsmaatreëls toegepas word, word negatiewe impakte deur positiewe impakte oorskadu. Oor die algemeen het die projek 'n positiewe ekonomiese impak op die streek en vir Suid-Afrika as geheel, aangesien krag wat deur die WEF opgewek word, Eskom se nasionale netwerk voed, werkgeleenthede skep en tot die plaaslike en streeksekonomie bydra.

Assessering van alternatiewe

Verskillende alternatiewe wat wissel van terreinligging, vervoer, ontwerp, turbinetegnologie tot die Geenontwikkelingopsie is almal vir die voorgestelde WEF oorweeg. Wanneer die aansoeker die alternatiewe oorweeg, moet hy omgewings-, maatskaplike en ekonomiese faktore en tegniese faktore in ag neem. Met die oog op die bogenoemde faktore, is EWFP van voorneme om van die beste beskikbare tegnologie gebruik te maak om hierdie faktore te bevredig.

Die voorkeurterrein is op grond van die volgende faktore gekies: omdat die terrein in 'n gebied geleë is wat 'n goeie windhulpbron het, die vier komponente van die voorgestelde ontwikkeling in dele van die terrein geleë is wat van lae-medium ekologiese sensitiwiteit is. Die Geenontwikkelingsalternatief is geïdentifiseer as 'n hoë negatiewe maatskaplike koste vir Suid-Afrika ten opsigte van die land se vermoë om met skoon, hernubare energie in sy kragbehoeftes te voorsien, en 'n medium negatiewe maatskaplike koste ten opsigte van verlore werk- en sakegeleenthede, en die voordele wat met die stigting van 'n gemeenskapstrust gepaardgaan.

Met betrekking tot die voorgestelde netwerkverbinding is die vernaamste implikasies van die Geenontwikkelingscenario dat die Umsinde Emoyeni WEF: Fase 2 nie gebou kan word nie. Hierdie resultaat sal die volgende insluit:

- Die grondgebruik bly landbou met geen verdere voordele wat geput word uit die implementering van 'n bykomende grondgebruik nie;
- Daar is geen verandering in die huidige landskap of omgewingsbasislyn nie;
- Hoewel geen WEF-ontwikkeling op die perseel sal plaasvind nie, sal ander windkragprojekte vir ander plaaslike gebiede soos beplan voortgaan;
- Geen bykomende elektrisiteit sal op die perseel opgewek word of voorsien word deur middel van hernubare energiehulpbronne nie. Dit sal gevolge hê vir die Suid-Afrikaanse regering om sy voorgestelde teiken vir hernubare energie te bereik;
- Daar is geen geleentheid vir bykomende werkgeleenthede (ofskoon tydelik) in die plaaslike gebied waar werkskepping as 'n sleutelprioriteit geïdentifiseer is nie; en
- Die plaaslike voordele vir ekonomiese ontwikkeling wat gepaardgaan met die WEF-ontwikkeling se REIPPPP-verbintenisse, sal nie gerealiseer word nie.
- Die spesialisteassessering van maatskaplike impak het gevind dat die Geenontwikkelingsopsie vir Suid-Afrika 'n verlore geleentheid om sy huidige energiebehoeftes met skoon, hernubare energie aan te vul, tot gevolg sou hê; asook 'n verlore geleentheid vir Murraysburg en die Beaufort-Wes- plaaslike munisipaliteit ten opsigte van sake- en werkgeleenthede asook die voordele wat gepaardgaan met die stigting van 'n gemeenskapstrust. Die resultaat sou 'n negatiewe maatskaplike koste van medium negatiewe betekenis wees. Derhalwe is die Geenontwikkelingsalternatief nie prakties geag in die konteks van die voorgestelde ontwikkeling nie.

Opsomming van die impakassessering

Potensiële omgewingsimpakte is geëvalueer volgens hulle omvang, duur, intensiteit en grootte. Negatiewe impakte van die voorgestelde projek op die biofisiese omgewing sluit in dat plantegroei verwyder moet word wat lei tot habitatfragmentasie, potensiële verlies van belangrike spesies, gronderosie, besoedeling van oppervlakwater, terwyl sosio-ekonomiese impakte minimale verlies van landbougrond, ontwrigting van maatskaplike verhoudinge in die voorgestelde gebied deur die invoering van kontrakwerkers uit verskillende gebiede, verspreiding van siektes, verlies van potensiële erfenishulpbronne en impak op 'n gevoel van plek insluit.

Alle impakte is geïdentifiseer en geassesseer by verskillende stadiums (ontwerp/beplanning, konstruksie, bedryf en buitegebruikstelling) en moontlike versagtingsmaatreëls is toegewys om lae betekenis (vir negatiewe impakte) te verseker of hoë betekenis (vir positiewe impakte) soos in die omgewingsbestuurprogram (Bylae B) uiteengesit. Hierdie impakte word opgesom in die tabelle hieronder vir die konstruksie- en bedryfsfase.

Impak tydens konstruksiefase	***Gevolg***	***Waarskynlikheid***	***Betekenis***	***Status***	***Vertroue***
Visueel – Geen versagting	Laag	Waarskynlik	Laag	-ief	Medium
Visueel – Met versagting	Laag	Waarskynlik	**LAAG**	-ief	Medium
Plantegroei en gelyste/beskermde plantspesies – Geen versagting	Medium	Beslis	Medium	-ief	Hoog
Plantegroei en gelyste/beskermde plantspesies – Met versagting	Medium	Beslis	**MEDIUM**	-ief	Hoog
Risiko van indringerplante – Geen versagting	Laag	Onwaarskynlik	Laag	-ief	Hoog
Risiko van indringerplante – Met versagting	Laag	Onwaarskynlik	**LAAG**	-ief	Hoog
Risiko van meer erosie – Geen versagting	Laag	Beslis	Laag	-ief	Hoog

Risiko van meer erosie – Met versagting	Baie laag	Waarskynlik	**BAIE LAAG**	-ief	Hoog

Impak tydens konstruksiefase	**Gevolg**	**Waarskynlikheid**	**Betekenis**	**Status**	**Vertroue**
Vlermuise – Nesversteuring – Substasie – Geen versagting	Medium	Waarskynlik	Medium	-ief	Hoog
Vlermuise – Nesversteuring – Substasie – Met versagting	Baie laag	Moontlik	**GERING**	-ief	Hoog
Vlermuise – Nesversteuring – Kragdraad – Geen versagting	Medium	Moontlik	Laag	-ief	Medium
Vlermuise – Nesversteuring – Kragdraad – Met versagting	Baie laag	Moontlik	**GERING**	-ief	Medium
Vlermuise – Weidingsversteuring – Substasie – Geen versagting	Medium	Beslis	Medium	-ief	Hoog
Vlermuise – Weidingsversteuring – Substasie – Met versagting	Laag	Beslis	**LAAG**	-ief	Hoog
Vlermuise – Weidingsversteuring – Kragdraad – Geen versagting	Laag	Beslis	Laag	-ief	Hoog
Vlermuise – Weidingsversteuring – Kragdraad – Met versagting	Baie laag	Beslis	**BAIE LAAG**	-ief	Hoog
Voëls – Habitatvernietiging – Geen versagting	Medium	Beslis	Medium	-ief	Hoog
Voëls – Habitatvernietiging – Met versagting	Baie laag	Beslis	**BAIE LAAG**	-ief	Hoog
Voëls – Versteuring & verskuiwing – Geen versagting	Laag	Waarskynlik	Laag	-ief	Hoog
Voëls – Versteuring & verskuiwing – Met versagting	Baie laag	Waarskynlik	**BAIE LAAG**	-ief	Hoog
Landboupotensiaal & Grondvermoë – Konstruksie van geboue en infrastruktuur – Geen versagting	Laag	Beslis	Laag	-ief	Hoog
Landboupotensiaal & Grondvermoë – Konstruksie van geboue en infrastruktuur – Met versagting	Laag	Beslis	**LAAG**	-ief	Hoog
Landboupotensiaal & Grondvermoë – Konstruksie van kragdrade – Geen versagting	Laag	Beslis	Laag	-ief	Hoog
Landboupotensiaal & Grondvermoë – Konstruksie van kragdrade – Met versagting	Laag	Beslis	**LAAG**	-ief	Hoog
Landboupotensiaal & Grondvermoë – Gebruik van voertuie en stortings – Geen versagting	Baie laag	Beslis	Laag	-ief	Hoog
Landboupotensiaal & Grondvermoë – Gebruik van voertuie en stortings – Met versagting	Baie laag	Onwaarskynlik	**GERING**	-ief	Hoog

Landboupotensiaal & Grondvermoë – Stofproduksie – Geen versagting	Laag	Beslis	Laag	-ief	Hoog
Landboupotensiaal & Grondvermoë – Stofproduksie – Met versagting	Baie laag	Onwaarskynlik	GERING	-ief	Hoog

Impak tydens konstruksiefase	***Gevolg***	***Waarskynlikheid***	***Betekenis***	***Status***	***Vertroue***
Paleontologie – Geen versagting	Hoog	Moontlik	Medium	-ief	Medium
Paleontologie – Met versagting	Medium	Moontlik	**LAAG**	-ief & +ief	Medium
Argeologie – Geen versagting	Medium	Waarskynlik	Medium	-ief	Hoog
Argeologie – Met versagting	Laag	Onwaarskynlik	**BAIE LAAG**	Neutraal	Hoog
Erfenis koloniale tydperk & kulturele landskap – Geen versagting	Hoog	Waarskynlik	Hoog	-ief	Hoog
Erfenis koloniale tydperk & kulturele landskap – Met versagting	Laag	Waarskynlik	**LAAG**	-ief	Hoog
Geraas – Geen versagting	Laag	Onwaarskynlik	Baie laag	-ief	Hoog
Geraas – Met versagting	Laag	Onwaarskynlik	**BAIE LAAG**	-ief	Hoog

Impak tydens bedryfsfase	***Gevolg***	***Waarskynlikheid***	***Betekenis***	***Status***	***Vertroue***
Visueel – Geen versagting	Hoog	Beslis	Hoog	-ief	Hoog
Visueel – Met versagting	Medium	Waarskynlik	**MEDIUM**	-ief	Medium
Risiko van indringerplante – Geen versagting	Medium	Onwaarskynlik	Laag	-ief	Hoog
Risiko van indringerplante – Met versagting	Laag	Onwaarskynlik	**LAAG**	-ief	Hoog
Risiko van meer erosie – Geen versagting	Medium	Beslis	Medium	-ief	Hoog
Risiko van meer erosie – Met versagting	Laag	Waarskynlik	**LAAG**	-ief	Hoog
Vlermuise – Botsings teen kragdrade – Geen versagting nodig	Laag	Onwaarskynlik	**BAIE LAAG**	-ief	Hoog
Vlermuise – Versteuring / Verskuiwing deur kragdrade – Geen versagting nodig	Laag	Onwaarskynlik	**BAIE LAAG**	-ief	Hoog
Voëls – Versteuring & verskuiwing – Geen versagting	Laag	Waarskynlik	Laag	-ief	Hoog

Voëls – Versteuring & verskuiwing – Met versagting	Laag	Moontlik	**BAIE LAAG**	-ief	Hoog
Voëls – Elektrokusie – Geen versagting	Hoog	Moontlik	Medium	-ief	Hoog
Voëls – Elektrokusie – Met versagting	Hoog	Onwaarskynlik	**MEDIUM**	-ief	Hoog

Impak tydens bedryfsfase	*Gevolg*	*Waarskynlikheid*	*Betekenis*	*Status*	*Vertroue*
Voëls – Botsings teen kragdrade – Geen versagting	Hoog	Waarskynlik	Hoog	-ief	Hoog
Voëls – Botsings teen kragdrade – Met versagting	Hoog	Moontlik	**MEDIUM**	-ief	Hoog
Landboupotensiaal & Grondvermoë – Gebruik van voertuie en stortings – Geen versagting	Baie laag	Beslis	Laag	-ief	Hoog
Landboupotensiaal & Grondvermoë – Gebruik van voertuie en stortings – Met versagting	Baie laag	Onwaarskynlik	**GERING**	-ief	Hoog
Landboupotensiaal & Grondvermoë – Stofproduksie – Geen versagting	Laag	Beslis	Laag	-ief	Hoog
Landboupotensiaal & Grondvermoë – Stofproduksie – Met versagting	Baie laag	Onwaarskynlik	**GERING**	-ief	Hoog
Geraas – Geen versagting nodig	Laag	Moontlik	**LAAG**	-ief	Hoog
Maatskaplik – Gevoel van plek – Geen versagting	Hoog	Waarskynlik	Hoog	-ief	Hoog
Maatskaplik – Gevoel van plek – Met versagting	Medium	Waarskynlik	**MEDIUM**	-ief	Hoog

Volgende stap in die OIA-proses

Die omgewingsimpakassesseringsverslag sintetiseer die inligting uit die spesialisteverslae en bied algemene aanbevelings aan oor die bestuur van die geïdentifiseerde impakte. Die OIAV sal by die DvO ingedien word, ná 'n tydperk vir openbare beoordeling waartydens die verslag aan alle belanghebbende en geaffekteerde partye (BGP's) op nasionale, provinsiale en plaaslike vlak voorgelê is. Afskrifte van die verslag en stawende dokumente sal aan alle BGP's beskikbaar gestel word.

'n Kommentaar-en-reaksieverslag sal opgestel word wanneer die tydperk vir openbare beoordeling afgehandel is waarin al die kommentaar wat van die publiek en die owerhede ontvang is, sowel as al hulle reaksie saangebied sal word.

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EXECUTIVE SUMMARY

Project Background

Emoyeni Wind Farm Project Proprietary Limited (EWFP) is proposing the Umsinde Emoyeni Wind Energy Facility (WEF), and associated infrastructure including grid connection infrastructure, located near the town of Murraysburg in the Western Cape and Northern Cape Province (the 'proposed development'). The Umsinde Emoyeni WEF is comprised of two development phases, each with up to 98 proposed wind turbines, with each turbine having an installed generation capacity of between 1.5 and 4.5 megawatts (MW). It should be noted that it is unlikely that the project will use turbines of less than 2 MW capacity, this would therefore mean a project of 70 turbines (140 MW / 2). The figure of 98 is a "worst case" scenario layout and it is not envisioned that this upper limit will be met.

Umsinde Emoyeni WEF is comprised of four components representing two development phases, all of which are under separate environmental applications.

- Electrical Grid Connection and Associated Infrastructure for Umsinde Emoyeni WEF Phase 1 (14/12/16/3/3/2/684);
- Umsinde Emoyeni WEF: Phase 1; (14/12/16/3/3/2/686);
- Umsinde Emoyeni WEF: Phase 2 (14/12/16/3/3/2/687); and
- **Electrical Grid Connection and Associated Infrastructure for Umsinde Emoyeni WEF Phase 2 (the 'proposed grid connection') (14/12/16/3/3/2/685).**

This report relates to the proposal by EWFP to obtain Environmental Authorisation (EA) from the Department of Environmental Affairs ("DEA") for the Electrical Grid Connection and Associated Infrastructure for Umsinde Emoyeni WEF Phase 2 (the 'proposed grid connection') (DEA Ref. No. 14/12/16/3/3/2/685). If an EA for the proposed grid connection is granted, this may be entirely or partially transferred from EWFP to Eskom Holdings SOC Limited (Eskom) as applicable after construction.

The location of the proposed grid connection and associated infrastructure site (the 'grid site') is shown on Figure 1.1. It is comprised of the Umsinde Emoyeni WEF site boundary (Phase 1 & 2) and the same land parcels as the neighbouring Ishwati Emoyeni WEF and grid site boundary (EA: 12/12/20/2351, currently under appeal). Figure 1.2 shows the grid site boundary coordinates. The servitude of the grid connection for Umsinde Emoyeni WEF Phase 2 will run from the substation to be constructed within the Umsinde Emoyeni WEF (Phase 2) site boundary to either the existing Gamma Substation, or should the neighbouring Ishwati Emoyeni WEF be constructed, to the proposed Ishwati Emoyeni substation. If Umsinde Emoyeni WEF Phase 1 is constructed first, the proposed grid connection will connect to the Umsinde Emoyeni WEF grid connection for Phase 1. The length of the proposed grid connection would then be less than 3 km. Due to these different possible scenarios it should be noted that the specialists were supplied with the grid site boundary for their assessments and that the footprint of the proposed grid connection will only occupy a small portion of the land within this grid connection site boundary. The results of these assessments must therefore be regarded as worst case scenarios.

Arcus Consultancy Services Ltd (Arcus) have been appointed to undertake the environmental impact assessment (EIA) process, incorporating both the scoping and EIA phase, for the Umsinde Emoyeni WEF, including the proposed grid connection. The scoping process was conducted through a combined exercise for all four components of the Umsinde Emoyeni WEF, with each component being subject to a separate application for Environmental Authorisation to the DEA. One Draft Scoping Report (DSR) was prepared for all four components of the Umsinde Emoyeni WEF in June 2014 and subsequently went through public consultation. A Final Scoping Report (FSR) and Plan of Study for the EIA (PSEIA) taking into account comments received during the consultation period on the DSR was prepared in December 2014.

During the scoping process for Umsinde Emoyeni WEF sensitive areas and constraints within the WEF site boundary were identified by the specialists. This included results from 12 month bird and bat monitoring programmes. Constraints maps were delivered to EWFP and these were taken into consideration in the development of the proposed turbine layout and grid connections. Therefore the proposed location of the turbines and substations, and transmission lines within the WEF site boundary take into consideration these identified constraints and are outside of highly sensitive areas.

Summary of Findings

During the EIA process, impacts on both the biophysical and socio-economic environments were assessed. The following specialist's studies were commissioned based on the sensitivities of the site and the potential impacts of the proposed development:

- Visual;
- Terrestrial Ecology (Flora and Fauna);
- Bats;
- Wetlands and Freshwater;
- Birds;
- Soils, Land Use and Agricultural Potential;
- Heritage and Palaeontology;
- Noise; and
- Socio-Economic.

From the assessment, it is evident that the construction and the operation of the WEF and grid connections will have negative impacts both socially and environmentally but when appropriate mitigation measures applied negative impacts are outweighed by positive impacts. Overall the project has positive economic impact regionally and for South Africa as a whole as power generated from the WEF will feed into the National Eskom grid, create job opportunities, and contribute to the local and regional economy.

Assessment of Alternatives

Different alternatives ranging from site location, transportation, design, turbine technologies, and the No Development option have all been considered for the proposed WEF. When considering the alternatives the applicant needs to consider environmental, social and economic factors and technical factors. Considering the above mentioned factors, EWFP intends to use the best available technology to satisfy these factors.

The preferred site was chosen based on the following: because the site is located within an area that has a good wind resource, the four components of the proposed development have been located in the sections of the site that are of low-medium areas of ecological sensitivity. The No Development alternative was identified as a high negative social cost to South Africa in terms of the country meeting its energy needs with clean, renewable energy, and a medium negative social cost in terms lost employment and business opportunities, and the benefits associated with the establishment of a Community Trust.

Relative to the proposed grid connection, the main implications of the No Development scenario is that the Umsinde Emoyeni WEF: Phase 2 cannot be constructed. This result will include the following:

- The land-use remains agricultural with no further benefits derived from the implementation of a complementary land use;
- There is no change in the current landscape or environmental baseline;
- Whilst no WEF development will occur on site, other wind energy projects go ahead as planned for other areas locally;

- No additional electricity will be generated onsite or supplied through means of renewable energy resources. This would have implications for the South African Government in achieving its proposed renewable energy target;
- There is no opportunity for additional employment (albeit temporary) in the local area where job creation is identified as a key priority; and
- The local Economic Development benefits associated with the WEF development's REIPPPP commitments will not be realised.
- The specialist social impact assessment found that the No Development option would result in a lost opportunity for South Africa to supplement it's current energy needs with clean, renewable energy; and a lost opportunity for Murraysburg and the Beaufort West Local Municipalitythe in terms of business and employment opportunities, and the benefits associated with the establishment of a Community Trust. The result would be a negative social cost of medium negative significance. Therefore, the No Development alternative was not considered feasible in the context of the proposed development.

Summary of the Impact Assessment

Potential environmental impacts were evaluated according to their extent, duration, intensity and magnitude. Negative impacts of the proposed project on the biophysical environment include clearing of vegetation that leads to habitat fragmentation, potential loss of species of concern, soil erosion, surface water pollution; while social-economic impacts being minimal loss of agricultural land, disruption of social relations within the proposed area by the introduction of contractor workers from different areas, spread of diseases, loss of potential heritage resources and impact on sense of place.

All impacts have been identified and assessed at different stages (design/planning, construction, operation and decommission) and possible mitigation measures assigned to ensure low significance (for negative impacts) or high significance (for positive impacts) as outlined in the Environmental Management Programme (Appendix B). These impacts have been summarised in the tables below for construction phase and operational phase.

Construction Phase Impact	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Visual – No Mitigation	Low	Probable	Low	–ve	Medium
Visual – With Mitigation	Low	Probable	**LOW**	–ve	Medium
Vegetation and Listed/Protected Plant Species – No Mitigation	Medium	Definite	Medium	–ve	High
Vegetation and Listed/Protected Plant Species – With Mitigation	Medium	Definite	**MEDIUM**	–ve	High
Alien Plant Invasion – No Mitigation	Low	Improbable	Low	–ve	High
Alien Plant Invasion – With Mitigation	Low	Improbable	**LOW**	–ve	High
Increased Erosion Risk – No Mitigation	Low	Definite	Low	–ve	High
Increased Erosion Risk – With Mitigation	Very Low	Probable	**VERY LOW**	–ve	High

Construction Phase Impact	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Bats – Roost Disturbance – Substation – No Mitigation	Medium	Probable	Medium	–ve	High
Bats – Roost Disturbance – Substation – With Mitigation	Very Low	Possible	**INSIGNIFICANT**	–ve	High
Bats – Roost Disturbance – Power Line – No Mitigation	Medium	Possible	Low	–ve	Medium
Bats – Roost Disturbance – Power Line – With Mitigation	Very low	Possible	**INSIGNIFICANT**	–ve	Medium
Bats – Foraging Disturbance – Substation – No Mitigation	Medium	Definite	Medium	–ve	High
Bats – Foraging Disturbance – Substation – With Mitigation	Low	Definite	**LOW**	–ve	High
Bats – Foraging Disturbance – Power Line – No Mitigation	Low	Definite	Low	–ve	High
Bats – Foraging Disturbance – Power Line – With Mitigation	Very Low	Definite	**VERY LOW**	–ve	High
Avifauna – Habitat Destruction – No Mitigation	Medium	Definite	Medium	–ve	High
Avifauna – Habitat Destruction - With Mitigation	Very Low	Definite	**VERY LOW**	–ve	High
Avifauna – Disturbance & Displacement – No Mitigation	Low	Probable	Low	–ve	High
Avifauna –– Disturbance & Displacement – With Mitigation	Very Low	Probable	**VERY LOW**	–ve	High
Agriculture Potential & Land Capability – Construction of buildings and infrastructure – No Mitigation	Low	Definite	Low	–ve	High
Agriculture Potential & Land Capability – Construction of buildings and infrastructure – With Mitigation	Low	Definite	**LOW**	–ve	High
Agriculture Potential & Land Capability – Construction of Power Lines – No Mitigation	Low	Definite	Low	–ve	High
Agriculture Potential & Land Capability – Construction of Power Lines – With Mitigation	Low	Definite	**LOW**	–ve	High
Agriculture Potential & Land Capability – Vehicle Operation and Spillages – No Mitigation	Very Low	Definite	Low	–ve	High
Agriculture Potential & Land Capability – Vehicle Operation and Spillages – With Mitigation	Very Low	Improbable	**INSIGNIFICANT**	–ve	High
Agriculture Potential & Land Capability – Dust Generation – No Mitigation	Low	Definite	Low	–ve	High
Agriculture Potential & Land Capability – Dust Generation – No Mitigation	Very Low	Improbable	**INSIGNIFICANT**	–ve	High

Construction Phase Impact	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Paleontology – No Mitigation	High	Possible	Medium	-ve	Medium
Paleontology – with Mitigation	Medium	Possible	**LOW**	-ve & +ve	Medium
Archaeology – No Mitigation	Medium	Probable	Medium	-ve	High
Archaeology – with Mitigation	Low	Improbable	**VERY LOW**	Neutral	High
Colonial Period Heritage & Cultural Landscape – No Mitigation	High	Probable	High	-ve	High
Colonial Period Heritage & Cultural Landscape – with Mitigation	Low	Probable	**LOW**	-ve	High
Noise – No Mitigation	Low	Improbable	Very Low	-ve	High
Noise – with Mitigation	Low	Improbable	**VERY LOW**	-ve	High

Operational Phase Impact	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Visual – No Mitigation	High	Definite	High	–ve	High
Visual – With Mitigation	Medium	Probable	**MEDIUM**	–ve	Medium
Alien Plant Invasion – No Mitigation	Medium	Improbable	Low	–ve	High
Alien Plant Invasion – With Mitigation	Low	Improbable	**LOW**	–ve	High
Increased Erosion Risk – No Mitigation	Medium	Definite	Medium	–ve	High
Increased Erosion Risk – With Mitigation	Low	Probable	**LOW**	–ve	High
Bats – Collisions with Power Lines - No Mitigation Required	Low	Improbable	**VERY LOW**	-ve	High
Bats – Disturbance / Displacement by Power Lines – No Mitigation Required	Low	Improbable	**VERY LOW**	-ve	High
Avifauna – Disturbance & Displacement – No Mitigation	Low	Probable	Low	-ve	High
Avifauna – Disturbance & Displacement – With Mitigation	Low	Possible	**VERY LOW**	-ve	High
Avifauna – Electrocution – No Mitigation	High	Possible	Medium	-ve	High
Avifauna – Electrocution – With Mitigation	High	Improbable	**MEDIUM**	-ve	High

Operational Phase Impact	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Avifauna – Power Line Collisions – No Mitigation	High	Probable	High	-ve	High
Avifauna – Power Line Collisions – With Mitigation	High	Possible	**MEDIUM**	-ve	High
Agriculture Potential & Land Capability – Vehicle Operation and Spillages – No Mitigation	Very Low	Definite	Low	–ve	High
Agriculture Potential & Land Capability – Vehicle Operation and Spillages – With Mitigation	Very Low	Improbable	**INSIGNIFICANT**	–ve	High
Agriculture Potential & Land Capability – Dust Generation – No Mitigation	Low	Definite	Low	–ve	High
Agriculture Potential & Land Capability – Dust Generation – No Mitigation	Very Low	Improbable	**INSIGNIFICANT**	–ve	High
Noise – No Mitigation required	Low	Possible	**LOW**	-ve	High
Social – Sense of place – No Mitigation	High	Probable	High	-ve	High
Social – Sense of place – With Mitigation	Medium	Probable	**MEDIUM**	-ve	High

Next step in the EIA process

The Environmental Impact Assessment Report synthesises the information from the specialist reports and presents general recommendations on the management of the identified impacts. The EIAR will be submitted to DEA, after a public review period where the report will be presented to all interested and affected parties (IAPs) at national, Provincial and local level. Copies of the report and supporting documents will be made available to all IAPs.

A comments and responses report will be compiled once the public review period is complete and will present all the comments received from the public and the authorities, as well as the responses from them.

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EAP STATEMENT OF INDEPENDENCE

This draft environmental impact assessment report has been commissioned by Windlab Developments South Africa (Pty) Ltd on behalf of Emoyeni Wind Farm Project Proprietary Limited (EWFP) to undertake an environmental impact assessment in terms of the 2010 EIA Regulations R.543, R.544, R.545 and R.546 under the National Environmental Management Act, 1998 (Act No. 107 of 1998, with amendments) ('the Regulations').

In compiling this report, the authors comply with the general requirements for Environmental Assessment Practitioners (EAPs) as set out below in the Regulations:

"*General requirements for EAPs or a person compiling a specialist report or undertaking a specialised process:*

17. An EAP appointed in terms of regulation 16(1) must—

(a) be independent;

(b) have expertise in conducting environmental impact assessments, including knowledge of the

Act, these Regulations and any guidelines that have relevance to the proposed activity;

(c) perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;

(d) comply with the Act, these Regulations and all other applicable legislation;

(e) take into account, to the extent possible, the matters referred to in Regulation 8 when preparing the application and any report relating to the application; and

(f) disclose to the applicant and the competent authority all material information in the possession of the EAP that reasonably has or may have the potential of influencing—

(i) any decision to be taken with respect to the application by the competent authority in terms of these Regulations; or

(ii) the objectivity of any report, plan or document to be prepared by the EAP in terms of these Regulations for submission to the competent authority."

Ashlin Bodasing

(EAP)

ABBREVIATIONS AND ACRONYMS

AGIS	Agricultural Geographic Information System
BGIS	Biodiversity Geographic Information System
BEE	Black Economic Empowerment
BID	Background Information Document
BWLM	Beaufort West Local Municipality
CITES	Convention on the Trade in International Endangered Species
CKDM	Central Karoo District Municipality
DAFF	Department of Agriculture, Forestry and Fisheries
dB	Decibel
DEA	National Department of Environmental Affairs
DEADP	Department of Environmental Affairs and Development Planning (Western Cape)
DEIAR	Draft Environmental Impact Assessment Report
DEM	Digital Elevation Model
DENC	Department of Environment and Nature Conservation (Northern Cape)
DoE	Department Of Energy
DWA	National Department of Water Affairs
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
ESA	Ecological Support Area
Eskom	Eskom Holdings SOC Limited
EWFP	Emoyeni Wind Farm Project Proprietary Limited
FEIAR	Final Environmental Impact Assessment Report
FEPA	Freshwater Ecosystem Priority Area
GIS	Geographical Information Systems
GNR	Government Notice Regulation
GWh	Gigawatt hour
HDI	Historically Disadvantages Individuals
HWC	Heritage Western Cape
HV	High Voltage
Hz	Hertz
I&AP	Interested and Affected Party
IDP	Integrated Development Plan
IPP	Independent Power Producer
IRP	Integrated Resource Plan

IUCN	International Union for the Conservation of Nature
km	Kilometre
kV	Kilovolt
kWh	Kilowatt Hours
LUPO	Land Use Planning Ordinance (Ordinance 15 of 1985)
m	Metre
mm	Millimetre
MW	Megawatt
NEMA	National Environmental Management Act (Act 107 of 1998)
NFEPA	National Freshwater Ecosystem Priority Area
NHRA	National Heritage Resources Act (Act 25 of 1999)
NSD	Noise Sensitive Development
PES	Present Ecological State
PPA	Power Purchasing Agreement
PICC	Presidential Infrastructure Coordinating Committee
PPP	Public Participation Programme
PSEIA	Plan of Study for EIA
QDS	Quarter Degree Squares
REIPPPP	Renewable Energy Independent Power Producer Procurement Programme
RSH	Rotor Swept Height
SABAAP	South African Bat Assessment Advisory Panel
SABIF	South African Biodiversity Information Facility
SAGC	South African grid code
SAHRA	South African Heritage Resources Agency
SAHRIS	South African Heritage Resources Information System
SANBI	South African National Biodiversity Institute
SANRAL	South African National Roads Agency Limited
SDF	Spatial Development Framework
SIA	Social Impact Assessment
SIPS	Strategic Integrated Projects
SPV	Special Project Vehicle
TWI	Total Wetness Index
WDSA	Windlab Developments South Africa (Pty) Ltd
WULA	Water Use License Application

1 INTRODUCTION

1.1 Background

Emoyeni Wind Farm Project Proprietary Limited (EWFP) is proposing the Umsinde Emoyeni Wind Energy Facility (WEF), and associated infrastructure including grid connection infrastructure, located near the town of Murraysburg in the Western Cape and Northern Cape Province (the 'proposed development'). The Umsinde Emoyeni WEF phase is comprised of two development phases, each with up to 98 proposed wind turbines, with each turbine having an installed generation capacity of between 1.5 and 4.5 megawatts (MW). It should be noted that it is unlikely that the project will use turbines of less than 2 MW capacity, this would therefore mean a project of 70 turbines (140 MW / 2). The figure of 98 is a "worst case" scenario layout and it is not envisioned that this upper limit will be met.

Umsinde Emoyeni WEF is therefore comprised of four components representing two development phases, all of which are under separate environmental applications.

- Electrical Grid Connection and Associated Infrastructure for Umsinde Emoyeni WEF Phase 1 (14/12/16/3/3/2/684)
- Umsinde Emoyeni WEF: Phase 1; (14/12/16/3/3/2/686)
- Umsinde Emoyeni WEF: Phase 2 (14/12/16/3/3/2/687); and
- **Electrical Grid Connection and Associated Infrastructure for Umsinde Emoyeni WEF Phase 2 (the 'proposed grid connection'). (14/12/16/3/3/2/685)**

This report relates to the proposal by EWFP to obtain Environmental Authorisation (EA) from the Department of Environmental Affairs (DEA) for the Electrical Grid Connection and Associated Infrastructure for Umsinde Emoyeni WEF Phase 2 ('the proposed grid connection) (DEA Ref. No. 14/12/16/3/3/2/685). If an EA for the proposed grid connection is granted, this will be entirely or partially transferred from EWFP to Eskom Holdings SOC Limited (Eskom) as applicable after construction.

The location of the proposed grid connection site (the 'grid connection site') is shown on Figure 1.1. It is comprised of the Umsinde Emoyeni WEF site boundary (Phase 1 & 2) and the same land parcels as the neighbouring Ishwati Emoyeni WEF and grid connection site boundary (EA: 12/12/20/2351, currently under appeal). Figure 1.2 shows the grid connection site boundary coordinates. The servitude of the grid connection for Umsinde Emoyeni WEF Phase 2 will run from the substation to be constructed within the Umsinde Emoyeni WEF (Phase 2) site boundary to either the existing Gamma Substation, or should the neighbouring Ishwati Emoyeni WEF be constructed, to the proposed Ishwati Emoyeni substation. If Umsinde Emoyeni WEF Phase 1 is constructed first the proposed grid connection will connect to the Umsinde Emoyeni WEF Phase 1 grid connection. The length of the proposed grid connection would then be less than 3 km. Due to these options it should be noted that the specialists were supplied with the grid site boundary for their assessments and that the footprint of the proposed grid connection will only occupy a small portion of the land within this grid connection site boundary. The results of these must therefore be regarded as worst case scenarios.

Arcus Consultancy Services Ltd (Arcus) have been appointed to undertake the environmental impact assessment ("EIA") process, incorporating both the scoping and EIA phase, for the Umsinde Emoyeni WEF, including the proposed grid connection. The scoping process was conducted through a combined exercise for all four components of the Umsinde Emoyeni WEF, with each component being subject to a separate application for Environmental Authorisation to the DEA. One Draft Scoping Report (DSR) was prepared for all four components of the Umsinde Emoyeni WEF in June 2014 and subsequently went

through public consultation. A Final Scoping Report (FSR) and Plan of Study for the EIA (PSEIA) taking into account comments received during the consultation period on the DSR was prepared in December 2014.

During the scoping process for Umsinde Emoyeni WEF sensitive areas and constraints within the WEF site boundary were identified by the specialists. This included results from 12 month bird and bat monitoring programmes. Constraints maps were delivered to EWFP and these were taken into consideration in the development of the proposed turbine layout and grid connections. Therefore the proposed location of the turbines and substations, and transmission lines within the WEF site boundary take into consideration these identified constraints and are outside of highly sensitive areas.

1.2 Project Proponents

1.2.1 Emoyeni Wind Farm Project Proprietary Limited (EWFP)

EWFP is a Special Purpose Vehicle (SPV) established under Windlab Developments South Africa (Pty) Ltd (WDSA), which is a wholly-owned subsidiary of Windlab Systems (Pty) Ltd (Windlab).

Windlab is an international wind energy development company which was established in 2003 through the commercialisation of wind mapping technology developed by Australia's Commonwealth Scientific and Industrial Research Organisation (CSIRO). Making use of wind mapping technology and a suite of world-leading atmospheric modelling and wind energy prospecting tools such as WindScape™ and RaptorNL™, Windlab is able to successfully identify, secure and develop commercial wind farm sites.

Windlab has a growing project portfolio of over 6,500 MW in varying stages of development and implementation with projects in the United States of America, Australia and South Africa. In 2007 and 2008, Windlab established three subsidiary companies in the United States, Canada and South Africa respectively. WDSA, the South African subsidiary of Windlab is therefore responsible for developing wind energy projects in South Africa, in accordance with the Department of Energy's (DoE) Renewable Energy Independent Power Producers Procurement Program (REIPPPP). The REIPPPP is described further in Section 3.6 of this report.

WDSA has been involved with a number of wind energy developments in South Africa both independently as well as in partnerships with other wind energy developers. Examples include two wind energy projects which were awarded preferred bidder status in Round 2 of the REIPPPP. The first is the 91 MW West Coast One project near Vredenburg in the Western Cape, and the second is the 138 MW Amakhala Emoyeni Phase 1 project near Bedford in the Eastern Cape.

Through a Special Project Vehicle ("SPV") Special Energy Project (Pty) Ltd, WDSA is also the proponent for the Ishwati Emoyeni WEF and associated grid infrastructure, the development boundary for which is adjacent to the Umsinde Emoyeni WEF proposed development site.

In accordance with the REIPPPP bid requirements, WDSA have established EWFP as a SPV to obtain the Environmental Authorisation and preferred bidder status for each of the proposed two phases of the Umsinde Emoyeni Wind Energy Facility.

1.3 The EIA Project Team

1.3.1 Details of the Environmental Assessment Practitioner (EAP)

The coordination and management of the EIA process is being conducted by Arcus with the lead EAP being Ashlin Bodasing.

Arcus is a specialist environmental consultancy providing environmental services to the renewable energy market. We have advised on over 150 renewable energy projects around the globe through both our EAP and in-house specialist services. Our company consists of specialists in the field of:

- Ecology;
- Avifauna;
- Bats;
- Cultural heritage;
- Noise;
- Hydrology and hydrogeology; and
- GIS.

Ashlin is an environmental consultant, having obtained her Bachelor of Social Science Degree from the University of Kwa-Zulu Natal; she has over 10 years' experience in the environmental consulting industry in southern Africa. She has gained extensive experience in the field of Integrated Environmental Management, environmental impact assessments and public participation. She has also been actively involved in a number of industrial and infrastructural projects, including electricity power lines and substations; road and water infrastructure upgrades and the installation of telecommunication equipment, green field coal mines, as well as renewable energy facilities, both wind and solar. Ashlin has major project experience in the development of Environmental Impact Assessments, Environmental Management Plans and the monitoring of construction activities.

Ashlin's CV is included in Appendix A.

Ashlin is being assisted with the Public Participation Process of the proposed development EIA process by EIMS.

1.3.2 EIA Team

The EAP has assembled a team of technical specialists for undertaking the scoping and EIA of the potential impacts of the proposed development. The topics included in the EIA for the proposed development are listed in column 3 of Table 1.1. These topics have been identified as relevant to the proposed development due to the experience of the EAP in undertaking EIA for this type of project, and consultation with the listed specialists who are familiar with the locality and this nature of development.

These specialists have been selected based on their experience in the field of EIA and of renewable energy projects, and the locality of the proposed development.

Table 1.1 below prescribes the roles and responsibilities of parties involved in the EIA.

Table 1.1: EIA Project Team

Name	Organisation	Role
Ashlin Bodasing	Arcus Consulting	Project Leader (EAP)
Liam Whitlow and Nobuhle Hughes	EIMS	Public Participation Coordination and Management of I&AP process.
Andrew Pearson and Mike Armitage	Arcus Consulting	Bird Impact Assessment and Monitoring
Kate McEwan	NSS Environmental	Bat Impact Assessment and Monitoring
Simon Todd	Anchor Environmental	Terrestrial Ecological Impact Assessment (Flora and Fauna)
Dr Tim Hart	ACO Associates	Heritage Impact Assessment

Name	Organisation	Role
Dr Almond	via ACO Associates	Palaeontology Assessment
Dr Brian Colloty	Scherman Colloty and Associates	Aquatic/ Wetland Assessment
Morne de Jager	Enviro-Acoustic Research	Noise Impact Assessment
Bernard Oberholzer	Bernard Oberholzer Landscape Architects	Visual Assessment
Quinton Lawson	Meirelles Lawson Burger Architects	
Dr JH van der Waals	Terrasoils	Soil and Agriculture
Tony Barbour	Tony Barbour Environmental Consulting and Research	Social Impact Assessment

1.4 Structure of this Report

This report is set out as follows:

Volume I:

- Chapter 1 – Background to the proposed development, the project proponents and the EIA project team;
- Chapter 2 – the Scoping and EIA Process and assessment methodology
- Chapter 3 – Review of policy and drivers for the proposed grid connection; need & desirability of the proposed grid connection;
- Chapter 4 – Project description, the REIPPP process, the proposed grid connection, including an overview of the site location, consideration of alternatives and the need for development;
- Chapter 5 – The baseline environment;
- Chapter 6 – Specialist assessments including visual, terrestrial ecology (flora and fauna), bats, wetlands and freshwater, avifauna, soils and agriculture, cultural heritage, archaeology and palaeontology, noise and social, transport and access;
- Chapter 7 – Public participation process;
- Chapter 8 – Summary and conclusions;
- Chapter 9 – References;
- Appendix A: EAP CV & Letter of independence;
- Appendix B: Environmental Management Programme.

Volume II: Public Participation Process with Issues and Responses Trail

Volume III: Specialist Studies

2 THE ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

This chapter describes the environmental impact assessment (EIA) process followed, including public participation. Details on the scoping phase processes including public participation, relevant legislation and the identification of key issues can be found in the Final Scoping Report (Arcus 2014). Comments and recommendations received during the scoping process have been taken into consideration in this DEIAR.

2.1 Legislation and Guidance

The EIA process is prescribed by the Environmental Impact Assessment Regulations, *viz*, the EIA Regulations 2010 (Government Notice (GN) No. R.543 in Government Gazette 33306 of 18 June 2010), which were introduced through Chapter 5 of the National Environmental Management Act (Act No. 107 of 1998) (NEMA). The Regulations also comprise three listing notices (GN No. R.544, R.545 and R.546).

On 4 December 2014, the Minister of Environmental Affairs promulgated new regulations in terms of Chapter 5 of the NEMA, *viz*, the EIA Regulations 2014 (Government Notices (GN) No. R. 982, R. 983, R. 984 and R. 985 in Government Gazette No. 38282 of 4 December 2014). These regulations came into effect on 8 December 2014.

The application for Environmental Authorisation for the proposed development was submitted to the Department of Environmental Affairs on 8 April 2014, before the new regulations were promulgated. Therefore, the EIA Regulations 2010 apply.

Other relevant legislation has informed the scope and content of this Draft Environmental Impact Assessment Report including:

- Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996);
- National Environmental Management Act, 1998 (Act No. 107 of 1998);
- Environmental Conservation Act, 1989 (Act No. 73 of 1989);
- National Heritage Resources Act, 1999 (Act No. 25 of 1999);
- National Environmental Management: Biodiversity Act, 2004 (Act No 10 of 2004);
- National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004);
- Conservation of Agricultural Resources Act, 1983(Act No. 43 of 1983);
- National Water Act, 1998 (Act No. 36 of 1998);
- Aviation Act, 1962 (Act No. 74 of 1962);
- National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008);
- National Forest Act, 1998 (Act No. 84 of 1998);
- National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003);
- National Roads Act, 1998 (Act No. 7 of 1998);
- Astronomy Geographic Advantage Act, 2007 (Act No. 21 of 2007);
- Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002);
- Performance Standards and Equator Principles, 2013 (IFC, June 2013);
- Independent Communications Authority of South Africa Act, 2000 (Act No. 13 of 2000; as amended).

2.2 Overview of the EIA Process

NEMA promotes the use of scoping and EIA in order to ensure the integrated environmental management of activities.

Section 24(1) of NEMA states:

"In order to give effect to the general objectives of integrated environmental management laid down in this Chapter, the potential impact on the environment of listed activities must

be considered, investigated, assessed and reported to the competent authority charged by this Act with granting the relevant environmental authorisation."

EIA is ultimately a decision-making process with the specific aim of selecting an option that will provide the most benefit, and cause the least impact. The EIA process should identify activities which may have a detrimental effect on the environment, and which would therefore require Environmental Authorisation prior to commencement.

The EIA process commenced with formally notifying the DEA of the proposed development by the submission of application forms on 8 April 2014. Following the notification, the EAP, along with the team of technical specialists, commenced the scoping phase, in order to inform decisions of the appropriate "scope" of the EIA process. This involved establishing the existing environmental baseline of the site proposed for development, considering the type of development and its potential impacts on the existing environment, and therefore determining what potential impacts should be assessed and how, within the EIA process. The EAP therefore compiled a Draft Scoping Report which was made available for public and stakeholder comment for a prescribed consultation period. All comments received in response to the DSR were considered and as appropriate incorporated into a Final Scoping Report (FSR) and Plan of Study for the EIA (PSEIA). Detailed information on the Scoping phase process can be found in the accepted Final Scoping Report (Arcus 2014).

The FSR and PSEIA were submitted to the DEA, as the competent authority, for approval on 16 January 2015. Interested and Affected Parties (I&APs) were able to comment on this FSR and PSEIA by submitting their comments directly to the DEA. The 'Combined Scoping Report for the Proposed Umsinde Emoyeni WEF Phase 1 and 2 and its Associated Grid Connection Phase 1 and 2, Western and Northern Cape Provinces' was accepted by the DEA on 30 April 2015, marking the end of the scoping phase of the EIA.

The DEA acceptance letter for the FSR included a list of additional requirements for the EIA report, which are presented in Table 2.1.

Table 2.1: Requests from DEA Scoping Acceptance Letter

DEA REQUEST	Applicable Section in DEIAR
All comments and recommendation made by all stakeholders and I&APs in the DSR and FSR must be taken into consideration for the EIAR	Volume II
Address and include all mitigation measures and recommendations from the specialists studies in the FEIAR and EMPr	Chapter 6 Appendix B
Submit all comments from relevant stakeholders (WC and NC provincial environment departments, DAFF, SACAA, DoT, DWS, SENTECH, SANRAL, SAHRA, EWT, BIRDLIFE, SABAAP, DMR,SKA, etc.)	Volume II
Address all issues raised by organs of state and I&APs prior to submission of the EIAr	Volume II
Proof of correspondence with the various stakeholders must be included in the EIAr, including proof of attempts to obtain comments	Volume II
A3 Regional Map of the area and the site layout, to illustrate turbine positions and associated infrastructure. The map must include: Cardinal points; Co-ordinates; Legible legends; Indicate alternatives; Latest land cover; Vegetation types; and A3 size locality map	Figure 1.1 Figure 1.2 Figure 1.3 Figure 5.1 Figure 5.4

Applied listed activities and their relevant issues be addressed and assessed	Section 2.3 Chapter 6
Relevant listing notice activities applied for are specific and can be linked to the development activity or infrastructure as described in the project description.	Section 2.3
Application form needs to be amended to specify the relevant activities	To be submitted with Final EIA Report
An amended application form with an indication of all the 2010 listed activities that are still listed;	To be submitted with Final EIA Report
An indication of the similarly listed 2014 activities; An indication if there are any new 2014 activities listed; An indication where in the report all the 2014 activities have been assessed and mitigated for;	Chapter 2 Table 2.2 Chapter 6
A letter/affidavit from the EAP indicating the above is true and correct	Appendix A
Provide an indication of the preferred and alternate locations from which the materials used for infilling will be sourced and where excavated material will be stored and disposed of. Impacts of this activity must be adequately assessed in the EIAr.	Appendix B: EMPr Commercially sourced
Engage with relevant provincial authorities (Northern Cape and Western Cape) for triggering GNR 546 • Activitiy 4: Construction of a road wider than 4 metres with a reserve less than 13,5 metres • Activity 10: The construction of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 m^3 • Activity 12: The clearance of an area of 300 m^2 or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation. • Activity 14: The clearance of an area of 5 Ha or more of vegetation where 75% or more of the vegetative cover constitutes indigenous Vegetation • Activity 19: The widening of a road by more than 4 m, or the lengthening of a road by more than 1 km • Activity 24: not triggered	Volume II
Provide an assessment of the impacts and mitigation measures for each of the listed activities	Chapter 6
Continuously involve relevant authorities, obtain their written comments and submit to DEA	Volume II
Provide technical details for the proposed facility in a table format as well as their description and/or dimensions. Minimum details:, area occupied by inverter / transformer stations / substations, capacity of on-site substation, area occupied by	Chapter 4, Table 4.1

both permanent and construction laydown areas, area occupied by buildings, length of internal roads, width of internal roads, proximity to grid connection, height if fencing, type of fencing	
Provide four corner coordinates or each bend coordinate of the proposed development site as well as the start, middle and end point of all linear activities.	Figure 1.2 Figure 1.3 Chapter 4, Table 4.1
Give clear indication of placing of turbines and all associated infrastructure mapped at an appropriate scale	Figure 1.3
Clear description of all associated infrastructure including power lines, internal roads infrastructure and all supporting onsite infrastructure such as laydown area, guard house and control room etc	Chapter 4 Section 4.2
Indicate location of the WEF in respect to the location of other energy facilities and their associated infrastructure	Figure 2.1
GNR544 Activities 11 and 18 may trigger Section 19 and Section 21 of the National Water Act No. 36 of 1998. Conduct a hydrological study whose terms of reference must include, inter alia the following: (a) Identification and sensitivity rating of all surface water courses for the impact phase of the proposed development; (b) identification, assessment of all potential impacts to the water courses and suggestion of mitigation measures; and (c) , recommendations on the preferred placement of turbines etc. and associated infrastructure	Chapters 5 and 6
Provide motivation for the applicability of Item 10 of GNR 546 and assess the impacts	Item 10 of GNR 546 does not apply, as less than 30 m^3 of dangerous goods will be stored.
Provide detailed need and desirability as to why there is a need for the development and why the specific location is desirable.	Chapter 4, Section 4.3
Submit the wind resource data as part of the EIAr. The data must be a summary of the wind resource available in the study area and motivate that the site has a good wind resource to sustain the Wind Energy Facility.	DEIAR for the Umsinde Emoyeni WEF: Phase 1
Submit proof of application for a Water Use License should one be required	n/a
Consult with the Department of Water and Sanitation during the course of the process and provide proof of consultation.	Volume II
SENTECH must be consulted to ensure that the WEF will not have any significant negative impact on the telecommunication signal in the area. Provide proof of consultation.	Volume II
Due to the proximity to SKA an EMI and RFI detailed studies must be undertaken and form part of the Draft EIAr. The EMI and RFI study must be sent to SKA for comment and their comments must be included in the EIAr and EMPr.	Appendix B: EMPr Volume II

Provide an indication of the internal access roads and the impacts associated with them must be adequately addressed in the EIAr and EMPr.	DEIAR for the Umsinde Emoyeni WEF: Phase 1
Provide an indication of the preferred powerline route alternative and provide an assessment and advantages and disadvantages of the alternative powerline route.	Chapter 4 Section 4.4
Include all received comments and response thereto in comments and response report	Volume II
Information on who will supply services required on site, e.g sewage, refuse removal, water and electricity. Obtain and include proof of agreements and confirmation of capacity.	Chapter 4
Separate each facility and assess individually and separately in the EIAr.	Yes
EIAr must be 4 separate documents with specialist studies specific to each site applied for. The specialist must provide recommendation and mitigation measures specific to each site. The EAP must provide mitigation measures; an assessment and recommendations for each site as well as the cumulative impacts on both facilities.	Chapter 6
The issues related specifically to each of the applications submitted, and the process followed according to the EIA regulations, 2010 must be indicated in the respective reports	Chapter 2 Chapter 6
The assessment of impacts and the Environmental Impact Assessment process; and the requirements of the Public Participation Process (PPP) must be in accordance with Regulation 54 to 57 of the GN R543 of EIA regulations 2010.	Section 2.6 Volume II
Include a copy of the final site layout map with all available biodiversity information. Existing infrastructure must be used as far as possible e.g. roads. Final layout map must include: 1. turbine positions and its associated infrastructure, 2. permanent laydown footprint, 3. internal roads indicating width (construction period width and operation width) and with numbered sections between the other site elements which they serve (to make commenting on sections possible) 4. wetlands, drainage lines, rivers, streams and water crossing of road and cables indicating the type of bridging structures that will be used 5. Location of sensitive environmental features eg CBAs, heritage sites, wetlands, drainage lines etc that will be affected by the facility and its associated infrastructure 6. Substation(s) and/or transformer(s) sites including their entire footprint	Figure 6.7 Figure 6.8

7. Connection routes (including pylon positions) to the distruibution/transmission network 8. All existing infrastructure on site, especially roads 9. Buffer areas 10. Buildings, including accommodation 11. All no-go areas	
Provide an environmental sensitivity map indicating environmental sensitive areas and features identified during the EIA process	Figure 6.6
Provide a map combining the final layout map superimposed (overlain) on the environmental sensitivity map	Figure 6.8
Submit a shapefile of the preferred development layout/footprint	Yes

Following the scoping phase, the EIA process moved into the impact assessment and reporting phase, in which the EAP undertakes the EIA and compiles this Draft EIA Report (DEIAR) which will then, like the Draft Scoping Report, be made available for public and stakeholder comment for a period of 40 days. This report constitutes the DEIAR for the Umsinde Emoyeni WEF Phase 2 Electrical Grid Connection and Associated Infrastructure. Any comments will be considered and incorporated as applicable into a Final EIA Report (FEIAR). Interested & Affected Parties (I&APs) will then notified of the availability of the FEIAR and advised that should they like to comment on the report, they must submit their comments directly to the DEA (contact details of the DEA will be included in the notification documents).

Once a FEIAR has been submitted, the competent authority (the DEA) will make a decision on whether to grant or refuse Environmental Authorisation.

2.3 Listed Activities in the EIA Regulations

All listed activities which potentially form part of the proposed grid connection, and which require Environmental Authorisation, are included in the application for Environmental Authorisation prepared and submitted to the DEA. The activities are indicated in Table 2.2.

Any Environmental Authorisation which is obtained from the DEA can cover only those specific listed activities for which applications were made. To ensure that all listed activities that could potentially be required are covered by the Environmental Authorisations, a precautionary approach was followed when identifying listed activities in the application for Environmental Authorisation form, i.e., if an activity could potentially form part of the proposed grid connection, it is listed. Any changes to this list will be notified in writing to the DEA, and I&APs will also be informed accordingly.

Table 2.2: Listed Activities that form part of the Umsinde Emoyeni Phase 2 Grid Connection Application

NEMA EIA Regulations: Amended 18 June 2010			**NEMA EIA Regulations: Amended 04 December 2014**		
Activity No.(s)	**Listed Activity**	**Triggered**	**Activity No.(s)**	**Listed Activity**	**Triggered**
GN R.544 10 (i)	The construction of facilities or infrastructure for the transmission and distribution of electricity – (i) Outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kV.	**YES** The grid connection will require the installation of 132 kV overhead lines. The proposed development is outside urban areas.	GN R.983 11 (i)	The construction of facilities or infrastructure for the transmission and distribution of electricity – (i) Outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kV.	**YES** The grid connection will require the installation of 132 kV overhead lines. The proposed development is outside urban areas.
GN R.544 11 (iii), (x) and (xi)	The construction of: (iii) bridges; (x) buildings exceeding 50 m² in size; or (xi) infrastructure or structures covering 50 m² or more Where such construction occurs within a watercourse or within 32 m of a watercourse, measured from the edge of a watercourse, excluding where such construction will occur behind the development setback line.	**NO**	GN R.983 12 (iii) (x) and (xi)	The construction of- (iii) bridges exceeding 100 square meters in size; (x) buildings exceeding 100 square meters in size; (xii) infrastructure or structures with a physical footprint of 100 square meters or more; Where such development occurs – (a) within a watercourse; (b) in front of a development setback; or (c) if no developments setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse.	**NO**
GN R.544 13	The construction of facilities or infrastructure for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 but not exceeding 500 m³.	**NO** Storage of fuel during construction will be required, and transformer oils during operation of the substation, will be required but the volume stored will be less than 80 m³.	GN R.983 14	The construction of facilities or infrastructure for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 cubic metres but not exceeding 500 cubic metres.	**NO** Storage of fuel and transformer oils on site will be required but the volume stored will be less than 80 m³.

NEMA EIA Regulations: Amended 18 June 2010			NEMA EIA Regulations: Amended 04 December 2014		
Activity No.(s)	**Listed Activity**	**Triggered**	**Activity No.(s)**	**Listed Activity**	**Triggered**
GN R.544 18 (i)	The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock from (i) a watercourse	**NO** Commercial aggregate material will be used and will not be sourced on site. No bridges will be constructed for the grid connection.	GN R.983 19 (i)	The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock from (i) a watercourse	**NO** Commercial aggregate material will be used and will not be sourced on site. No bridges will be constructed for the grid connection.
GN R.544 23 (ii)	The transformation of undeveloped, vacant or derelict land to – (ii) residential, retail, commercial, recreational, industrial or institutional use, outside an urban area and where the total area to be transformed is bigger than 1 hectare but less than 20 hectares.	**NO** The grid connection infrastructure is located on currently undeveloped land. The substation compound covers 5 hectares that will be transformed. The servitude to Gamma would cover 457 hectares.	GN R.983 27	The clearance of an area of 1 hectares or more but less than 20 hectares of indigenous vegetation, except where such clearance is required for (i) the undertaking of a linear activity; or (ii) maintenance purposes undertaken in accordance with a maintenance management plan.	**YES** The substation compound covers 5 hectares that will be transformed. The servitude is a linear activity.
GN R.544 24	The transformation of land bigger than 1000 m² in size, to residential, retail, commercial, industrial or institutional use, where, at the time of the coming into effect of this Schedule such land was zoned open space, conservation or had an equivalent zoning.	**NO** The proposed development site does not include any areas zoned as open space, conservation or equivalent.	GN R.983 28 (ii)	Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture or afforestation on or after 01 April 1998 and where such development (ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare.	**YES** The proposed development site includes areas used for agriculture. The total land to be developed is bigger than 1 hectare.
GN R.544 26	Any process or activity identified in terms of section 53(1) of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004).	**Possibly** At present this section of the NEMBA is not yet defined so it does not apply at this time.	GN R.983 30	Any process or activity identified in terms of section 53(1) of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004).	**Possibly** At present this section of the NEMBA is not yet defined so it does not apply at this time.

NEMA EIA Regulations: Amended 18 June 2010			NEMA EIA Regulations: Amended 04 December 2014		
Activity No.(s)	**Listed Activity**	**Triggered**	**Activity No.(s)**	**Listed Activity**	**Triggered**
GN R.544 27 (ii)	The decommissioning of existing facilities or infrastructure, for – (ii) electricity transmission and distribution with a threshold of more than 132kV	**NO** No existing facilities or infrastructure will be decommissioned	GN R.983 (i), (ii) (iii), (iv) and (v)	The decommissioning of existing facilities or infrastructure for (i) any development and related operation activity or activities listed in this Notice, Listing Notice 2 of 2014 or Listing Notice 3 of 2014; (ii) any expansion and related operation activity or activities listed in this Notice, Listing Notice 2 of 2014 or Listing Notice 3 of 2014; (iii) any development and related operation activity or activities and expansion and related operation activity or activities listed in this Notice or Listing Notice 3 of 2014; or (v) any activity regardless the time the activity was commenced with, where such activity: (a) is similarly listed to an activity in (i), (ii), (iii), or (iv) above; and (b) is still in operation or development is still in progress	**NO** No existing facilities or infrastructure will be decommissioned
GN R.544 38	The expansion of facilities for the transmission and distribution of electricity where the expanded capacity will exceed 275 kilovolts and the development footprint will increase.	**NO** Expansion works at the existing Gamma or Ishwati substation (should it be constructed) will be required, however these will not increase the development footprint of the facility. The Gamma Substation is already a 400 kV substation, and the grid connection is 132kV.	GN R.983 47	The expansion of facilities for the transmission and distribution of electricity where the expanded capacity will exceed 275 kilovolts and the development footprint will increase.	**NO** Expansion works at the existing Gamma or Ishwati substation (should it be constructed) will be required, however these will not increase the development footprint of the facility. The Gamma Substation is already a 400 kV substation, and the grid connection is 132kV.

NEMA EIA Regulations: Amended 18 June 2010			NEMA EIA Regulations: Amended 04 December 2014		
Activity No.(s)	**Listed Activity**	**Triggered**	**Activity No.(s)**	**Listed Activity**	**Triggered**
GN R.544 39 (iii)	The expansion of: (iii) bridges within a watercourse or within 32 m of a watercourse, measured from the edge of a watercourse, where such expansion will result in an increased development footprint.	**NO** The construction of the grid connection will not require the expansion of any bridges.	GN R.983 48 (iii)	The expansion of (iii) bridges where the bridge is expanded by 100 square meters or more in size; where such development occurs – (a) within a watercourse; (b) in front of a development setback; or (c) if no developments setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse.	**NO** The construction of the grid connection will not require the expansion of any bridges.
GN R.544 47 (i) (ii)	The widening of a road by more than 6 m, or the lengthening of a road by more than 1 km – (i) where the existing reserve is wider than 13,5 m; or (ii) where no reserve exists, where the existing road is wider than 8 m	**NO** The construction of the grid connection will not require this.	GN R.983 56 (i) and (ii)	The widening of a road by more than 6 m, or the lengthening of a road by more than 1 kilometre – (i) where the existing reserve is wider than 13.,5 metres; or (ii) where no reserve exists, where the existing road is wider than 8 metres	**NO** The construction of the grid connection will not require this.
GN R.545 8	The construction of facilities or infrastructure for the transmission and distribution of electricity with a capacity of 275 kV or more, outside an urban area or industrial complex.	**YES** A 400 kV line will be required at least as a new turn-in from the Gamma substation to an existing Eskom 400 kV line.	GN R.984 9	The development of facilities or infrastructure for transmission and distribution of electricity with a capacity of 275 kilovolts or more, outside an urban area or industrial complex.	**YES** A 400 kV line will be required at least as a new turn-in from the Gamma substation to an existing Eskom 400 kV line.
GN R.545 15	Physical alteration of undeveloped, vacant or derelict land for residential, retail, commercial, recreational, industrial or institutional use where the total area to be transformed is 20 ha or more.	**YES** The footprint of the substation compound will be 5 hectares, but the servitude to be cleared can be 457 hectares.	GN R.984 15	The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for (i) the undertaking of a linear activity; or (ii)maintenance purposes undertaken in accordance with a maintenance plan.	**NO** The footprint of the substation compound will be 5 hectares, but the servitude to be cleared is a linear activity.

NEMA EIA Regulations: Amended 18 June 2010			NEMA EIA Regulations: Amended 04 December 2014		
Activity No.(s)	**Listed Activity**	**Triggered**	**Activity No.(s)**	**Listed Activity**	**Triggered**
GN R.546 4	The construction of a road wider than 4 m with a reserve less than 13.5 m (a) In Northern Cape (ii) Outside urban areas, in (bb) National Protected Area Expansion Strategy Focus, (cc) Sensitive areas as identified in an environmental management framework as contemplated in Chapter 5 of the Act and as adopted by the competent authority (ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans (d) In Western Cape: ii. All areas outside urban areas;	**NO** No roads wider than 4 m will be constructed.	GN R.985 4.	The development of a road wider than 4 metres with a reserve less than 13.5 metres (a) In Northern Cape (ii) Outside urban areas, in (bb) National Protected Area Expansion Strategy Focus, (cc) Sensitive areas as identified in an environmental management framework as contemplated in Chapter 5 of the Act and as adopted by the competent authority (ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans (f) in Western Cape: (i) areas outside urban areas; (aa) areas containing indigenous vegetation	**NO** No roads wider than 4 m will be constructed.
GN R.546 10	The construction of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 m^3 **(a) In Northern Cape Province:** ii. Outside urban areas, in: (ii) Areas on the watercourse side of the development setback line or within 100m from the edge of a watercourse where no such setback line has been determined.	**NO** Storage of fuel and transformer oil on the site will be required however the volume of this storage will not exceed 30 m^3.	GN R.985 10	The development of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 cubic metres (a) In Northern Cape (ii) Outside urban areas, in (bb) National Protected Area Expansion Strategy Focus, (cc) Sensitive areas as identified in an environmental management framework as contemplated in Chapter 5 of the Act and as adopted by the competent authority (ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the	**NO** Storage of fuel and transformer oil on the site will be required however the volume of this storage will not exceed 30 m^3.

NEMA EIA Regulations: Amended 18 June 2010			NEMA EIA Regulations: Amended 04 December 2014		
Activity No.(s)	**Listed Activity**	**Triggered**	**Activity No.(s)**	**Listed Activity**	**Triggered**
	(e) In Western Cape: ii. All areas outside urban areas;			competent authority or in bioregional plans g) In Western Cape: (i) All areas outside urban areas;	
GN R.546 12 (b)	The clearance of an area of 300 m² or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation. (b) Within critical biodiversity areas identified in bioregional plans	**YES** The 73 m wide servitude could run a short distance (~3 km) through a critical biodiversity area as identified in the flora and fauna specialist study.	GN R.985 12 (a) (ii) (b) (ii)	The clearance of an area of 300 square metres or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan. (a) In Eastern Cape, Free State, Gauteng, Limpopo, North West and Western Cape provinces*:* (ii) Within critical biodiversity areas identified in bioregional plans (b) In Northern Cape (ii) within critical biodiversity areas identified in bioregional plans	**YES** The 73 m wide servitude will run a short distance (~3 km) through a critical biodiversity area.
GN R.546 13 (2) (a)	The clearance of an area of 1 ha or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation in (a) critical biodiversity areas and ecological support areas as identified in systematic biodiversity plans adopted by the competent authority (b) National Protected Area Expansion Strategy Focus Areas	**YES** The site covers a small portion that falls within the Karoo Escarpment Grassland (NPAESFA) of the Western Cape Province. The servitude will run through critical biodiversity areas and ecological support areas. The preferred alternative will not trigger this activity.	GN R.985 15 (c) (i)	The transformation of land bigger than 1000 square metres in size, to residential, retail, commercial, industrial or institutional use, where, such land was zoned open space, conservation or had an equivalent zoning, on or after 02 August 2010 (c) in Western Cape: (i) Outside urban areas	**NO** The site is not zoned open space, conservation or equivalent.
GN R.546 14	The clearance of an area of 5 ha or more of vegetation where 75% or	**YES**	n/a		

NEMA EIA Regulations: Amended 18 June 2010			NEMA EIA Regulations: Amended 04 December 2014		
Activity No.(s)	**Listed Activity**	**Triggered**	**Activity No.(s)**	**Listed Activity**	**Triggered**
	more of the vegetative cover constitutes indigenous vegetation: (a) In the Northern Cape and Western Cape: i. All areas outside urban areas.	The site falls outside of urban areas.			
GN R.546 16 (iii) (a) and (iv)	The construction of: (iii) buildings with a footprint exceeding 10 m² in size; or (iv) infrastructure covering 10 m² or more where such construction occurs within a watercourse or within 32 m of a watercourse, measured from the edge of a watercourse. (a) In Northern Cape: (ii) outside urban areas, in: (bb) National Prortected Area Expansion Focus areas; (dd) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority. (d) In the Western Cape: (ii). Outside urban areas, in: (bb) National Protected Area Expansion Strategy Focus Areas (NPAESFA); (dd) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act	**NO** A 32 m construction buffer has been applied by the around watercourses.	GN R.985 14 (iii) (x) and (xi) (a) and (c) (f) (i) (bb) and (ff)	The development of (x) buildings exceeding 10 square metres in size and (xii) infrastructure or structures with a physical footprint of 10 square metres or more where such development occurs – (a) within a watercourse and (c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse (a) In Northern Cape: (ii) Outside urban areas, in: (bb) National Protected Area Expansion Strategy Focus; (dd) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority; (ff) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; (f) In Western Cape: (i) outside urban areas, in: (bb) National Protected Area Expansion	**NO** A 32 m construction buffer has been applied by the around watercourses.

NEMA EIA Regulations: Amended 18 June 2010			NEMA EIA Regulations: Amended 04 December 2014		
Activity No.(s)	**Listed Activity**	**Triggered**	**Activity No.(s)**	**Listed Activity**	**Triggered**
	and as adopted by the competent authority; (ff) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans			Strategy Focus (ff) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans	
GN. R.546 19	The widening of a road by more than 4 m, or the lengthening of a road by more than 1 km (a) In the Northern Cape: (ii) Outside urban areas, in: (ii) Areas on the watercourse side of the development setback line or within 100m from the edge of a watercourse where no such setback line has been determined; (d) In the Western Cape: (ii) All areas outside urban areas.	**NO** No roads will need to be widened by more than 4 meters.	GN R.985 18 (a)	The widening of a road by more than 4 metres; or the lengthening of a road by more than 1 kilometre (a) In [...] Northern Cape provinces: (ii) outside urban areas, in: (bb) National Protected Area Expansion Strategy Focus areas, (ee) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; (f) In Western Cape: (i) All areas outside urban areas: (aa) Areas containing indigenous vegetation.	**NO** No roads will need to be widened by more than 4 meters.

2.4 The Impact Assessment and Reporting Phase

The primary objective of the environmental impact assessment and reporting phase (EIA phase) is to present sufficient information to the competent authority (CA) and interested and affected parties (I&APs) on predicted impacts and associated mitigation measures required to avoid or mitigate negative impacts, as well as to improve or maximise the benefits of the project.

This must include addressing issues raised in the scoping phase, an assessment of alternatives to the proposed development in a comparative manner, an assessment of identified impacts and a determination of their significance, as well as a formulation of mitigation measures.

In terms of legal requirements, Regulations 31, 32 and 33 of the NEMA EIA Regulations of 18 June 2010 which came into effect on 2 August 2010 relate to the EIA phase. These sections regulate and prescribe the content of the EIA Report and specify the type of supporting information that must accompany the submission of the report to the authorities. Table 2.3 shows how and where the legal requirements are addressed in this DEIAR. In addition, Regulations 54 to 57 relate to the Public Participation Process (PPP) and, specifically, the registration and recording of submissions from I&APs. Volume II of this DEIA Report contain the PPP undertaken during this EIA phase. As the comments are received on this DEIAR these will be collated and included in a final issues and response report.

The DEIAR presents a summary of the findings and recommendations of all specialist reports as set out in the FSR and PSEIA in Chapters 5, 6 and 7.

Table 2.3: Legal Requirements for Environmental Impact Assessment Reports

Section	Requirement for EIA Report	Where this is provided
31 (2)(a)(i)	Details of the EAP who prepared the report	Chapter 1: Section 1.3.1
31 (2)(a)(ii)	Details of the expertise of the EAP to carry out an environmental impact assessment	Chapter 1: Section 1.3.1
31 (2)(b)	Description of the proposed activity	Chapter 2: Section 2.3 Chapter 4: Section 4.4
31 (2)(c)	Description of the property on which the activity is to be undertaken and the location of the activity on the property, or if it is:	Chapter 5: Section 5.1 Chapter 5: Section 5.2
31 (2)(c)(i)	A linear activity, a description of the route of the activity	Chapter 4: Section 4.4
31 (2)(d)	A description of the environment that may be affected by the activity and the manner in which the physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed activity	Chapter 5: All sections Chapter 6: All sections
31 (2)(e)	Details of the public participation process conducted in terms of sub-regulation (1), including:	Chapter 7 Volume II
31 (2)(e)(i)	Steps undertaken in accordance with the plan of study	Chapter 6 and 7 Volume II
31 (2)(e)(ii)	A list of persons, organisations and organs of state that were registered as interested and affected parties	To be included in Final EIA Report

Section	Requirement for EIA Report	Where this is provided
31 (2)(e)(iii)	A summary of comments received from, and a summary of issues raised by registered interested and affected parties, the date of receipt of these comments and the response of the EAP to those comments	Volume II
31 (2)(e)(iv)	Copies of any representations and comments received from registered interested and affected parties	Volume II
31 (2)(f)	A description of the need and desirability of the proposed activity	Chapter 4: Section 4.5
31 (2)(g)	A description of the identified potential alternatives to the proposed activity, including advantages and disadvantages that the proposed activity or alternatives may have on the environment and the community that may be affected by the activity	Chapter 4: Section 4.6
31 (2)(h)	An indication of the methodology used in determining the significance of potential environmental impacts	Chapter 2: Section 2.6
31 (2)(i)	A description and comparative assessment of all alternatives identified during the environmental impact assessment process	Chapter 2: Section 2.6
31 (2)(j)	A summary of the findings and recommendations of any specialist report or report on a specialised process	Chapter 5 Chapter 6
31 (2)(k)	A description of the environmental issues that were identified during the environmental impact assessment process, an assessment of the significance of each issue and an indication of the extent to which the issue could be addressed by the adoption of mitigation measures	Chapter 6
31 (2)(l)	An assessment of each identified potentially significant impact, including	Chapter 6 Volume II
31 (2)(l)(i)	Cumulative impacts	Chapter 6 Volume II
31 (2)(l)(ii)	The nature and extent of the impact	Chapter 6 Volume II
31 (2)(l)(iii)	The extent and duration of the impact	Chapter 6 Volume II
31 (2)(l)(iv)	The probability of the impact occurring	Chapter 6 Volume II
31 (2)(l)(v)	The degree to which the impact can be reversed	Chapter 6 Volume II
31 (2)(l)(vi)	The degree to which the impact may cause irreplaceable loss of resources; and	Chapter 6 Volume II
31 (2)(l)(vii)	The degree to which the impact can be mitigated	Chapter 6 Volume II
31 (2)(m)	A description of any assumptions, uncertainties and gaps in knowledge	Chapter 6 Volume II

Section	Requirement for EIA Report	Where this is provided
31 (2)(n)	A reasoned opinion as to whether the activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation;	Chapter 8
31 (2)(o)	An environmental impact statement which contains (i) a summary of key findings of the environmental impact assessment; and (ii) a comparative assessment of the positive and negative implications of the proposed activity and identified alternatives	Chapter 8
31 (2)(p)	A draft environmental management programme containing the aspects contemplated in regulation 33	Appendix B
31 (2)(q)	Copies of any specialist reports and reports on specialised processes complying with regulation 32	Volume III
31 (2)(r)	Any specific information that may be required by the competent authority	Table 2.1
31 (2)(s)	Any other matters required in terms of sections 24(4)(a) and (b) of the Act	Volume I & II & III
31 (3)	Detailed, written proof of an investigation as required by section 24(4)(b)(i) of the Act and motivation if no reasonable or feasible alternatives, as contemplated in subregulation 31(2)(g), exist	Chapter 4 Section 4.4
Requirements for specialist reports and reports on specialised processes		
32 (3)(a)	Details of the person who prepared the specialist report and their expertise	Volume III
32 (3)(b)	A declaration that the specialist is independent	Volume III
32 (3)(c)	An indication of the scope of and the purpose for which the specialist report was prepared	Volume III
32 (3)(d)	A description of the methodology adopted in preparing the specialist report or carryiong out the specialised proccess	Volume III
32 (3)(e)	A description of any assumptions made and any uncertainties or gaps in knowledge	Volume III
32 (3)(f)	A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment	Volume III Chapter 6
32 (3)(g)	Recommendations in respect of any mitigation measures that should be considered by the applicant and the competent authority	Volume III Chapter 6
32 (3)(h)	A description of any consultation process that was undertaken during the course of carrying out the study	Volume II
32 (3)(i)	A summary and copies of any comments that were received during any consultation process	Volume II
32 (3)(j)	Any other information requested by the competent authority	Table 2.1

2.5 Assessment Techniques for the EIA

Each of the specialist assessments follows a systematic approach to the assessment of impacts, with the principal steps being:

- Description of existing environment/baseline conditions;
- Prediction of likely potential impacts, including cumulative impacts (both positive and negative);
- Assessment of likely potential impacts (positive and negative);
- Identification of appropriate mitigation measures; and
- Assessment of residual (potential) environmental impacts.

2.5.1 Baseline Description

In order to evaluate the potential environmental impacts, information relating to the existing environmental conditions were collected through field and desktop research; this is known as the baseline. Climate change is expected to affect the proposed development site over the lifetime of the proposed development; however, the nature, scale and severity of climate change effects are uncertain. Given this uncertainty, the existing environment is assumed to remain constant throughout the lifetime of the proposed development, and forms the current and future baseline for the impact assessments.

The baseline was used to determine the sensitivity of receptors on and near the proposed grid connection site and what changes may take place during the construction, operation and decommissioning of the proposed grid connection and the impacts, if any, that these changes may have on these receptors.

Within each specialist assessment, the methods of data collection have been discussed with the relevant I&APs. Data was collected from public records and other archive sources and where appropriate field surveys were also carried out.

2.5.2 Identification of Potential Impacts

The identification of potential impacts covers the three phases of the proposed grid connection: construction, operation and decommissioning. During each phase, the potential environmental impacts may be different.

The project team have experience from environmental studies for other projects in the locality of the proposed development as well as other WEFs. The team are therefore able to identify potential impacts addressed in the EIA based on their experience and knowledge of the type of development proposed and the local area. Their inputs informed the scope for the EIA.

Each specialist assessment considered:

- The extent of the impact (local, regional or (inter) national;
- The intensity of the impact (low, medium or high);
- The duration of the impact and its reversibility;
- The probability of the impact occurring (improbable, possible, probable or definite);
- The confidence in the assessment; and
- Cumulative impacts.

Following identification of potential environmental impacts, the baseline information was be used to predict changes to existing conditions, and permit an assessment of the impacts associated with these changes.

2.5.3 Assessment of Potential Effects

The potential impact that the proposed grid connection may have on each environmental receptor could be influenced by a combination of the sensitivity and importance of the receptor and the predicted degree of alteration from the baseline state (either beneficial or adverse).

Environmental sensitivity (and importance) may be categorised by a multitude of factors, such as the rarity of the species; transformation of natural landscapes or changes to soil quality and land use.

The overall significance of a potential environmental impact is determined by the interaction of the above two factors (i.e., sensitivity/importance and predicted degree of alteration from the baseline).

2.5.4 Cumulative Assessment

By definition, cumulative impacts are those that result from incremental changes caused by past, present or reasonably foreseeable future actions together with the proposed development. Cumulative impacts are the combined impacts of several developments that are different to the impacts from the developments on an individual basis. For example the landscape impact of one WEF may be insignificant, but when combined with another it may become significant.

New proposals for wind energy development have been stimulated by the policy support shown by the South African Government in response to the current energy crisis the country finds itself in. The impacts of all existing WEFs, approved developments and applications received, within a 100 km radius, was considered in the EIA (Figure 2.1). The impacts of the proposed grid connection in combination with other approved developments, or developments for which applications have been received, are specifically assessed in the cumulative impacts section of this Draft EIAR. The appropriate extent of cumulative work relevant to each specialist assessment was agreed during the consultation process.

As the proposed grid connection is one of four components of the proposed Umsinde Emoyeni WEF as detailed in Section 1.1 there is potential for cumulative impacts between the four components. As such, the impact of the proposed grid connection is assessed both individually, and cumulatively. In addition, all four components are assessed cumulatively with the neighbouring Ishwati Emoyeni WEF and its associated grid connection, plus other developments in the area for which applications have been lodged to commence the EIA process, and for which, in the opinion of the specialists, there is a potential for cumulative impacts to arise. It is important to note that not all EIAs will result in an EA and those projects that are granted an Authorisation will not necessarily reach Preferred Bidder status and commence development. To summarise the following cumulative scenarios are assessed:

- Umsinde Emoyeni WEF: Phase 2 and Electrical Grid Connection and Associated Infrastructure for Umsinde Emoyeni WEF Phase 2;
- Cumulative impacts of Umsinde Emoyeni WEF and Grid Phase 1, and Umsinde Emoyeni WEF and Grid Phase 2;
- Cumulative impacts of Umsinde Emoyeni WEF and Grid Phase 1, Umsinde Emoyeni WEF and Grid Phase 2, and Ishwati Emoyeni WEF and Grid; and
- Cumulative impacts of Umsinde Emoyeni WEF and Grid Phase 1, Umsinde Emoyeni WEF and Grid Phase 2, Ishwati Emoyeni WEF and Grid and where relevant other applications which may, dependent on the specialist's studies, result in cumulative effects. This is noted throughout Chapter 7 of this DEIAR.

2.5.5 Mitigation

The EIA proposes measures to avoid, reduce or remedy significant adverse impacts which were identified; these are termed mitigation measures. Where the assessment process identified any significant adverse impacts, mitigation measures were proposed to reduce those impacts where practicable. Such measures include the physical design evolutions such as movement of turbines and management and operational measures. Design alterations such as the route of the servitude to avoid certain sensitive receptors are

mitigation embedded into the design of the proposed development, i.e., embedded mitigation.

This strategy of avoidance, reduction and remediation is a hierarchical one which seeks:

- First to avoid potential impacts;
- Then to reduce those which remain; and
- Lastly, where no other measures are possible, to propose compensatory measures.

Each specialist consultant identified appropriate mitigation measures (where relevant).

2.5.6 Residual Impacts

The assessment process concludes with an examination of residual impacts after mitigation has been applied, i.e., the overall predicted (potential) impacts of the proposed grid connection, using the same assessment method as without mitigation.

2.6 Consultation and Participation

2.6.1 EIA phase process

The public participation process (PPP) takes place throughout the EIA process (which includes the Scoping phase and the EIA phase). The main purpose of the PPP is:

- To identify I&APs that will be affected by the proposed development;
- To identify parties that have an interest in the proposed development and/or the environment under consideration;
- To establish a record of the procedure by which I&APs were identified and afforded the opportunity to participate at all appropriate stages of the process;
- To provide opportunities to I&APs to express their views regarding the scope and content of the environmental reports, including alternatives and issues that are being investigated;
- To provide an opportunity for I&APs to verify that their issues were included and considered in the EIA; and
- To maintain a record of all correspondence and views of I&APs.

Evidence of consultation conducted to date is included in Appendix IV. Details on the public participation process during the scoping phase, including public consultation events, notifications and scoping phase consultations with authorities can be found in the Final Scoping Report.

I&AP Identification

The identification of I&APs and/or stakeholders has been carried out in three separate tasks, namely:

- Those identified during the screening process (i.e., by review of available stakeholder information);
- Those identified as directly affected landowners within the proposed development site; and
- Those who registered as a result of the advertising and notification process.

Landowners have been identified through three main mechanisms, namely:

- Available databases from previous projects within the vicinity of the proposed development site;
- Landowner information obtained from a detailed deeds search; and
- One on one consultation with the landowners within the proposed development site.

I&APs are registered on a Microsoft Excel database which has been split into a landowner database and a database containing the information of all other key stakeholders (referred to as key I&APs). The I&AP databases include the full contact details of all parties identified and contacted during the EIA process and all parties who replied to advertisements and other notices, or contacted the PPP consultant regarding the proposed development.

The I&AP databases will be expanded and updated throughout the EIA process.

Issues and Responses Report

An Issues and Responses Report (IRR) has been compiled for the proposed development (Appendix IV). This report represents a "living" record of the public consultation process. The IRR captures the following information:

- Date of comment/question;
- Method of comment/question (e.g., public meeting, letter, etc.);
- Name and organisation of the person who made the comment/asked the question;
- The comment/question. The IRR will be grouped according to the themes of the issues and concerns raised; and
- An answer to the question/response to the comment or a reference as to where such information may be obtained in the Scoping Report and EIR.

The final IRR in the Final Environmental Impact Assessment report (FEIAR) will include a column which will reflect the associated section in the Draft Environmental Management Programme (EMPr) and/or FEIAR in which the issue is addressed.

The DEIAR will be released for a 40 day long public review & comment period. All I&APs on the I&AP databases (landowners and key I&APs) will be notified in writing, via letter, fax and/or email of the availability of the DEIAR for review. The following methods will be utilised to notify registered I&APs of the availability of the DEIAR and associated public meeting to present the findings of the report:

- The DEIAR will be made available for public review at the Murraysburg local municipal office, Murraysburg Farmers' Co-operative, and the Richmond police station, the Ubuntu and Beaufort West local municipalities, as well as the website (www.eims.co.za). The comment period for reviewing the DEIAR will be 40 days;
- Notification letters, faxes and/or emails will be distributed to registered I&APs (including all affected landowners) regarding the availability of the DEIAR for comment; and
- A public meeting to present findings of the DEIAR will be arranged and the details thereof included in the notification regarding the availability of the DEIAR.

The DEIAR will then be finalised and notifications issued to all registered I&APs via letters, faxes and/or emails regarding the submission of the FEIAR to the DEA. In addition I&APs will be informed of any material changes made to the DEIAR which are incorporated in the FEIAR. I&APs will have an opportunity to comment on the FEIAR, with any comments submitted directly to the DEA (details of where and to whom to send such comments will be included in the FEIAR availability notification letter).

Copies of the FEIAR will be placed at the Murraysburg local municipal office and Farmers' Co-operative as well as the Richmond police station and library. The FEIAR will also be available at the Ubuntu and Beaufort West local municipalities and on the project website (www.eims.co.za).

All environmental documentation will be made available to the competent authority (the DEA) as well as the:

- Western Cape Department of Environmental Affairs and Development Planning (DEADP);
- Northern Cape Department of Environmental Affairs and Nature Conservation (DENC);
- Beaufort West Local Municipality; and
- Ubuntu Local Municipality.

This step marks the end of the EIA Phase. Once the DEA has reviewed the FEIAR, they will make a decision on the report and subsequently decide on whether or not to grant the Environmental Authorisation.

2.6.1.1 Ongoing Communication

Throughout the project, stakeholders are encouraged to get into contact with the PPP team to raise issues, ask questions or make suggestions. Communication can be via telephone or in written form. Once a contact has been made, the issue/question/suggestion will be logged on the Issues and Responses Report and a response will be provided to the stakeholder.

Registration of I&APs continues throughout the EIA process however comments on the DEIAR need to be received within the specified time periods to ensure they can be taken into account in the FEIAR.

2.6.1.2 Informing stakeholders of the Decision to Grant or Refuse Environmental Authorisation

At the end of the EIA phase, after submission of the Final EIA Report, the relevant competent authority (DEA) will issue an Environmental Authorisation, should the project be approved. Notification regarding the DEA's decision and the appeal procedure will be distributed to all registered I&APs within 12 days of the issuing of the decision. This task will include the advertisement of the Environmental Authorisation in the same newspapers used to advertise the initial project notifications.

3 REVIEW OF POLICY

3.1 Introduction

The following section provides a review of policy and planning documentation at a national, provincial and municipal level relevant to the development of the Umsinde Emoyeni WEF, of which the proposed grid connection forms a component. This section has been prepared by Arcus in conjunction with Tony Barbour Environmental Consulting. Through this documentation, it is demonstrated that at all levels of governance and policy supports the development of renewable energy in order to address energy supply issues, and to promote economic growth in South Africa.

A small section of the proposed development site is located in the Ubuntu Local Municipality within the Northern Cape Province. However, the majority of the site is located within the Beaufort West Local Municipality (BWLM), which is one of three local municipalities that make up the Central Karoo District Municipality (CKDM) in the Western Cape Province. The focus of overview of the local level policy and planning environment is therefore on the BWLM and CKDM.

3.2 National Level Energy Policy

- National Energy Act (Act No. 34 of 2008);
- The White Paper on the Energy Policy of the Republic of South Africa (Department of Minerals and Energy, 1998);
- The White Paper on Renewable Energy (Department of Minerals and Energy, 2003);
- National Integrated Resource Plan (IRP) for Electricity (2010-2030) (Department of Energy, 20011);
- The National Development Plan – Vision for 2030 (National Planning Commission, 2011); New Growth Path Framework (Economic Development Department, 2010);
- National Infrastructure Plan (Presidential Infrastructure Coordinating Commission, 2012).

3.3 Provincial Level Policy and Planning

- A Climate Change Strategy and Action Plan for the Western Cape (Department of Environmental Affairs and Development Planning, 2008);
- White Paper on Sustainable Energy for the Western Cape (Department of Environmental Affairs and Development Planning: Western Cape, 2008);
- Strategic Initiative to Introduce Commercial Land Based Wind Energy Development to the Western Cape. Towards a Regional Methodology for Wind Energy Site Selection (Department of Environmental Affairs and Development Planning: Western Cape. 2006);
- Delivering the Open Opportunity Society for All. Western Cape Draft Strategic Plan (PGWC: Department of the Premier, 2010);
- The Western Cape Provincial Spatial Development Framework (Department of Environmental Affairs and Development Planning: Western Cape, 2009);
- Western Cape Amended Zoning Scheme Regulations for Commercial Renewable Energy Facilities (Province of the Western Cape *Provincial Gazette 6894, Friday 29 July 2011;* PN 189/2011);
- Guideline for the Management of Development on Mountains, Hills and Ridges in the Western Cape Provincial Government Western Cape: Department of Environmental Affairs and Development Planning (2002);
- Northern Cape Province Growth and Development Strategy (2004-2014);
- Northern Cape Provincial Spatial Development Framework (2012);
- Northern Cape Climate Change Response Strategy (in progress).

3.4 Local Level Policy and Planning

- Central Karoo District Municipality Integrated Development Plan (2012-2017);
- Central Karoo Spatial Development Framework (SDF);
- Beaufort West Local Municipality (BWLM) Local Economic Development Plan.

3.5 International

- International Finance Corporation (IFC) Equator Principles (2013).

3.6 Renewable Energy Independent Power Producer Procurement Programme (REIPPPP)

The REIPPPP is the mechanism which the Department of Energy (DoE) has provided for Independent Power Producers (IPPs), that is private companies, to develop, construct and operate renewable energy facilities in South Africa. Renewable energy in terms of the REIPPPP includes projects making use of any onshore wind, solar thermal, solar photovoltaic, biomass, biogas, landfill gas, or small hydro technologies.

The REIPPPP is essentially a selection process whereby the DoE evaluates potential renewable energy developments proposed by the IPP's through a competitive bidding process.

The bid is first evaluated to confirm it is compliant with the bidding requirements. This includes having completed the EIA and received an Environmental Authorisation from the competent authority. Compliant bids are then evaluated against the two main criteria: price of electricity from the project (tariff) and its Economic Development commitments.

In terms of the project's economic development commitments, bidders must demonstrate how a project would contribute towards elements such as job creation, local content and local manufacturing, rural development and community involvement, education and development of skills, enterprise development, socio-economic development and participation by historically disadvantaged individuals (HDIs). Reporting to demonstrate compliance with commitments made by the project over the life of the project is a strict requirement of the REIPPPP.

The most competitive compliant projects are awarded "Preferred Bidder Status" based on adjudication split 70/30 between the tariff and project's economic development commitments.

If awarded Preferred Bidder Status, the IPP would enter into an implementation agreement with the DoE and a Power Purchase Agreement (PPA) with the buyer of the energy, which is in the majority of cases Eskom. Once operational the electricity would be sold to Eskom under the PPA at the agreed bid price. Eskom then distribute the energy through the national grid to the energy users.

4 PROJECT DESCRIPTION

4.1 Introduction

The proposed grid connection is one of four components of the proposed Umsinde Emoyeni Wind Energy Facility, which comprises the following:

- Electrical Grid Connection and Associated Infrastructure for Umsinde Emoyeni WEF Phase 1 (14/12/16/3/3/2/684);
- Umsinde Emoyeni WEF: Phase 1; (14/12/16/3/3/2/686)
- Umsinde Emoyeni WEF: Phase 2 (14/12/16/3/3/2/687); and
- **Electrical Grid Connection and Associated Infrastructure for Umsinde Emoyeni WEF Phase 2 (the 'proposed grid connection')** (14/12/16/3/3/2/685).

The proposed grid connection will fall into the proposed 'grid site boundary' (Figure 1.1), which encompasses the entire site boundary for Umsinde Emoyeni WEF Phase 1 & 2, (the 'WEF site boundary') as well as the neighbouring Ishwati Emoyeni WEF and grid site boundary (EA: 2/12/20/2351) (Figure 1.1) through which the grid connections will run.

The two phases of the Umsinde Emoyeni WEF will both be located within the Umsinde Emoyeni WEF site boundary. The preliminary proposed turbine layouts, which incorporates constraint and sensitivity mapping conducted during the scoping phase is shown in Figure 1.3. This is a worst case scenario layout and reflects the upper limit in terms of the number of turbines that could be installed.

The proposed grid connection consists of an on-site substation to be constructed for Umsinde Emoyeni WEF Phase 2. From here a system of 132 kV power lines will run either to the existing Gamma substation, or alternatively to the closer Ishwati Emoyeni substation (if constructed). If the Umsinde Emoyeni Phase 1 is constructed first, a short 132 kV line will go directly from the substation and connect to the Phase 1 line.

4.2 The Proposed Grid Connection

The coordinates of the proposed grid site boundary are given in Figure 1.2 and it comprises the following farm parcels:

- Portion 0 (Remaining Extent) Of Farm No. 28 (Swavel Kranse)
- Portion 1 Of Farm No. 29 (Hout Kloof)
- Portion 2 (Kapoksfontein) Of the Farm De Hoop No. 30
- Portion 3 (a portion of Portion1) Of the Farm De Hoop No. 30
- Portion 1 of the Farm Matjeskloof No. 27
- The Farm Voetpad No. 51
- Remaining Extent of Farm 30 (De Hoop)
- Portion 7 (De Tafel)(Portion of Portion 2) of the Farm Driefontein No. 26
- Portion 1 of the Farm MiddelValy No. 52
- Remainder of the Farm Klein Driefontien No. 152
- Portion 3 (portion of portion 1) of the Farm Driefontein No. 26
- Remainder of portion 2 of the Farm Driefontein No. 26
- Portion 10 (a portion of Portion 1) of the Farm Driefontein No. 26
- The Farm Rhenosterfontein No. 50
- Portion 7 (a portion of Portion 6) of the Farm Witteklip No. 32
- Portion 1 of Farm Klein Driefontein No.152
- Portion 2 (portion of portion 9) of the Farm Witteklip No. 32
- Remainder of Portion 1 (Springfontein) of the Farm De Hoop No. 30
- Portion 4 of the Farm De Hoop No. 30
- Portion 4 (a portion of portion 1) of the Farm Driefontein No 26
- Portion 2 (Hartebeesfontein) of the Farm Swavel Kranse No 28

- Remainder of the Farm Leeuwenfontein No. 6
- Portion 2 of the Farm Leeuwenfontein No. 6
- Remainder of Portion 1 (Zwaggershoek-Success) of the Farm Leeuwenfontein No. 6
- Portion 2 (portion of portion 1) of the Farm Allemansfontein No. 7
- Portion 3 (Voorspoed) (Portion of portion 1) of the Farm Leeuwenfontein No. 6
- Portion 4 (Spes Bona) (a portion of portion 1) of the Farm Allemansfontein No. 7
- The Farm Klein Los Kop No. 5
- Portion 3 (Rooi Koppies) of the Farm Driefontein No. 8
- Remainder of the Farm Driefontein No. 8
- Portion 1 (Krieger's Fontein) of the Farm Driefontein No. 8
- The Farm Riet Poort No. 9
- Portion 3 of the Farm Badfontein No. 10
- Remainder of the Farm Schietkuil No. 3
- Portion 2 of the Farm Schietkuil No. 3

- **Richmond RD**
- Portion 1 of the farm Klipplaat No 109[1]
- Portion 3 (portion of Portion 2) of the farm Klipplaat No 109[1]
- Portion 4 (Annex Klipplaat) (a portion of portion 2) of the Farm Klipplaat No 109
- Portion 7 (Middelste Rivier) of the Farm Klipplaat No 109
- Portion 6 Of Farm 109 (Klipplaat)
- The Remainder of Portion 2 of the Farm Klipplaat No. 109
- The Remainder of the Farm Klipplaat No.109

It should be noted that not all of the above mentioned farm portions will be affected by the proposed grid connection, but that these represent the area that has been assessed.

The electricity generated by the proposed Umsinde Emoyeni WEF: Phase 2 will need to be transferred from the turbines via cabling to a substation that is to be constructed on site (Figure 1.3). The substation will house electrical infrastructure such as transformers and switch gear to enable the energy to be transferred into the Eskom national grid. As the switching component of the substation will be transferred to Eskom together with the grid connection, the substation forms part of both this application, and the application for Umsinde Emoyeni WEF: Phase 2. Power lines linking the Wind Energy Facility and the onsite substation and to the grid could be above ground.

The substation will be placed on a concrete foundation with the substation compound occupying an area of up to 200 m x 250 m. There will be an on-site office compound of up to 150 m x 80 m, including site offices, parking and an operation and maintenance facility.

Further technical details of the proposed grid connection are presented in Table 4.1.

Table 4.1: Technical Details of Proposed Grid Connection

Applicable DEA Request	Technical Detail
Area occupied by inverter/transformer stations/substations	200 m x 250 m substation compound Single storey
Capacity of on-site substation	33 / 132 kV
Area occupied by both permanent and construction laydown areas	9 000 m^2
Area occupied by buildings	Maximum 200 m x 250 m = 5 hectares

[1] Please note that these properties are recorded on the title deed as being in the Richmond RD, Northern Cape Province, however they are in the Murraysburg RD Western Cape Province. The project applicant is assisting the landowner to have the title deed amended so as to reflect the correct Registration Division and Province.

Height and type of fencing	Galvanised weldmesh around substation; may have security fencing around the substation
Transmission line	Power line from the on-site substation to Gamma / Ishwati substation would be 132 kV line (single or double string) on single pole pylon (wooden, steel or concrete). Preferred alternative coordinates (Decimal degrees): Start-point: S 31.821834; E 023.94501 Mid-point: S 31.82875; E 023.93261 End-point: S 31.7104; E 023.92020
Servitude corridor	73 m width Length to Umsinde Emoyeni Phase 1 Grid: 2.8 km Length to Ishwati Emoyeni substation: 32.2 km Length to Gamma substation: 56.3 km
Lay down area and construction camp.	Adjacent to on-site substation 150 m x 60 m = 9 000 m^2 (0.9 hectares)

Electricity will be transferred from the on-site substation to Eskom's existing grid network in the area via a 132 kV overhead power line. This will either be by direct transfer to Eskom's existing Gamma substation, or should the approved Ishwati Emoyeni WEF be successful in the REIPPPP and be constructed, to the Ishwati Emoyeni substation. If Umsinde Emoyeni WEF Phase 1 is constructed first, the proposed grid connection for phase 2 will feed into the Umsinde Emoyeni Grid Connection Phase 1, approximately 2.8 km from the proposed Phase 2 substation, most likely in a loop in-loop out configuration or either in parallel to the existing Phase 1 grid connection route within the existing servitude route. This will greatly reduce the length of the proposed grid connection.

From the Gamma substation the energy will be transferred to the national grid to be used. The proposed route alternatives are presented in Figure 1.3.

The route for the 132 kV lines will include a servitude corridor of up to 73 m in width. At this stage it is recommended that the proposed route of the overhead line follows existing linear infrastructure as far as possible as this will potentially reduce the impacts associated with its construction and operation. The proposed route for the preferred alternative from the on-site substation to the Umsinde Emoyeni Grid Connection Phase 1 has a length of 2.8 km if Phase 1 is built first.

Should Umsinde Emoyeni Phase 1 not be built first the route from the on-site substation to Ishwati Emoyeni will be approximately 32.2 km in length and run along the same route as proposed for Umsinde Emoyeni Grid Connection Phase 1.

Should Ishwati Emoyeni WEF not be built the preferred route will be from the on-site substation to Gamma substation and be 56.3 km in length (Figure 1.3).

At the Ishwati Emoyeni Substation, the distribution overhead lines will connect into an existing feeder bay. At the Gamma Substation (400 / 132 kV), any works required for purposes of connecting would be done within the existing foot print of the site.

Municipal services for the proposed grid connection will not be required. Water required for construction will be brought in with tanker trucks, and waste will be removed to the nearest registered landfill. The EMPr will include measures for the reduction, reuse and the recycling of wastes during the construction phase. Potable toilets will be used during construction and septic tanks will be used during the operation of the facility.

4.2.1 Construction Phase

4.2.1.1 Establishment of a Servitude

A servitude is by definition "the right to use someone else's land for a specified purpose", in this case the right to erect, operate and maintain a power line, as well as access rights to carry out these activities. Ownership of the land remains with the original landowner who signs a servitude agreement and keeps overall responsibility for the land.

A topographical survey will be conducted along the preferred alternative to inform the final route and design of the tower foundations, pylons and structures. Once the final servitude route has been confirmed construction of the power line begins. The servitude is generally cleared of wooded plant species and any protruding alien vegetation to reduce fire risk and prevent shortages with vegetation, in line with the Environmental management Programme (EMPr) and Eskom requirements and guidelines.

Although existing roads and tracks will be used as much as possible, access roads for minor vehicles may be created for the construction phase as well as for periodic maintenance, in negotiation with the relevant landowner.

4.2.1.2 Construction of Power Line Tower Structures

The type of structures which will support the overhead lines is yet to be determined and may include:

- Concrete, steel or wood monopoles;
- Guy line supported steel structures;
- Free standing metal lattice towers; or
- Multi-pole structures such as H-towers or K-towers.

The preferred type of tower is dependent on a variety of factors, including the terrain, cost, conductor size, live line compatibility and required electrical characteristics. Tower type selection will therefore be based on additional on-site investigations during the detailed design phase of the project. Similarly, the foundation size and type will depend on the type of tower selected as well as conditions of the local terrain. Tower steel is typically delivered on a 24-ton truck, or on smaller vehicles in difficult terrain. The tower structures are assembled on the ground and erected on the constructed foundations using an 8-ton crane truck. Following this the power lines and conductors are strung from tower to tower. The average span between two 132 kV towers is 200 m but can vary between 150 and 375 m depending on the terrain and ground profile.

4.2.1.3 Stringing High Voltage Cables

Power lines to be strung are delivered to the site on cable drums that are placed along the servitude at regular intervals. If the area is inaccessible these may be delivered by helicopter. A pilot cable is then lain down by a pilot tractor driven along the route of the power line. This is used to string the conductors between towers in sections from bend to bend by the means of a pulley system. The correct tension required to reduce sagging and comply with minimum clearance distances is then obtained before clamping the conductors and cutting off any excess cabling.

4.2.1.4 Rehabilitation of disturbed areas and protection of erosion sensitive areas

Following the construction of the substation and grid connection all areas outside of the servitude and other areas required for maintenance will be rehabilitated in accordance with the EMPr.

4.2.2 Operational Phase

The life span of the power line is approximately 25 years, during which time ongoing maintenance is required. Eskom is expected to be responsible for the operational phase and decommissioning phase and will undertake maintenance in accordance with the EMPr and 'Eskom Standard for Bush Clearance and Maintenance within Overhead Powerline Servitudes' (Eskom 2003) and the Transmission Vegetation Management Guideline (Eskom 2009). The guideline promotes minimising the removal of vegetation other than alien vegetation unless it poses a fire hazard.

4.2.3 Decommissioning Phase

Eskom will be responsible for the decommissioning phase. This will include unstringing the power line cables, disassembling the towers, removing the foundations and rehabilitating the servitude according to the EMPr.

4.3 The Need for the Development

The proposed grid connection is required to transfer electricity generated by the Umsinde Emoyeni WEF Phase 2 to the national grid. The proposed grid connection and Umsinde Emoyeni WEF Phase 2 therefore rely on authorisation of the other to move forward.

The need for the proposed grid connection is thus linked to the need for the Umsinde Emoyeni WEF: Phase 2. The questions for need and desirability of the proposed grid connection are therefore answered in the context of being a component of a renewable energy facility.

The Western Cape DEA&DP Guideline on Need and Desirability state that the aim of investigating need and desirability of a proposed development is to determine its suitability, i.e. if the proposed project is in the right location for the suggested activity, as well as the timing, i.e. is it the right time for the activity. In other words it answers the question of whether the activity is being proposed at the right time in the right place. The guidelines pose a number of questions that should be considered in this investigation, which are addressed in the section below.

The proposed development's land use is in line with the relevant Spatial Development Framework and projects and programmes identified as priorities by the credible IDP.

- The National Development Plan (NDP) – Vision for 2030 (National Planning Commission, 2011) identifies 'energy' as a key area for investment in infrastructure, with an objective of at least 20 000MW of capacity to come from renewable sources.
- The Western Cape Spatial Development Framework (SDF) names energy diversification as a key policy that must be pursued. It states that emergent IPPs and sustainable energy producers must be supported and encouraged to thrive in the rural areas as means to uplift stagnating economies. It also encourages and supports renewable energy generation at scale for climate change mitigation.
- The proposed grid connection is in line with the Beaufort West Local Municipality Integrated Development Plan (IDP), which states 'Basic Service delivery and infrastructure development' including electricity, as well as local economic development as key performance areas.

Development of this type of land use should occur here at this point in time.

- The proposed grid connection itself will not cause a significant change in land use, as the development site is primarily low intensity agriculture (sheep grazing), which can still proceed once the grid connection is constructed.
- The proposed grid connection will allow the Umsinde Emoyeni WEF to proceed, which will contribute positively towards the creation of employment and local economic

development, in an area with high levels of unemployment and low levels of economic growth. The area is not suitable for alternative more profitable types of land use.
- The NSP, SDF and IDP call for the promotion of energy infrastructure and renewable energy in particular.

The community and area need the activity, which is a societal priority.

- The NDP identifies energy infrastructure as a key investment area and the country is facing a national energy crisis.
- The region suffers from a stagnating economy with low levels of economic growth and high unemployment rates. The Western Cape SDF supports energy developments particularly in these rural areas to combat this problem. The proposed grid connection is required for the development of the Umsinde Emoyeni WEF which will create jobs and contribute towards socio-economic development in an area with otherwise few opportunities.

There is adequate capacity for the required services currently available and no additional capacity must be created to cater for the development.

- The existing Eskom Gamma Substation is able to provide connection to the national grid, and the Ishwati Emoyeni WEF, through or to which the grid connection will run, has received Environmental Authorisation.
- Any water required during construction will be sourced from existing reticulation systems from either the local municipality or landowners. If additional water is required this would be delivered in by tankers.
- Waste removal will be in accordance with best practice as per the EMP by qualified waste removal contractors.
- Portable sanitation facilities will be utilised during construction, so that no connection to the local sewerage system will be required.

The proposed grid connection is not provided for in municipal planning, however the overall effect will be beneficial to the municipality.

- Any additional infrastructure required will be provided and maintained by the applicant. There is therefore no cost involved to the municipality.
- The land in the proposed grid site boundary has low agricultural potential and the economic yield is currently low. The construction of the proposed grid connection and the Umsinde Emoyeni WEF will lead to an increased income for the property owners of the land that the servitude and WEF are on.

The proposed grid connection is part of a national programme to address an issue of national concern.

- The National Integrated Resource Plan for Electricity (IRP2) (2011) states that 42% of the national electricity supply should come from renewable energy sources by 2030. The proposed grid connection will contribute towards this goal by allowing the Umsinde Emoyeni WEF to move forward.
- The proposed grid connection as well as the associated Umsinde Emoyeni WEF fall under the National Infrastructure Plan.

The proposed grid connection is the best practicable environmental option for this site.

- The proposed grid connection in combination with the Umsinde Emoyeni WEF will contribute towards lower carbon emission goals to combat climate change and provide cleaner energy than coal which currently makes up the large majority of the national energy mix.
- The current land use is non-arable, low-potential grazing land with a low per m^2 yield. Therefore the opportunity cost of not proceeding is high in terms of yield per m^2.

- The preferred alternative minimises negative environmental impacts.

The approval of this application will not compromise the integrity of the existing approved and credible municipal IDP and SDF as agreed to by the relevant authorities.

- The Beaufort West IDP supports the improvement of the local electricity supply and the improvement of electrical infrastructure, as well as local economic development, which the proposed activity will contribute to.
- The proposed development is supported by the Western Cape SDF, which promotes IPPs and renewable energy developments.

The approval of this application will not compromise the integrity of the existing environmental management priorities for the area.

- Throughout the EIA process Critical Biodiversity Areas (CBAs), ecological priority areas as well as sensitive areas and no-go areas in the proposed development site were identified through specialist input. The presented alternative routes for the grid connection avoid these areas and considered these in the design of the proposed grid connection as well as the design of the Umsinde Emoyeni WEF turbine layout. Therefore any negative environmental impacts are minimised. Mitigation measures have been identified to further minimise negative impacts.

Location factors favour this land use in this area.

- The region was identified through a comprehensive wind monitoring process as being extremely favourable for wind energy facilities; the wind resource can be considered ideal for wind energy facility's with wind speeds at the site in excess of 7.5 m/s at all monitoring locations. A variety of alternative locations were considered and this process is detailed in the Umsinde Emoyeni WEF: Phase 1 EIA Report. In addition rood road access, favourable terrain and landowner support were factors contributing to site selection.
- In term of the proposed grid connection route, land use will not change significantly as low intensity grazing can continue in the area post-construction.

The predicted impacts on sensitive natural and cultural areas will be of overall low-medium significance with the implementation of mitigation measures.

- Detailed specialist impact assessments were conducted through the EIA process which identified potential impacts and predicted their significance. No-go and sensitive areas were identified and the design of both the proposed grid connection as well as the Umsinde Emoyeni WEF took these into consideration. Any future layout changes will also adhere to these identified no-go areas.
- Mitigation measures were identified by the specialists that minimise environmental impacts and lower the significance rating of these impacts.

The impact of the proposed grid connection and infrastructure will be of very low to low significance to people's well-being, with a medium impact on visual receptors.

- The impact of noise associated with the proposed grid connection as well as the Umsinde Emoyeni WEF was determined as of minor significance by the noise impact specialist study
- A social impact assessment (SIA) was conducted and found the impact of the proposed grid connection to be of low significance with mitigation.
- The SIA found any health risks (noise, shadow, flicker and electro-magnetic radiation from the proposed grid connection and the Umsinde Emoyeni WEF to be of very low significance.
- The visual impact of the proposed grid connection will be of medium significance with mitigation measures as determined by a specialist study on visual impacts.

The proposed grid connection and infrastructure will not result in unacceptable opportunity costs.

- The current land use is low-intensity grazing and the land is not suitable for other agricultural uses. The yield per m^2 is very low.
- The proposed grid connection will increase the yield per m^2 as the landowners will be paid for the use of their land. This could increase agricultural investments in the area.
- The opportunity cost of not proceeding with the proposed grid connection is therefore high.
- The specialist social impact assessment found that the No Development alternative would result in a negative social cost of medium negative significance.

It is unlikely that the proposed grid connection and infrastructure will result in unacceptable cumulative impacts.

- Since the overall social and environmental impact of the proposed grid connection is considered low it is unlikely that it will contribute towards larger cumulative impacts in any significant way.
- Regional assessments of the impacts of power lines in combination with wind energy facilities in the area are assessed in the specialist assessments. It was found that the proposed grid connection will not contribute significantly to any potential cumulative impacts.

The proposed grid connection and infrastructure will impact on the sense of place but this impact is of low significance.

- The Social Impact Assessment found that the affected landowners did not object to the transmission line, as long as it is located away from homesteads and not visible from the farm Badsfontein.

The proposed land use will not set a precedent.

- The proposed grid connection is required for the development of the Umsinde Emoyeni WEF: Phase 2 and will not lead to more grid connections in the area.
- There are existing and proposed approved grid connections in the area, including Eskom's Gamma Substation which is connected to the national grid.

The proposed grid connection and infrastructure will not affect any person's rights.

- Section 24 of Chapter 2 (The Bill of Rights) of The Constitution of South Africa states that everyone has the right to an environment that is not harmful to their wellbeing, and to have the environment protected for the benefit of present and future generations through reasonable legislative and other measures that prevent pollution and ecological degradation, promote conservation and secure ecologically sustainable development, and use of natural resources while promoting justifiable economic and social developments
- The proposed grid connection will contribute towards the prevention of pollution and ecological degradation as well as the promotion of sustainable development and use of natural resources through the Umsinde Emoyeni WEF. Wind energy has a much smaller carbon footprint than coal, which is currently the dominant form of electricity generated in South Africa.
- The affected landowners do not object to the proposed grid connection ….

The proposed grid connection and infrastructure will not compromise the 'urban edge'.

- The proposed grid connection is outside of any urban areas. The closest town is Murraysburg, which is 7 km away.

4.4 Consideration of Alternatives

Alternatives are different means of meeting the general purpose and need of a proposed development and may include alternative sites, alternative layouts/designs, alternative technologies and/or the no development alternative.

The EIA Regulations indicate that alternatives that are considered in an assessment process should be reasonable and feasible and that I&APs should be provided with an opportunity to provide inputs into the process of formulating alternatives.

The assessment of alternatives should, as a minimum, include the following:

- The consideration of the no-development alternative as a baseline scenario;
- A comparison of reasonable and feasible selected alternatives; and
- The provision of reasons for the elimination of an alternative.

For the purposes of the grid connection, a grid connection corridor (Figure 1.1) was provided to all specialists to use during the scoping phase and EIA phase. This corridor is the same as the Ishwati WEF site, as the preferred route option for the grid connection is to connect to the proposed Ishwati substation, which will then in turn connect to the Eskom Gamma Substation. A preferred line route was supplied to all specialist for assessment (Figure 1.3).

4.4.1 The No Development Scenario

The No Development scenario assumes that the proposed development does not proceed. It is equivalent to the future baseline scenario in the absence of the proposed development.

Relative to the proposed grid connection, the main implication of the No Development scenario is that the Umsinde Emoyeni WEF: Phase 2 cannot be constructed. The result will include the following:

- The land-use remains agricultural with no further benefits derived from the implementation of a complementary land use;
- There is no change in the current landscape or environmental baseline;
- Whilst no WEF development will occur on site, other wind energy projects go ahead as planned for other areas locally;
- No additional electricity will be generated onsite or supplied through means of renewable energy resources. This would have implications for the South African Government in achieving its proposed renewable energy target;
- There is no opportunity for additional employment (albeit temporary) in the local area where job creation is identified as a key priority; and
- The local Economic Development benefits associated with the WEF development's REIPPPP commitments will not be realised.

South Africa, like many nations in the world, faces serious electricity and water shortages due to its heavy dependency on fossil fuels and increase in demand. There is therefore a strong need for additional electricity generation options to be developed and to diversify the sources of energy that feed into the national grid.

The purpose of the proposed grid connection is to allow the Umsinde Emoyeni WEF: Phase 2 to generate renewable electricity and export this to the national grid. Many other socio-economic and environmental benefits will result from this such as:

- Reduced air pollution emissions - burning fossil fuels generates CO_2 emissions which contributes to global warming. In addition burning fossil fuels produces emissions of sulphurous and nitrous oxides which are hazardous to human health and impact on ecosystem stability;

- Water resource saving – conventional coal fired power stations use large quantities of water during their cooling processes. WEFs require limited amounts of water during construction and almost no water during operation. As a water stressed country South Africa should be conserving such resources wherever possible;
- Improved energy security – renewables can often be deployed in a decentralised way close to consumers improving grid strength while reduce expensive transmission and distribution losses. They also contribute to a diverse energy portfolio;
- Exploit significant natural renewable energy resources – biomass, solar and wind resources remain largely unexploited;
- Sustainable energy solution – The uptake of renewable energy technology addresses the country's energy needs in a sustainable manner, generating electricity to meet growing demands in a manner which is sustainable for future generations.
- Employment creation and other local economic benefits associated with support for a new industry in the South African economy.

The 'No Development' alternative will not assist the government in addressing climate change, nor will it assist in supplying the increasing electricity demand within the country.

Climate change is widely considered by environmental professionals as one of the single largest threats to the environment on a local, national and global scale. As such, the 'No Development' alternative is not a preferred alternative.

The specialist social impact assessment found that the No Development alternative would result in a negative social cost of medium negative significance.

4.4.2 The Preferred Alternative

The preferred alternative is the servitude route that runs from Umsinde Emoyeni WEF Phase 2 substation to the proposed Ishwati Emoyeni WEF substation (Figure 1.3). Should the Umsinde Emoyeni WEF Phase 1 already be constructed then the proposed grid connection would only be 1.7 km in length and join with the Umsinde Emoyeni Phase 1 grid connection as indicated in Figure 1.3. This alternative is only possible if Ishwati Emoyeni WEF is successful in the REIPPPP and is constructed. The electricity would then be exported from the Ishwati substation along already constructed lines to Eskom's existing Gamma Substation and the national grid. This is the shortest route and would minimise any environmental impacts.

4.4.3 Route Alternative 1

In the event that Ishwati Emoyeni WEF is not constructed the route of the grid connection would then run for approximately 32.2 km along the same route as the preferred alternative to the location of the proposed Ishwati substation, and then 24.1 km to the existing Gamma substation, along the same route as the approved Ishwati grid connection route, and totalling approximately 56.3 km in length (Figure 1.3)

4.4.4 Route Alternative 2

The route from the Phase 1 substation to Victoria substation was considered as a route alternative. Victoria Substation is further from the proposed developments substation and therefore the servitude would have a length of 70 km. Environmental impacts associated with the proposed development are proportional to its length. Therefore any negative environmental impacts will be greater than for Alternative 1 or the preferred alternative. In addition, the Victoria substation did not have the capacity required to connect Umsinde Emoyeni WEF to the National grid. Therefore this alternative was disregarded.

5 DESCRIPTION OF THE BASELINE ENVIRONMENT

This chapter provides an overview of the receiving bio-physical and socio-economic environment which may be affected by the Umsinde Emoyeni WEF Grid Connection Phase 2. It is a summary of the baseline studies conducted by the EIA Specialist team (Section 1.3.2) and aims to provide the reader with a better understanding of the baseline environment and potential areas of concern. Detailed specialist studies of the proposed grid connection site are provided in Volume II. It should be noted that the baseline environments of the four components of the Umsinde Emoyeni WEF are identical and considered as the proposed development site.

5.1 Site Location

The proposed development site is located near the town of Murraysburg in the Western Cape Province, with a small portion transcending into the Northern Cape Province (Figure 1.1)

The majority of the proposed development site is located within the Beaufort West Local Municipality (BWLM), which is one of three local municipalities that make up the Central Karoo District Municipality (CKDM) in the Western Cape Province. A small section of the proposed development site is also located in the Ubuntu Local Municipality within the Northern Cape Province.

The proposed development site covers a total area of approximately 93,000 hectares, of which only a small proportion will be occupied by the final proposed development and infrastructure footprint.

It is accessed via the R63 trunk road, which passes through the southern portion of the proposed development site, and other unnamed/ unnumbered local gravel roads. Graaff-Reinet and the Camdeboo National Park lie approximately 60 km to the southeast on the R63. The junction between the R63 and the N1 National Road is approximately 40 km northwest of Murraysburg. It should be noted that the eastern portion of the proposed grid connection site is the same study area proposed for the grid infrastructure associated with the proposed Ishwati Emoyeni WEF.

5.2 Climate

The area has a dry arid to semi-arid climate typical for much of the Karoo. Murraysburg, the closest settlement to the proposed development experiences hot dry summers and mild wet winters. Mean monthly temperatures range from 14.7°C in June to 29.2°C in January. Nights can be very cold in winter with an average temperature of 0.6°C at night in July. The mean annual rainfall is 198 mm per year in Murraysburg, with the majority of this occurring during the autumn months. The lowest average rainfall is recorded in July and September (5 mm) and the highest is in recorded in March (54 mm).

5.3 Visual Receptors

5.3.1 Landscape Receptors

The proposed development site forms part of the Great Karoo, an area renowned for its wide open spaces, serenity, quiet and starry skies at night; qualities which attract both local and overseas visitors.

The dolerite koppies, scarps and rock outcrops are attractive scenic features and as such are considered to be visually sensitive. The proposed developments site notably lacks visual intrusions, such as manmade vertical and linear features, including masts and power lines.

As such the characteristic of the landscape is considered to present a sensitive receptor to the proposed grid connection.

5.3.2 Visual Receptors

Visual receptors are receptors whom may be impacted upon by the proposed grid connection by their ability to view it. The term 'visual' used in this report is taken in its broadest meaning to include visual, scenic, aesthetic and amenity values represented by the natural and the cultural landscape, which can be described as the area's 'sense of place'.

Sensitive visual receptors which need to be considered include:

- Murraysburg - a historic settlement with a number of noteworthy buildings;
- Commuters and visitors using the R63, an important arterial route linking Graaff-Reinet and Murraysburg with the N1 National Road, and the two gravel roads connecting the R63 with Richmond;
- Visitors to game farms and guest farms, such as Ratelfontein, Badsfontein and Brand-kraal; and
- Residents of Murraysburg and farms within the study area.

A high ridgeline exists outside the eastern boundary of the proposed development site which would provide a physical visual barrier for the areas to the east of the proposed development. Other smaller ridges and koppies within the proposed development site would also provide some visual screening.

5.4 Vegetation

5.4.1 Broad-Scale Vegetation Types

According to the national vegetation map (Mucina & Rutherford 2006), only three different vegetation types occur within the WEF Site: Upper Karoo Hardeveld, Eastern Upper Karoo and Southern Karoo Riviere (Figure 5.1).

The WEF Site is dominated by Eastern Upper Karoo, which at 49,821 km^2 is the most extensive vegetation type in South Africa and forms a large proportion of the central and eastern Nama Karoo Biome. This vegetation type is classified as Least Threatened, and about 2 % of the original extent has been transformed largely for intensive agriculture. The vegetation type is however poorly protected and less than 1 % of the 21 % target has been formally conserved.

Mucina & Rutherford (2006) list eight endemic species for this vegetation type, which considering that it is the most extensive unit in the country, is not very high. Dominant species within the study area include *Pentzia incana, Rosenia humilis, Pteronia sordida, Zygophyllum lichtensteinii, Eriocephalus ericoides, Salsola calluna, Osteospermum leptolobum* and *Ruschia intricata* with a variable grass layer often including *Fingerhuthia africana, Eragrostis bergiana, Tragus koeleroides* and *Eragrostis lehmanniana*. There may be occasional areas of deeper sands present, usually of aeolian nature, blown up against hills which are dominated by grass species such as *Stipagrostis ciliata, S.obtusa* and *Eragrostis lehmanniana* with occasional scattered shrubs such as *Lycium cinereum, Gnidia polycephala, Rosenia oppositifolia* and *Melolobium candicans.*

The Upper Karoo Hardeveld vegetation type is associated with 11 734 km^2 of the steep slopes of koppies, butts mesas and parts of the Great Escarpment covered with large boulders and stones. The vegetation type occurs as discrete areas associated with slopes and ridges from Middelpos in the west and Strydenburg, Richmond and Nieu-Bethesda in the east, as well as most south-facing slopes and crests of the Great Escarpment between Teekloofpas and eastwards to Graaff-Reinet. Altitude varies from 1000-1900m. Mucina &

Rutherford (2006) list 17 species known to be endemic to the vegetation type. This is a high number given the wide distribution of most Nama karoo species and illustrates the relative sensitivity of this vegetation type compared to the surrounding Eastern Upper Karoo. Typical and dominant species characteristic of these areas includes grasses such as *Themeda triandra, Heteropogon contortus, Enneapogon scaber, Digitaria eriantha, Erogrostis lehmanniana and Aristida diffusa subsp. burkei; shrubs such as Felicia filifolia, Pentzia globosa, Hermannia filifolia, H.munitiflora, Melolobium candicans, Nenax microphylla, Eriocephalus ericoides, Asparagus suaveolens and Chrysocoma ciliata* and low trees and large shrubs such as *Searsia burchellii, Ehretia rigida* and *Lycium oxycarpum, Cadaba aphylla, Melianthus comosus* and *Buddleja glomerata*.

The Southern Karoo Riviere vegetation type is associated with the rivers of the central karoo such as the Buffels, Bloed, Dwyka, Gamka, Sout, Kariega and Sundays Rivers. About 12% has been transformed as a result of intensive agriculture and the construction of dams. Although it is classified as Least Threatened, it is associated with rivers and drainage lines and those areas classified under this vegetation type should be considered sensitive. Within the site, dominant and typical species within this vegetation type includes Acacia karoo which is usually dominant along the larger water courses, as well as Olea europea subsp. *africana, Searsia lancea* and *Diospyros lycioides*. On the open plains large woody species are less conspicuous the systems often anastomise with extensive alluvial floodplains dominated by species such as *Salsola aphylla, Salsola rabieana* and *Atriplex vestita var. appendiculata, Aridaria noctiflora subsp straminea, Drosanthemum lique* and *Lycium cinereum*.

Compared to the other vegetation types, this is the only vegetation type at the site which contains a significant amount of trees. The other vegetation types at the site are dominated by low shrubs and grasses with occasional larger shrubs. The extent of this vegetation type is not well mapped and is much more extensive along the larger drainage systems of the site than has been mapped. This vegetation type is present all along the Buffels, Bakensklip and other large drainage lines of the site. These areas are also ecologically important because they function as ecological corridors for the movement of fauna about the landscape and also represent key resource areas for many fauna.

5.4.2 Habitat Types

The vegetation of the site, is relatively homogenous at a broad scale, but is repetitively patterned within the site at a fairly fine scale, related primarily to soil texture, depth and landscape position. Within the Umsinde Emoyeni site, the main driver of vegetation composition is elevation. Elevation is a key driver of vegetation pattern as it has a dominant influence on rainfall as well as on temperature. There are some areas of dolerite outcrops at the site associated with the Upper Karoo Hardeveld vegetation type and these areas contain significantly greater plant and animal species richness than the surrounding areas on shale-derived soils.

The landscape diversity and rugged topography of the area is reflected in the map, which illustrates the varied nature of the site with hills, drainage features and more flat areas repeatedly interspersed across the site. The majority of turbines are located on the flatter open plains of the site, which is considered the least sensitive habitat. However, there are also a number of turbines located on steeper slopes especially within dolerite outcrops and within the plains wash habitat. On the steeper slopes, access roads and turbines will generate a significant erosion risk and there are also sensitive features present in these areas including localised habitats such as rock fields and densely-vegetated south-facing slopes. The dolerite outcrops are considered sensitive as these habitats contain high diversity of fauna and flora compared to the adjacent areas and are considered vulnerable to human impact and disturbance.

The washes of the site are sometimes very broad and difficult to avoid and in many cases, these are anthropogenic features resulting from the loss of vegetation cover due to livestock grazing and concomitant increase in runoff and development of incipient erosion. These areas are vulnerable to disturbance and specific precautions will need to be taken in these areas to ensure that the development does not trigger or exacerbate erosion problems in these areas. The proper regulation of runoff and water flow is a key factor in these areas and mitigation should aim to slow the flow of water and thereby reduce it energy and erosion potential as much as possible.

Within the higher-lying areas, there are some rock fields present which also contain succulent and geophyte species not found elsewhere at the site. Many of these are small and would only be located during a walk-through of the facility, should either phase become a preferred bidder under the REIPPP.

5.4.3 Plant Species of Conservation Concern

In terms of the presence of species of conservation concern within the site, the abundance of such species is fairly low. According to the SIBIS database, only five such species are known from the area. However an additional species *Gethyllis longistyla* which is classified as Rare was observed in a rockfield near one of the wind measuring masts near the eastern margin of the site. The other listed species are not likely to impose a significant constraint on the development as several are associated with mesic areas such as vleis and, as these areas are intrinsically sensitive, such areas would need to be avoided in any case. Some other listed species are relatively widespread species whose local populations are not likely to be compromised by the relatively low footprint of the wind farm. It is, however, likely that additional listed species occur at the site as it has not been well sampled in the past.

5.4.4 Critical Biodiversity Areas (CBA)

The site falls within the planning domain of the Critical Biodiversity Areas map for the Central Karoo District Municipality. Figure 5.2 indicates the CBA status of the area, as well as the underlying reasons that certain areas were designated as CBA or ESA. In many areas there may however be several reasons that an area is a CBA or ESA and so it is not possible to illustrate all the possible combinations, but the dominant or most relevant reason has been illustrated.

5.5 Fauna

5.5.1 Mammals

The site falls within the distribution range of approximately 53 terrestrial mammals, indicating that the mammalian diversity at the site is potentially high. The site is extensive and topographically diverse, suggesting that a large proportion of these species are likely to occur at the site. Species observed during the site visit to Umsinde Emoyeni or to the adjacent Ishwati Emoyeni site include Greater Kudu *Tragelaphus strepsiceros*, Aardvark *Orycteropus afer*, Rock Hyrax *Procavia capensis*, Springbok *Antidorcas marsupialis*, Steenbok *Raphicerus campestris*, Cape Hare *Lepus capensis*, South African Ground Squirrel *Xerus inauris*, Yellow Mongoose *Cynictis penicillata*, Bat-eared Fox *Otocyon megalotis*, Namaqua Rock Mouse *Aethomys namaquensis*, Bush Vlei Rat *Otomys unisulcatus* and Cape Porcupine *Hystrix africaeaustralis*. Three listed species potentially occur at the site, the Black-footed Cat *Felis nigripes* (Vulnerable), Leopard *Panthera pardus* (Near-threatened) and Honey Badger *Mellivora capensis* (SARDB Endangered).

In terms of the listed mammals, it is possible that there are Leopard in the area given the rugged topography of the site, while the Black-footed Cat and Honey Badger probably also occur at the site at a low density as is typical for these species within arid environments.

Although some impact on these species may occur as a result of development in the area, they are widespread species and this would not be likely to compromise the local or regional populations of these species. It is not considered likely that the Riverine Rabbit *Bunolagus monticularis* occurs at the site. This species is associated with silty floodplains and if it were to occur anywhere at the site, it would be on the lowland floodplains of the major rivers. As these areas would be avoided by the development, the possibility of impact on this species can be discounted.

Some concern was raised during the scoping phase of the development around the potential impact of the development on predator distribution at the site and the potential for predators to move out of the development area and into the wider area. This was partly based on a premise that the wind farm development may deter natural prey species from the area and secondly that predators themselves would move out of the area due to the wind turbines. During the construction phase, there will be a lot of noise and disturbance at the site and it is reasonable to expect that some movement of sensitive faunal species out of the affected area will occur. However, many species such as small mammals, hares, dassies and small antelope are likely to remain in the area and as these are the dominant prey species, it is not likely that prey abundance will decline significantly. In the operational phase there is no evidence that turbines scare animals away, which usually quickly become habituated to their presence. In addition, turbines may attract some predators which learn that there may be dead birds and bats beneath the turbines and a variety of studies have shown that such carcases are quickly removed by predators, which is often a confounding factor in bird and bat mortality studies. Therefore, any impacts on predator-prey dynamics are likely to occur during the construction phase and would be transient and in the long-term predator prey dynamics in the area is unlikely to be affected and the wind farm site would not be source area for predators more than is currently the case. Any changes to the management of the area or changes in livestock and predator management would have an overwhelming influence compared to any potential impact of the development infrastructure itself.

5.5.2 Reptiles

According to the SARCA database, 23 reptiles have been recorded from the half degree squares 3123D and 3124C, but this rises to 50 species when the area of interest is expanded to the whole of 3123 and 3124. The latter is a much bigger area than the study site and probably includes a variety of habitats that are not present within the study area, but sampling density across the karoo is generally very low and so a conservative approach is necessary to ensure that all potential species present at the site are captured. However, even within the larger dataset, there are few listed reptiles that are likely to be present at the site.

The only listed species known from the area according to the SARCA database is the Karoo Padloper, *Homopus boulengeri*, which is a Karoo endemic restricted to the Nama Karoo in the Eastern, Western and Northern Cape. The distribution of this species is however fairly large and the site is not within an area of known significance for this species which appears to favour lowland habitats over mountainous terrain.

It is possible that the Plain Mountain Adder *Bitis inornata* occurs within the high-lying parts of the site, above 1600 m. This little-known species is found in the Sneeuberge and may occur at the site as well. It is currently listed as Endangered and has apparently declined significantly in recent times. Although it has not been recorded from the site, the area has not been well investigated and there is a reasonable probability that it occurs at the site. Although the presence of this species would not constitute a fatal flaw, it nevertheless highlights that areas above 1600 m may have additional high-elevation species present and should be considered higher sensitivity as a result.

5.5.3 Amphibians

Amphibian diversity in the study area is low, with only 11 species known from the area. This is however not surprising given the aridity of the area and low abundance of favourable amphibian habitats. Clearly the larger river systems, the Buffels and Bakensklip would be the most important areas for amphibians as these rivers contain permanent pools which would be home to species such as Platanna, Cape River Frog and Clicking Stream Frog. The smaller drainage lines and ephemeral pans are likely to be used by less water-dependent species such as Common Caco and Karoo Toad. The only listed species known from the area is the Giant Bullfrog, *Pyxicephalus adspersus* which is associated with ephemeral pans and is not likely to be common in the area and is only sporadically encountered in the Karoo.

In terms of impacts on amphibians, the large number of river crossings is a concern as disturbance leading to erosion and silt input are a threat to amphibians on the site. Many of the drainage lines are currently little impacted by direct human influences and the large amount of disturbance at the site during construction would certainly be likely to lead to a decline in water quality in the area due to increased turbidity and potentially pollution as well. With the appropriate mitigation and avoidance, impact to drainage systems, erosion and hence impact on amphibians can be kept to a minimum and in the long-term impacts on amphibians are likely to be low.

5.6 Bats

Bats represent a significant portion of vertebrate Biodiversity (Simmons 2005), and are among the most overlooked, yet economically important, non-domesticated animals. Their conservation, therefore, is in the best interest of national and international economies (Boyles *et al*. 2011). Insectivorous bats provide essential pest control service to farmers, and eat substantial quantities of disease-carrying insects like mosquitoes (Kalka *et al*. 2008; Gonsalves *et al.* 2013). Frugivorous bats facilitate plant pollination and seed dispersal, and thereby, orchestrate habitat regeneration. By fulfilling these important ecological roles, bats are excellent indicators of environmental disturbance.

Unfortunately, many bat species are vulnerable to severe population crashes. Compared to other similar-sized mammals, bats have low reproductive rates. Females usually give birth to only one or two pups at a time, and females of some species only give birth every second year. Bats are also long-lived, reaching up to 30 years of age (O'Shea *et al*. 2003). Due to their high longevity and low reproductive rates, generation turn-over is slow, and populations have low resilience against major die-offs. Cave-dwelling and/or migratory bats are especially vulnerable to disturbance because large numbers (hundreds or thousands) of individuals may be concentrated in a few restricted localities (Hester & Grenier 2005). Consequently, disturbance of only a few populations can have a devastating impact on a species.

Given the ecological and economic importance of bats, and their susceptibility and low resilience to severe population crashes, the potential impacts of WEFs on bats deserve thorough evaluation and effective mitigation.

5.6.1 Legislation

Unlike in the UK and the USA, bats are not directly legally protected in South Africa. However, there are various Acts and Regulations relevant to the protection of fauna, including bats:

- National Environmental Management Act, 1998 (Act 107 of 1998) (NEMA);
- NEMA: Biodiversity Act, 2004 (Act 10 of 2004);
- NEMA: Biodiversity Act, 2004: Threatened and Protected Species (TOPS) Regulations

  - A person may not carry out a restricted activity involving a specimen of TOPS without a permit;
  - However, the NEMA TOPS Regulations fail to recognise most bat species of conservation concern - only one bat species, the Large-eared Free-tailed Bat (*Otomops martienssenii*), is listed on the TOPS list.

- NEMA: Protected Areas Act, 2003 (Act 57 of 2003)

- National Policies, Guidelines and Inventories:

  - National Spatial Biodiversity Assessment (NSBA)
  - South Africa's National Biodiversity Strategy and Action Plan (NBSAP)
  - Red Data Species Listings according to IUCN categories at a National level, e.g. Birds; Mammals; Frogs; Butterflies, etc.

- The Western Cape Nature Conservation Ordinance No. 19 of 1974 lists in Schedule 2, under Protected Wild Animals – "All bats except Fruit Bats of the family PTEROPODIDAE";
- General Provincial Biodiversity Guidelines and Conservation Plans;
- Permits for capturing and releasing of bats, transporting bats, and conducting scientific research on bats are required by the Provincial Authorities.

5.6.2 Bat Monitoring Results Summary

The methodology for the bat monitoring consisted of a desktop review of literature and legislation, 12 months of fieldwork, data analysis and report writing. The fieldwork consisted of static ultrasonic monitoring, roost surveys, driven transect surveys and live trapping and release. Seventeen static monitoring sites were set up in mid July 2013 and the fieldwork ran from mid-July 2013 to mid-July 2014, with 95 % of the possible nights and hours of recording time over the year over the total monitoring stations being successful.

Of the 14 potentially occurring bat species at Umsinde, six have been confirmed for the site and two additional ones suspected based on call structure or evidence of night roosts - *Miniopterus natalensis*, *Tadarida aegyptiaca, Rhinolophus clivosis, Rhinolophus capensis, Cistugo lesueri, Eptisicus hottentotus, Neoromicia capensis* and *Nycteris thebaica*.

The annual average bat passes per date for Umsinde Emoyeni WEF was 29.1 bat passes/ date at 10m and 8.6 bat passes/ date at 60 m. The annual average bat passes per hour for Umsinde Emoyeni WEF was 2.4 bat passes/ hour at 10 m and 0.7 bat passes/ hour at 60 m. There is approximately 71 % less activity at 60 m compared with at 10m.

Most bat activity seems to occur in the lower lying warmer areas of the site (less than ±1450 m), with bats being found along the higher ridge areas only during warmer periods. Whilst average activity ranged between 3 and 158 bat passes/ date at the various stations at 10m and 60m respectively, over 500 bat passes/ date at TB13, over 700 bat passes/date at TB15, over a 1000 bats passes/ date at TB8, over 40 bat passes/ date at TB10 top and over 150 bat passes/ date at TB17 top were experienced on some dates. November and autumn had the most number of nights with these distinct peaks.

There is definitely evidence of seasonal movement or migration events happening. This is particularity evident for Species Group C bats (consisting only of *Miniopterus natalensis*), but Species Group A and B bats also displayed some unexpected activity fluctuations. Autumn and spring and early summer are definitely key activity times at Umsinde both at 10 m and 60 m.

From the activity vs time of night results, the following overall comments can be made:

- In winter there is generally lower activity, however, there is a distinct peak in activity from sunset for approximately two hours.
- In spring, bat activity definitely increases from winter and there is a peak of activity from sunset for approximately 3 hours. However, there remains activity throughout the night.
- In summer, activity levels are very similar to spring, except that bat activity remains equally active throughout the night.
- In autumn, there is a peak in activity for Species Group A and B bats after sunset, but bat activity for Species Group C bats remains constant throughout the night.

From the activity vs time of night results, the following overall comments can be made based on data obtained:

- In all seasons, Species Group A bats dominated, with some Species Group B activity.
- There is a more defined peak in activity immediately after sunset for these two groups, however, activity remains throughout the night.
- In Autumn, Species Group C bats are active throughout the night.

80 % of bat activity within the rotor swept zone at Umsinde Emoyeni WEF occurs within wind speeds of less than 7.75 m/s. 80 % of bat activity within the rotor swept zone at Umsinde Emoyeni WEF occurs within temperatures of greater than 13.38 °C.

Six confirmed and 14 potential bat roosts were located at Umsinde Emoyeni WEF. The roost types that were identified included house roof and tree roosts, rock overhangs in the gorges and small caves/ overhangs in the rocky outcrops. There seems to be a *Miniopterus natalensis* roost very close to mast TB 13, under a large inaccessible overhang in a deep gorge. Other species of bat could also be roosting in the gorge.

Transect surveys confirmed what the static monitoring stations had revealed, that bat activity is highest in the lower valley and ravine areas. Bats are using these areas to forage and as movement corridors.

5.7 Wetlands and Freshwater

The grid site boundary extends over three quaternary catchments, namely L21A, L21b & L21C (Figure 5.3). Several main stem rivers are found within these catchments which form part of the Brak River. These tributaries include:

- Skietkuilspruit;
- Brak River;
- Snynderskraal River;
- Buffels River; and
- Several unknown tributaries.

The proposed development from an aquatic vegetation point of view is dominated by species associated with the Nama Karoo vegetation ecosystem. These systems are thus usually devoid of any trees with strict riparian or wetland affiliations and this is due to the largely ephemeral nature of the rivers / water courses within the region. However the larger systems, such as those listed above have a higher Mean Annual Runoff and thus contain a woody layer component within the riparian floodplain areas which are dominated by *Acacia karoo*, *Searsia lanceolata* and *Combretum* species.

Based on the 6 levels of the National Wetland Classification System, these systems are typical of Inland Systems (Level 1), within the Drought Corridor Ecoregion (Level 2).

Wetland landscape units (Level 3) were thus valley floors (riparian / palustrine) or un-channelled valley bottom hydrogeomorphic units (Level 4). Several of these have been indicated in the National Wetland Inventory, however upon closer inspection during the

site visit and the National Freshwater Priority Ecosystems Areas (NFEPA) database (Nel *et al*. 2011) most of the indicated wetlands are man-made systems.

Within the remaining waterbodies, the low annual rainfall within the region the water courses infrequently contain any surface runoff or open water (Level 5), but would remain important habitat or refugia within a landscape when flowing or inundated. These were thus classified as riverine drainage lines, alluvial river beds and small to medium sized water courses.

5.7.1 The Present Ecological State (PES) of the Rivers

The Present Ecological State of a river represents the extent to which it has changed from the reference or near pristine condition (Category A) towards a highly impacted system where there has been an extensive loss of natural habit and biota, as well as ecosystem functioning (Category E).

The national Present Ecological Score or PES scores have been revised for the country and based on the new models, aspects of functional importance as well as direct and indirect impacts have been included. The new PES system also incorporates EI (Ecological Importance) and ES (Ecological Sensitivity) separately as opposed to EIS (Ecological Importance and Sensitivity) in the old model. Although the new model is still heavily centred on rating rivers using broad fish, invertebrate, riparian vegetation and water quality indicators. The Recommended Ecological Category (REC) is still contained within the new models, with the default REC being B, when little or no information is available to assess the system or when only one of the above mentioned parameters is assessed or then overall PES is rated between a C or D.

Table 5.1: The Present Ecological State scores (PES) for the drainage lines and the rivers in the study area were rated as follows (DWS, 2014 – where C = Moderately Modified & B = Largely Modified)

Subquaternary Catchment Number	Present Ecological State	Ecological Importance	Ecological Sensitivity
6621	C	Moderate	Moderate
6748	D	Moderate	Moderate
6756	C	Moderate	Moderate
6810	C	High	Moderate

It is thus evident that the study area systems are largely functional, however significant impacts as a result of current land use practices and alien trees (e.g. *Salix babylonica*) do occur. This was confirmed for each of the affected reaches located within the development footprint. In other words, the systems observed are natural, with small or narrow riparian zones, dominated by *Searsia lancea* and *Vachellia karroo.* The only obligate species observed include small areas of *Juncus rigidus* and *Phragmites australis* associated with small pools created by road culverts found throughout the study area.

The present day impacts have affected the Ecological Importance (EI) and Ecological Sensitivity (ES) of these systems, with most being rated as Moderate (EI & ES).

The only exception being Sub-Quaternary Catchment, 6810 (L21D), where EI was rated as High. This was due to the importance of this catchment in being a Fish Corridor and containing downstream habitat for the various listed fish species discussed above, i.e. high scores for fish rarity metrics for this catchment.

5.8 Avifauna

A desktop assessment and 12 month monitoring programme was conducted on the Umsinde Emoyeni WEF site, which covers the eastern area of the proposed grid connection site. In addition, the 12 month monitoring report conducted by Smallie (2014) for the Ishwati Emoyeni WEF site, which covers the balance of the proposed grid connection site was added to the desktop assessment. Therefore the baseline study covers the entire grid site.

5.8.1 Desktop Assessment

5.8.1.1 SABAP 1 AND SABAP 2

The South African Bird Atlas Project 1 (SABAP 1) data was collected over an 11 year period between 1986 and 1997 and remains the best long term data set on bird distribution and abundance available in South Africa at present. These data were collected in quarter degree squares, with the WEF site covering the following squares: 3123DB, 3123DD, 3124CA and 3124CC. Within these squares, the total number of all species recorded varied from 91 to 171. Square 3123DD covered the majority of the WEF site, and also had the highest number of cards submitted and the most records of priority species. Overall, the SABAP1 project recorded a total of 194 species including 28 priority species and 17 red data species as well as 24 endemic or near-endemic species[2] for the area.

White Stork is afforded protection internationally under the Bonn Convention on Migratory Species and was recorded in square 3124CA. Report rates are essentially percentages of the number of times a species was recorded in the square, divided by the number of times that square was counted (i.e. the number of cards submitted). It is important to note that these species may have been recorded anywhere within in the entire quarter degree square in each case and may not necessarily have been recorded on the WEF site.

SABAP 2 is part of an ongoing study by the Animal Demography Unit at the University of Cape Town. SABAP2 data were examined for surveyed pentads in the study area. Pentads are roughly 8 km x 8 km squares, and smaller than the squares used in SABAP1. The following pentads were examined: 3155_2350; 3150_2350; 3145_2345; 3140_2350; 3140_2400; 3145_2400; 3150_2400; 3155_2400; and 3155_2355. A total of 176 species were recorded, including 22 priority species, 11 red data species and 22 endemic or near-endemic species. SABAP2 recorded 15 species that were not recorded by SABAP1; including Southern Black Korhaan (a priority species) that had been split from the Black Korhaan since the SABAP1 project. Both Northern and Southern Black Korhaan have been recorded in the area by SABAP2. It is important to note that these species were recorded in the entire pentad, and in some cases may not necessarily have been recorded on the WEF site.

5.8.1.2 Coordinated Waterbird Count (CWAC)

Coordinated Waterbird Counts are conducted at least six-monthly since 1992 on over 400 wetlands in South Africa organised by the Animal Demography Unit. These counts therefore provide a good indication of the potential occurrence of waterbirds in an area. The nearest CWAC site is Nqweba Dam which is located approximately 49 km to the south east of the WEF site, near Graaff-Reinet. This dam is counted regularly and 19 cards have been submitted with 59 species identified of which six were priority species. Twelve species were recorded during CWAC counts that were not recorded by SABAP1 or SABAP2, including two regional red data species, Maccoa Duck (*Near-threatened*) and Caspian Tern (*Vulnerable*) as well as Marsh Owl, a priority species.

[2] Endemic or near endemic (i.e. ~70% or more of population in RSA) to South Africa (not southern Africa as in field guides) or endemic to South Africa, Lesotho and Swaziland. Taken from BirdLife South Africa Checklist of Birds in South Africa, 2014.

Twenty cards have been submitted for Kriegerspoort Dam, which is located approximately 70 km to the north east of the WEF site, 34 species were recorded. The numbers of individuals recorded is not publically available. Of these species, three were priority species including a regional red data species, Pink-backed Pelican (*Vulnerable*) which was not recorded by SABAP1 or SABAP2 data considered above for the WEF site. It is considered highly unlikely that this species would utilise or pass through the WEF site.

Both CWAC dams are located in Important Bird Areas: Nqweba Dam is located within the Karoo Nature Reserve (IBA code: SA090) and Kriegerspoort Dam is located within the Platberg-Karoo conservancy (IBA code: SA037).

5.8.1.3 Important Bird Area project (IBA)

Two IBAs are located within 50 km of the WEF site: the Karoo Nature Reserve (IBA code: SA090) and the Platberg-Karoo conservancy (IBA code: SA037).

5.8.1.4 Karoo Nature Reserve

The Birds in Reserves Project of the Animal Demography Unit has recorded 175 species within this IBA. 18 priority species were recorded of which three were not captured by SABAP2, namely Lanner Falcon, Lesser Kestrel and Denham's Bustard.

5.8.1.5 Platberg-Karoo Conservancy

This IBA holds important populations of two globally threatened species, the Lesser Kestrel and the Blue Crane. The Karoo population of Blue Crane is the only strong population remaining on natural vegetation in southern Africa. Other important species within the IBA include Martial Eagle, Kori Bustard, Ludwig's Bustard, Black Harrier, Pallid Harrier, Black Stork, Blue Korhaan, Greater Flamingo, Secretarybird, South African Shelduck, and Lanner Falcon (Barnes 1998).

5.8.1.6 Avifaunal Impact Assessment for the Proposed Ishwati Emoyeni WEF (Smallie, 2014)

An avifaunal pre-construction monitoring survey and impact assessment for the proposed Ishwati Emoyeni WEF was conducted by Smallie (2014).

The avifaunal study included four seasonal surveys across a 12 month period and recorded 181 bird species. Winter surveys recorded the lowest number of species, 96, while the most species, 162 were recorded in spring. Of the total 181 species recorded, 25 priority species were observed. Importantly however, the following power line collision or electrocution prone species were identified as being at risk and/or were recorded in relative abundance: Blue Crane, Ludwig's Bustard, Kori Bustard, Karoo Korhaan, Jackal Buzzard, Verreaux's Eagle and Booted Eagle. An active Verreaux's Eagle nest was located by Smallie (2014) at 31°43'39.50"S; 23°40'44.07"E.

During the scoping phase for the proposed Ishwati Emoyeni project, comments made by I&APs highlighted that the Badsfontein Dam, located about 13 km from the most western proposed turbine string of the Umsinde Emoyeni WEF Phase 2, may be an important stopover point for birds, such as flamingos and other migratory species. It was also noted that Pectoral Sandpiper may be an occasional visitor to the dam. The Badsfontein dam was monitored by Smallie (2014) and was found to have higher densities of water-associated bird species than the broader area. A wetland count was also conducted by Arcus at Badsfontein dam during the 12 month pre-construction bird surveys.

5.8.2 12 Month Pre-Construction Monitoring Results

5.8.2.1 Species Summaries Seasonal Surveys

A combined total of 181 species was recorded in and around the WEF and control sites during the four seasonal surveys. This includes 29 priority species and 28 South African endemic or near endemic species. A total of 13 red data species were observed across all four surveys (Table 5.2), including three species listed as regionally *Endangered*, four as *Vulnerable* and six as *Near-threatened* (Taylor 2015).

Table 5.2: Red Data Species Recorded During Four Seasonal Surveys on the WEF and Control Site

Species	Red Data Status (Taylor, 2015)
Black Harrier	Endangered
Ludwig's Bustard	Endangered
Martial Eagle	Endangered
Lanner Falcon	Vulnerable
Secretarybird	Vulnerable
Southern Black Korhaan	Vulnerable
Verreauxs' Eagle	Vulnerable
African Rock Pipit	Near-threatened
Blue Crane	Near-threatened
Double-banded Courser	Near-threatened
Greater Flamingo	Near-threatened
Karoo Korhaan	Near-threatened
Kori Bustard	Near-threatened

Generally the highest diversities and abundances of small passerine species were restricted to drainage lines, particularly where relatively dense riparian scrub habitat existed. The open plains and plateaux were frequented mainly by larks, pipits, chats, bustards and korhaans. Waterbirds were concentrated around farm dams and raptors were generally observed flying over all habitat types. Key foraging areas for raptor species such as Verreaux's Eagle, Jackal Buzzard and Rock Kestrel were generally observed along cliff faces at higher altitude VPs, with flight paths often occurring along ridgelines. In contrast, Blue Crane, korhaans and bustards were observed foraging on the lower altitude plains, especially in the south of the WEF site. Large flocks of Blue Crane seem to forage in the area, especially during winter and near the cultivated fields on the WEF site's southern border. Birds of the family *Corvidae* (crows and ravens) were abundant with White-necked Raven, in particular, being one of the most regularly observed larger species.

Verreaux's Eagle is a species of concern to the proposed development and was observed across the site in high abundance with more than one pair being observed at a time on several occasions and up to 6 individuals being seen at the same time. Similarly, Blue Crane was regularly observed in large numbers within and around the WEF site.

Key findings from the four seasonal surveys can be summarised as follows:

- 181 species were identified;
- 29 priority species;
- 28 South African endemic or near endemic species;
- The overall average ± SD passage rate for the WEF was 0.97 ± 2.02 target birds per hour of observation;
- Raptors constituted the majority of flight paths recorded within the WEF, with Verreaux's Eagle being the most commonly recorded vantage point target species;

- A total of 472 flights and 665 individuals of 23 different priority species were recorded on the WEF site. 252 (53.4 %) of these flights were by Verreaux's Eagle. This red data species is listed as *Vulnerable* (Taylor 2015);
- Flat open areas were utilised by relatively high numbers of terrestrial species such as the red data Blue Crane, Southern Black Korhaan, Karoo Korhaan and Ludwig's Bustard;
- Blue Crane accounted for 17.8 % of the total number of incidental observations and 39 % of the total number of incidentally recorded individuals and Karoo Korhaan accounted for 24.7 % of the total number of incidental observations and 17.4 % of the total number of incidentally recorded individuals in the WEF site;
- While Blue Crane, Karoo Korhaan, Ludwig's Bustard and Southern and Northern Black Korhaan were encountered regularly as incidental observations they are not well represented in flight path surveys, with Blue Crane accounting for only 6.5 % and Karoo Korhaan accounting for only 2.9 % of the total number of flight paths recorded in the WEF site; and
- Observations within the control site were also dominated by flight path records of Verreaux's Eagle.

5.8.2.2 Nest Survey Species Summary

The most important findings of the nest surveys were:

- 21 active Verreaux's Eagle nests, of which five are situated within the WEF site boundary;
- One active Martial Eagle nest outside the WEF site approximately 3.2 km from the site boundary to the west;
- Seven Jackal Buzzard nest sites, five of which are situated within the WEF site.
- 22 Rock Kestrel nest sites, seven of which are situated within the WEF site;
- One Rufous-breasted Sparrowhawk nest situated within the WEF site;
- One Pale Chanting Goshawk nest situated within the WEF site;
- One Peregrine Falcon nest situated outside the WEF site; and
- The most extensive and suitable cliff nesting habitat/s are situated on the periphery of the WEF and concentrated in the south and east of the WEF site.

5.8.3 Avifaunal Community Summary

The avifaunal community in the area was estimated by combining all available records of birds in the area (Section 5.8.1) with the conducted surveys (Section 5.8.2). These data sources report a combined total of 240 species, including 33 priority species and 33 endemic or near-endemic species. Seventeen species with red data status have been recorded and are therefore likely to at some stage be present on the proposed development.

They include the following red data species: Ludwig's Bustard (*Endangered*), African Marsh Harrier (*Endangered*), Martial Eagle (*Endangered*), Black Harrier (*Endangered*), Double-banded Courser (*Near-threatened*), Greater Flamingo (*Near-threatened*), Karoo Korhaan (*Near-threatened*), African Rock Pipit (*Near-threatened*), Kori Bustard (*Near-threatened*), European Roller (*Near-threatened*), Blue Crane (*Near-threatened*), Verreaux's Eagle (*Vulnerable*), Lanner Falcon (*Vulnerable*), Black Stork (*Vulnerable*), Southern Black Korhaan (*Vulnerable*), Secretarybird (*Vulnerable*) and Blue Korhaan (*Least Concern*).

5.8.4 Discussion

Overall the baseline environment in terms of avifauna at the proposed grid connection site was found to be varied and diverse and typical for the habitat types in the region.

The combined avifaunal community which potentially exists on the proposed grid connection site comprises up to 240 species, including 33 priority species, 33 endemic or near-endemic species and 17 red data species. During the 12 months of monitoring 181 of these 240 species were recorded in and around the WEF and control sites, including 29 of the 33 priority species, 28 of the 33 South African endemic or near-endemic species, and 13 of the 17 red data species.

These three figures are all high, when compared with the specialist's experience on other WEF sites in South Africa. This is likely due in part to the high monitoring effort (i.e. person hours spent on site), the large area surveyed during the monitoring, as well as the varied habitats and bird micro-habitats existing throughout the areas covered by the WEF site. However, it is not only the presence (or potential presence) of certain species on a WEF site that is important, but also the abundance of those species as well as their behaviour.

Of the 13 red data species recorded, four (Blue Crane, Verreaux's Eagle, Southern Black Korhaan and Karoo Korhaan) were found to have a moderate to high abundance on the WEF site, and of these only Verreaux's Eagle recorded relatively high to very high flight activity. Therefore, when considering the potential impacts of the proposed development, these species were most important.

Verreaux's Eagle were found to be abundant, widespread and relatively active across the WEF site, and particularly in the south of the site, along prominent ridgelines and near to nest sites. It would be important to afford this species protection by not placing turbines in areas of high recorded flight activity, as well as avoiding prominent ridgelines. Further protection will also be gained by enforcing a strict no-go buffer for turbine placement around the identified Verreaux's Eagle nests.

The density (approximately 1 pair/57 km^2) of the Verreaux's Eagle population of the WEF site and it's surrounds is broadly comparable with other relatively high density populations of this species studied in other parts of the region (e.g. Nuweveld escarpment, Beaufort West: mean density 1 pair/24 km^2, Cederberg, W Cape: mean inter-pair distance 4.7 km (n = 22, range 3.4 - 7.2 km), Sandveld, W Cape: mean inter-pair distance 5.8 km (n = 24, range 1.6 - 15.2 km) – M. Murgatroyd, Jenkins 2014: Pers. comm.). As such, this population, together with the Martial Eagle pair located to the west of the WEF site, represent an important biodiversity asset of the site, and are likely to be important components of the local ecology.

Blue Crane were found across the WEF site, although large flocks were concentrated in the south and near to cultivated lands. Buffering of these cultivated lands should afford protection to this species, and the location of the proposed WEF phases in the most part avoid the areas favoured by this species (particularly the large flocks). The majority of this species flights were below RSH.

Martial Eagle activity was generally infrequently recorded on the WEF site, with a total of seven recorded flights over the 12 month survey period. However, it remains an important species as it is Endangered and is scarce outside of protected areas with the population in the Eastern, Western and Northern Cape approximately 100-150 birds (< 1 bird / 5000 km2) (Hockey *et al.* 2005). Its average breeding territory in north east South Africa is 130-150 km^2 and at least 280 km^2 in the Nama Karoo and Namibia (Hockey *et al.* 2005) while inter-nest distances in the central Karoo average about 15 km (Boshoff 1993; Machange *et al.* 2005). These large territories show that this is a wide ranging species. It's also important to note that this species is monogamous and the pair bond is often maintained over several seasons, regularly re-using and breeding at the same nest site. The active nest site located will need to be appropriately buffered.

Of the two korhaan species recorded flying, only Karoo Korhaan was regularly recorded flying on site, and the vast majority of flights were below RSH, and therefore this species

is considered to be more at risk from power line collisions and disturbance than from turbine collisions.

High numbers of various waterbird and waterfowl species were observed at the various dams surveyed. This shows the importance of farm dams for avifauna in the area, and these features have been buffered accordingly. It was also considered that there would be movement of these species across the WEF site, from dam to dam. VP monitoring did not pick up high levels of waterbird/waterfowl movements, with only flights of Egyptian Goose and South African Shelduck being recorded with some regularity, and no clear 'fly ways' could be identified. However, it is important to note that many of these species fly before dawn and after dusk, and may these nocturnal and crepuscular movements may have been missed. This has been considered in the impact assessment in Section 5.

Although not a red data species or a priority species, the Rock Kestrel population of the area was substantial. The Avisense survey team found pairs of this species "apparently and definitely" resident on most of the cliffs that were surveyed. The total nest sites for this species is therefore only a sample of the population present, given that there were many small cliffs in the area that were not visited. This species has been known to collide with turbines in South Africa and is therefore potentially at risk.

5.9 Soil, Land use, Land Capability and Agricultural Potential

The geology of the area is characterised by the mudstones and sandstones of the Beaufort Group, creating a gently undulating to flat landscape which is typical of the Karoo. Dolerite dykes and sills exist, which intrude the Beaufort sedimentary formations, and are more resistant to erosion, creating the scenic ridges and koppies of the area, which in turn are more visually sensitive. The topography is a reflection of the geology of the area, with flattish plains often interspersed by flat-topped dolerite koppies. The western portion of the proposed development site is more low-lying, than the eastern side. The altitude varies between 1200 m and 1900 m above mean sea level from west to east elevation with these higher areas being more exposed to wind, and at the same time more visually exposed.

The Brak River is the principal watercourse on the proposed development site, running through the far western part. A number of tributaries of the Brak River also flow through the proposed development site, namely:

- Skietkuilspruit (far western part of the grid site);
- Snynderskraal River (eastern part of the grid site, to the west of the WEF boundary);
- Buffels River (from east to west through the southern part of the WEF site);
- Bakensklip (from east to west, through the northern part of the WEF site); and
- Several unnamed tributaries.

5.9.1 Land Use/ Type

The majority of the site is characterised by a land use dominated by extensive sheep grazing with small occurrences, generally to the south, of crop production in alluvial deposits in drainage features. The soils are generally shallow and the annual rainfall is low (approximately 300 mm) and erratic. The farms tend to be large in area in order to be viable for sheep farming, with farmsteads being on average 5 to 10 km apart. Some farms provide guest accommodation, such as Ratelfontein to the north, which is a large game farm, and Badsfontein to the west. Recreational and tourism activities include hunting, horse-riding and 4x4 trails.

No National Parks or nature reserves occur in the proposed development site and immediate surrounding area. The closest settlements are Murraysburg, approximately 7 km away and Richmond, 30 km away.

The N1 national road passes through the far western part of the proposed development Site, in a southwest-northeast orientation, where it intersects the R63 regional route. The R63 runs from Victoria West (to the northwest) to Graaff-Reinet (to the southeast) through Murraysburg and passes through the southern part of the proposed development site. Three other minor local roads pass through the proposed development site in a northerly direction towards Richmond; one to the west of the WEF Site, one through the centre of the WEF Site and one which passes in and out of the eastern WEF Site.

A land type maps is provided in Figure 5.4.

The site falls predominantly into the Fc131 and Da147 land types with the Fb488, Fc402, Ia94, Ib126, Ib262 and Ib397 land types having a limited occurrence[3].

A brief description of the land types, in terms of soils, land capability, land use and agricultural potential, follows:

5.9.1.1 Land Type Fc131

Land Type: Fc land types denote areas that are dominated by pedologically[4] young landscapes with lithocutanic B[5] horizons and lime in all landscape positions.

Soils: Mainly shallow and rocky soils in upland and midslope positions with a variety of structured to apedal soils of moderate to shallow depth in footslope and valley bottom positions – most containing lime. Duplex and pedologically young soils dominate in these positions with the exception of dolerite outcrops where more stable structured soils occur.

Land capability and land use: Land use is limited to extensive sheep grazing with small occurrences of crop production in alluvial deposits in drainage features. The land capability mimics the land use.

Agricultural potential: The agricultural potential is linked to the soil depth and the bulk of the land type is therefore of low to very low crop production potential (land capability classes VII and VIII). The soils are suited to extensive grazing only as the soils are shallow and the rainfall is low (around 300 mm per year – Figure 9.5) and erratic.

5.9.1.2 Land Type Da147

Land Type: Da land types denote areas where duplex soils with red B horizons dominate.

Soils: Mainly variable depth duplex soils throughout the landscape with hills being dominated by rocky soils and rock outcrops.

Land capability and land use: Land use is limited to extensive sheep grazing with small occurrences of crop production in alluvial deposits in drainage features. The land capability mimics the land use.

Agricultural potential: The agricultural potential is linked to the soil depth and the bulk of the land type is therefore of low crop production potential (land capability classes VII and VIII). The soils are suited to extensive grazing only due the low and erratic rainfall (around 300 mm per year). Irrigated crop production is possible where adequate water resources are available but these land uses require very intensive management in duplex soil environments.

[3] LAND TYPE SURVEY STAFF. (1972 – 2006). Land Types of South Africa: Digital map (1:250 000 scale) and soil inventory databases. ARC-Institute for Soil, Climate and Water, Pretoria.

[4] Pedology is the study of soils.

[5] Lithocutanic B is a specific type of soil (Soils of South Africa, Fey. M 2010)

5.9.1.3 Land Type Fc402

The Fc402 land type is similar to the Fc131 land type with the difference that structured soils dominate throughout.

5.9.1.4 Land Type Ia94

Soils: Mainly pedologically young soils derived from alluvium in footslope and valley bottom positions. Lime occurs throughout.

Land capability and land use: Land use ranges from grazing through dryland agriculture to irrigated agriculture.

Agricultural potential: The agricultural potential is linked to the soil depth and large areas are of high potential in the presence of water. In the absence of irrigation water the potential is low and then limited to extensive grazing. Dryland crop production is not possible as the rainfall is too low: in the region of 300 mm per year.

5.9.1.5 Land Types Ib126, Ib262 and Ib262

Soils: Almost exclusively shallow and rocky soils with rock outcrops due to undulating and hilly topography. A range of soils occur to a limited extent in depressions and flatter areas.

Land capability and land use: Land use is limited to extensive grazing.

Agricultural potential: The agricultural potential is very low and limited to extensive grazing sheep production (land capability classes VII and VIII). This is due to the shallow and rocky soils as well as the low rainfall.

5.10 Cultural Heritage, Archaeology and Palaeontology

5.10.1 Physical Characteristics

The landscape of the proposed grid connection site is generally only moderately transformed. It contains a wealth of well-preserved archaeological sites; one of the deepest palaeontological sequences in the world, and in later years was the last refuge of the Southern African San before their ancient lifestyle became extinct during settlement of the land by Dutch colonists.

The study area was subject to a 2 week survey by ACO Associates during which time staff worked in the general survey area recording a diversity of heritage sites.

The Karoo geology gives rise to numerous aquifers and fountains which has effectively made this land viable farming country. By the same token the land was habitable for prehistoric people and animals. Ground water in the Great Karoo is usually associated with dolerite dykes and to a lesser extent, sills. Cracks in the Karoo shales along dolerite intrusions serve as aquifers which get topped up by seasonal rains. Intensive borehole pumping and donga formation has lowered the water table in historic times. Many natural fountains no longer flow because of this.

The Karoo is arid or semi-arid with characteristic vegetation that consists of dwarf shrublands and open grasslands (Cowling and Roux 1987). Much of the Karoo has been of high economic value to South Africa. During the last 2 centuries the region has been subjected to intensive sheep grazing, at the expense of indigenous fauna and flora. Many species of indigenous fauna in the Karoo have become depleted as the area is used for the rearing of sheep. The mammalian fauna of the area is, in comparison with that mentioned in historic texts, depleted. Large herds of *Eguus quagga* (quagga), *Connochaetes sp*. (gnu) and *Alcelaphus buselaphus* (hartebeest) no longer exist. The huge herds of trek springbok have been fragmented with the advent of barbed wire fences. Acocks (1953) is of the opinion that the great diversity and mobility of game in the Karoo would have resulted in

diverse grazing habits and so maintained the veld in climax state. The identification of warthog bones from an archaeological site near Richmond (Hart 1989) indicates that at times in the past there was enough grassland during the mini-ice age of 1200-1400 AD to maintain grazing animals.

5.10.2Pre-history and history of the study area

The Karoo has been occupied by people for hundreds of thousands of years. This information is borne out by solid scientific studies by researchers both local and international who have worked in the central interior of the country since the early years of the 20th century. Virtually the entire full range of material evidence of human evolution is manifested in the archaeological sites of this area. To limit the scope of this study and maintain its relevancy, an impression of what the Karoo around the project area was like prior to European settlement is presented in the following historic accounts.

Sir John Barrow journeyed through the Sneeuberg Mountains in 1789 and followed the course of the Seekoei River to the Orange. By the time that Barrow reached the Graaff Reinet district there were no independent "Hottentots" in the area as they were all employed by the Dutch. There was a bitter state of conflict between the colonists and the San of the Karoo. In 1789 it was impossible for a farmer to venture out of his home unarmed less he be attacked by raiding San. In turn the Boers were actively hunting the San by means of *Kommandos* (Barrow 1806, Moodie 1838). Sheep farming, despite the circumstances, was very well entrenched and some farmers were already managing between 3-4000 animals (Barrow 1806). It is of interest to note the Barrow passed directly through the project area mentioning a farm at “Three Fountains”. Today this farm is known as Driefontein, one of the major farms in the project area. Barrow (1801:259) found the plains of the Great Karoo covered with countless herds of wildebeest, eland, springbok, hartebeest and quagga. Carnivores also abounded. Interestingly, within the project area farms that Barrow mentions in his travels were all informally occupied with the first formal granting of land Middelvaly (Middelvei) being granted in 1828 (Deeds Office 10/1928).

In 1812 William Burchell crossed into the Great Karoo on his journey to the border of the colony from the Kuruman district. He too would have passed through, or very close to the study area south of the Kompasberg. He was the last person to encounter the last free groups of indigenous San people. He travelled over many miles of Karoo and wrote one of the most detailed accounts available. While travelling somewhere between where De Aar and Hanover are today in the summer of 1812 Burchell crossed several huge plains where no true grasses were seen except for "Cyperus usitatus” intermingled in various places with low bushes such “*as are generally met within the lands partaking of the nature of the Karoo* (Burchell 1822; Vii :71)." As the party penetrated deeper into the colony towards the Agtersneeuberge the amount of grasses increased and many new species of bush were seen. Somewhere between present day Hanover and Richmond Burchell found himself on a huge plain where large herds of springbok and wildebeest were grazing. The plain was covered with low bushes not more than nine inches high and mat rushes grew in abundance along the banks of the Seekoei River (Burchell 1822, vii: 79) as he approached the project area. Once in the colony, a much frequented road lay along the Seekoei River (a source of permanent water which became a travellers corridor) which serviced the needs of the transhumant *trekboers*.

Burchell makes mention of people he met while on his journey from the Orange River to the colony. The Khoekhoen group, the "Koras" (sometimes known as the Koranas) were at that time, encamped along the banks of the Orange River (Burchell 1822; Vii: 6-7) where they were keeping cattle and sheep. 'Bushmen' were only seen in the central Karoo. Burchell made contact with these people with the help of a “half bushman” acting as an interpreter. *Kaabi,* a bushman, eventually led Burchell to a kraal of some people that he knew. Burchell took this as an act of friendship as the 'Bushmen' concealed the position of

their kraals from the colonists. The kraal was situated on the summit of a ridge and consisted of "*half a dozen wretched worn huts*" (Burchell 1822; Vii: 27). This kraal, according to Burchell was a melancholy picture of poverty which inspired him to depart with liberal quantities of tobacco and meat.

Once Burchell entered the colony no more kraals were seen so it was quite clear that by 1812 indigenous people were only to be found beyond the borders of the colony in what is now the Northern Cape. The area south of Colesberg had been cleared and occupied by the colonists even though by that time very little land had been formally granted.

The demise of the indigenous peoples of the Karoo came with the advent of European farmers. In 1770 a war of attrition lasting some 40 years began. Reports came back to the Cape that the colonists were being raided by San who were making forays from places of refuge in the mountains onto farms. By 1774 the situation became so serious that many of the trekboer farmers of the Eastern Karoo were abandoning their farms. Calls for assistance were made to the Cape, while on the war front intensified *kommando* activity began to take place. The *kommando* was an informal detachment of *freeburgers* and armed Hottentots who actively hunted out the marauding San with the blessing of the government. The notorious actions of the veld cornet Adriaan van Jaarsveld resulted in the slaying of scores of San with 120 people being killed in a single incident (Moodie 1838; viii: 43). Accounts in Moodie's Record (1838) indicate that the colonists were facing a united front of unprecedented San resistance in 1776. In 1777 legislation passed at the Cape opened the way for the formal annihilation of the San. By the time that Burchell had passed through the region in 1812, very few San were seen.

The formal granting of farms to wandering *trekboers* saw the vast landscapes of the Karoo partitioned in 5000 morgen allocations (Sampson, Sampson and Neville 1994). These were situated close to fountains and in the best grazing land. Indigenous people were increasingly marginalised onto the few remaining patches of as yet unclaimed land. Deprived of the ability to hunt (by the early 1800's the game herds had been shot out) and with traditional social structures disrupted they had little choice but to seek work on farms or settle at mission stations established for their emancipation (Sampson, Sampson and Neville 1994). A life-style thousands of years old ended, however the archaeological heritage that has survived is prolific and is manifested in the form of thousands of archaeological sites.

5.10.3 The Karoo as a Cultural Landscape

The central Karoo is almost entirely given over to sheep and game farming. Overgrazing since the advent of formal farming in the 19th century has caused some changes to the landscape in terms of the composition of vegetation. Acocks (1953) has claimed that pure grass veld gave way to Karoo scrub only after livestock was introduced; however it is apparent that rainfall fluctuation does cause seasonal and even cyclical oscillations with respect to prevalence of Karoo scrub versus grasslands.

Overall, the damage caused by modern surface development has been slight. To all intents and purposes the project area has the qualities of an intact natural area, which on a world scale is fast becoming a rare resource. In areas where transformation has taken place – sheet erosion and donga formation has had an impact. The settlements and farms represent a comparatively ephemeral imposition of the landscape of colonial settlement. The flood zones of major water courses have been transformed by agriculture. Aside from these comparatively moderate interventions the Karoo remains dominated by its wilderness qualities. Indications are that this situation is changing: there are numerous proposals for the establishments of renewable energy facilities which will have a significant impact in terms of industrialisation of the landscape, there is a possibility of *fracking* taking place, as well as the construction of the Square Kilometer Array, will accumulatively add a significant

21st century development layer that will significantly impact the status-quo and probably irreversibly.

The heritage of the Karoo is essentially a series of layers of events (or landscapes) that has become superimposed on the land surface. The earliest of these is the Karoo palaeontology – an ancient landscape that was deposited as a result of a vast inland sea. The shores and swamps of this landscape abounded with ancient species of fish, plants, invertebrates and early mammal-like reptiles. After the breakup of Gondwanaland the Karoo took on the geology that has resulted in its particular character. Millions of years later it was home to successions of early human occupation. Stone Age occupations of the Early, Middle and Later Stone age left half a million years of human made debris on the land surface. Superimposed on the Karoo landscape one more is the history of European colonisation and the wars that went with it.

The overall project area is highly scenic, comprising of varied topography, ranging from high dolerite plateaus, ridges, canyons and plains. Overall a landscape quality grading of 3A – 3B is warranted.

The project area is located in the high Karoo 25 km north of the lip of the Escarpment at its closest point. Here the landscape is hilly, if not mountainous in places. Within the project area is a smaller escarpment where mudstone flats and incised canyons in the east give rise to a high sill of fragmented dolerite - very rough snow adapted country (altitude 14-1500 m asl) strewn with loose dolerite scree. Several river systems run off this plateaux flowing through deeply incised gullies and canyons converging just west of Murraysburg forming the Kareedo River which plunges over the Great Escarpment and flows over the Plains of Camdeboo just west of Aberdeen.

The high dolerite strewn country is not hospitable – the extremely stony land surface makes walking anywhere tortuous, the few existing roads into the area being equally difficult to negotiate. The spatial patterning of both archaeological sites and historic farms reveal that people preferred to settle away from the high dolerite country close to more arable land in valley floors or the flats to the east. The inhospitable high country is exposed and has high wind speeds.

5.10.4 The Palaeontological Landscape

The Karoo is to all intents and purposes is a massive palaeontological landscape consisting of multiple layers of sediments that contain a vast array of fossils ranging from fish, early vertebrates, plant remains and trace fossils. It is considered to be one of the most complete fossil repositories on the planet. Generally the Karoo fossils predate the age of the life forms popularly known as *dinosaurs* by some scores of millions of years. The vertebrates of these times are known as early mammal-like reptiles which were ancestral to dinosaurs, hence the Karoo palaeontological sequence has contributed on a world scale to understanding the development of life forms on the planet. The project area lies in the heart of one of the most fossiliferous areas of the Karoo.

The geology and paleontology of the region has been a subject of research since the early 20th century. The flat plains of the Nama Karoo are underlain by a series of shale and mudstone strata which represent some 400 million years of depositional events (Visser 1986). The basal rocks of the Karoo sequence are known as the Dwyka formation which was deposited by a wet based glacier during the Permo-Carboniferous glaciation. This was followed by the deposition of the Ecca formation which is made up of sediments deposited in a shallow lake that covered what is now the interior of Southern Africa. Ecca shales form many of the large flat plains of the Northern Karoo (Truswell 1977; Visser 1986). The best known depositional event of the Karoo sequence is the laying down of the Beaufort shales about 230 million years ago. These shales are rich in a stratified sequence of fish, reptilian and amphibian remains that lie fossilized in Permian and Triassic period swamp deposits

(Truswell 1977; Visser 1986). At the end of the Triassic period a series of geological upheavals took place with the fragmentation of the Gondwanaland continent. These were largely responsible for giving the Karoo its characteristic landscape. Triassic period volcanic activity took place over an extended period of time beginning at 187 million years ago (Truswell 1977). During this time the horizontal volcanics of the Drakensberg were laid down and the shales of the Karoo were penetrated by dolerite intrusions and extrusions in the form of vertical dykes and horizontal sills following the bedding planes of the shales. These geological structures give rise to a very characteristic topography with general occurrences of mesas, hillocks and sharp ridges (Visser 1986). In the study area extruding dolerite dykes and hillocks exposed through differential erosion are dominant features of the landscape giving rise to the vast flat plains of mudstones dolerite outcrops and hills that are so characteristic of this area. These igneous events resulted in the formation of Hornfels a fine grained black rock with a conchoidal fracture. Hornfels is formed when a dolerite intrusion takes place and bakes the surrounding mudstone to a metamorphic form (Visser 1986). Millions of years later prehistoric peoples enthusiastically exploited hornfels exposures for raw material for making artefacts – a staple resource in the Karoo for hundreds of thousands of years.

The proposed Umsinde Emoyeni WEF project area is largely underlain by Permian fluvial sediments of the Lower Beaufort Group (Karoo Supergroup) that have yielded a wealth of important fossil remains from the Murraysburg region over the past century or more. These include diverse vertebrate fossils of the Late Permian Cistecephalus and Dicynodon Assemblage Zones such as gorgonopsian, therocephalian and cynodont predators as well as small- to large-bodied herbivorous dicynodonts, among others. Recent palaeontological fieldwork confirms that well-preserved fossils belonging to a range of tetrapod groups are present at the surface in a high proportion of sites where Lower Beaufort Group bedrocks are well-exposed. Other fossil groups represented here include concentrations of medium to large vertebrate burrows, low-diversity invertebrate trace fossils and vascular plant remains (e.g. horsetail ferns). The palaeosensitivity of the Umsinde Emoyeni study area is therefore rated as high.

5.10.5 The pre-colonial cultural landscape

A comprehensive survey of a 5000 square kilometre catchment area (the Valley of the Zeekoei River from the Sneeuberg Mountains to the Gariep River Valley) which lies some 20 km north east of the project area revealed the presence of some 10 000 archaeological sites representing a history of human occupation that dates back at least 250 000 years (or more). Of the 10 000 sites recorded and identified to industry (phases), some 6000 were attributable to the Late Stone Age. Sampson identified some 7 industries (phases) of human history within his study area – each of which are legible on the landscape today, and each of which represent a pre-colonial layer of the human history of the Karoo.

The different phases are broadly termed the Early Stone Age and Middle Stone Age. Artefacts of both the Early and Middle Stone Age are widespread and may generally be described as an ancient litter that occurs at a low frequency across the landscape. Where definable scatters of Early and Middle Stone Age material occur, they are considered to be significant heritage sites. More intensive occupation of the Karoo started around 13 000 years ago during the Later Stone Age, which is essentially the heritage of Khoisan groups who lived throughout the region.

The latest phase of occupation of the Great Karoo is a period known as the Late Stone Age. It is a very important layer on the landscape as this represents the heritage of the Khoekhoen (historically known as “Hottentot” by early writers) and San (popularly known as Bushman) people of South Africa. The direct descendants of these groups make up a significant proportion of the population today. This heritage is represented by two industries (phases). These are the Interior Wilton which is characterised by a microlithic

stone artefact industry characterised by lightly patinated hornfels (indurated shale stone) and the later Smithfield industry characterised by specific classes of stone artefacts and the presence of grass tempered ceramics.

The scarcity of natural caves and shelters in the Karoo landscape has resulted in the majority of archaeological sites being open occurrences of stone artefacts, ostrich eggshell fragments and occasionally pottery. Bone remains are rarely preserved in open contexts. Also associated with the Late Stone age of the Karoo are rare rock paintings which occur in the few caves and shelters to be found in the dolerites, however more plentiful are engraved rocks and stones and stone surfaces.

After 1000 years BP (before present) people who were herding sheep/goats and possibly cattle, made an incursion into Karoo and established a new economic order based on transhumant pastoralism (Hart 1989, Sampson *et al.* 1989, Sampson 2010). The presence of herding people is represented by stone walled structures that occur throughout the Karoo. They have been recorded within the Zeekoei River Valley, between De Aar and Victoria West (within this project study area) and even in the inhospitable high Karoo near Sutherland (Hart 2005) and on the West Coast.

The spatial distribution of Late Stone Archaeological sites in the Karoo is quite patterned. People needed to be close to water so rivers, pans and springs played an important role in influencing where people lived. The climate of the Karoo also played a key role. The winters can be extremely cold with temperatures dropping well below zero, made worse by freezing winds. The summers in contrast are harsh, hot and rainfall is unreliable. Sampson has observed that almost all Late Stone Age sites are situated at the bottom of the breaks of dolerite dykes, in sheltered areas on the crests of dolerite dykes, as well as in dolerite mazes and outcrops. So too, are the stone circles and circle complexes built by Khoekhoen groups after 1000 AD which are almost always built on the edges of low ridges and dykes. The higher ridges provided a view, some security, loose stones with which to build kraals and screens and allowed people to be elevated above the frost levels in winter. Definable sites of the Late Stone Age are sparse on the vast flat shale plains as these areas offered little protection from the wind and collect frost in winter. Hence, natural features such as rock outcrops and dolerite dykes played a significant role for Late Stone Age people.

The pre-colonial heritage on the study site consists of occasional open air scatters, several rock shelters, and San rock painting sites. The spatial patterning of the heritage sites indicates that the locations of sites were related to the availability of water sources. Valley bottoms and sides proved to be the most sensitive areas, most of which have been excluded from both Phase 1 and Phase 2 areas. Rock engraving sites were fairly common, including some that appear to be ancient. The range includes very complex patterns, animal forms and mere scribblings. The engravings on dolerite boulders are found throughout the project area. There is one rock painting site in the study area worthy of Grade 2 status.

5.10.6 The landscape of colonial settlement

The indigenous people of Karoo waged a bitter war against colonial expansion as they gradually lost control of their traditional land. Penn (2005) notes the most determined indigenous resistance to *trekboer* expansion occurred when they entered the harsh environment of the escarpment of the interior plateau (namely Hantam, Roggeveld and Nieuweveld Mountains). Similarly *trekboer* settlers find their progress onto the upper escarpment halted as the Sneeuberg close to the project area. San launched an almost successful campaign to drive them out. Numerous place names throughout the Karoo such as Oorlogspoort and Oorlogskloof are testimony the skirmishes of the late 18th century. The situation became so desperate that the colonists fought back by establishing the “Kommando” system – the “hunting” of San was officially sanctioned in 1777 (Dooling 2007) and in some instances bounties were obtainable from the local landrost (on

presentation of body parts). The Drosdy of Graaf Reinett played a significant role in this long and bitter war which eventually saw the almost complete destruction of the Karoo San.

The advent of the early European Settlers into the Great Karoo is one which is largely un-documented. These European pastoralists were highly mobile; trekking between winter and summer grazing on and off the escarpment. Land ownership was informal, and only became regulated after the implementation of the quitrent system of the 19th century used by the Government to control the lives and activities of the farmers.

The Europeans moved onto land associated with water sources or perennial fountains (Westbury and Sampson 1993). Many of the early settlers first attempted to cultivate wheat, and to all accounts were successful at first. Almost all historic ruins of farm houses have associated *traplvloere* – floors where wheat was winnowed in all likelihood for domestic use. The San resisted the presence of the Europeans vigorously – life on the frontiers of the Cape was no easy matter for all parties involved. The San saw their traditional territories and hunting areas diminishing, the vast game herds of the Karoo dwindled. The San used every opportunity to impede the progress of the Europeans by raiding lonely farms, murdering the occupants and stealing stock. The Europeans were allowed by law to shoot San males on sight and take women and children into servitude. By 1770 the Karoo was the furthest frontier of the Cape Colony. By 1820 after the suppression of the San the Karoo was quickly divided into quitrent or loan farms, the process of land seizure from the indigenous inhabitants was formalized through a government regulated process of formal land grants. Even in the early 19th century there were tracts of landscape simply known as “crown land” – much of this was marginal being away from rivers and fountains. It was on these patches of crown land that the last surviving groups of San eked out a meager existence. As the land parcels that were available to them diminished, they found themselves with little option other than to work as herdsmen and servants for the colonists (Sampson, Sampson and Neville 1994, Penn 2004).

The two major regional centers in the area, Beaufort West and Graaf Reinet were established as administrative centers to exert hegemony over the activities of the *Trekboere* who were prone to behave as free agents without governance. Of the two centers, Graaf Reinett, is the oldest being establish under the Dutch rule at the Cape as a legal and administrative center. The town has an extraordinarily colourful history, as being so remote from Cape Town, its citizens were inclined to exert independence to the point that Graaf Reinet was the seat of several rebellions, and for a period a self-proclaimed republic. The appointment of the a firm-handed administrator, Andries Stockenstroom saw the dissent quelled, and ongoing problems for farmers caused by the Sneeuberg San brought to an end by force of arms (Franzen 2006).

Farm houses and structures within the project area are of interest, and at least 5 buildings are worthy of formal grading. These are 19th century farm houses and barns that are of heritage interest graded between 3A and 3B. There are numerous stone kraals and lesser stone features in many areas. Most of the historic farm houses are no longer lived in and are deteriorating. There are also formal and informal cemeteries all situated in alluvial soils.

5.11 Noise Sensitive Receptors

Potentially sensitive receptors, also known as noise-sensitive developments (NSDs), located within or close to the proposed development were identified using Google Earth® during the Scoping Phase. This was supported by a site visit to confirm the status of the identified dwellings. Noise sensitive receptors confirmed during the EIA phase are shown in Figure 5.5.

5.11.1Ambient sound

Ambient (background) noise levels were previously measured at other locations within 150 km of the proposed development, indicating an area with a sound level character typical of a rural area (away from dwellings, plantations, roads and towns), during periods when wind speeds were below 3 m/s. These measurements were considered applicable, as the topography, vegetation and meteorological conditions are similar.

Wind induced noises are normally seen as unwanted noises, with measurements reflecting acoustic interference (due to wind induced noises) normally discarded. However, for the purpose of this study it will be included, as the typical operating noise of the wind energy facility will only be emitted during times when wind induced noise levels are relevant. Site-specific measurements was conducted during the EIA phase and discussed in the following section.

The measurement of ambient sound levels is defined by the South African National Standard SANS 10103:2008 as: "*The measurement and rating of environmental noise with respect to land use, health, annoyance and to speech communication*".

As discussed in the previous section, ambient sound measurements are ideally collected when wind speeds are less than 3 m/s with no measurements collected when wind speeds exceed 5 m/s. Due to the fact that wind energy facilities will only be in operation during periods that the wind is blowing, it is critical that ambient sound level measurements reflect expected sound levels at various wind speeds. Because of the complexity of these measurements the following methodology is followed:

- Compliance with the latest version of SANS 10103;
- The sound measuring equipment was calibrated directly before, and directly after the measurements was collected. In all cases drift[6] was less than 0.2 dBA between these two measurements;
- The measurement equipment made use of a windshield specifically designed for outdoor use during increased wind speeds;
- The areas where measurements were recorded was selected so as to limit the risks of direct impacts by the wind on the microphone;
- Measurements took place in 10-minute bins for at least two full night-time periods;
- Noise data was synchronised with the wind data measured onsite using an anemometer at a 1.5 m height.

Ambient sound levels were measured over a period of 2 nights beginning July 2014 with the locations used to measure ambient (background) sound levels are presented in Figure 5.5.

5.11.2 Measurement Point UEASL01 - (NSD08)

This measurement location was situated in an open field approximately 30 meters from the house (Figure 5.5). The sounds from the house were not audible and the location represents the typical natural sound levels of the area.

While more than 5 m away from the nearby vegetation, large conifers were located in the area and created a constant soft noise (susurration) as the wind blew through the needles. Other sounds that were noted, included bird and insect sounds (soft and infrequent), although the wind induced noises dominated consistently.

Measured $L_{Aeq,i}$ day/night-time data: During the daytime $L_{Aeq,i}$ values ranged from 21.9 to 59.9 dBA. The night-time $L_{Aeq,i}$ values (night-time reference period 22:00 – 06:00) ranged from 26.1 to 55.2 dBA. The daytime mathematical average was 45.8 dBA while

[6] Changes in instrument readings due to a change in altitude (air pressure), temperature and humidity

night-time average was 44.2 dBA. The equivalent daytime sound levels ("average" value over 16 hours) were 46 (afternoon only), 52.2 and 46 (morning only) dBA. The equivalent night-time sound levels ("average" value over 8 hours) were 43.4 and 50.2 dBA. Measured data indicated an area that is relative quiet with natural sounds and wind induced noises impacting on most measurements.

Measured $L_{Aeq,f}$ day/night-time data: During the daytime $L_{Aeq,f}$ values ranged from 20.3 to 56.8 dBA. The night-time $L_{Aeq,f}$ values (night-time reference period 22:00 – 06:00) ranged from 24.9 to 54.8 dBA. The daytime average was 44 dBA while the night-time average was 43 dBA. The equivalent daytime sound levels were 45 (afternoon), 51 and 42 (morning) dBA. Night-time equivalent sound levels were 43 and 50 dBA.

Measured 10-minute $L_{A90,f}$ day/night-time data: L_{A90} is a statistical indicator that describes the noise level that is exceeded 90% of the time and frequently used to define the background sound level. Daytime values ranged from 19 to 54 dBA90 averaging at 38.7 dBA90. The night-time L_{A90} values ranged from 21 to 51 dBA90 (night-time reference period 22:00 – 06:00) averaging at 40 dBA90. Measured L_{A90} data also confirm an area that is generally quiet.

$L_{Aeq,i}$ - $L_{Aeq,f}$ average difference, day/night-time: The average daytime difference between the $L_{Aeq,i}$ and $L_{Aeq,f}$ variables was 1.8 dBA while the night-time average difference was 0.8 dBA. There are therefore very little impulsive noises in the area.

L_{Amax} night-time occurrences: There was only one noise event during the two night-time periods where the sound level exceeded 65 dBA. Night-time maximum noise events may affect sleeping patterns in humans.[7]

Third octave spectral analysis:

Lower frequency (20 – 250 Hz) – Noise sources of significance in this frequency band would include nature (wind especially) and sounds of anthropogenic origin (such as electric motors) and vehicles (engine revolutions). Lower frequencies tend to travel further through the atmosphere than higher frequencies. As with most of the measurements, the measurements reflect significant acoustic energy in these frequency bands. The smoother curves generally relate to higher wind speeds, where sound from the wind could mask the other noises that may be present.

Third octave surrounding the 1000 Hz – This range contains energy mostly associated with human speech (350 Hz – 2,000 Hz; mostly below 1,000 Hz) and dwelling noises (including sounds from larger animals such as cattle, dogs, goats and sheep). While acoustic energy due to wind-induced noise dominates, a few measurements indicate noises from different sources, typical of a rural area. It should be noted that the wind induced noises could also mask other noises in this frequency band.

Higher frequency (2,000 Hz upwards) – Smaller faunal species such as birds, crickets and cicada use this range to communicate and hunt etc. Measurements however indicated very noise sounds in these frequency ranges during the measurement period, likely due to the winter season.

Spectral data analysis concludes that the area has few anthropogenic activities impacting on ambient sound levels with wind-induced noises dominating the ambient soundscape. While elevated sound levels were measured the site can be considered naturally quiet.

SANS 10103 Rating Level: While the area have a rural development character, ambient sound level measurements indicated an area where wind-induced and insect sounds raised the ambient sound levels significantly, more typical of an urban district. The character of

[7] World Health Organization, 2009, '*Night Noise Guidelines for Europe.*

these noises however is very different from urban areas with sounds from natural origin mainly dominating.

5.11.3 Measurement Point UEASL02 – (NSD12)

The measurement location is at an open area approximately 20 meters from the house of the owner. There was an unused chicken pen close to the measurement location. There was no vegetation close to the microphone, although there were large eucalyptus trees close to the house.

The location was very quiet, with wind induced noises dominating.

Measured $L_{Aeq,i}$ day/night-time data: During the daytime **$L_{Aeq,i}$** values ranged from 33.4 to 60.3 dBA. The night-time **$L_{Aeq,i}$** values (night-time reference period 22:00 – 06:00) ranged from 27 to 49.3 dBA. The daytime mathematical average was 45.3 dBA while night-time average was 41.5 dBA. The equivalent daytime sound levels ("average" value over 16 hours) were 47 (afternoon), 49 and 46 (morning) dBA. The equivalent night-time sound levels ("average" value over 8 hours) were 42 and 45 dBA. Measured data indicated an area with elevated sound levels.

Measured $L_{Aeq,f}$ day/night-time data: During the daytime **$L_{Aeq,f}$** values ranged from 30 to 56 dBA. The night-time **$L_{Aeq,f}$** values (night-time reference period 22:00 – 06:00) ranged from 26 to 48.5 dBA. The daytime mathematical average was 43 dBA while night-time average was 40.5 dBA. The equivalent daytime sound levels ("average" value over 16 hours) were 44 (afternoon), 45 and 40 (morning) dBA. The equivalent night-time sound levels ("average" value over 8 hours) were 42 and 44 dBA.

$L_{Aeq,i}$ - $L_{Aeq,f}$ average difference, day/night-time: The average daytime difference between the **$L_{Aeq,i}$** and **$L_{Aeq,f}$** variables was 2.2 dB while the night-time was 1 dB. There are therefore very little impulsive noises in the area.

Measured 10-minute $L_{A90,f}$ day/night-time data: **L_{A90}** is a statistical indicator that describes the noise level that is exceeded 90% of the time and frequently used to define the background sound level. Daytime values ranged from 22 to 48 dBA90 averaging at 38 dBA90. The night-time **L_{A90}** values ranged from 20 to 45 dBA90 (night-time reference period 22:00 – 06:00) averaging at 31.9 dBA90. Measured **L_{A90}** data indicate a noisy area. This is illustrated in **Figure 5-8**.

L_{Amax} night-time occurrences: There were no instances where the sound level exceeded 65 dBA at night. Most people, when exposed to 10 or more noisy events where the maximum sound level exceeds 65 dBA may experience disturbances in sleeping patterns.[8]

Third octave spectral analysis:

Lower frequency (20 – 250 Hz) – As with UEASL01, wind induced noises mainly dominated the low frequency bands.

Third octave surrounding the 1000 Hz band – Wind induced noises did dominate this frequency band, with only a few measurements showing sounds from either animals or people close to the microphone.

Higher frequency (2,000 Hz upwards) – Nothing.

Spectral data analysis concludes that the area has few anthropogenic activities impacting on ambient sound levels with wind-induced noises dominating the ambient soundscape.

[8] World Health Organization, 2009, '*Night Noise Guidelines for Europe.*

5.11.4Ambient Sound Levels – Summary

Considering the results of the ambient sound measurements, the main source of sound was from wind-induced noises. These sounds were prominent during both the day- and night-time periods. While the sound levels were slightly elevated the area is naturally quiet and the SANS 10103 rating levels are typical of a rural noise district.

5.12 Socio-economy

5.12.1 Administrative Context

The proposed WEF is located in the Beaufort West Local Municipality (BWLM) of the Western Cape Province. The BWLM is one of three Local Municipalities that make up the Central Karoo District Municipality (CKDM). The administrative seat of the BWLM and CKDM is Beaufort West. A small section of the site is located in the Ubuntu Local Municipality (ULM) within the Northern Cape Province (*the proposed project, WEF Phase 1 – only lies in the Western Cape Province*). The ULM is one of eight local municipalities that make up the Pixley ka Seme District Municipality (PKSDM). The town of Victoria West is the administrative seat of the ULM. The main settlements in the CKDM include, Beaufort West, Nelspoort, Murraysburg, Prince Albert, Leeu Gamka, Prince Albert Road, Matjiesfontein and Klaarstroom.

Beaufort West: Beaufort West is the gateway to the Western Cape as well as the main service and development centre for the area. The town has a broad range of lower-order shops and social facilities and is the biggest retail and service sector in the District. There are a number of schools of all levels, a hospital, police station and municipal offices (CKDM IDP 2012-2017).

Nelspoort: Nelspoort is a small dormitory settlement located 42 km northeast of Beaufort West, just south of the N1, and one of the many small villages established to serve the rail service. The local school was closed down and the closest school is at Restvale, which is 3 km away. There are no shops or services in Nelspoort, with the exception of a postal agency. Very few public transport services operate from Nelspoort (CKDM IDP 2012-2017).

Murraysburg: Murraysburg is located on the R63 between Victoria West and Graaff-Reinet. It is an exceptionally poor town, with few businesses remaining. Unemployment is high and social problems due to poverty and destitution abound. There is no rail connection to Murraysburg and residents depend on road transport links to larger towns, Graaff-Reinet being the closest (CKDM IDP 2012-2017).

Prince Albert: Prince Albert is the second largest settlement in the Central Karoo District. It is located 400 km north of Cape Town and 170 km southwest of Beaufort West (CKDM IDP 2012-2017). The town has a well-developed tourism sector.

Leeu Gamka: The settlement of Leeu Gamka is located on the N1 national route and the main railway line to Cape Town. Inhabitants rely on rail transport to Beaufort West, which is located approximately 80 km to the northeast (CKDM IDP 2012-2017).

Prince Albert Road: This settlement is located on the N1 and on the main north-south railway line. It is a very small settlement that was originally established to serve the railway station. The daily Cape Town to Pretoria rail service stops at Prince Albert Road (CKDM IDP 2012-2017).

Laingsburg: Laingsburg is a relatively small service centre situated approximately 200 km from Cape Town on the N1. It is a major petrol stop for much of the through traffic, especially passenger cars and trucks (CKDM IDP 2012-2017).

Matjiesfontein: This small, historic settlement is situated off the N1 between Laingsburg and Beaufort West. It has a hotel, a museum, a church and a railway station. The daily

Sholoza Meyl Cape Town to Pretoria service stops at Matjiesfontein. Most people who visit the town are travellers and tourists who are aware of the historic nature of the village and the area (CKDM IDP 2012-2017).

Klaarstroom: Klaarstroom is a small rural village east of Prince Albert close to the northern access to Meiringspoort. The town is a residential village with limited facilities. Those who are employed work on the local farms. The latter have better agricultural potential than those in the more northern areas of the Central Karoo (CKDM IDP 2012-2017).

Beaufort West is the most populated of the local municipalities with a population size of 49 586, followed by Prince Albert (13 136) and Laingsburg (8 289) (Census 2011). The main language spoken in the district is Afrikaans followed by IsiXhosa.

5.12.2 CENTRAL KAROO DISTRICT MUNICIPALITY

5.12.2.1 Economic Overview

The CKDM IDP (2012-2017) indicates that economic development remains a developmental challenge for the DM. This is due to the low population density, distance from large markets and the arid climate. In addition there are high levels of unemployment and poverty and a lack of skilled persons.

In 2008 the CKDM economic growth rate was 6 % compared to the Province's annual growth rate of 4.3% (CKDM IDP 2012-2017). However, the due to global recession the growth rate in 2009 was 0.2 %, while the Province's economy contracted by 1.2 %. The decline in the growth from 2008 to 2009 was due to the impact of the 2008/09 global recession.

In the Beaufort West LM mining and quarrying displayed a growth rate of 26.9 % while manufacturing recorded a growth rate of 10.12 %. In the Prince Albert LM the construction (15.2 %) and finance, insurance, real estate and business (14.4 %) sectors all displayed strong growth. In the Laingsburg LM construction (11.8 %) and manufacturing (9.7 %) recorded strong growth.

In terms of employment the most important economic sector is the Community, social and personal services sector (16.9 %), followed by Agriculture; hunting; forestry and fishing (15.7 %) and Wholesale and retail trade (14.0 %). The Agriculture sector also plays a key role in the other District Municipalities in the Western Cape, accounting for 27.9 % and 24.2 % the jobs in the West Coast and Cape Winelands respectively.

5.12.2.2 Employment

The Community survey of 2007 found that the Central Karoo had the lowest percentage of the Western Cape's labour force (0.8 %). At the same time the DM also had the highest unemployment rate (30.8 %). Based on the 2011 Census figures the unemployment rate in the CKDM was 23.1 % compared to 21.6% for the Western Cape Province. Within the DM the unemployment rates for the BWLM, Prince Albert and Laingsberg LM were 25.5, 17.9 and 19.4 % respectively in 2011 (Census 2011).

In terms of unemployment by population group, the unemployment rate for Black Africans (45.0 %) was greater than any other population group. The figure for Coloureds was 33.4 % while for Whites is was only 2.6 %. Disparities are also found within different age groups, with younger age groups experiencing higher levels of unemployment and representing significantly higher shares of the unemployed in comparison with their share of the labour force. The unemployment rate for those in younger age groups is significantly higher than the older age groups. The differences in unemployment rates between age groups may in part be accounted for in the higher education, skill and experience levels of relatively older workers – these characteristics make work-seekers more attractive to

prospective employers and improve their chances of finding employment (CKDM IDP 2012-2017).

CKDM has third lowest proportion of skilled labour force (38.6 %) and the second highest of low skilled (26.6 %) people in the Western Cape. The low skill levels in the CKDM places a strain on the region's economy and poses a challenge to the areas future development (CKDM IDP, 2012-2017). The IDP notes that a large proportion of occupations in the DM are classified as either skilled (39 %) or high skilled (21 %). The concentration of employment opportunities in the skilled sector therefore means that there are relatively few opportunities available to those with low skill levels. The current proportion of low skilled occupations available in the District is 27 % (CKDM IDP 2012-2017). This mismatch in terms of skills levels and employment opportunities highlights the need for individuals to up-skill in order to improve their chances of finding employment within the district CKDM IDP 2012-2017).

5.12.2.3 Household Income

The CKDM IDP (2012-2017) indicates that the 32 % of households in 2009 earned income between R0 and R42 000, 41.8 % earned between R42 000 and R132 000, 23.1 % between R132 000 and R600 000 and 3.1 % earn above R600 000. The IDP notes that the figures indicated that there has been a shift in earning power in the number of people earning at the lower end of the scale while the people in the middle to upper ends of the scale has increased significantly.

5.12.2.4 Poverty Rate and Indigent Households

Research undertaken by Global Insight indicates that the number of people living in poverty in the CKDM in 2010 was approximately 20 200 people. In this regard the CKDM had the highest number of people living in poverty in the Western Cape (32.5 %). Prince Albert has the highest proportion of poor people and it is rising compared to the rest of the district.

According to the Western Cape Department of Local Government information the number of households in the Central Karoo District totalled 14 945 of which 5 903 (39.5 %) were classified as indigent (August 2011). From the Department's information, of the total number of households, 43.1 % received free basic access to water, 40.2 % to electricity, and 39.4 % to sanitation services. Within the CKDM the Beaufort West LM has the highest number of indigent households followed by the Prince Albert and Laingsburg LM.

5.12.3 Beaufort West Local Municipality

The Beaufort West Local Municipality (BWLM) is a category-B municipality, comprising the towns of Beaufort West, Merweville, Nelspoort and Murraysburg in the Central Karoo District. In February 1837, the BWLM became South Africa's first and therefore oldest municipality. It is the centre of an agricultural district based mainly on sheep farming and meat production, and is strategically positioned on the N1 national road, which links Cape Town with the interior of South Africa.

5.12.3.1 Economic Overview

The regional gross value added figure (GVA-R) for the BWLM amounted to R840.741 million in 2009 and accounted for 74.4 % of the total of the regional economy of R1.130 billion, making it the largest economic contributor in the CKDM[9]. The economy of the BWLM grew at a lower rate than the District's economy between the 2001 and 2009 period with the exception of 2003 and 2006 when the BWLM economy outperformed the economy of the

[9] GVA and Gross Domestic Product (GDP) are similarly related concepts. GVA excludes taxation and subsidies, while these are included in GDP.

District. Beaufort West's economy grew at an annual average rate of 3.5 % over the period 2001 to 2009 compared to the District's annual average growth rate of 3.6 %. In 2008, Beaufort West's and the District's economic growth peaked at 6% and 5.3 % respectively, at the height of the global financial crisis. However, in 2009 the economic growth for BWLM and the District were stagnant. In terms of sectors, the leading sector contributors to the BWLM economy in 2009 were; finance (29 %); community services (27 %), agriculture (14 %) and transport (7 %). The agricultural sector's contribution to the local economy decreased from 15.2 % to 14.9 % between 2001 and 2009. The finance sector's contribution increased from 19.7 % to 28.9 %, whilst the community services sector's contribution decreased marginally from 27.3 to 26.6 % between 2001 and 2007.

5.12.3.2 Household Income

The majority of households (51.3 %) in Beaufort West had an income of between R4 801 and R38 400 per annum. Of all the households, 9.5 % had no income, 3.3 % earned between R0 and R4 800 per annum, 5.8 % between R 4 801 and R 9 600, 21.7 % between R 9 601 and R 19 600, and 23.8 % between R 19 601 and R 38 200 per annum (Census 2011).

In 2007, there were 11 160 social grant beneficiaries, of which 57.2 % beneficiaries received the child support grant, followed by the old age pension grant (23 %) and the disability grant (16.7 %). The municipality offers additional social support through its indigent policy. The indigent policy provides free and discounted rates on basic services such as water, electricity, sanitation, refuse and property rates. According to the municipality, there were 4 147 indigents registered in the 2010/11 financial year (BWLM IDP 2012-2017).

5.12.4 Summary of Central Karoo and Beaufort Local Municipalities

The population of the CKDM increased by from 60 483 in 2001 to 71 011 in 2011, which represents an increase of ~ 17.4 %. The population of the BWLM increased from 43 290 in 2001 to 49 586 in 2011 (~ 14.5 %) over the same period. This represents an average annual increase of ~ 1.6 % and 1.36 % for the CKDM and BWLM respectively. The increase in the population in both the CKDM and BWLM was linked to an increase in the economically active 15 - 65 year age group. The increase in the economically active 15 - 65 age group in also reflected in the decrease in the dependency ratios in both the CKDM and BWLM (see below). As expected, the number of households in both the CKDM and BWLM increased between 2001 and 2011. The size of the household sizes in both areas decreased marginally, from 3.8 to 3.6 in the CKDM and 3.9 to 3.6 in the BWLM.

Table 5.3 Overview of key demographic indicators for the CKDM and BWLM

	CKDM		**BWLM**	
ASPECT	**2001**	**2011**	**2001**	**2011**
Population	60 483	71 011	43 290	49 586
% Population <15 years	32.7	30.5	32.8	31.5
% Population 15-64	61.4	63.3	61.6	62.6
% Population 65+	6.0	6.2	5.7	5.9
Households	15 009	19 076	10 540	13 089
Household size (average)	3.8	3.6	3.9	3.6

Formal Dwellings %	95.7 %	97.0 %	95.8 %	97.9 %
Dependency ratio per 100 (15-64)	62.9	58.0	62.4	59.7
Unemployment rate (official) **- % of economically active population**	36.2 %	23.1 %	38.2 %	25.5 %
Youth unemployment rate (official) **- % of economically active population 15-34**	47.3 %	30.9 %	49.7 %	34.5 %
No schooling - % of population 20+	17.3 %	10.1 %	17.2 %	10.1 %
Higher Education - % of population 20+	6.1 %	7.1 %	6.0 %	6.5 %
Matric - % of population 20+	14.9 %	21.5 %	16.4 %	23.6 %

Source: Compiled from StatsSA Census 2011 Municipal Fact Sheet

The majority of the population is in the BWLM was Coloured (73.5 %), followed by Black Africans (16.3 %) and Whites (9.2 %) (Census, 2011). The dominant language within the Municipality is Afrikaans (~81.7 %), followed by isiXhosa (~10.4 %) and English (~2.4 %) (Census 2011).

5.12.4.1 Municipal services

The provision of and access to municipal services as measured in terms of flush toilets, weekly refuse removal, piped water and electricity, increased in both the CKDM and BWLM for the period 2001 to 2011 (Table 5.4). As indicated in Table 5.4 there have been significant improvements in the number of households with access to piped water inside their dwellings in both the CKDM and BWLM. These improvements also contribute significantly to the overall improvement in the quality of life of the residents of the CKDM and BWLM.

However, the service levels in the CKDM and BWLM, with the exception of piped water inside dwellings for the BWLM, are lower than the 2011 provincial averages for the Western Cape Province. The provincial figures are flush toilets (85.9%), weekly refuse removal (89.9%), piped water (78.7%) and electricity (93.4%).

Table 5.4: Overview of access to basic services in the CKDM and BWLM

	CKDM		**BWLM**	
	2001	**2011**	**2001**	**2011**
% households with access to flush toilet	75.1	77.6	80.2	83.2
% households with weekly municipal refuse removal	78.1	78.7	82.4	83.7
% households with piped water inside dwelling	55.5	77.2	57.5	81.3
% households which uses electricity for lighting	83.9	89.4	86.6	92.0

Source: Compiled from StatsSA Census 2011 Municipal Fact Sheet

5.12.5 PIXLEY KA SEME AND UBUNTU MUNICIPALITY

5.12.5.1 Demographic overview

The population of the PKSDM increased by from 166 547 in 2001 to 186 351 in 2011, which represents an increase of ~ 12 % (Table 5.5). The population of the ULM increased from 16 375 in 2001 to 18 601 in 2011 (~ 14 %) over the same period. This represents an average annual increase of ~ 1.12 % and 1.27 % for the PKSDM and ULM respectively. The increase in the population in the PKSDM was linked to an increase in the 15-64 and 65 and older age groups. This is likely to reflect a situation where the majority of job seekers in the 15-64 age group are single males who have not settled down and started a family in the area. In the ULM the increase was in the under 15 age group while there was no change in the economically active group of 15 - 64 and a decrease in the over 65 group. As expected, the number of households in both the PKSDM and ULM increased between 2001 and 2011. The size of the household sizes in both areas essentially remained the same, namely in the region of 3.5 - 3.8.

The majority of the population is in the ULM was Coloured (69.8 %), followed by Black Africans (21.3 %) and Whites (7.6 %) (Census, 2011). The dominant language within the Municipality is Afrikaans (~81.4 %), followed by isiXhosa (~12.3 %) and English (~1.8 %) (Census 2011).

Table 5.5: Overview of key demographic indicators for the PKSDM and ULM

	PKSDM		**ULM**	
ASPECT	**2001**	**2011**	**2001**	**2011**
Population	166 547	186 351	16 375	18 601
% Population <15 years	32.6	31.6	33.2	33.3
% Population 15-64	61.5	62.4	61.1	61.1
% Population 65+	5.9	6.1	5.7	5.6
Households	41 707	49 193	4 163	5 129
Household size (average)	3.8	3.7	3.7	3.5
Formal Dwellings %	84.7 %	86.3 %	93.0 %	87.6 %
Dependency ratio per 100 (15-64)	62.7	60.4	63.8	63.5
Unemployment rate (official) **- % of economically active population**	36.4 %	28.3 %	34.1 %	29.1 %
Youth unemployment rate (official) **- % of economically active population 15-34**	44.1 %	35.4 %	41.5 %	34.8 %
No schooling - % of population 20+	27.1 %	14.6 %	30.6 %	16.4 %
Higher Education - % of population 20+	5.7 %	6.1 %	8.0 %	6.0 %
Matric - % of population 20+	12.9 %	20.5 %	12.2 %	18.7 %

Source: Compiled from StatsSA Census 2011 Municipal Fact Sheet

5.12.5.2 Municipal services

The municipal service levels in the PKSDM and ULM all improved over the period 2001 to 2011 (Table 5.6). This represents a socio-economic improvement. The service levels in the PKSDM and ULM are, with the exception of households that use electricity for energy, all higher than the provincial averages for the Northern Cape Province (85.4 %).

Table 5.6 Overview of access to basic services in the PKSDM and ULM

Municipal Services	**PKSDM**		**ULM**	
	2001	**2011**	**2001**	**2011**
% households with access to flush toilet	45.4	65.7	38.4	64.3
% households with weekly municipal refuse removal	67.8	72.6	63.8	66.6
% households with piped water inside dwelling	32.8	47.0	35.0	49.2
% households which uses electricity for lighting	75.1	85.1	75.7	84.8

Source: Compiled from StatsSA Census 2011 Municipal Fact Sheet

6 IMPACT ASSESSMENT CHAPTER

This chapter summarises the identified potential impacts of the proposed grid connection and associated infrastructure as well as the specialist's assessments of these potential impacts. It also includes details on sensitivity mapping conducted during the EIA process, which informed the design process of the proposed development. It must be noted that the specialists were supplied with the grid site boundary for their assessments, as well as the preferred routing, and that their assessments are based on the grid connection being within this corridor. The impact assessments presented here are identical to the potentially much longer Umsinde Emoyeni Grid Phase 1, and therefore represent a worst case scenario.

6.1 Identification of Impacts

6.1.1 Visual Impacts

During the construction phase there is the potential for intrusion caused by heavy construction vehicles and cranes, stockpiling of materials, construction camps and excavations, including dust and noise. The receptors will be residents, visitors and road users in proximity to the overall project.

The proposed industrial infrastructure (powerlines, access roads and substation) have the potential for visual intrusion on the Karoo's rural 'sense of place'.

6.1.1.1 Visual Assessment Methodology

The visual assessment is based on a number of quantitative and qualitative criteria to determine potential visual impacts, as well as their relative significance. The criteria are listed below:

Visual Exposure

Visual exposure is determined by the viewshed, being the geographic area within which the project would be visible. The boundary of the viewshed tends to follow ridgelines and high points in the landscape. Some areas within the viewshed fall within a view shadow, and would therefore not be affected by the proposed grid connection. The viewsheds indicate potentially less visual exposure to the east because of a line of ridges.

Visual Sensitivity

Visual sensitivity is determined by topographic features, steep slopes, rivers, scenic routes, cultural landscapes, and tourist facilities such as guest farms.

Landscape Integrity

Visual quality is enhanced by the scenic or rural quality and intactness of the landscape, as well as lack of other visual intrusions. The Karoo landscape of the study area is at present generally intact with few visual intrusions. The proposed WEF therefore has potential significance in terms of altering the rural landscape.

Cultural Landscape

Besides natural attributes, landscapes have a cultural value, enhanced by the presence of palaeontological and archaeological sites, historical settlements, farmsteads and cultivated lands.

Visual Absorption Capacity

This is the potential of the landscape to screen the project. The study area has a few ridges and koppies, which will tend to have a screening effect at the broader scale, but is

otherwise relatively open and visually exposed in terms of the more immediate surroundings, and therefore locally has a relatively low visual absorption capacity.

6.1.1.2 Visual Impact Assessment Criteria

The extent of the area over which the visual impact will be experienced will be confined to the study area with an approximate radius of 30 km, and is therefore considered local.

The criteria described in section 6.1.1.1 were considered in combination to determine the potential visual impact 'intensity' as indicated in Table 6.1. It should be noted that the construction activities associated with the proposed grid connection were assessed in combination with construction activities associated with the Umsinde Emoyeni WEF: Phase 2 construction activities. This resulted in a high intensity value with the scenic or visual characteristics of the area becoming severely altered.

Table 6.1: Intensity of Potential Visual Impacts

Criteria	Comments	Phase 2 Infrastructure / powerlines	Phase 2 Construction Activities
Visibility of facilities Distance from selected viewpoints	Viewing distance is a mitigating factor in some cases. Powerlines visible from sensitive receptors. Construction activities are an aggravating factor.	Medium (3)	Very high (5)
Visual exposure Zone of visual influence or view catchment	Sensitive receptors within powerline viewshed.	Medium (3)	High (4)
Visual sensitivity Effect on landscape features and scenic resources	Includes topographic features, skyline ridges, steep slopes, road corridors and farmsteads. General remoteness is a mitigating factor.	Medium (3)	High (4)
Landscape integrity Effect on rural/ natural character of the area	Largely intact natural / rural landscape would be affected by industrial type wind energy development.	Medium (3)	Very high (5)
Visual absorption capacity (VAC)	Surrounding ridges provide some visual enclosure / absorption, but vegetation is low / sparse.	Medium (3)	Medium (3)
Overall visual impact intensity	Combination of the characteristics above.	**Medium (15)**	**Very high (21)**

Rating values: Very low (1), Low (2), Medium (3), High (4), and Very high (5).
Overall values: Very low (1-5), Low (6-10), Medium (11-15), High (15-20), Very high (21+)

For construction activities the timeframe of the impact will be less than two years (short-term), and the probability of the impact occurring is estimated to be between 70 and 90 % (probable).

For the operational phase of the proposed grid connection and associated infrastructure the extent of the impact will also be local. The duration will be for the duration of the operational phase, which is long-term (> 15 years). The likelihood of this impact occurring without mitigation is more than 90 % (definite). The assessment is based on photomontages and therefore the confidence in the assessment is high. Essential mitigation measures can reduce the intensity of the impact to medium and the probability of it occurring to probable.

6.1.2 Terrestrial Ecology (Flora and Fauna)

6.1.2.1 Impacts on vegetation and protected plant species

During construction site clearing for roads, other infrastructure would result in the loss of currently intact vegetation. This may include protected and red-listed plant species as well as their habitats. This impact is highly likely to occur in all areas where development takes place.

6.1.2.2 Alien Plant Invasion Risk

The large amount of disturbance created during construction will leave the site vulnerable to alien plant invasion. This would be a particular concern if it resulted in the spread of large woody species such as *Prosopis* which can have ecosystem-level consequences for hydrology as well as biodiversity and the delivery of ecosystem services.

Although, this impact is generated during construction, it is only expressed during operation and is therefore assessed for the operational phase and not for construction. Some invasion of short lived weedy species may occur during construction; however, their control would occur largely during the operational phase after the completion of the site.

Disturbance along the power line would be limited and of a short duration. As such this impact is not considered a likely impact associated with the power line corridor.

6.1.2.3 Increased erosion risk

Increased erosion risk would result from soil disturbance and the loss of plant cover within cleared and disturbed areas. The site is topographically diverse and includes quite a lot of steep areas that would be vulnerable to erosion impact. There are also a lot of drainage lines present that could be disturbed and the risk of erosion problems would therefore be high. As the larger rivers at the site are considered priority rivers under the NFEPA, erosion leading to impact on the riverine ecosystems would be highly undesirable.

This impact could potentially occur along the power line route if suitable avoidance and mitigation measures are not implemented during construction.

6.1.2.4 Direct Faunal impacts

Increased levels of noise, pollution, disturbance and human presence will be detrimental to fauna. Sensitive and shy fauna would move away from the area during the construction phase as a result of the noise and human activities present, while some slow-moving species would not be able to avoid the construction activities and might be killed. Some mammals and reptiles such as tortoises would be vulnerable to illegal collection or poaching during the construction phase as a result of the number of construction personnel that are likely to be present. There are also some mammals of conservation concern which occur in the area and impacts on these species would be undesirable. Some habitat loss for these species is likely to occur, but would not be of high significance given the scale of the development relative to the distribution extent of these species.

Faunal impacts are not likely along the power line route as construction activity will be localised and of short duration. Consequently faunal impacts were not assessed for the power line corridor.

6.1.2.5 Loss of landscape connectivity and disruption of broad-scale ecological processes

The presence of the facility and associated infrastructure could potentially contribute to the disruption of broad-scale ecological processes such as dispersal, migration or the ability of fauna to respond to fluctuations in climate or other conditions. It is highly unlikely that the power line corridor would contribute significantly to this impact.

6.1.3 Bats

6.1.3.1 Roost disturbance and/or destruction due to wind turbine, O&M building and sub-station construction

Six confirmed and 14 potential bat roosts were located at Umsinde Emoyeni WEF. The roost types that were identified included house roofs and tree roosts, rock overhangs in the gorges and small caves/ overhangs in the rocky outcrops. There seemed also to be a *Miniopterus natalensis* roost very close to mast TB 13, under a large inaccessible overhang in a deep gorge in the north west of the site. Other species of bat could also be roosting in the gorge.

6.1.3.2 Roost disturbance and/or destruction due to 132 kV grid connection transmission line construction.

The current 132 kV line route crosses over at least 5 potential roosts.

6.1.3.3 Disturbance to and displacement from foraging habitat due to wind turbine, O&M building and sub-station construction

Construction will involve vegetation clearance at the footprint of each turbine, hard stand area, along the road network, at the office and sub-station buildings. This causes disturbance to bat foraging habitat. General dust and noise will increase in the area which may cause more sensitive species to disperse either temporarily or permanently.

6.1.3.4 Disturbance to and displacement from foraging habitat due to 132 kV grid connection transmission line construction.

Construction will involve vegetation clearance at the lay-down areas and pylon bases. This causes disturbance to bat foraging habitat. General dust and noise will increase in the area which may cause more sensitive species to disperse either temporarily or permanently.

6.1.3.5 Fatalities due to collision with transmission lines.

Whilst collision and electrocution of birds by power lines is well reported, only a few cases have been reported involving very large fruit bats in eastern regions of the world. These fruit bats are larger than any bats that can occur in SA and no reports of bats being directly killed by power lines have ever been reported in SA.

6.1.3.6 Disturbance or displacement of bats due to electromagnetic interference emitted from transmission lines

Whilst some laboratory studies have shown that electromagnetic radiation can have behavioural effects on bats and rats, it is uncertain that this would be the case outside of the lab in natural circumstances. No known cases have ever been reported.

6.1.4 Impacts on Wetlands and Freshwater

With a 32 m buffer around all watercourses in place, no potential impacts on wetlands and freshwater by the proposed grid connection are anticipated.

6.1.5 Impacts on Avifauna

The results of the 12 month avifaunal monitoring programme informed the identification and assessment of potential impacts. In addition, the gathered information was used to inform the design process and lower any potential impacts of the proposed development on birds.

6.1.5.1 Habitat Destruction

During the construction of the grid connection and infrastructure some habitat destruction and alteration will take place. The clearing of vegetation for the tower/pylon placements will result in a loss of habitats for birds for the duration of the project. There will also be temporary loss of habitats (that may be rehabilitated following construction) for the construction of access roads and construction camps/laydown areas etc. In some areas habitat will be altered, for example the clearing of vegetation under the power line. The loss or alteration of habitat may have an impact on birds breeding, foraging and roosting, and may also result in species being displaced from the immediate development site. However, the grid sites do not appear to contain particularly scarce avifaunal habitats.

The extent of habitat destruction will be restricted to the proposed grid connection and construction areas. As the proposed grid site does not appear to have particularly scarce avifaunal habitats the intensity of the impact is considered to be medium with a definite probability of this occurring.

6.1.5.2 Disturbance and Displacement

Disturbances and noise during construction of the grid connections may result in species being displaced, either temporarily (i.e. for some period during the construction activity) or permanently (i.e. they are disturbed and do not return) from the development site. Overall the duration of the disturbance is expected to last for the duration of the construction phase (medium-term). Disturbance during the breeding season and close to nesting sites can potentially impact the breeding success of birds nesting in the area and various species sensitive to disturbance and displacement may occur, such as Ludwig's Bustard, Blue Crane and Verreaux's Eagle.

During operation, servitudes for the power lines will have to be cleared of excess vegetation at regular intervals. This is done to allow access to the power line for maintenance, to prevent vegetation from intruding into the legally prescribed clearance gap between the ground and the conductors, and to minimize the risk of fire under the line which can result in electrical flashovers. These and other maintenance activities can disturb sensitive species occurring on site.

The extent of disturbance during both construction and operational phases will be local. It will last throughout the construction and operational phases. The proposed phase 1 grid connection passes within 500 m of an identified Verreaux's Eagle nest. Therefore the intensity of the impact is considered medium for the construction phase.

6.1.5.3 Electrocution

Electrocution of birds on electrical infrastructure including overhead lines and substation infrastructure is an important and well documented cause of unnatural mortality of birds, especially raptors and storks (APLIC 1994; van Rooyen & Ledger 1999). Electrocution refers to the scenario where a bird is perched or attempts to perch on the electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components (van Rooyen 2004).

The extent of this impact is restricted to the actual grid connection and substation for the duration of its operational lifespan (long-term). As the result of electrocution is mostly death the impact intensity is considered high. The probability of electrocution occurring in the absence of mitigation is considered possible, as only certain large species as mentioned above are able to electrocute themselves.

6.1.5.4 Power Line Collisions

Collisions with large (132kV or above) power lines are a well-documented threat to birds in southern Africa (van Rooyen 2004), while smaller lines pose a higher threat of electrocution but can still be responsible for collision. Collision refers to the scenario where a bird collides with the conductors or earth wires of overhead power lines in flight. Recent research in South Africa indicates that, as flying birds readily see and avoid support structures, most collisions occur in the central sector of the line between support structures (Shaw *et al.* 2010). Species such as bustards, storks, cranes and various waterfowl are usually most affected. They are mostly heavy-bodied birds with limited manoeuvrability, which makes it difficult for them to take the necessary evasive action to avoid colliding with power lines, or their line of site does not allow them to detect the wire at all. Of particular concern in this area are the red data species Ludwig's Bustard (*Endangered*), Greater Flamingo (*Near-threatened*) and Blue Crane (*Near-threatened*). The latter two often fly before dawn and after dusk (pers. obs. and pers. comm. with BARESG), reducing their ability to see and avoid power lines. Ludwig's Bustard is known to be particularly prone to collision (pers. comm. R. Simmons, J. Smallie, M. Martins and BARESG). Other species that may be affected on the grid sites include Karoo Korhaan, Northern Black Korhaan, and Secretarybird. Some of these species are long living, slow reproducing species whose population can be unable to cope with high adult mortality over a prolonged period of time.

Electrocution is also possible on electrical infrastructure within the substation particularly for species such as crows and owls. Various large raptors (such as Martial Eagle, Verreaux's Eagle and African Fish-Eagle), susceptible to electrocution (particularly in the absence of safe and mitigated structures) have been recorded in the area and potentially occur on the grid connection sites.

The intensity of this long-term impact is considered to be high. The impact is probable to occur and the confidence in this prediction is high.

6.1.6 Soil, Land use, Land Capability and Agricultural Potential

The overall soil impacts are expected to be relatively low for the shallow and rocky soil zones. The impacts on the deeper soils will be limited to road crossings and therefore limited to localised erosion.

The following activities may have an impact on soil, land use or land capability:

- The construction of buildings and other infrastructure;
- The construction of roads;
- The construction of powerlines;
- Vehicle operation on site;
- Dust generation.

6.1.7 Cultural Heritage, Archaeology and Palaeontology

During the construction phase the following physical impacts to the landscape and any heritage (including palaeontology) that lies on it can be expected:

Heritage, palaeontological and archaeological sites, which are highly context sensitive, are most vulnerable to the alteration of the land surface through:

- Upgrading of existing farm tracks;
- Erection of a 132 kV power line;
- Construction of electrical infra-structure in the form of one or more sub-stations.

The best way to manage impacts to such material is to avoid impacting them. This means routing access roads around sensitive areas. If primary avoidance of the heritage resource is not possible, then some degree of mitigation can be achieved by systematically removing

the archaeological material form the landscape. This is generally considered a second best approach as the process that has to be used is exacting and time-consuming, and therefore expensive. Furthermore the NHRA requires that archaeological material is stored indefinitely which has cost implications and places an undue burden on the limited museum storage space available in the provinces.

6.1.7.1 Impacts to Palaeontological Heritage

Given that the grid connection will involve fairly light weight structures not requiring the deep foundation conditions of turbines, the impacts will be surface only, however it must be noted that the grid connection traverses areas of fossiliferous mudstone as opposed to the non-fossiliferous dolerites with the result that the likelihood of an impact occurring is high.

The main cause of impacts to palaeontological sites is physical disturbance/destruction of fossil material and its context which in the study area, could result in an un-redeemable loss to science and knowledge.

It is expected that impacts will be limited (local). There is a chance that the deep excavations for bases could potentially impact buried fossil material, similarly excavation of cable trenches and clearing of access roads could impact material that lies buried in the surface mudstones. Potential impacts caused by power line and proposed access roads are similarly likely to be limited and local. The physical survey of the study area has shown that palaeontological material is common in areas where there is mudstone geology, and often visible on the surface.

The destruction of palaeontological material is usually considered to be negative; however opportunities for the advancement of science and knowledge can result provided that professional assessments and mitigation is carried out. Without mitigation the impact will be medium negative, but potentially positive with successful mitigation.

6.1.7.2 Impacts to Archaeological Material and Rock Engravings

The main cause of impacts to archaeological sites is physical disturbance of the material itself and its context. The heritage and scientific potential of an archaeological site is highly dependent on its geological and spatial context. This means that even though, for example a deep excavation may expose archaeological artefacts, the artefacts are relatively meaningless once removed from the area in which they were found.

Given observations by Sampson (1985) and our own experience it is argued that the impact of the construction of power lines is limited. The likelihood of towers directly impacting archaeological sites is low, and in the event of this happening the impact will be over a small area.

Of perhaps greater concern are the service roads, laydown areas and construction camps and the substation site. If these are to be physically prepared or mechanically scraped, impacts may occur. If the power line service road (which runs through the servitude) is to be a simple 4x4 track, the amount of damage that will occur will be substantially less.

Impacts to heritage sites on the plains are likely to be very small, however the likelihood of impacts occurring increases in hilly areas, river valleys and on dolerite dykes and outcrops is higher as this is where many archaeological are typically situated. Given the general low frequency of open archaeological sites very few impacts are expected.

Archaeological sites of the Early, Middle and Late Stone Age will be found in the corridor of the powerline with similar low frequency. Dolerite ridges, dykes and mazes and valleys are likely to be the most sensitive land forms in terms of the archaeology of Khoekhoen and San.

Rock engravings are also likely to be found in the powerline corridor/substation site.

The destruction of archaeological material is usually considered to be negative; however opportunities for the advancement of science and knowledge about a place can result provided that professional assessments and mitigation is carried out in the event of an unexpected find. In this case there is so little material on site that there will be no opportunity to benefit therefore the impact will be neutral.

6.1.7.3 Impacts to Colonial Period Heritage and Cultural Landscape

Impacts to colonial period heritage are expected to be confined to changes to the quality of the setting of farm houses on the powerline route. Individual residences that lie within close proximity of the power lines will experience changes to their views, however how an individual interprets this aesthetic change is subjective. Certainly any residence within 500 m of the transmission line will experience a noticeable and negative change in the quality of the local environment.

Almost all the farms that were examined (as is typical of the Karoo) were found to have attributes that were historical and fell within the general protections of the National Heritage Resources Act. Such attributes include farm grave yards, old stone wall alignments barns and sheds and farm residences. Aside from unlikely event of total demolition, the main impact that will occur relate to changes to sense of place and setting, and not to physical fabric. The proposed power line from the on-site substation passes unacceptably close to farm buildings at Hartebeestfontein and Bakensklip, both of which have heritage qualities and sensitive landscape settings.

6.1.7.4 Human remains

All identified grave yards were mapped and co-ordinates given to the proponent for planning purposes. Graves are generally found associated with historic farms and appear to be confined to alluvial deposits in river valleys as elsewhere soil depth is very shallow, if not non-existent. Because of this it is anticipated that the likelihood of graves existing in the project area is extremely low (but the possibility cannot be completely ruled out). Such remains are protected by a plethora of legislation including the Human Tissues Act (Act No 65 of 1983), the Exhumation Ordinance of 1980 and the National Heritage Resources Act (Act No 25 of 1999). In the event of human bones being found on site, an archaeologist must be informed immediately and the remains removed under an emergency permit. This process will incur some expense as removal of human remains is at the cost of the developer. Time delays may result while application is made to the authorities and an archaeologist is appointed to do the work.

6.1.8 Noise

Increased noise levels are directly linked to various activities associated with the construction of the facility and related infrastructure as well as the operational phase of the activity.

6.1.8.1 Noise and Animals

The responses of animals to noise differ with the type of noise, its duration and source. Generally speaking, animals respond to impulsive (sudden) noises (higher than 90 dBA) by running away. If the noises continue, animals try to relocate. Most species exhibit adaptation with noise, including aircraft noise and sonic booms. More sensitive species are those that depend on hearing to hunt or evade prey, or species that make use of sound/hearing to locate suitable mates. Domestic animals are generally not bothered by noise, excluding impulsive noises. Studies showed that most wildlife adapt to noises, and would even return to a site after an initial disturbance, even if the noise is continuous. The

more sensitive animals that might be impacted by noise would most likely relocate to a quieter area. Noise impacts are therefore very highly species dependent.

6.1.8.2 Noise and Communities

Noise can be defined as "unwanted sound", and an audible acoustic energy that adversely affects the physiological and/or psychological well-being of people, or which disturbs or impairs the convenience or peace of any person. One can generalise by saying that sound becomes unwanted when it:

- Hinders speech communication;
- Impedes the thinking process;
- Interferes with concentration;
- Obstructs activities (work, leisure and sleeping); and
- Presents a health risk due to hearing damage.

However, it is important to remember that whether a given sound is "noise" depends on the listener or hearer. The driver playing loud rock music on their car radio hears only music, but the person in the traffic behind them hears nothing but noise.

Response to noise is unfortunately not an empirical absolute, as it is seen as a multi-faceted psychological concept, including behavioural and evaluative aspects. For instance, in some cases, annoyance is seen as an outcome of disturbances, in other cases it is seen as an indication of the degree of helplessness with respect to the noise source.

Noise does not need to be loud to be considered “disturbing”. One can refer to a dripping tap in the quiet of the night, or the irritating “thump-thump” of the music from a neighbouring house at night when one would like to sleep.

Severity of the annoyance depends on factors such as:

- Background sound levels, and the background sound levels the receptor is used to;
- The manner in which the receptor can control the noise (helplessness);
- The time, unpredictability, frequency distribution, duration, and intensity of the noise;
- The physiological state of the receptor; and
- The attitude of the receptor about the emitter (noise source).

There are a number of factors that determine the audibility as well as the potential of a noise impact on receptors. Maximum noises generated can be audible over a large distance, however, are generally of very short duration. If maximum noise levels however exceed 65 dBA at a receptor, or if it is clearly audible with a significant number of instances where the noise level exceeds the prevailing ambient sound level with more than 15 dB the noise can increase annoyance levels and may ultimately result in noise complaints. Average or equivalent sound levels are another factor that impacts on the ambient sound levels and is the constant sound level that the receptor can experience.

6.1.8.3 Potential Noise Sources: Construction Phase

- Construction of substation - site clearing and levelling (including the removal / cutting of rock outcrops) and construction of access road/s (where required); construction of a substation terrace and foundation; assembly, erection and installation of equipment (including transformers); connection of conductors to equipment; and rehabilitation of any disturbed areas and protection of erosion sensitive areas;
- Construction of laydown area;
- Construction of power line;
- Site rehabilitation - once construction is completed and all construction equipment is removed, the site will be rehabilitated where practical and reasonable.

- Construction traffic is expected to be generated throughout the entire construction period, however, the volume and type of traffic generated will be dependent upon the construction activities being conducted, which will vary during the construction period. Noise levels due to additional traffic will be estimated using the methods stipulated in SANS 10210:2004 (Calculating and predicting road traffic noise).

6.1.8.4 Potential Noise Sources: Operational Phase

- Transformer noises (substations): Also known as magnetostriction; this is when the sheet steel used in the core of the transformer tries to change shape when being magnetised. When the magnetism is taken away, the shape returns, only to try and deform in a different manner when the polarity is changed. The resultant is the "hum" frequently associated with transformers. While this may be a soothing sound in small home appliances, various complaints are logged in areas where people stay close to these transformers. At a voltage frequency of 50 Hz, these "vibrations" takes place 100 times a second, resulting in a tonal noise at 100 Hz. This is normally not an issue if the substation is further than 200 meters from a potentially sensitive receptor. This is a relatively easy noise to mitigate with the use of acoustic shielding and/or placement of the transformer equipment and will not be considered further in the EIA study.
- Transmission Line Noise (Corona noise): Corona noise is caused by the partial breakdown of the insulation properties of air surrounding the conducting wires. It can generate an audible and radio-frequency noise, but generally only occurs in humid conditions as provided by fog or rain. A minimum line potential of 70 kV or higher is generally required to generate corona noise depending on the electrical design. Corona noise does not occur on domestic distribution lines. Corona noise has two major components: a low frequency tone associated with the frequency of the AC supply (100 Hz for 50 Hz source) and broadband noise. The tonal component of the noise is related to the point along the electric waveform at which the air begins to conduct. This varies with each cycle and consequently the frequency of the emitted tone is subject to great fluctuations. Corona noise can be characterised as broadband 'crackling' or 'buzzing', but fortunately it is generally only a feature during fog or rain. Corona discharges are associated with high voltage transmission lines, and not the lower voltage distribution lines proposed for construction by the developer. Electrical Service Providers (such as Eskom) go to great lengths to design power transmission equipment to minimise the formation of corona discharges. In addition, it is an infrequent occurrence with a relative short duration compared to other operational noises. At the relative low voltages proposed for this project Corona noises would not be an issue. Therefore this will not be further investigated.

The impact of the noise associated with the construction of the proposed grid connection was assessed in combination with noise associated with the construction of Umsinde Emoyeni WEF, and thus includes additional noise sources that are not part of the proposed grid connection application. The assessment can therefore be regarded as the precautionary approach.

The extent of daytime construction and operational activities will be limited to the project site and directly adjacent properties and is therefore local. Noise sensitive developments may experience an increase in ambient sound levels but these will be very low. The projected noise levels during construction will be similar to the expected ambient sound levels. The probability of an impact is considered unlikely.

6.1.8.5 Decommissioning Phase Noise Impact

Final decommissioning activities will have a noise impact lower than either the construction or operational phases. This is because decommissioning and closure activities normally take

place during the day using minimal equipment (due to the decreased urgency of the project). While there may be various activities, there is a very small risk for a noise impact.

6.1.9 Social, Transport and Access

None of the affected landowners interviewed indicated that they had any issues with the proposed transmission line. However, they did indicate that is should be located at a distance from homesteads. Mr Izak van der Merwe also indicated that the overhead transmission line should not be visible from Badsfontein Farm.

The only identified impact from a social perspective is the visual impact already discussed. Therefore no further assessment of social impacts of the proposed grid connection was conducted.

6.2 Site Sensitivity and Constraints

This section details development buffers identified for the Umsinde Emoyeni Wind Energy Facility during the EIA Phase. While these buffers do not necessarily apply to the proposed grid connection and substation, they should still be taken into consideration in the detailed design phase.

6.2.1 Visual Informants Mapping

Setbacks for wind turbines are indicated in Table 6.2 below based on the Provincial Government of the Western Cape (PGWC, 2006) guidelines, and on more recent guidelines developed by the Visual Assessment specialists with the CSIR (2014). Figure 6.1 shows the Visual Constraints Map for the grid site.

Table 6.2: Recommended Buffers

Landscape features/criteria	PGWC Guide-lines (2006)	Recommended visual buffer guidelines (2014)
Project area boundary	-	270 m (subject to turbine specification)
Ephemeral streams/ tributaries	-	250 m
Perennial rivers, wetland features	500 m	500 m
Major ridgelines, peaks and scarps	500 m	As per visual informants map, subject to micro-siting. (500 m recommended for peaks).
Local roads	500 m	500 m
Local district gravel roads	review if scenic	1 to 3 km (can be less if outside the viewshed).
R63 arterial route	review if scenic	1 to 3km (can be less if outside the viewshed).
Farmsteads (inside the project site)	400 m (noise)	800 m
Farmsteads (outside the project site)	400 m (noise)	2 to 4 km (can be less if outside the viewshed).
Private nature reserves/ game farms/ guest farms/ resorts	500 m	2 to 5 km (can be less if outside the viewshed).

6.2.2 Ecological Sensitivity Mapping

An ecological sensitivity map (Figure 6.2) of the site has been produced by integrating the available ecological and biodiversity information (excluding conservation planning designations).

As a starting point, mapped sensitive features such as wetlands, drainage lines and water bodies were collated and buffered where appropriate to comply with legislative requirements or suggested ecological considerations. Additional sensitive areas were then identified from the satellite imagery. All the different layers created were then merged to create a single coverage.

Features that were specifically captured in the sensitivity map include drainage features, wetlands and dams, as well as rocky outcrops and steep slopes. The ecological sensitivity of the different units identified in the mapping procedure was rated according to the following scale:

- **Low** – Units with a low sensitivity where there is likely to be a low impact on ecological processes and terrestrial biodiversity. This category represents transformed or natural areas where the impact of development is likely to be local in nature and of low significance with standard mitigation measures;
- **Medium** – Areas of natural or previously transformed land where the impacts are likely to be largely local and the risk of secondary impact such as erosion are low. Development within these areas can proceed with relatively little ecological impact provided that appropriate mitigation measures are taken;
- **High** – Areas of natural or transformed land where a high impact is anticipated due to the high biodiversity value, sensitivity or important ecological role of the area. Development within these areas should only proceed with caution as it may not be possible to mitigate all impacts appropriately;
- **Very High** – Critical and unique habitats that serve as habitat for rare/endangered species or perform critical ecological roles. These areas should be avoided as much as possible.

In some situations, areas were also categorised between the above categories, such as Medium-High, where an area appeared to be of intermediate sensitivity with respect to the two defining categories.

Highly sensitive features that should be avoided include the very steep slopes of the WEF Site, as well as the drainage systems. In the sensitivity map, a 500 m buffer (in either direction) has been implemented around the larger rivers, to create a 1 km wide corridor along them which will be the starting point for initial design considerations. As the design process progresses these buffers maybe amended for example due to the presence of NFEPAs.

Steep slopes are considered sensitive due to their high biodiversity as well as vulnerability to disturbance from erosion.

In terms of important faunal habitats, these have largely been captured within the existing sensitive areas such as the steep slopes, river corridors, wetlands and their associated buffer areas. In general, the sensitivity map indicates that the WEF Site is fairly typical of mountainous terrain, and although the steep slopes and drainage lines are sensitive, the intervening areas are of less sensitivity. The abundance of listed and protected species in the area is quite low and impacts on vegetation and flora within the less sensitive areas is likely to be relatively low. There may be some localised sensitive habitats present, such as rock fields and gravel patches, with specialised species present, but these are not usually extensive and would be identified through field surveys during the EIA and will be taken in account during the process of confirming the final design layout and development the EMP.

The resulting sensitivity map presents a summary of the reported desk based information to date. It is noted this will need to be ground trothed through site visits in order to confirm the constraints upon the design of the Proposed Development.

6.2.3 Bat Sensitivity Map

A sensitivity map was compiled for the study boundary area highlighting bat sensitive areas of varying sensitivity classes (Figure 6.3). A description of each class is presented in Table 6.2**.**

Table 6.3 Bat Sensitivity Map Classifications and Recommendations

Sensitivity Class	Description
Low to Medium	The Low-Medium Sensitivity Areas were: The remaining areas above the 1440 m, after the identified higher sensitivity classes were delineated. All areas otherwise not designated with a higher sensitivity Most of these areas are higher lying plateau areas. The reason this is area is classified as Low to Medium, as opposed to just Low is that no one can be certain that the risk of bat fatality is low. Experience from the USA shows that whilst high activity does normally equate to high fatality, low activity does not necessarily equate to low fatality (*pers comm*. Cris Hein, 28 August 2014). Additionally, IWS is monitoring at 5 operational WEFs and all have had bat fatalities to a greater or lesser extent. IWS believes that the bats occurring in the lower valley areas for most of the year and in the harsher weather conditions will move and forage along the higher lying plateaus in optimal low wind speed and warm conditions.
Medium	The Medium Sensitivity Areas were: The Upper Karoo Hardeveld vegetation type, and All areas otherwise not designated with a higher sensitivity below the 1440m contour.
Medium to High	The Medium - High Sensitivity Areas were made up as follows: All potential bat roosts with a 500 m buffer.
High	The High Sensitivity Areas were made up as follows: All FEPA wetlands & rivers with a 500 m buffer. Confirmed bat roosts with 1 km

The map was created to inform the final design of the proposed development and lower any potential impacts on bats discussed below.

6.2.4 Aquatic buffers

Presently there are no prescribed aquatic buffers other than those proposed in this portion of the Western Cape, thus the, recommendations by Desmet and Berliner (2007) will be applied as these are becoming more widely accepted (Table 6.4). These are shown below, to make the engineers and contractors aware of these buffers during the planning phase, i.e. construction, associated batch plants, stockpiles, lay down areas and construction camps should avoid these buffer areas i.e. 32 m for this development (Figure 6.4)

Table 6.4: Recommended buffers for rivers, with those applicable to the project highlighted in blue

River criterion used	Buffer width (m)	Rationale

Mountain streams and upper foothills of all 1:500 000 rivers, i.e. rivers mapped at this scale by DWS	50	These longitudinal zones generally have more confined riparian zones than lower foothills and lowland rivers and are generally less threatened by agricultural practices.
Lower foothills and lowland rivers of all 1:500 000 rivers i.e. rivers mapped at this scale by DWS	100	These longitudinal zones generally have less confined riparian zones than mountain streams and upper foothills and are generally more threatened by development practices.
All remaining 1:50 000 scale streams, i.e. all systems that appear on the topo-cadastral maps	▪ 32	▪ Generally smaller upland streams corresponding to mountain streams and upper foothills, smaller than those designated in the 1:500 000 rivers layer. They are assigned the riparian buffer required under South African legislation.

6.2.5 Avian Sensitivity and No-Go Areas

An Avifaunal Sensitivity Map was created (Figure 6.5) using flight line data of priority species recorded during the 12 month pre-construction bird monitoring at the WEF site.

Observed flight sensitivity was determined by creating a Grid Cell Sensitivity Score (GCSS), falling within either a Low, Medium or High classification for a 200 m x 200 m grid covering the WEF site. The GCSS was derived by analysing the following characteristics of all mapped priority species flight lines passing through each grid cell:

- Priority species score and the number of individuals associated with each flight line;
- Risk height factor, which considered if the flight was within the Rotor Swept Height; and
- The duration of the flight.

Grid cells within the WEF site boundary without a GCSS did not have any recorded priority species flights passing through from the monitoring survey.

Additional 'Medium Sensitivity' areas were identified by buffering the following important avifaunal features after analysis of incidental record and flight path locations:

- Cultivated lands – the majority of large flocks of Blue Crane were recorded in cultivated lands. A 200 m buffer was applied to afford this species protection from disturbance, as well as when arriving or departing.
- Ridgelines associated with steep slopes and/or rocky habitats frequented by Verreaux's Eagle were buffered by 150 m.

Avifaunal No-Go Areas (Figure 6.5) were identified through the results of the desktop study and monitoring programme and were advised by the recommendations in the report by specialist Andrew Jenkins (Appendix VI) as follows:

- National Freshwater Ecosystem Priority Areas (NFEPA) rivers and wetlands buffers: 200 m
- Nest Site buffers:
  - Verreaux's Eagle nest sites (active): 3 000 m
  - Verreaux's Eagle nest site (inactive): 2 000 m
  - Martial Eagle nest site (active): 5 000 m
  - Peregrine Falcon: 1 000 m
  - Pale Chanting Goshawk: 500 m

- Jackal Buzzard: 500 m
- Rock Kestrel: 500 m
- Rufous-breasted Sparrowhawk: 500 m

The Avifaunal Sensitivity Map (Figure 6.4) as well as the Avifaunal No-Go Areas Map (Figure 6.5) were submitted to the developer to inform turbine placement. It was recommended that the hierarchy of sensitivity scores presented in the Bird Sensitivity Map be considered, with preferential turbine placement in areas with Low Sensitivity areas, and decreasing preference through to High Sensitivity areas. While not classified as no-go areas, it was recommended that placement of turbines in grid cells with a High GCSS be avoided. Where two or more sensitivity areas overlap, the layer with the higher sensitivity designation should take preference. No turbines should be placed in Avifaunal No-go Areas.

6.2.6 Environmental Constraints Map

An environmental constraints map (Figure 6.6) has been created for the proposed Umsinde Emoyeni Wind Energy Facility Phase 1 and 2 showing all identified environmental constraints. While the environmental constraints map describes environmental and social constraints for the placing of turbines it should also be considered in the detailed design phase of the substation and servitude of the proposed grid connection. Figure 6.7 presents the identified constraints overlain with the proposed layout prior to mitigation proposed during the impact assessment process. Figure 6.8 shows the layout of once the mitigation measures and buffers are applied. This layout should be the one approved by the DEA.

6.3 Impact Assessments

All impact assessments followed the methodology as described in Volume III by defining extent, intensity, duration and probability of the impact to estimate its significance. The confidence in the prediction was also considered. Below are summary tables of all assessments relating to the construction phase (Table 6.5) as well as the operation phase (Table 6.5) of the proposed grid connection. Detailed assessment tables for each impact can be found in the relevant specialist reports in Volume III of this Draft EIA Report.

It must be noted that the specialists were supplied with the grid site boundary for their assessments, as well as the preferred routing, and that their assessments are based on the grid connection being within the grid connection corridor. The impact assessments presented here are identical to the potentially much longer Umsinde Emoyeni Grid Phase 1, and therefore represent a worst case scenario.

6.3.1 Assessment of Construction Phase Impacts

Table 6.5: Impact Summary Construction Phase

Impact	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Visual – No Mitigation	Low	Probable	Low	–ve	Medium
Visual – With Mitigation	Low	Probable	**LOW**	–ve	Medium
Vegetation and Listed/Protected Plant Species – No Mitigation	Medium	Definite	Medium	–ve	High
Vegetation and Listed/Protected Plant Species – With Mitigation	Medium	Definite	**MEDIUM**	–ve	High
Alien Plant Invasion – No Mitigation	Low	Improbable	Low	–ve	High

Impact	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Alien Plant Invasion – With Mitigation	Low	Improbable	**LOW**	–ve	High
Increased Erosion Risk – No Mitigation	Low	Definite	Low	–ve	High
Increased Erosion Risk – With Mitigation	Very Low	Probable	**VERY LOW**	–ve	High
Bats – Roost Disturbance – Substation – No Mitigation	Medium	Probable	Medium	–ve	High
Bats – Roost Disturbance – Substation – With Mitigation	Very Low	Possible	**INSIGNIFICANT**	–ve	High
Bats – Roost Disturbance – Power Line – No Mitigation	Medium	Possible	Low	–ve	Medium
Bats – Roost Disturbance – Power Line – With Mitigation	Very low	Possible	**INSIGNIFICANT**	–ve	Medium
Bats – Foraging Disturbance – Substation – No Mitigation	Medium	Definite	Medium	–ve	High
Bats – Foraging Disturbance – Substation – With Mitigation	Low	Definite	**LOW**	–ve	High
Bats – Foraging Disturbance – Power Line – No Mitigation	Low	Definite	Low	–ve	High
Bats – Foraging Disturbance – Power Line – With Mitigation	Very Low	Definite	**VERY LOW**	–ve	High
Avifauna – Habitat Destruction – No Mitigation	Medium	Definite	Medium	–ve	High
Avifauna – Habitat Destruction - With Mitigation	Very Low	Definite	**VERY LOW**	–ve	High
Avifauna – Disturbance & Displacement – No Mitigation	Low	Probable	Low	–ve	High
Avifauna –– Disturbance & Displacement – With Mitigation	Very Low	Probable	**VERY LOW**	–ve	High
Agriculture Potential & Land Capability – Construction of buildings and infrastructure – No Mitigation	Low	Definite	Low	–ve	High
Agriculture Potential & Land Capability – Construction of buildings and infrastructure – With Mitigation	Low	Definite	**LOW**	–ve	High
Agriculture Potential & Land Capability – Construction of Power Lines – No Mitigation	Low	Definite	Low	–ve	High
Agriculture Potential & Land Capability – Construction of Power Lines – With Mitigation	Low	Definite	**LOW**	–ve	High
Agriculture Potential & Land Capability – Vehicle Operation and Spillages – No Mitigation	Very Low	Definite	Low	–ve	High

Impact	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Agriculture Potential & Land Capability – Vehicle Operation and Spillages – With Mitigation	Very Low	Improbable	**INSIGNIFICANT**	–ve	High
Agriculture Potential & Land Capability – Dust Generation – No Mitigation	Low	Definite	Low	–ve	High
Agriculture Potential & Land Capability – Dust Generation – No Mitigation	Very Low	Improbable	**INSIGNIFICANT**	–ve	High
Paleontology – No Mitigation	High	Possible	Medium	-ve	Medium
Paleontology – with Mitigation	Medium	Possible	**LOW**	-ve & +ve	Medium
Archaeology – No Mitigation	Medium	Probable	Medium	-ve	High
Archaeology – with Mitigation	Low	Improbable	**VERY LOW**	Neutral	High
Colonial Period Heritage & Cultural Landscape – No Mitigation	High	Probable	High	-ve	High
Colonial Period Heritage & Cultural Landscape – with Mitigation	Low	Probable	**LOW**	-ve	High
Noise – No Mitigation	Low	Improbable	Very Low	-ve	High
Noise – with Mitigation	Low	Improbable	**VERY LOW**	-ve	High

6.3.2 Assessment of Operational Phase Impacts

Table 6.6: Summary Operational Phase Impact Assessments

Construction Phase Impact	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Visual – No Mitigation	Medium	Definite	Medium	–ve	High
Visual – With Mitigation	Low	Probable	**LOW**	–ve	Medium
Alien Plant Invasion – No Mitigation	Medium	Improbable	Low	–ve	High
Alien Plant Invasion – With Mitigation	Low	Improbable	**LOW**	–ve	High
Increased Erosion Risk – No Mitigation	Medium	Definite	Medium	–ve	High
Increased Erosion Risk – With Mitigation	Low	Probable	**LOW**	–ve	High
Bats – Collisions with Power Lines - No Mitigation Required	Low	Improbable	**VERY LOW**	-ve	High

Construction Phase Impact	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Bats – Disturbance / Displacement by Power Lines – No Mitigation Required	Low	Improbable	**VERY LOW**	-ve	High
Avifauna – Disturbance & Displacement – No Mitigation	Low	Probable	Low	-ve	High
Avifauna – Disturbance & Displacement – With Mitigation	Low	Possible	**VERY LOW**	-ve	High
Avifauna – Electrocution – No Mitigation	High	Possible	Medium	-ve	High
Avifauna – Electrocution – With Mitigation	High	Improbable	**MEDIUM**	-ve	High
Avifauna – Power Line Collisions – No Mitigation	High	Probable	High	-ve	High
Avifauna – Power Line Collisions – With Mitigation	High	Possible	**MEDIUM**	-ve	High
Agriculture Potential & Land Capability – Vehicle Operation and Spillages – No Mitigation	Very Low	Definite	Low	–ve	High
Agriculture Potential & Land Capability – Vehicle Operation and Spillages – With Mitigation	Very Low	Improbable	**INSIGNIFICANT**	–ve	High
Agriculture Potential & Land Capability – Dust Generation – No Mitigation	Low	Definite	Low	–ve	High
Agriculture Potential & Land Capability – Dust Generation – No Mitigation	Very Low	Improbable	**INSIGNIFICANT**	–ve	High
Noise – No Mitigation required	Low	Possible	**LOW**	-ve	High
Social – Sense of place – No Mitigation	High	Probable	High	-ve	High
Social – Sense of place – With Mitigation	Medium	Probable	**MEDIUM**	-ve	High

6.3.3 Assessment of Decommissioning Phase Impacts

The decommissioning phase impacts will have less impacts than the construction phase, but some of the construction activities will be similar. Overall the impacts will be reduced from the construction phase, and there will be no new impacts. Therefore the decommissioning phase was not assessed individually. The EMPr will include measures to be taken into consideration during the decommissioning of the proposed grid connection, should this occur. The EMPr is considered a live document, should impacts arise during the construction and operational phases that need to be included, this will be done by the relevant environmental control officer or manager and submitted to the DEA for approval.

6.3.4 Assessment of Cumulative Impacts

Cumulative Impacts were assessed in combination with the proposed Umsinde Emoyeni WEF Phase 1 and 2, the approved Ishwati Emoyeni Wind Energy Facility as well as all developments under application in the area. It must be noted that the proposed grid

connection itself will not contribute significantly to these cumulative impacts, which are largely caused by the effects of the proposed wind energy facilities.

6.3.4.1 Cumulative Visual Impact

This is the accumulation of visual impacts in the area, particularly in relation to other existing or proposed energy projects and industrial-type facilities in the immediate area, (see Fig. 2.1).

The proposed Umsinde Emoyeni project would consist of 2 phases, resulting in a total of up to 196 proposed wind turbines, ("worst-case" scenario layout), which could have a major visual effect on the local area. In addition, the proposed Ishwati Emoyeni WEF (80 proposed turbines) adjacent to the project site, would increase the cumulative visual effect. Seen together these WEF projects, along with their associated substations and powerlines, could have a significant visual effect on the visual character and scenic resources of the area.

The Victoria West WEF (30 wind turbines), the Noblesfontein WEF, (under construction), and the approved Modderfontein WEF, are all to the west of the N1, about 50km away, and would not be visible from the Umsinde Emoyeni project area.

6.3.4.2 Cumulative impact on Critical Biodiversity Areas and cumulative disruption of broad-scale ecological processes

Transformation within CBAs would potentially disrupt the functioning of the CBA or result in biodiversity loss. In addition, the presence of the Umsinde Emoyeni WEF and associated infrastructure could potentially contribute to the cumulative disruption of broad-scale ecological processes such as dispersal, migration or the ability of fauna to respond to fluctuations in climate or other conditions. There are a number of other renewable energy facilities in the broad area and the cumulative impact of these on habitat loss and the broad scale disruption of landscape connectivity is a potential concern. This impact results from the facility itself and the power line is not considered a significant contributor.

6.3.4.3 Cumulative Impact on Bats

Whilst it is very important to consider the local, regional and national impacts that may be caused by individual developments; it is equally important to consider the cumulative impacts of the facility in light of other similar developments nearby. It is already evident that several other wind and solar developments could be constructed within a 200km radius of the Umsinde Emoyeni WEF site, many as close as 30 to 100 km away.

The Bat Impact Assessment concluded with the following in regard to cumulative assessment: "Based on IWS's experience at 5 operational WEFs already, several bat species are being killed by wind turbines. Species that occur at Umsinde and surrounds that have been reported as wind turbine fatalities in SA include *Tadarida aegyptiaca, Neoromicia capensis* and *Miniopterus natalensis*. Whilst the fatality thresholds that could lead to population crashes are unknown at this stage due to a lack of bat population level data, multiple fatalities of specific species at numerous WEFs cannot be good news for those specific species. The consequences of bat population declines are decreased pest-insect control by insectivorous bats, decreased pollination and seed dispersal by frugivorous bats and other ecosystem services provided by bats and increased mitigation measures required by WEFs."

6.3.4.4 Cumulative Impact on Wetlands & Freshwater

The following potential impacts were identified for the Umsinde Emoyeni WEF Phase 1 and 2:

- Impact 1: Loss of riparian systems and water courses
- Impact 2: Impact on riparian systems through the possible increase in surface water runoff on riparian form and function
- Impact 3: Increase in sedimentation and erosion
- Impact 4: Potential impact on localised surface water quality

The significance of all four potential impacts was assessed as low with. As no impacts of the proposed grid connection on freshwater and wetlands were identified the cumulative impact with Umsinde Emoyeni WEF Phase 1 and 2 would therefore also be low.

For the cumulative assessment of the proposed Umsinde Emoyeni WEF and other developments in the area the following was identified:

Impact 1: Loss of riparian systems and water courses

Possible increase in surface run-off velocities and a reduction in the potential for groundwater infiltration is likely to occur, considering that the site is near the main drainage channel. However the annual rainfall figures are low and this impact is not anticipated.

Impact 2: Impact on riparian systems through the possible increase in surface water runoff on riparian form and function

Downstream alteration of hydrological regimes due to the increased run-off from the area. However due to low mean annual runoff within the region this is not anticipated due to the nature of the development together with the proposed layout.

Impact 3: Increase in sedimentation and erosion

During flood events, any unstable banks (eroded areas) and sediment bars (sedimentation downstream) already deposited downstream. However due to low mean annual runoff within the region this is not anticipated due to the nature of the development together with the proposed layout.

Impact 4: Potential impact on localised surface water quality

Possible impact on the remaining catchment due to changes in run-off characteristics in the development site. However due to low mean annual runoff within the region this is not anticipated due to the nature of the development together with the proposed layout.

In summary, no cumulative impacts are anticipated.

6.3.4.5 Cumulative Impacts on Avifauna

All potential impacts, and particularly those associated with the operational phase of the proposed development, may be intensified to some degree due to the potential cumulative impacts of both WEF phases and/or a number of proposed WEFs within 50 km of the project site. The Umsinde Emoyeni Wind Energy Facility is neighbouring the Ishwati Emoyeni Wind Energy Facility and together these may contribute significantly to habitat fragmentation and disruptions of broad-scale ecological processes such as the dispersal and migration of species in response to fluctuations of local and regional climate. If both facilities are approved they may present a significant barrier to movement of birds, particularly in the north-south direction. The extent of this impact depends on the final turbine layout and numbers and can be reduced if constraints corridors, such as those suggested around the Snyderskraal River in the east of the Ishwati Emoyeni Wind Energy Facility (CSIR 2014), remain free of turbines, and if the minimum number (32) of turbines for each WEF phase is constructed.

Phase 2: WEF and Grid Connection

The cumulative impact of Phase 2 WEF and Phase 2 Grid Connection are expected to be of the same significance as the individual impacts. The Phase 2 Grid Connection will only be approximately 1.8 km in length and should therefore not have any significant effect if mitigated as discussed.

Phase 1 and 2: WEF and Grid Connections

The cumulative impact of all four components of the proposed development are expected to be higher than the individual impacts, particularly for the operational phase. Depending largely on turbine placement, the combined impact of up to 196 turbines has the potential to affect the viability of local populations. If all no-go and highly sensitive areas are avoided, and if an alternative option of less than 49 turbines per phase is adopted, the cumulative impacts of the two WEF phases would be similar to those of one individual WEF phase (of 98 turbines), and would be acceptable.

Phase 1 and 2 WEFs and Grid Connections and Ishwati Emoyeni WEF

The significance of the cumulative impact of the four components of the Umsinde Emoyeni WEF together with the neighbouring approved Ishwati Emoyeni Wind Farm can be higher than the significance of the individual components. Particularly the operational impacts could be intensified and possibly affect the viability of some species local and regional populations. This will depend largely on final turbine placement and number. It is possible that the cumulative impacts of collision (with turbines and power lines) will have a high significance, particularly on the local populations of key species such as Verreaux's Eagle and Blue Crane. Post-construction monitoring results from both WEF facilities (and all phases) should be combined and analysed collectively in order to identify any regional effects.

Combined Umsinde Emoyeni WEF, Ishwati Emoyeni WEF and proposed nearby Developments

Currently there are four further wind energy facilities and three solar projects under application within a 50 km radius from the WEF site. Conducting a detailed cumulative impact assessment of all of these facilities together on a regional scale is beyond the scope of this specialist study and would need the input of all developers and specialists working on the abovementioned projects. Such an assessment is best undertaken by appropriate regional or national agencies in the context of strategic planning, and should not be required in the context of assessing a single proposal. In the scope of this study it is therefore difficult to say at this stage what the cumulative impact of all the proposed developments will be on birds because there is no cumulative baseline to measure against. The extent of actual impacts will only become known once a few wind farms are developed and operational data becomes available, and because the developments considered may not all be constructed.

However, at a high level and with medium confidence it can be said that, if all of these facilities are approved and constructed they may present a significant threat to birds. Electrocutions, collisions with powerlines and wind turbines can potentially affect the viability of regional and even national populations, particularly of Verreaux's Eagle and Blue Crane.

The extent of these impacts will depend largely on the final turbine layouts (and PV technologies and layout extents) of each facility which can be reduced if turbine placement is informed by pre-construction monitoring and nest surveys. Corridors, such as those suggested around the Snyderskraal River in the east of the Ishwati Emoyeni Wind Energy Facility (CSIR, 2013) and the high sensitivity areas identified by Smallie (2014), should remain free of turbines.

If all proposed projects implement appropriate mitigation measures as well as post-construction monitoring programmes and share the information gained from these, then the overall significance of the discussed impacts can be reduced. However, the significance of some cumulative impacts is likely to remain high negative even after mitigation.

6.3.4.6 Cumulative Impacts to Soils, Land use, land capability and Agricultural Potential

Cumulative impacts on soils, land use and agricultural potential were assessed in the specialist study (Volume III) and found to be of low significance:

- Construction of Buildings and Other Infrastructure: The cumulative impact of this activity will be small as it is limited in extent on land with low agricultural potential.
- Construction of Roads: The cumulative impact of this activity will be small as it is linear and limited in geographical extent.
- Construction of Power Lines: The cumulative impact of this activity will be small as it is linear and limited in geographical extent. Impacts are only associated with pylon foundations and not the line.
- Vehicle Operation on Site: The cumulative impact of this activity will be small if managed.
- Dust Generation: The cumulative impact of this activity will be small if managed but can have widespread impacts if ignored.

6.3.4.7 Cumulative Impacts to Cultural Heritage, Archaeology and Palaeontology

The cumulative impact will affect the landscape qualities of the Karoo which is generally considered to be significantly scenic. This area is well known for its wide open spaces, its exposed geology and semi-desert natural qualities. In terms of the larger picture the Karoo is destined to change. Applications for wind and solar energy are numerous to the extent that if these are all authorised the likelihood is that there will be few regions where there will not be an industrial development on the horizon. The sense of isolation and wilderness of this unique landscape will be affected and highly compromised in wind farm areas. The combination of both phases of the proposed activity will affect the quality of the environment within and around the project area, which combined with the proposed Ishwati Emoyeni will have a strong negative impact on the general character of the region. Although other proposed facilities are some 50 km away and given that turbines will be visible for up to 18 km the amount of landscape affected by the combined clusters of wind farms is 36 linear km out of a linear 50 km. This is a significant impact on the character of the Karoo.

6.3.4.8 Cumulative Impacts to Noise Receptors

As the noise impact of the proposed Umsinde Emoyeni WEF is considered to be insignificant and localised there is no cumulative impact in terms of noise is anticipated.

6.3.4.9 Cumulative Impacts to Socio-economy

The proposed Ishwati Emoyeni WEF is located immediately to the west of the proposed Umsinde WEF site. The potential for cumulative impacts associated with combined visibility (whether two or more solar facilities will be visible from one location) and sequential visibility (e.g. the effect of seeing two or more renewable energy facilities along a single journey, e.g. road or walking trail) is therefore high. However, due to the proximity of the two sites the WEFs could be viewed as a single large WEF as opposed to two separate WEFs. While viewing these WEFs as a single large facility, as opposed to separate facilities, does not necessarily reduce the overall visual impact on the scenic character of the area, it does reduce the potential cumulative impact on the landscape. Viewing each of the proposed WEFs as a single, large WEF eliminates the cumulative impacts associated with

combined visibility (whether two or more wind farms will be visible from one location) and sequential visibility (e.g. the effect of seeing two or more wind farms along a single journey, e.g. road or walking trail). This therefore reduces the potential cumulative impact of the WEFs on the landscape. The proximity of the WEFs also has the benefit of concentrating the visual impacts on the areas sense of place in to one area as opposed to impacting on a number of more spread out areas.

However, the potential impact of wind energy facilities on the landscape is an issue that does need to be considered, specifically given South African's strong attachment to the land and the growing number of wind facility applications. With regard to the area, a number of WEFs have been proposed in the Western Cape Province. The Environmental Authorities should therefore be aware of the potential cumulative impacts when evaluating applications.

In addition to the potential negative impacts, the establishment of the proposed WEF and other renewable energy projects in the area also has the potential to create a number of socio-economic opportunities for the town of Murraysburg and the BWLM, which, in turn, will result in a positive social benefit. The positive cumulative impacts include creation of employment, skills development and training opportunities, creation of downstream business opportunities. This benefit is rated as High Positive with enhancement.

6.4 Mitigation Measures

This chapter presents the mitigation measures for the impacts identified above. These are included in the EMPr, and measured against the construction and operational phases of the proposed grid connection.

6.4.1 Construction Phase Mitigation Measures

6.4.1.1 Visual Mitigation Measures:

- Access and haul roads to use existing farm tracks as far as possible.
- Construction camp, stockpiles and lay-down area to be located out of sight of district roads, possibly in the vicinity of the proposed substation and O&M buildings.
- Disturbed areas rather than pristine or intact land to preferably be used for the construction camp. Construction camp and laydown areas to be limited in area to only that which is essential.
- Measures to control wastes and litter to be included in the contract specification documents.
- Provision to be made for rehabilitation/ re-vegetation of areas damaged by construction activities.

6.4.1.2 Fauna and Flora Mitigation Measures

- Pre-construction walk-through in order to locate species of conservation concern that can be avoided or translocated as well as comply with the provincial permit conditions;
- Vegetation clearing to commence only after walk through has been conducted and necessary permits obtained;
- Pre-construction environmental induction for all construction staff on site to ensure that basic environmental principles are adhered to. This includes awareness as to no littering, appropriate handling of pollution and chemical spills, avoiding fire hazards, minimizing wildlife interactions, remaining within demarcated construction areas etc.;
- ECO to provide supervision and oversight of vegetation clearing activities within sensitive areas such as near drainage areas;
- Vegetation clearing to be kept to a minimum. No unnecessary vegetation to be cleared;
- All construction vehicles should adhere to clearly defined and demarcated roads. No off-road driving to be allowed outside of the construction area;
- Temporary lay-down areas should be located within previously transformed areas or areas that have been identified as being of low sensitivity. These areas should be rehabilitated after use;
- Wherever excavation is necessary, topsoil should be set aside and replaced after construction to encourage natural regeneration of the local indigenous species;
- The recovery of the indigenous grass layer should be encouraged through leaving some areas intact through the construction phase to create a seed source for adjacent cleared areas;
- Due to the disturbance at the site as well as the increased runoff generated by the hard infrastructure, alien plant species are likely to be a long-term problem at the site and a long-term control plan will need to be implemented;
- Regular monitoring for alien plants within the development footprint as well as adjacent areas which receive runoff from the facility as there are also likely to be prone to invasion problems;
- Regular alien clearing should be conducted using the best-practice methods for the species concerned. The use of herbicides should be avoided as far as possible;

- Dust suppression and erosion management should be an integrated component of the construction approach;
- Disturbance near to drainage lines or the pan should be avoided and sensitive drainage areas near to the construction activities should demarcated as no-go areas;
- Regular monitoring for erosion problems along the access roads and other cleared areas;
- Erosion problems should be rectified on a regular basis;
- Sediment traps may be necessary to prevent erosion and soil movement if there are topsoil or other waste heaps present during the wet season;
- A low cover of vegetation should be left wherever possible within the construction footprint to bind the soil, prevent erosion and promote post-disturbance recovery of an indigenous ground cover;

6.4.1.3 Bat Mitigation Measures

- Clearing of natural and agricultural areas be kept to a minimum.
- Dust suppression measures to be used during the full construction phase.
- Any new roosts discovered, should be reported and incorporated into the adaptive management plan.
- No pylons to be built within 500 m of these potential roosts or 1 km from any known roosts.
- Office, sub-station and lay-down areas should only be in areas of Low-Medium and Medium bat sensitivity (Figure 6.3).
- Clearing of natural and agricultural areas be kept to a minimum.

6.4.1.4 Wetlands and Freshwater

If the 32 m buffer of all watercourses is adhered to no further mitigation measures are required.

6.4.1.5 Avifauna Mitigation Measures:

- A site specific Operational Environmental Management Plan (OEMP) must be implemented, which gives appropriate and detailed description of how operational and maintenance activities must be conducted to reduce unnecessary disturbance. All contractors are to adhere to the OEMP and should apply good environmental practice during all operations.
- Any grid connection power line/s must be of a design that minimizes electrocution risk by using adequately insulated 'bird friendly' monopole structures, with clearances between live components of 2 m or greater.
- The operational monitoring programme for the associated WEF site must be in line with the South African monitoring guidelines (Jenkins et al. 2015) and must include regular monitoring of the grid connection power line and all new associated substations for electrocution (and collision) mortalities. Any mortalities should be reported to the Endangered Wildlife Trust (EWT).
- Construct new power lines close to existing power lines where possible.
- The proposed Grid Connection should be re-routed to avoid, by 2 km or more, the location of the Verreaux's Eagle nest located at (31°43'39.50"S; 23°40'44.07"E) by Smallie (2014).
- An avifaunal specialist must conduct a site walk through of final grid connection route and pylon positions prior to construction to determine if, and where, bird flight diverters (BFDs) are required.
- Install bird flight diverters as per the instructions of the specialist following the site walkthrough, which may include the need for modified BFDs fitted with solar powered LED lights on certain spans.

6.4.1.6 Soil, Land use, Land capability and Agricultural Potential Mitigation

- Limit footprint to the immediate development area and keep to existing roads as far as possible;
- Maintain vehicles, prevent and address spillages;
- Limit vehicle movement to absolute minimum, construct proper roads for access.

6.4.1.7 Palaeontological Mitigation:

Once the final layout of the transmission line is determined, a pre-construction palaeontological study is to be undertaken of those limited sectors of the footprint that overlie potentially-fossiliferous sediments (i.e. Lower Beaufort Group bedrocks, older consolidated alluvium). The study should be carried out by a suitably qualified palaeontologist and would involve (a) recording of near-surface fossil material, including relevant geological data (e.g. stratigraphy, sedimentology, taphonomy), (b) judicious sampling of scientifically-valuable fossils as well as (c) making recommendations regarding further mitigation or conservation of specific fossil sites for the construction phase of the transmission line.

During the construction phase a chance-finds procedure should be applied should substantial fossil remains such as vertebrate bones, teeth or trackways, plant-rich fossil lenses or dense fossil burrow assemblages be exposed by excavation or discovered within the development footprint. The responsible Environmental Control Officer should safeguard the fossils, preferably in situ, and alert the responsible heritage management authority (Heritage Western Cape for the Western Cape, SAHRA for the Northern Cape) so that appropriate action can be taken by a professional palaeontologist, at the developer's expense. Mitigation would normally involve the scientific recording and judicious sampling or collection of fossil material as well as associated geological data (e.g. stratigraphy, sedimentology, taphonomy) by a professional palaeontologist.

Palaeontological mitigation recommendations should be incorporated into the Construction Environmental Management Plan (EMP) for the Umsinde Emoyeni Wind Energy Facility and associated transmission line. Provided that the recommended mitigation measures are carried through, it is likely that any potentially negative impacts of the proposed developments on local fossil resources will be substantially reduced. Furthermore, they will be partially offset by the positive impact represented by our increased understanding of the palaeontological heritage of the Great Karoo region.

6.4.1.8 Archaeological Mitigation

Given the size of the original project area and the fact that the level of coverage of the assessment survey was quite thin, a walk down survey is essential to check final road positions and infrastructures sites.

The presence of rock engravings on dolerite outcrops at unpredictable localities in the project areas are a concern. Road alignments and infrastructure sites will have to be walked, the rock engravings identified and recorded and where possible moved to the side of the road. The work should be done by an archaeologist (certainly at first) however an ECO which some heritage training may be able to assume this role.

A work plan to be submitted to Heritage Western Cape must detail how this is to be done, the level of sampling required and a dossier or catalogue of images and descriptions compiled.

Cultural Landscape Mitigations:

- Powerlines to avoid visually sensitive peaks, major ridgelines, scarp edges and slopes steeper than 1:5 gradient.

- Substations to be sited in unobtrusive, low-lying areas, away from roads and habitations, and screened by berms and/or tree-planting where feasible.
- Access roads to be in sympathy with the contours, avoid steep 1:5 slopes and drainage courses, and kept as narrow as possible.
- The proposed powerline must be adjusted to avoid Bakensklip and Hartebeestfontein by at least 500 m as these sits have heritage qualities.

6.4.1.9 Noise Mitigation Measures

The study considers the potential noise impact on the surrounding environment due to construction activities during the daytime periods. It was determined that the potential noise impact would be of low significance and mitigation measures are not required or recommended.

The developer must know that community involvement needs to continue throughout the project. Annoyance is a complicated psychological phenomenon; as with many industrial operations, expressed annoyance with sound can reflect an overall annoyance with the project, rather than a rational reaction to the sound itself. At all stages surrounding receptors should be informed about the project, providing them with factual information without setting unrealistic expectations. It is counterproductive to suggest that the activities (or facility) will be inaudible due to existing high ambient sound levels. The magnitude of the sound levels will depend on a multitude of variables and will vary from day to day and from place to place with environmental and operational conditions. Audibility is distinct from the sound level, because it depends on the relationship between the sound level from the activities, the spectral character and that of the surrounding soundscape (both level and spectral character).

Mitigation Options to Reduce Construction Noise Impact:

While not required the following measures are included for the developer to consider.

- The use the smaller/quieter equipment when operating near receptors;
- Where possible only operate during the day. If night-time activities is required, do not operate closer than 500 m from any receptors (prevent noise impact of high significance)
- Ensure a good working relationship between the developer and all potentially noise-sensitive receptors. Communication channels should be established to ensure prior notice to the sensitive receptor if work is to take place close to them (especially if work is to take place within 500 m from them at night). Information that should be provided to potentially sensitive receptor(s) includes:
    - Proposed working dates, the duration that work will take place in an area and working times;
    - The reason why the activity is taking place;
    - The construction methods that will be used; and
    - Contact details of a responsible person where any complaints can be lodged should there be an issue of concern.
    - When simultaneous noise emitting activities are to take place close to potential noise-sensitive receptors, co-ordinate the working time with periods when the receptors are not at home. An example would be to work within the 8 am to 2 pm time-slot, as:
    - Potential noise-sensitive receptors are most likely to be at school or work; and normal daily household activities (cleaning, listening to TV/Radio, etc.) will generate other noises that would most likely mask construction noises, thus minimizing the effects of cumulative noise impacts.
    - Ensure that equipment is well maintained and fitted with the correct and appropriate noise abatement measures. Engine bay covers over heavy equipment

could be pre-fitted with sound absorbing material. Heavy equipment that fully encloses the engine bay should be considered, ensuring that the seam gap between the hood and vehicle body is minimised.

6.4.1.10 Social Mitigation Measures

- The alignment of the transmission power line should be done so as to ensure that it is not visible from Badsfontein Farm.
- The recommendations of the Visual assessment should be implemented.

6.4.2 Operational Phase Mitigation Measures

6.4.2.1 Visual Mitigation Measures

- Powerlines to avoid visually sensitive peaks, major ridgelines, scarp edges and slopes steeper than 1:5 gradient.
- Substations to be sited in unobtrusive, low-lying areas, away from roads and habitations, and screened by berms and/or tree-planting where feasible.
- Operations and maintenance buildings and parking areas to be located in an unobtrusive area and consolidated to avoid sprawl of buildings in the open landscape.
- Access roads to be in sympathy with the contours, avoid steep 1:5 slopes and drainage courses, and Fauna and Flora Mitigation Measures

6.4.2.2 Fauna and Flora Mitigation Measures

- Wherever excavation is necessary, topsoil should be set aside and replaced after construction to encourage natural regeneration of the local indigenous species.
- The recovery of the indigenous shrub/grass layer should be encouraged through leaving some areas intact through the construction phase to create a seed source for adjacent cleared areas.
- Due to the disturbance at the site as well as the increased runoff generated by the hard infrastructure, alien plant species are likely to be a long-term problem at the site and a long-term control plan will need to be implemented. Problem woody species such as *Prosopis* are already present in the area and are likely to increase rapidly if not controlled.
- Regular monitoring for alien plants within the development footprint as well as adjacent areas which receive runoff from the facility as there are also likely to be prone to invasion problems.
- Regular alien clearing should be conducted using the best-practice methods for the species concerned. The use of herbicides should be avoided as far as possible.
- All roads and other hardened surfaces should have runoff control features which redirect water flow and dissipate any energy in the water which may pose an erosion risk.
- Regular monitoring for erosion after construction to ensure that no erosion problems have developed as result of the disturbance.
- All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques.
- All cleared areas should be revegetated with indigenous perennial grasses from the local area. These can be cut when dry and placed on the cleared areas if natural recovery is slow.

6.4.2.3 Bat Mitigation Measures

No mitigation measures are required.

6.4.2.4 Wetlands and Freshwater Mitigation measures

No mitigation measures are required.

6.4.2.5 Avifauna Mitigation Measures

- A site specific Operational Environmental Management Plan (OEMP) must be implemented, which gives appropriate and detailed description of how operational and maintenance activities must be conducted to reduce unnecessary disturbance. All contractors are to adhere to the OEMP and should apply good environmental practice during all operations.
- The operational monitoring programme for the associated WEF site must be in line with the South African monitoring guidelines (Jenkins *et al.* 2015) and must include regular monitoring of the grid connection power line and all new associated substations for electrocution (and collision) mortalities. Any mortalities should be reported to the Endangered Wildlife Trust (EWT).

6.4.2.6 Soil, Land use, Land Capability and Agricultural Potential

- Site management has to be implemented with the appointment of a suitable environmental control officer (ECO) to oversee the process, address problems and recommend and implement corrective measures;
- Implement site specific erosion and water control measures to prevent excessive surface runoff from the site
- Plan the road and site layout in such a way as to make maximal use of existing roads and fence/border areas to minimise impacts and to keep grazing and natural units as intact as possible; and
- Prevent dust generation and vehicle associated pollution and spillages.

6.4.2.7 Cultural Heritage, Palaeontological and Archaeological Mitigation

No operational phase mitigation measures are recommended.

6.4.2.8 Noise Operational Phase Mitigation Measures

The significance of noise during the operational phase is low and additional mitigation measures are not required.

6.4.2.9 Social Mitigation Measures

- No social mitigation measures during the operational phase of the proposed grid connection are recommended.

6.4.3 Decommissioning

6.4.3.1 Fauna and Flora Mitigation Measures

- Rehabilitation of all cleared and disturbed areas with local species.
- Post-decommissioning monitoring and control of alien species for at least 3 years after decommissioning.
- Removal of all infrastructure components from the site.
- Rehabilitation of all cleared and disturbed areas with local species.
- Off-site disposal of all facility components such as cabling, etc.
- Monitoring programme for at least three years after decommissioning to document vegetation recovery across the site.

6.4.3.2 Avifauna Mitigation Measures

- All contractors shall apply good environmental practice during decommissioning and adhere to a Decommissioning Environmental Management Plan (DEMP) which must be compiled and detail appropriate ecological measures to be taken.
- Prior to decommissioning, a walkthrough by an avifaunal specialist must be conducted to identify if any birds are breeding in the area that need to be considered in terms of timing, and nests need to be moved if feasible.
- Prior to decommission, consult with the avifaunal specialist who will advise if any additional relevant and updated mitigations must be implemented during this phase.

7 PUBLIC PARTICIPATION

The first stage of public consultation was undertaken during the Scoping phase where the draft scoping report was made available for presentation and public review. The objective of this consultation was to inform the National, Provincial and local Government Authorities, relevant public, private sector entities, NGOs and local communities about the project and capture their initial views and issues of concern that will be important for the formulation of draft ToR.

The primary aims of the public participation process are:

- To inform Interested and Affected Parties (I&APs) of the proposed development;
- To identify issues, comments and concerns as raised by I&APs;
- To promote transparency and an understanding of the project and its potential consequences;
- To facilitate open dialogue and liaise with all I&APs;
- To assist in identifying potential environmental (biophysical and socio-economic) impacts associated with the proposed development; and
- To ensure that all I&AP issues and comments are accurately recorded, addressed and documented in an issues trail.

The public participation in the EIA phase has the following objectives:

- Inform I&APs about the EIA process followed to date;
- Present the specialist studies undertaken, impacts and proposed mitigation measures;
- Present the results of the Environmental Impact Assessment; and
- Collect concerns and expectations and take them into consideration in the EIA.

The public participation activities undertaken during this phase included:

- Updating the stakeholders' database prepared during the Scoping phase;
- Public notification about the public meetings (newspaper adverts, invitations – Appendix IV);
- Provision of copy of the Draft EIA for public consultation;
- Preparation of public meetings;
- Public meeting 1 (date, venue, attendees to be finalised)

Details of the above information is attached in a public participation report included as Volume II.

8 SUMMARY & CONCLUSIONS

The proposed grid connection forms part of the proposed Umsinde Emoyeni Wind Energy Facility and the results of this Draft EIA Report must be regarded as such.

During the EIA process, impacts on both the bio-physical and socio-economic environments were assessed. The following specialist's studies were commissioned based on the sensitivities of the site and the potential impacts of the proposed development:

- Visual;
- Terrestrial Ecology (Flora and Fauna);
- Bats;
- Wetlands and Freshwater;
- Birds;
- Soils, Land Use and Agricultural Potential;
- Heritage and Palaeontology;
- Noise; and
- Socio-Economic.

Different alternatives ranging from site location, transportation, design, turbine technologies, and the no-go option were considered for the proposed WEF, of which the proposed grid connection is a required component. When considering the alternatives the applicant needs to consider environmental, social and economic factors and technical factors.

The preferred site was chosen based on the following: because the site is in an area with a good wind resource, the four components of the proposed development have been located in the sections of the site that are of low-medium areas of ecological sensitivity and there are feasible grid connection alternatives. The specialist social impact assessment found that the No Development alternative would result in a negative social cost of medium negative significance. The No Development alternative was also not considered feasible in the context of the proposed development and the needed power that will be generated from this renewable resource.

The proposed grid connection servitude follows the shortest possible route avoiding sensitive areas and minimizing potential impacts. Micro-siting of the pylon positions will be required in certain areas (Figures 6.7 and 6.8).

8.1 Impact Statement

Potential environmental impacts were evaluated according to their extent, duration, intensity and magnitude. No residual impacts of high significance were identified by the specialist studies for the proposed grid connection, and no fatal flaws were identified.

Residual negative impacts of the proposed project on the biophysical environment of medium significance after mitigation were identified as follows:

- Potential loss of fauna and flora species of concern;
- Visual impact (assessed as low negative from a social perspective);
- Electrocution of birds on power lines;
- Collisions of birds on power lines;
- Impact on Sense of Place.

From the specialist assessments, it is evident that the construction and the operation of the WEF and grid connections will have some negative impacts both socially and environmentally but when appropriate mitigation measures are applied, negative impacts can be reduced to within reasonable levels and are outweighed by positive impacts. Overall the proposed development has positive economic benefits regionally and for South Africa

as a whole as power generated from the WEF will feed into the national Eskom grid, and create local job opportunities and Economic Development benefits. It is the opinion of the EAP that following the impact assessment the proposed grid connection will have a low to medium environmental impact and should be approved by the department. All mitigation measures, sensitive areas and buffers outlined in Chapter 6 must be adhered to by the EWFP.

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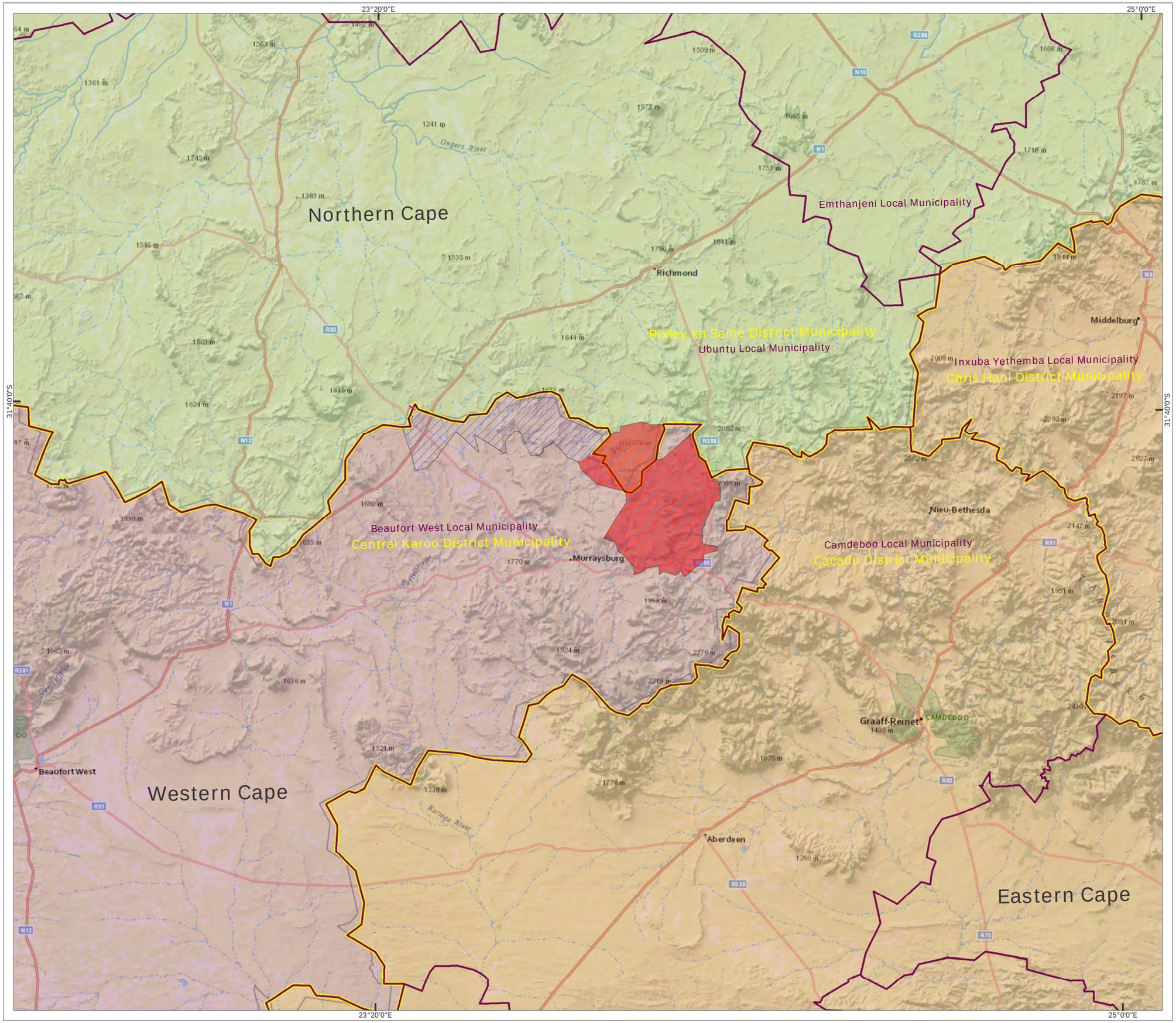
APPENDIX A: EAP CV & DECLARATION OF INDEPENDANCE

APPENDIX B: DRAFT ENVIRONMENTAL MANAGEMENT PROGRAMME



Basemapping from Chief Directorate: National Geo-Spatial Information of South Africa

ARCUS

- Grid Site
- WEF Site
- Gamma Substation
- Local Municipality
- District Boundary
- Eastern Cape
- Western Cape
- Northern Cape

Projection: Transverse Mercator
Datum: Hartebeeshoek 94
Reference Ellipsoid: WGS 84
Central Meridian: 23°

1:750,000 Scale @ A3

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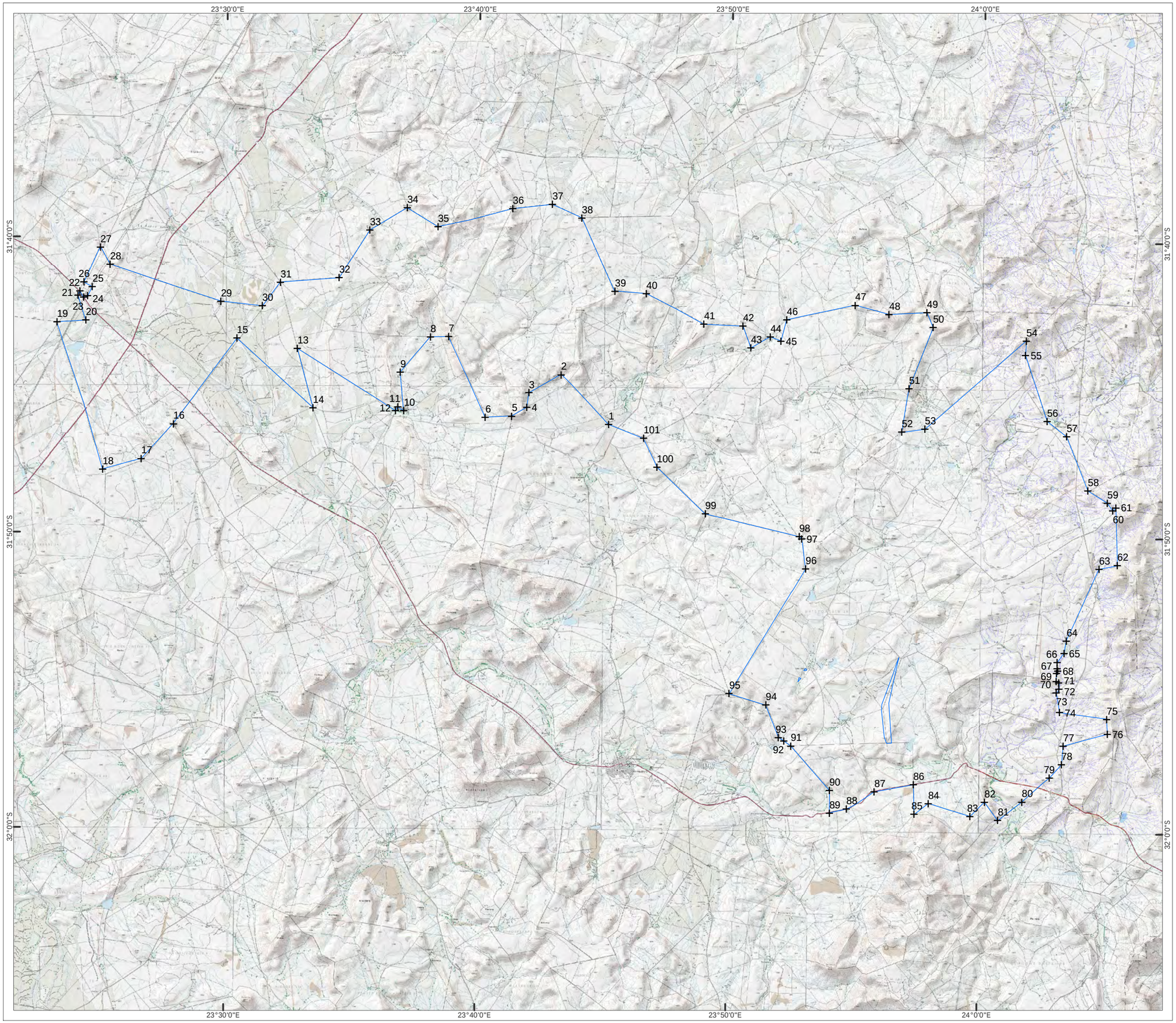
N

Produced: AT Reviewed: SC Approved: AB	Ref: 2146/REP/018
	Date: 06/01/2016

Site Location
Figure 1.1

Umsinde Emoyeni WEF
Grid Connection Phase 2
Draft EIA Report



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12	23.6122	-31.7642	62	24.0906	-31.8484
13	23.5471	-31.7292	63	24.0785	-31.8505
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15	23.5071	-31.7235	65	24.0559	-31.8984
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24	23.4083	-31.6999	74	24.0534	-31.9318
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34	23.6192	-31.6495	84	23.9668	-31.9838
35	23.6395	-31.6600	85	23.9575	-31.9899
36	23.6890	-31.6496	86	23.9569	-31.9732
37	23.7151	-31.6470	87	23.9309	-31.9773
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46	23.8705	-31.7113	96	23.8843	-31.8519
47	23.9156	-31.7028	97	23.8814	-31.8348
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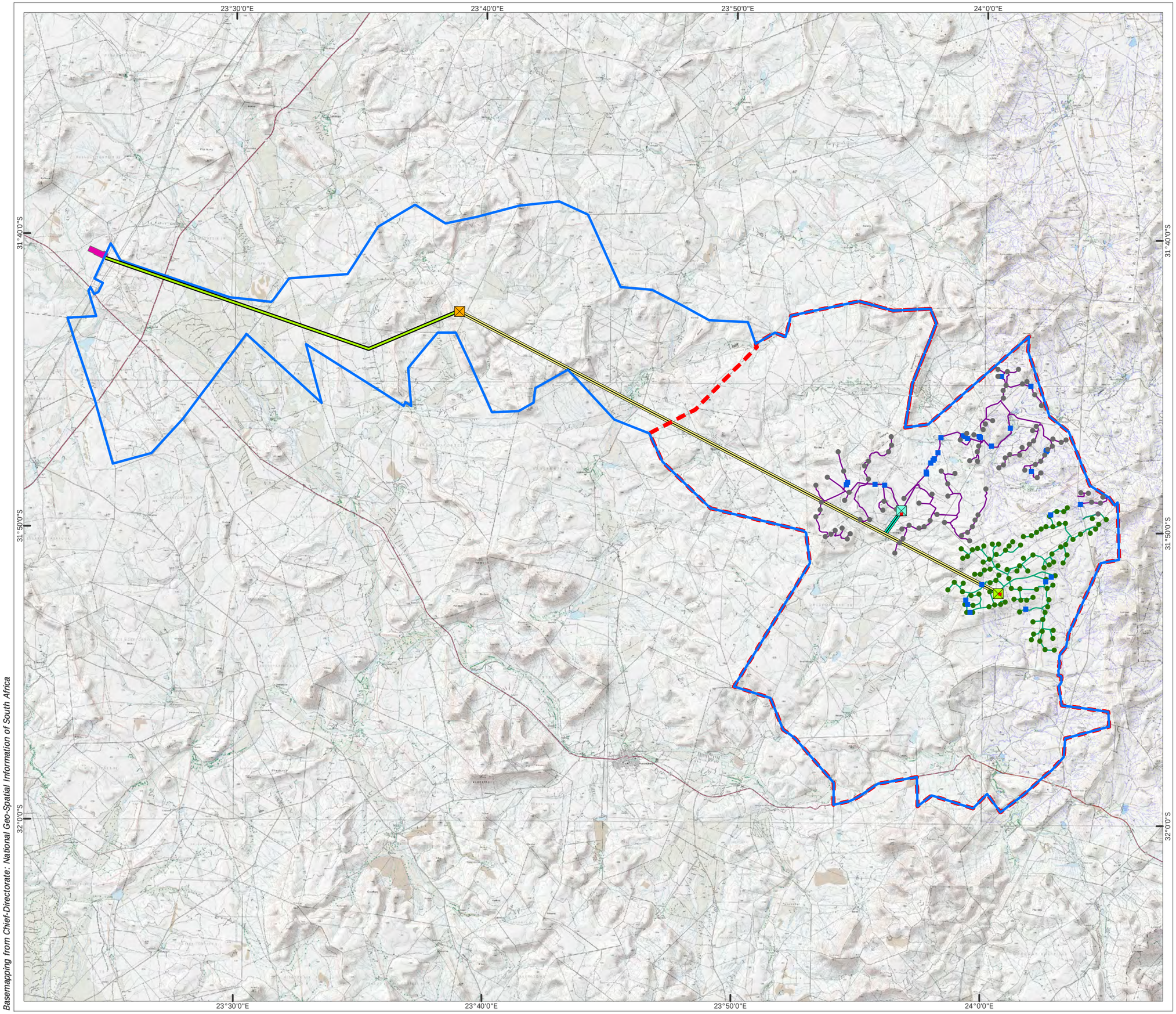
Produced: AT Reviewed: SC Approved: AB	Ref: 2146/REP/019
	Date: 26/11/2015

Grid Site Boundary
Phase 1 and 2
Figure 1.2

Umsinde Emoyeni WEF
Grid Connection Phase 2
Draft EIA Report



ARCUS

- WEF Site Boundary
- Grid Site Boundary
- Eskom Gamma Substation
- Approved Ishwati Emoyeni Substation
- Approved Ishwati Emoyeni Grid Route
- Proposed Turbine Phase 1
- Proposed Turbine Phase 2
- Proposed Road Phase 1
- Proposed Road Phase 2
- Proposed Substation Phase 1
- Proposed Substation Phase 2
- Proposed Grid Connection Phase 1
- Proposed Grid Connection Phase 2
- Proposed Laydown Area
- Proposed Water Crossing

1:225,000 Scale @ A3

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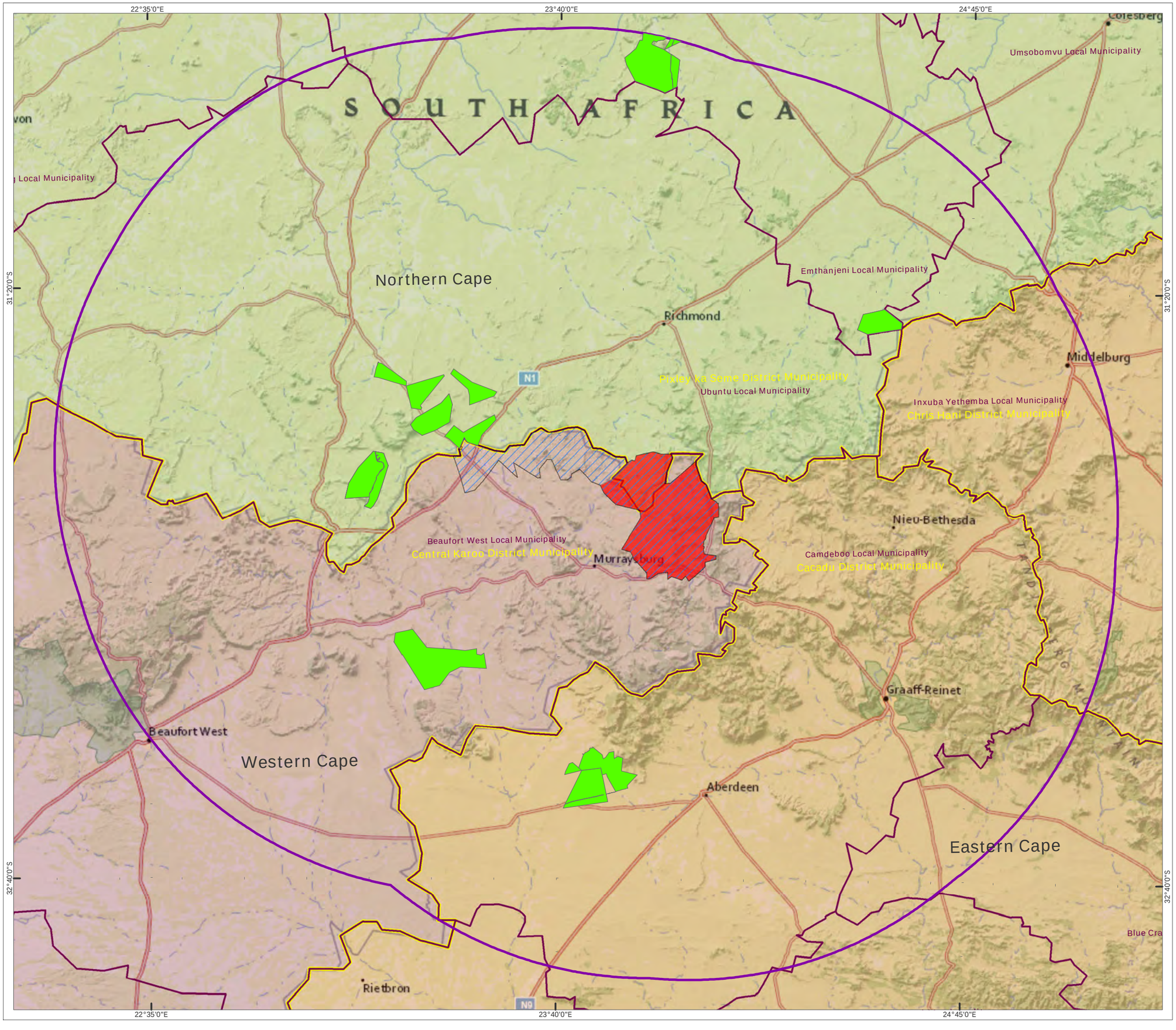
Produced: AT Reviewed: SC Approved: AB	Ref: 2146/REP/020
	Date: 05/01/2016

The Proposed Development Layout
Figure 1.3

Umsinde Emoyeni WEF
Grid Connection Phase 2
Draft EIA Report

Basemapping from Chief-Directorate: National Geo-Spatial Information of South Africa



Basemapping from Chief Directorate: National Geo-Spatial Information of South Africa

ARCUS

- Grid Site
- WEF Site
- Local Municipality
- District Boundary
- WEF Applications DEA Q1 2015
- 100 km Radius
- Eastern Cape
- Western Cape
- Northern Cape

Projection: Transverse Mercator
Datum: Hartebeeshoek 94
Reference Ellipsoid: WGS 84
Central Meridian: 23°

1:900,000 Scale @ A3

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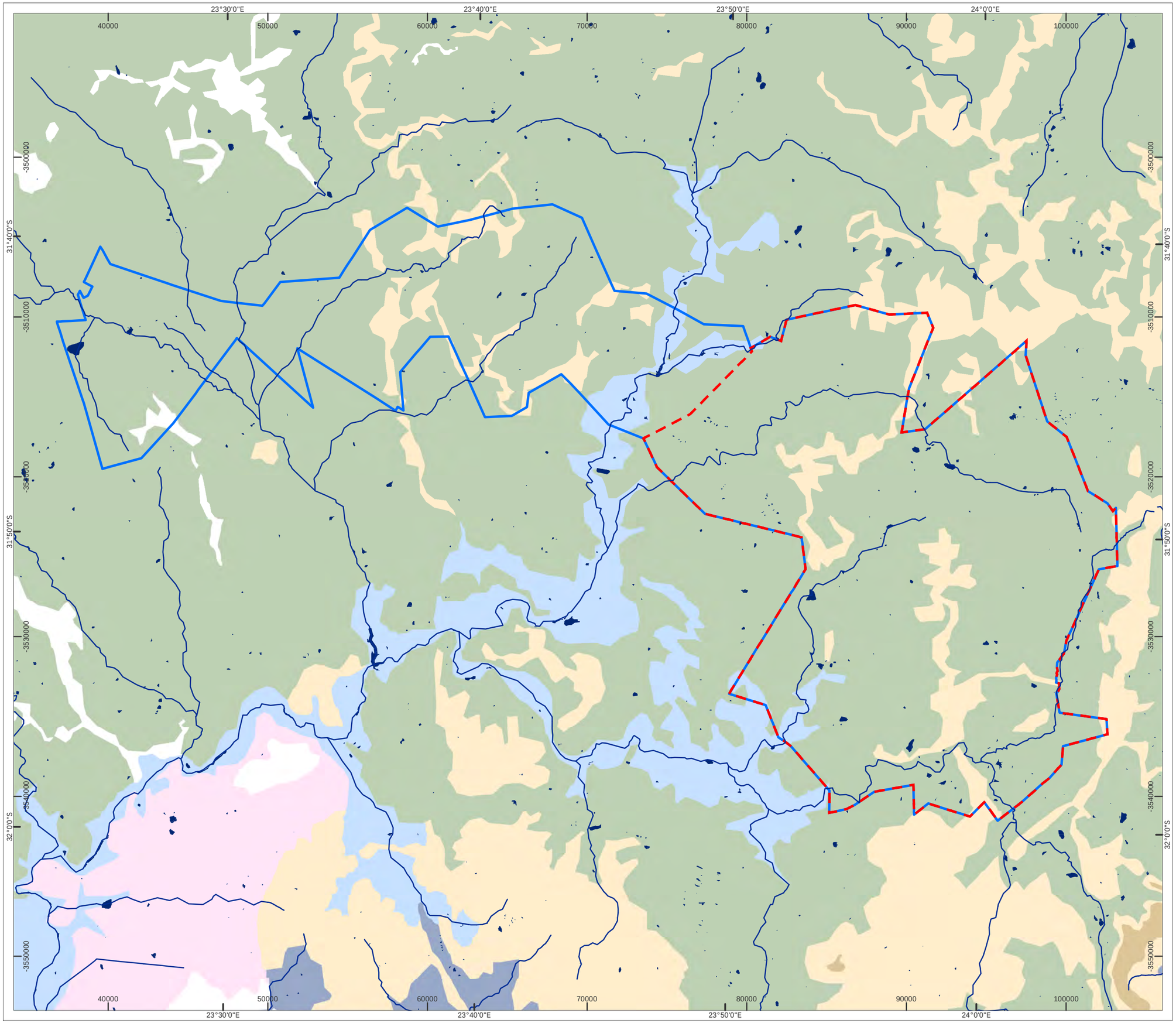
	Date: 05/01/2016

Proposed Regional Wind Energy Projects
Figure 2.1

Umsinde Emoyeni WEF
Grid Connection Phase 2
Draft EIA Report



ARCUS

- WEF Site Boundary
- Grid Site Boundary
- NFEPA River
- NFEPA Wetland
- Eastern Lower Karoo
- Eastern Upper Karoo
- Gamka Karoo
- Karoo Escarpment Grassland
- Southern Karoo Riviere
- Upper Karoo Hardeveld

Projection: Transverse Mercator
Datum: Hartebeeshoek 94
Reference Ellipsoid: WGS 84
Central Meridian: 23°

1:225,000 Scale @ A3

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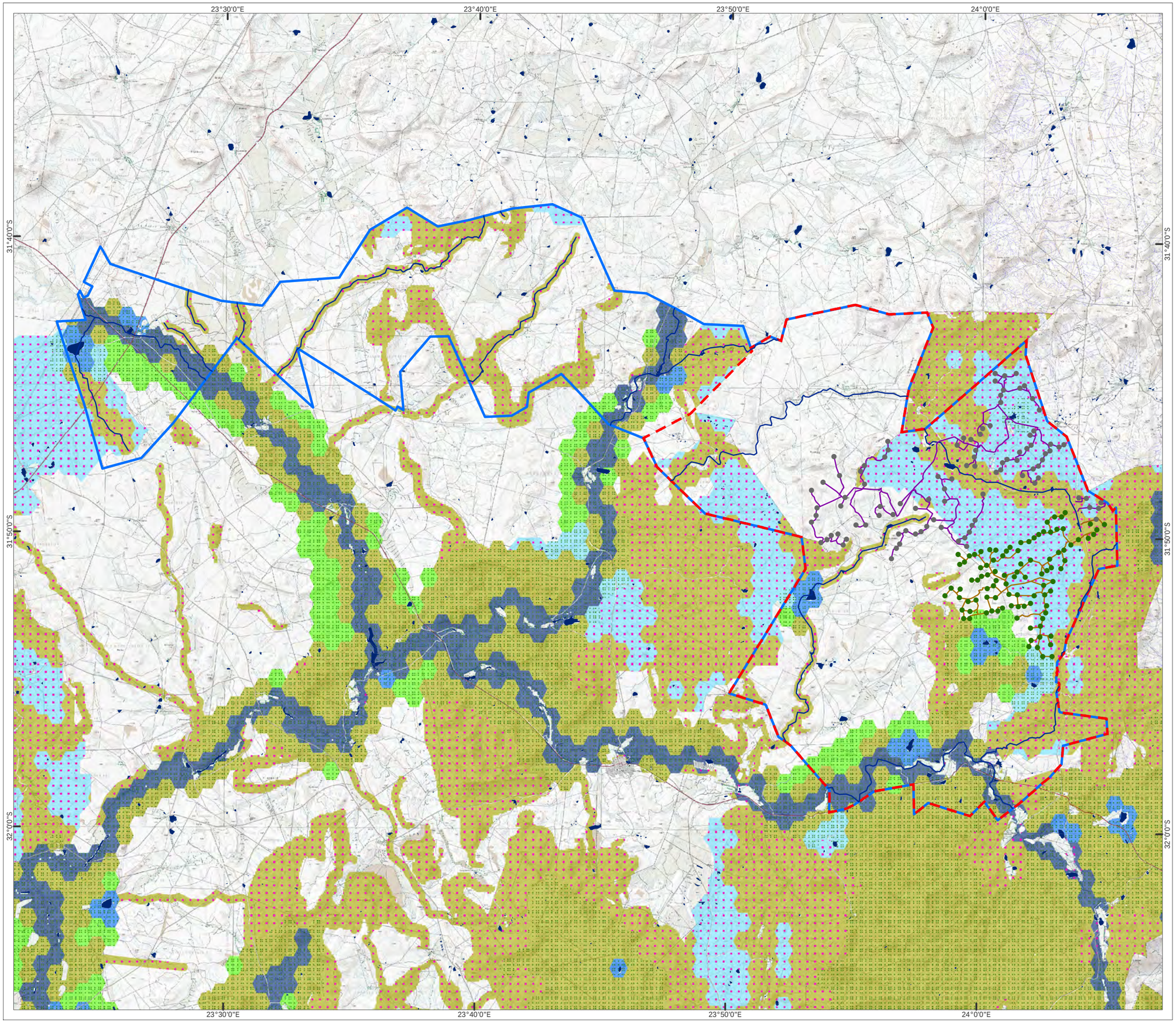
Produced: JA Reviewed: SC Approved: AB	Ref: 2146/REP/022
	Date: 05/01/2016

Vegetation Map
Figure 5.1

Umsinde Emoyeni WEF
Grid Connection Phase 2
Draft EIA Report

Basemapping from the Chief Directorate National Geo-Spatial Information of South Africa



ARCUS

- WEF Site Boundary
- Grid Site Boundary
- Proposed Turbine Phase 1
- Proposed Turbine Phase 2
- Proposed Road Phase 1
- Proposed Road Phase 2
- NFEPA Wetland
- NFEPA Rivers
- Critical Biodiversity Area
- Ecological Support Area
- Priority River Reach
- Priority Catchment
- Potential Wetland
- Maintain ecological processes
- Habitat Required as part of Best Design

1:225,000 Scale @ A3

N

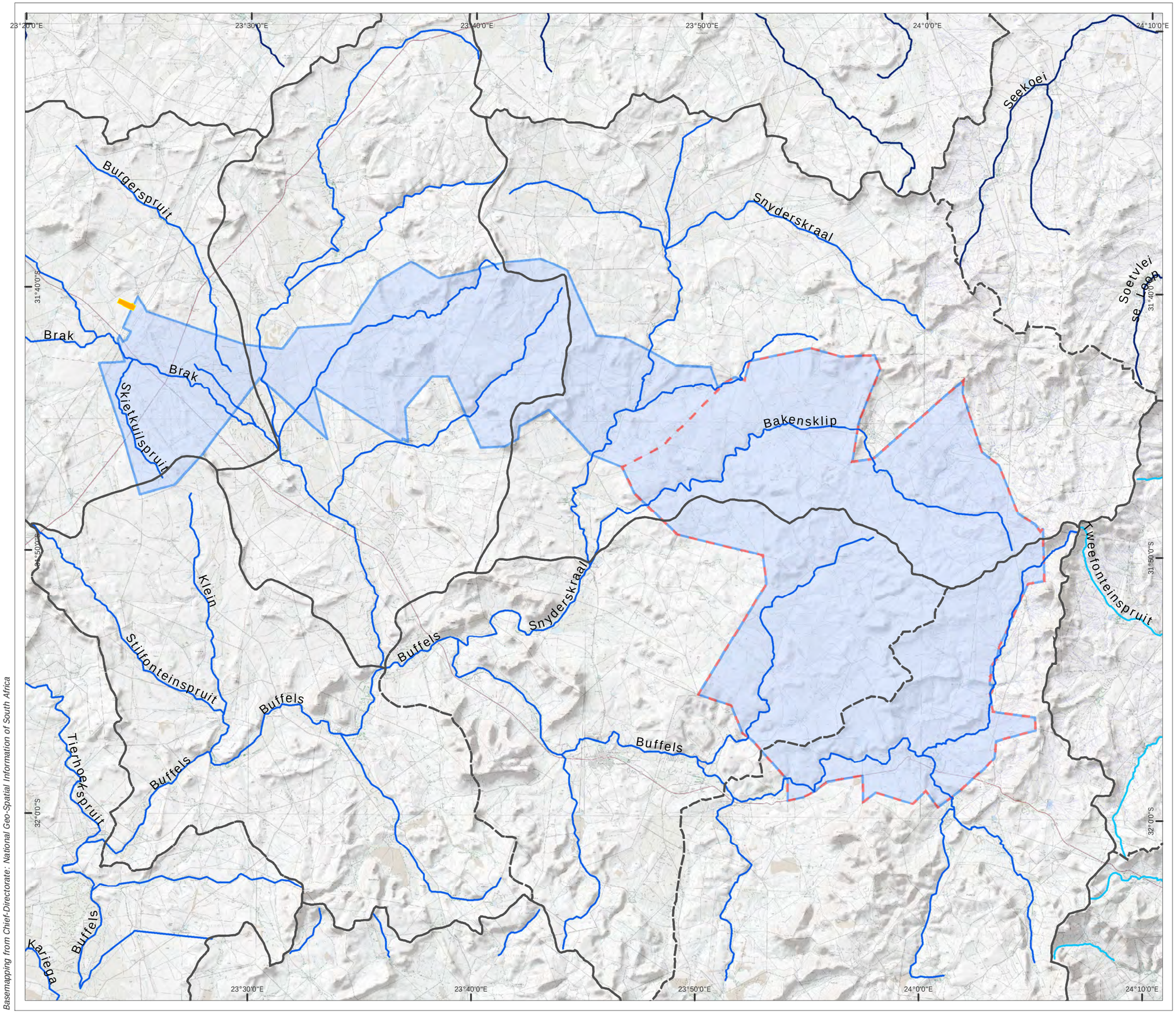
0 5 10 km

Produced: JA Reviewed: SC Approved: AB	Ref: 2146/REP/023
	Date: 05/01/2016

Critical Biodiversity Areas
Figure 5.2

Umsinde Emoyeni WEF
Grid Connection Phase 2
Draft EIA Report

Basemapping from Chief-Directorate: National Geo-Spatial Information of South Africa



Basemapping from Chief-Directorate: National Geo-Spatial Information of South Africa

ARCUS

- WEF Site Boundary
- Grid Site Boundary
- Gamma Substation
- Quaternary Catchments

PES Scores of NFEPA Rivers

- Class B: Largely Natural
- Class C: Moderately Modified
- Class D: Largely Modified

Projection: Transverse Mercator
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Reference Ellipsoid: WGS 84
Central Meridian: 23°

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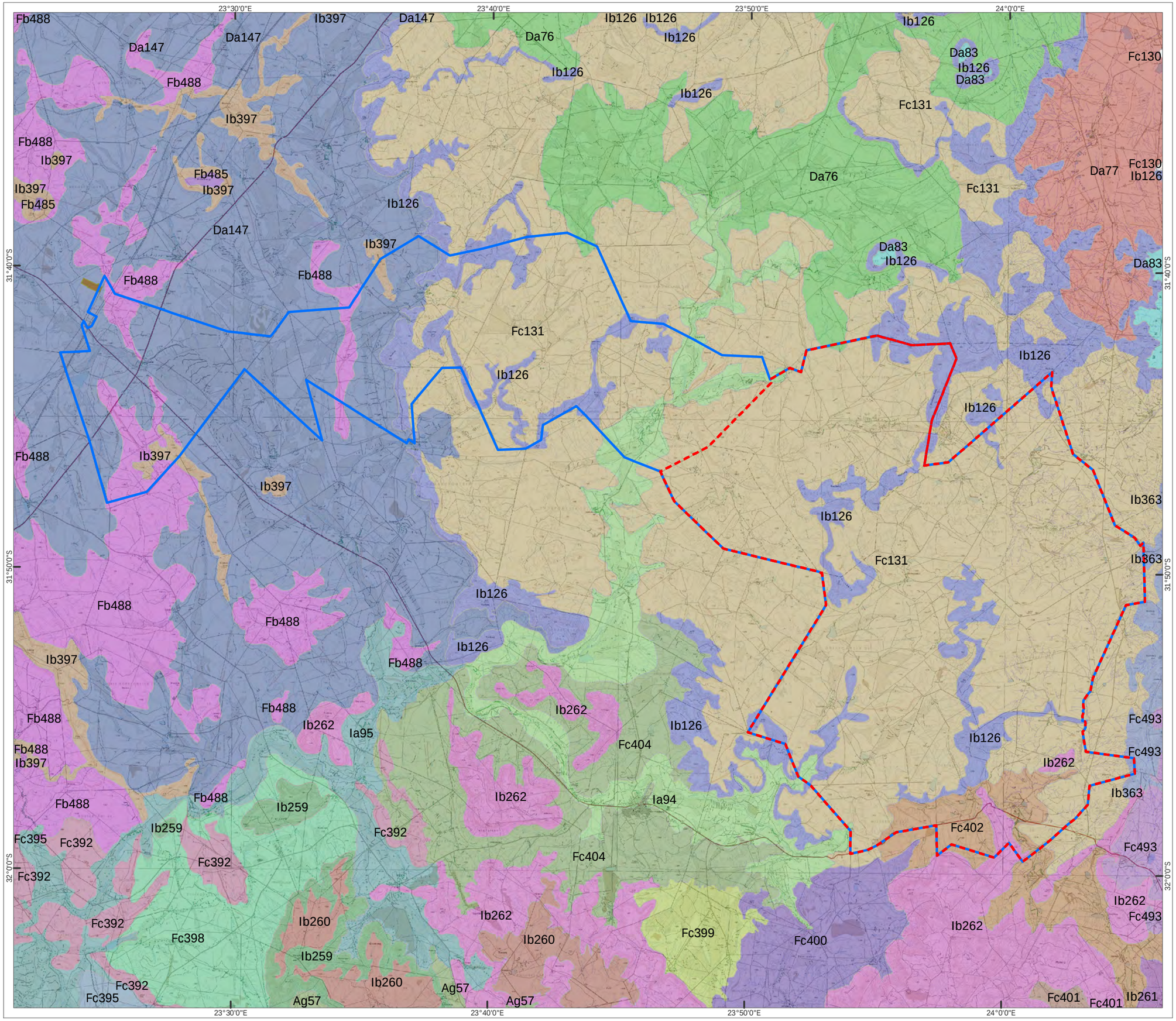
Produced: AT Reviewed: SC Approved: AB	Ref: 2146/REP/024
	Date: 05/01/2016

Quaternary Catchments and Rivers
Figure 5.3

Umsinde Emoyeni WEF
Grid Connection Phase 2
Draft EIA Report



ARCUS

- WEF Site Boundary
- Grid Site Boundary

LANDTYPE

- Ag57
- Da147
- Da76
- Da77
- Da83
- Fb485
- Fb488
- Fc131
- Fc392
- Fc395
- Fc398
- Fc399
- Fc400
- Fc401
- Fc402
- Fc404
- Fc493
- Ia94
- Ia95
- Ib126
- Ib259
- Ib260
- Ib261
- Ib262
- Ib363
- Ib397

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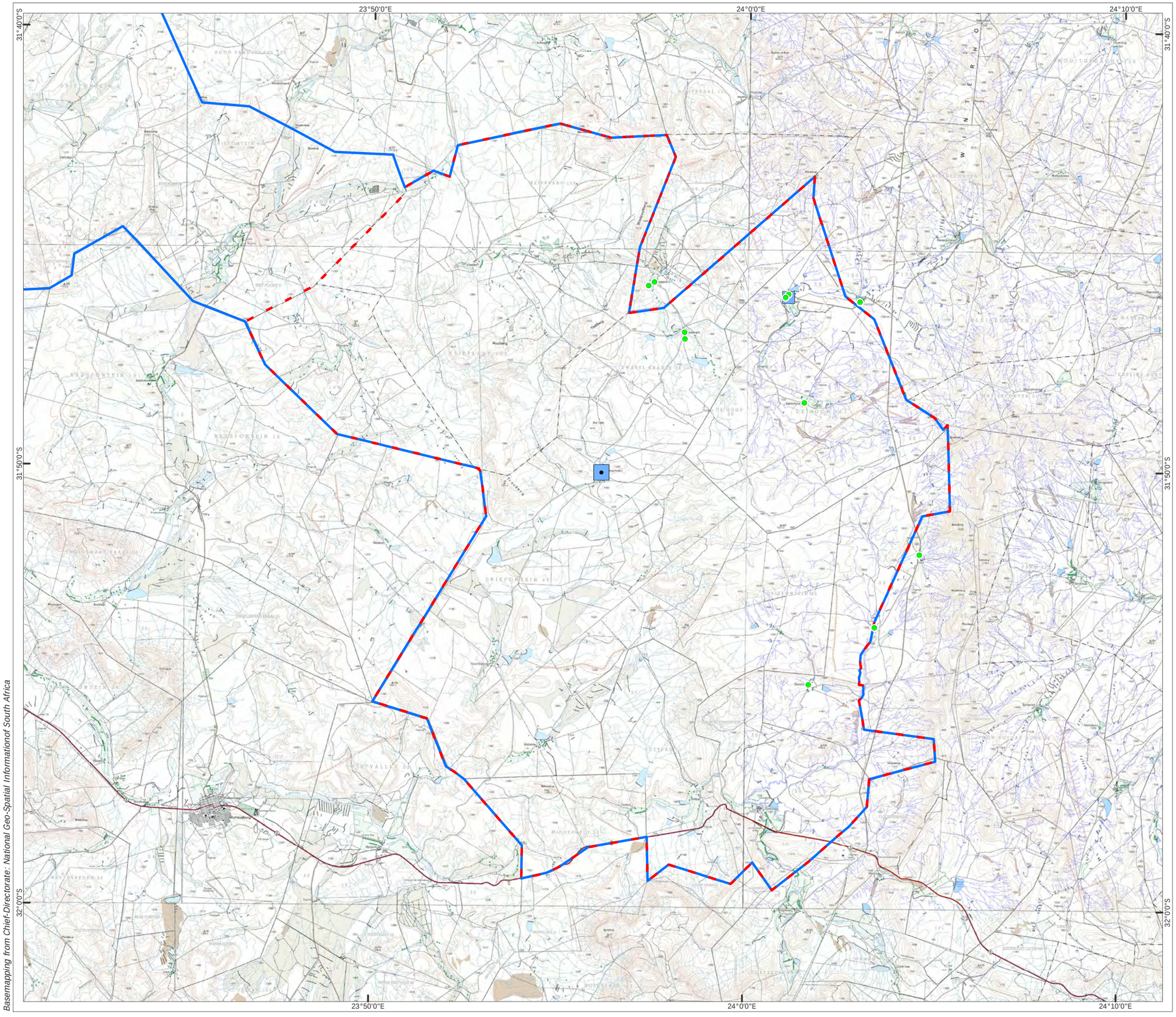
Land Types
Figure 5.4

Umsinde Emoyeni WEF
Grid Connection Phase 2
Draft EIA Report

Basemapping from Chief-Directorate: National Geo-Spatial Information of South Africa



Basemapping from Chief-Directorate: National Geo-Spatial Informationof South Africa

ARCUS

- WEF Site Boundary
- Grid Site Boundary
- Noise Sensitive Receptor
- Ambient Sound Measurement Location

1:150,000 Scale @ A3

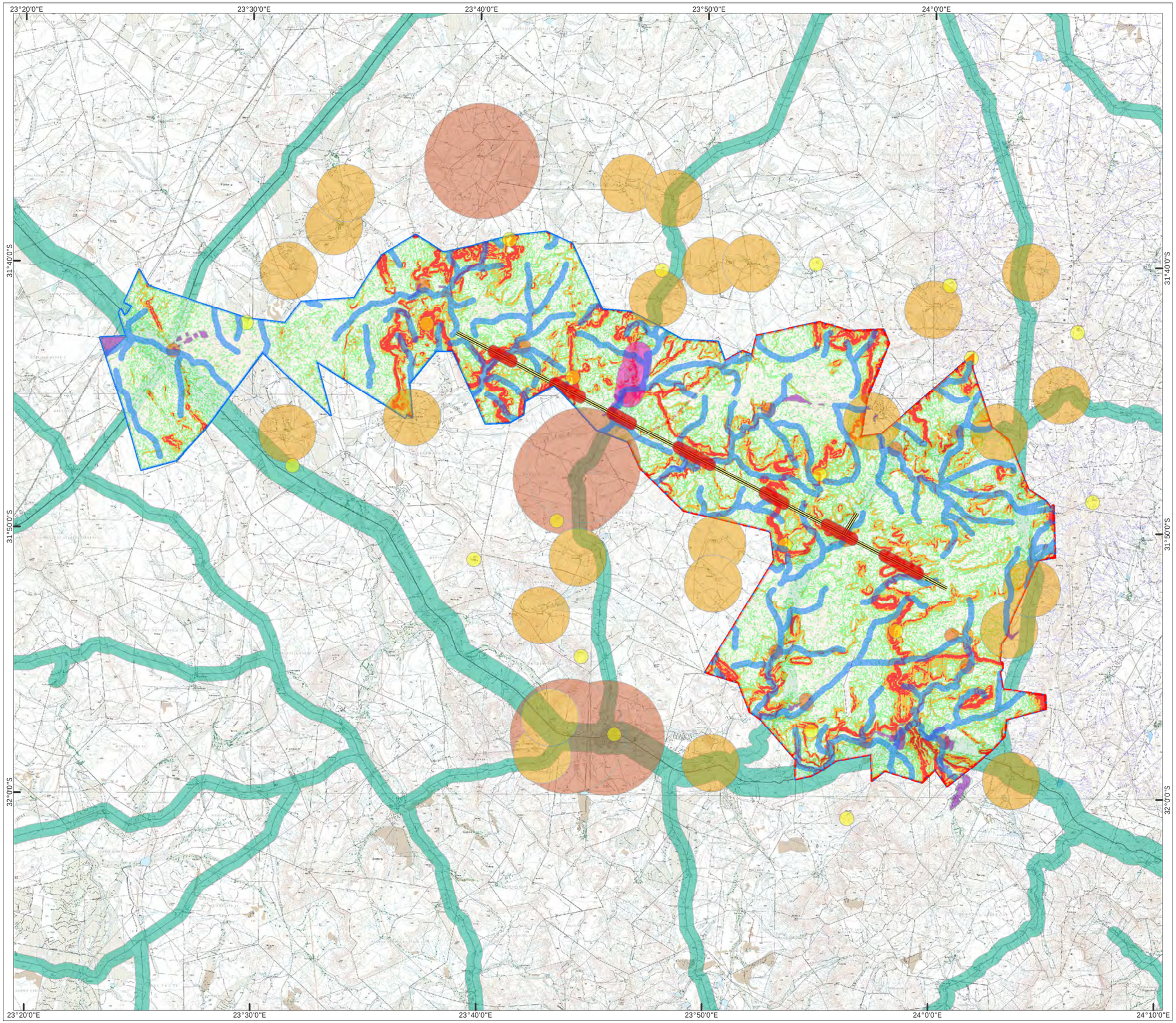
0 4 8 km

N

Produced: AT Reviewed: SC Approved: AB	Ref: 2146/REP/026
	Date: 06/01/2016

Noise Sensitive Receptors and Recording Sites on the WEF Site
Figure 5.5

Umsinde Emoyeni WEF
Grid Connection Phase 2
Draft EIA Report



ARCUS

- WEF Site Boundary
- Grid Site Boundary
- Grid Micro-siting Region
- Proposed Grid Connection
- Cultivated Landscape
- 500 m Buffer Farmsteads within Site
- 2 km Buffer Farmsteads
- 4 km Buffer Towns and Guestfarms
- 500 m Buffer of Peaks
- River Buffer
- 1 km / 500 m Buffer of National / Regional Roads
- 1 km Buffer Scenic Poort
- Slope less than 1:20
- Slope at 1:20
- Slope at 1:10
- Slope at 1:5

1:250,000 Scale @ A3

0 5 10 km

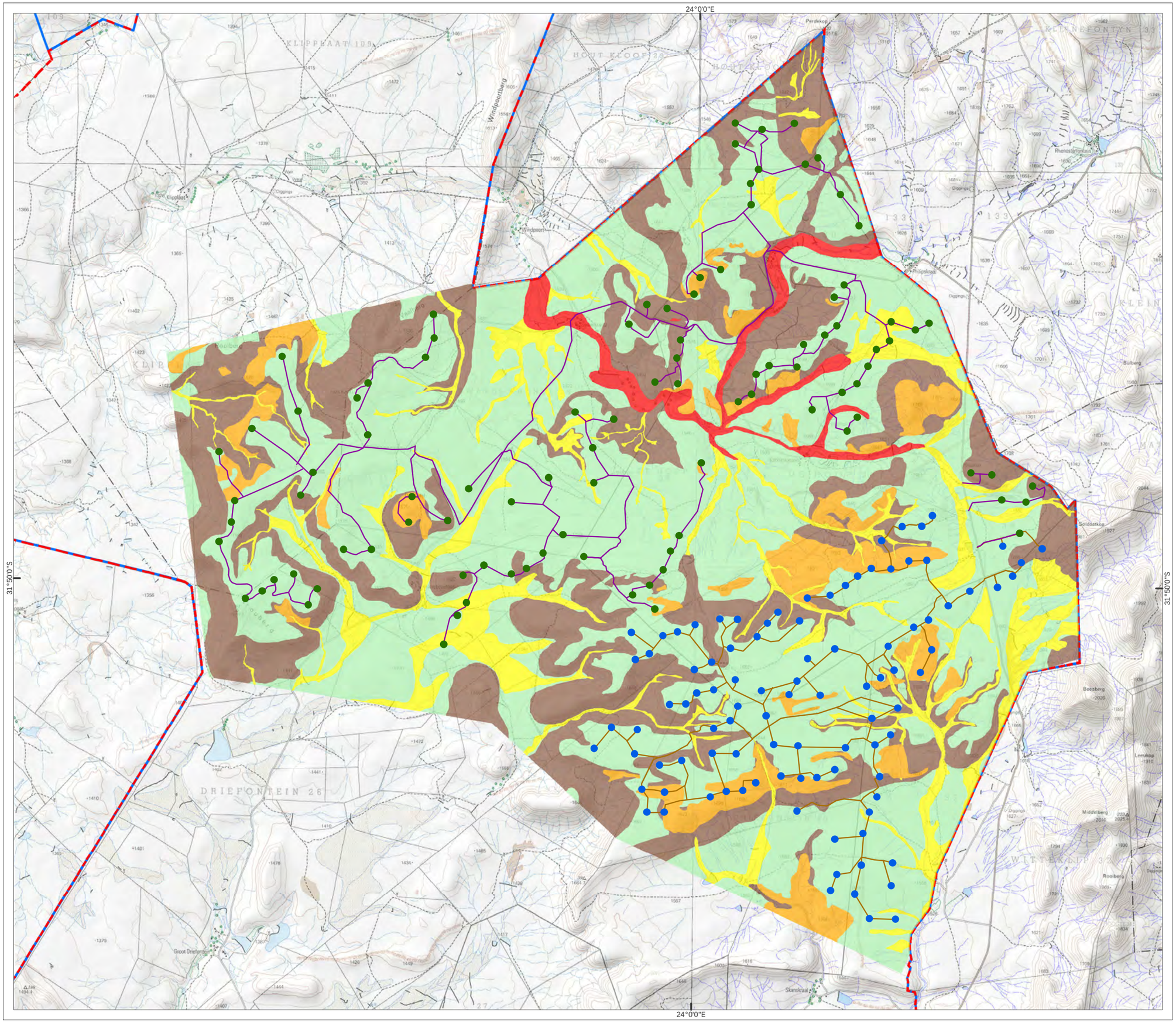
N

Produced: AT Reviewed: RMc Approved: AB	Ref: 2146/REP/027 Date: 06/01/2016

Visual Constraints
Figure 6.1

Umsinde Emoyeni WEF
Grid Connection Phase 2
Draft EIA Report

Basemapping from Chief-Directorate: National Geo-Spatial Information of South Africa



Basemapping from Chief-Directorate: National Geo-Spatial Information of South Africa

ARCUS

- WEF Site Boundary
- Grid Site Boundary
- Proposed Turbine Phase 1
- Proposed Turbine Phase 2
- Proposed Road Phase 1
- Proposed Road Phase 2

Ecological Sensitivity

- Medium (Plains)
- High (Washes and Minor Drainage)
- High-Slopes (Steep slopes and Hills)
- High-Very High (Dolerite Outcrops)
- Very High (Steep)

1:80,000 Scale @ A3

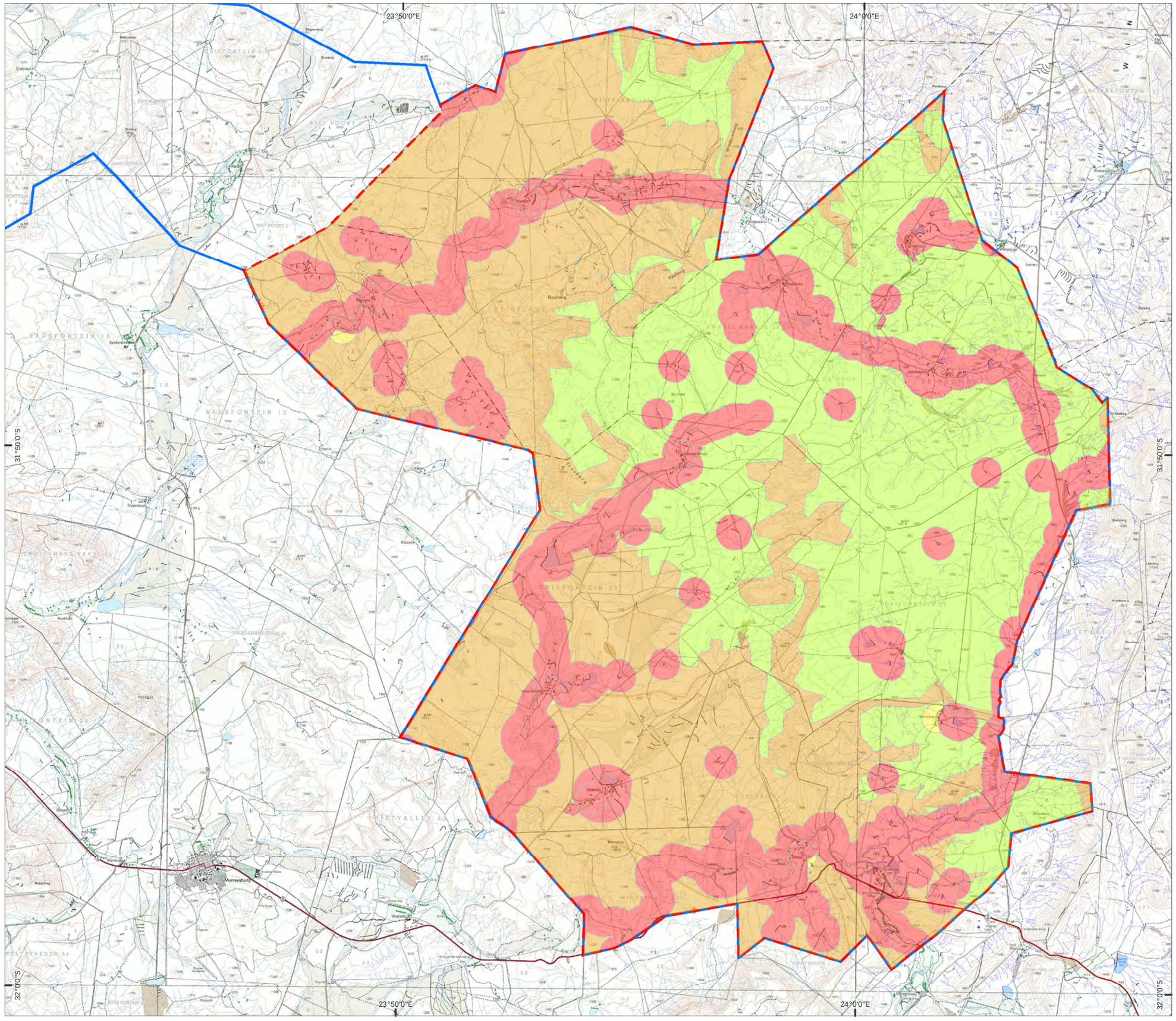
N

0 2 4 km

Produced: JA Reviewed: RMc Approved: AB	Ref: 2146/REP/028
	Date: 06/01/2016

Ecological Sensitivity
Figure 6.2

Umsinde Emoyeni WEF
Grid Connection Phase 2
Draft EIA Report



ARCUS

WEF Site Boundary

Grid Site Boundary

Bat Sensitivity

- Low - Medium
- Medium
- Medium - High
- High

1:125,000 Scale @ A3

0 2.5 5 km

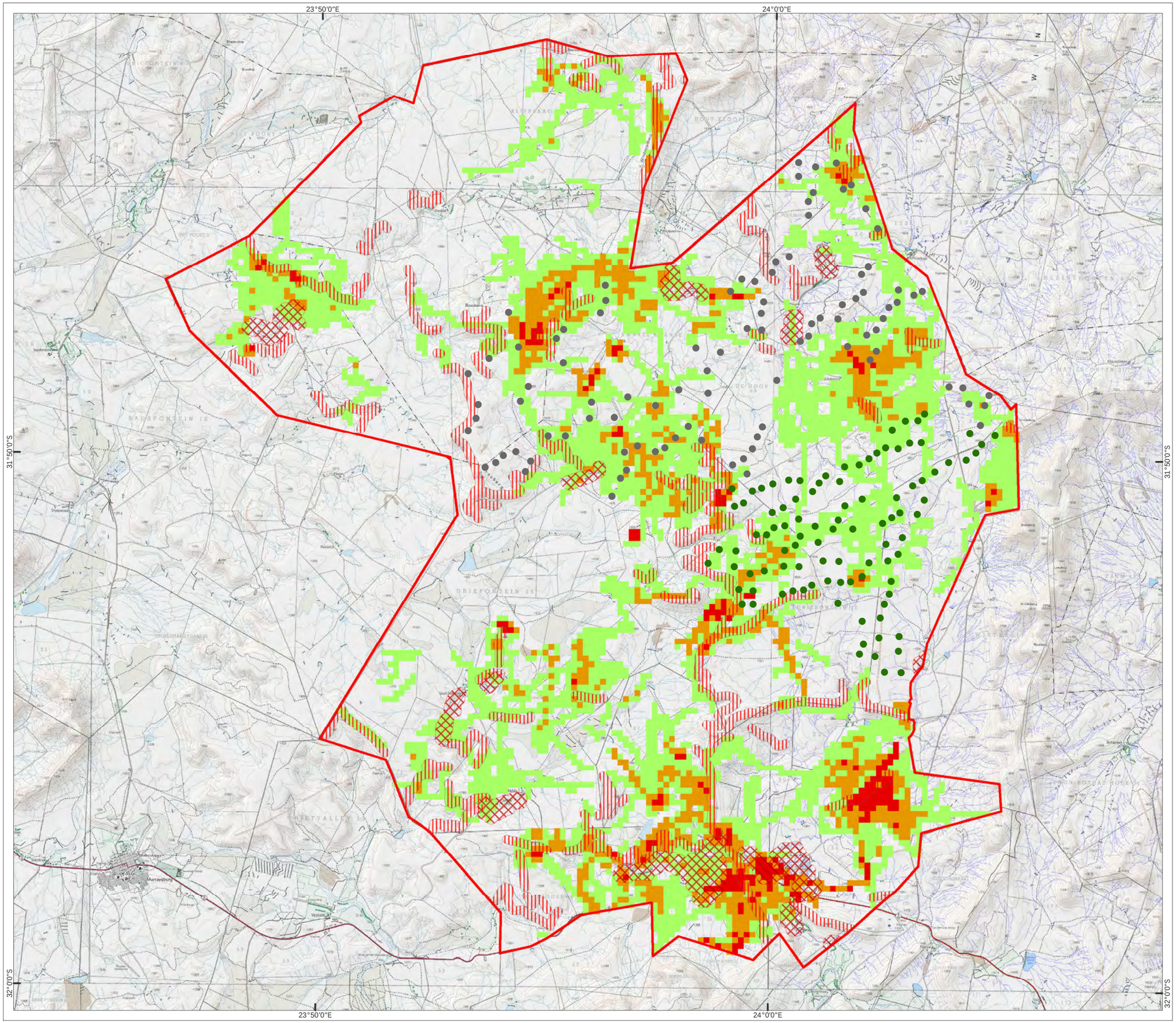
N

Produced: AT Reviewed: RMc Approved: AB	Ref: 2146/REP/029
	Date: 06/01/2016

Bat Sensitivity
Figure 6.3

Umsinde Emoyeni WEF
Grid Connection Phase 2
Draft EIA Report

Basemapping from Chief-Directorate: National Geo-Spatial Information of South Africa



ARCUS

- WEF Site Boundary
- Proposed Turbine Phase 1
- Propsoed Turbine Phase 2
- 150 m Buffer of Ridgelines (medium Sensitivity)
- 200 m Buffer of Cultivated Land
- 174 - 3,550 (Low Sensitivity)
- 3,560 - 10,777 (Medium Sensitivity)
- 10,777 - 39,360 (High Sensitivity)

1:125,000 Scale @ A3

0 2 4 km

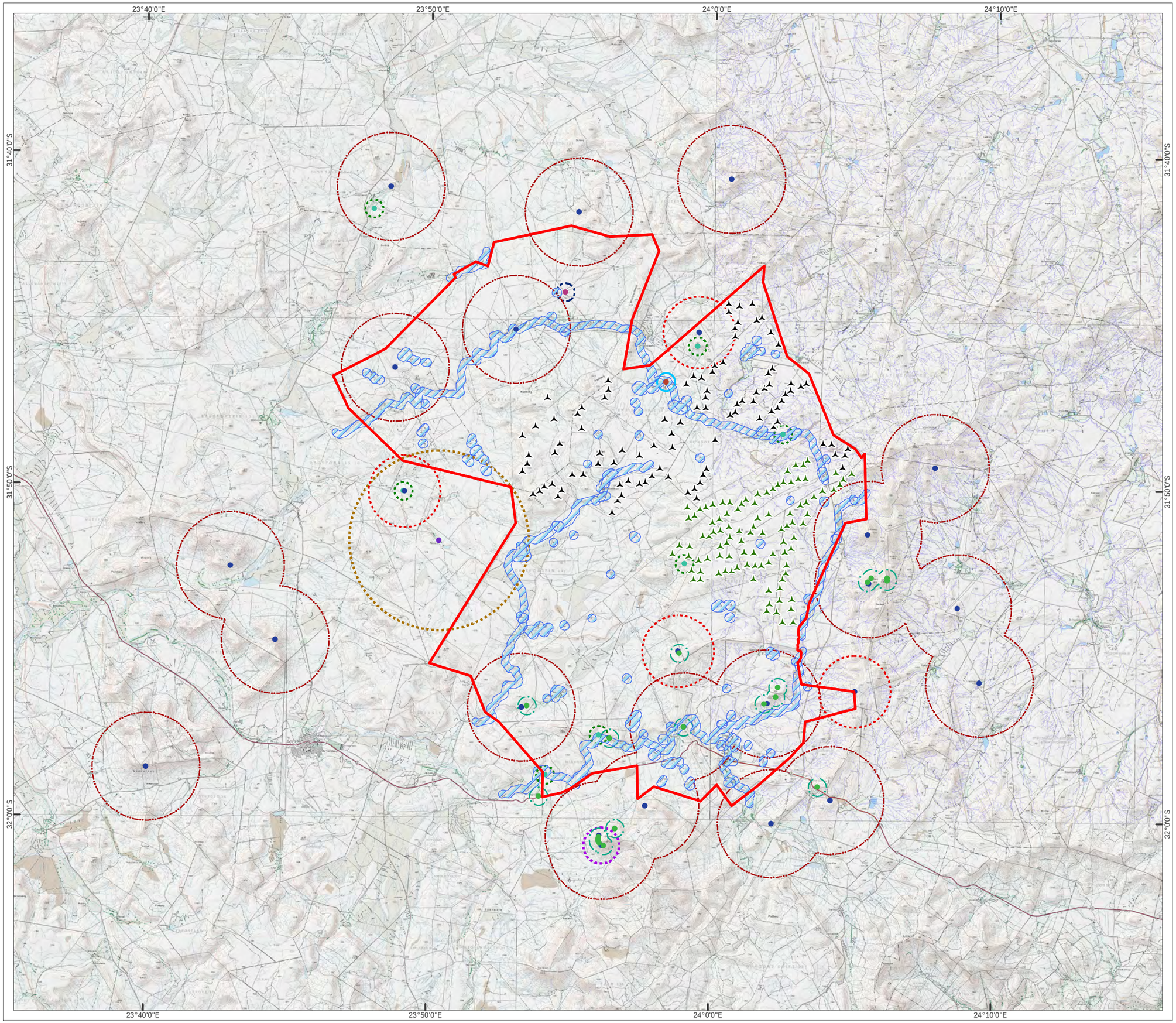
N

Produced: AT Reviewed: SC Approved: AB	Ref: 2146/REP/030
	Date: 06/01/2016

Avifaunal Sensitivity
Figure 6.4

Umsinde Emoyeni WEF
Grid Connection Phase 2
Draft EIA Report

Basemapping from Chief-Directorate: National Geo-Spatial Information of South Africa



ARCUS

- WEF Site Boundary
- Proposed Turbine Phase 1
- Proposed Turbine Phase 2
- 1km Buffer of Peregrine Falcon
- 2km Buffer of Verreaux's Eagle (unoccupied)
- 3km Buffer of Verreaux's Eagle (occupied)
- 500m Buffer of Jackal Buzzard
- 500m Buffer of Pale-chanting Goshawk
- 500m Buffer of Rock Kestrel
- 500m Buffer of Rufus-breasted Sparrowhawk
- 5km Buffer of Martial Eagle
- 200 m buffer of NFEPA Wetlands and Rivers

Nest Sites

- Verreaux's Eagle
- Pale-chanting Goshawk
- Peregrine Falcon
- Jackal Buzzard
- Martial Eagle
- Rock Kestrel
- Rufous-chested Sparrowhawk

1:200,000 Scale @ A3

0 5 10 km

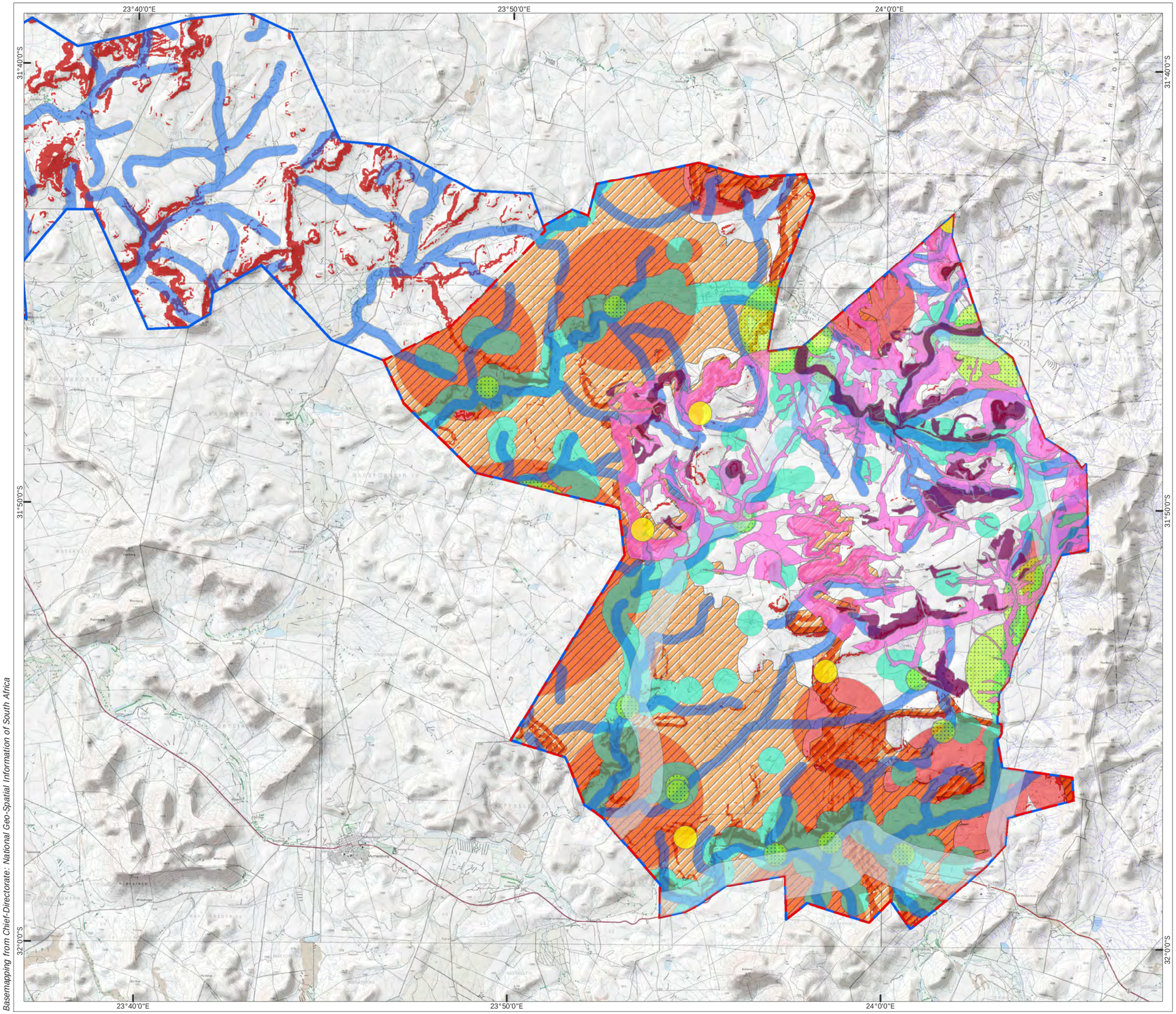
N

Produced: AT Reviewed: SC Approved: AB	Ref: 2146/REP/031
	Date: 06/01/2016

Avifaunal No-Go Areas
Figure 6.5

Umsinde Emoyeni WEF
Grid Connection Phase 2
Draft EIA Report

Basemapping from Chief-Directorate: National Geo-Spatial Information of South Africa



ARCUS

- Grid Site Boundary
- WEF Site Boundary
- 500 m River Buffer
- High Ecological Sensitivity
- High-Very High Ecological Sensitivity
- High Bat Sensitivity
- Medium - High Bat Sensitivity
- Nest Buffer
- 500 / 2000 m Farm Buffer
- 500 m Buffer of Peak
- National / Regional Road Buffer
- Slope 1:5

1:150,000 Scale @ A3

N

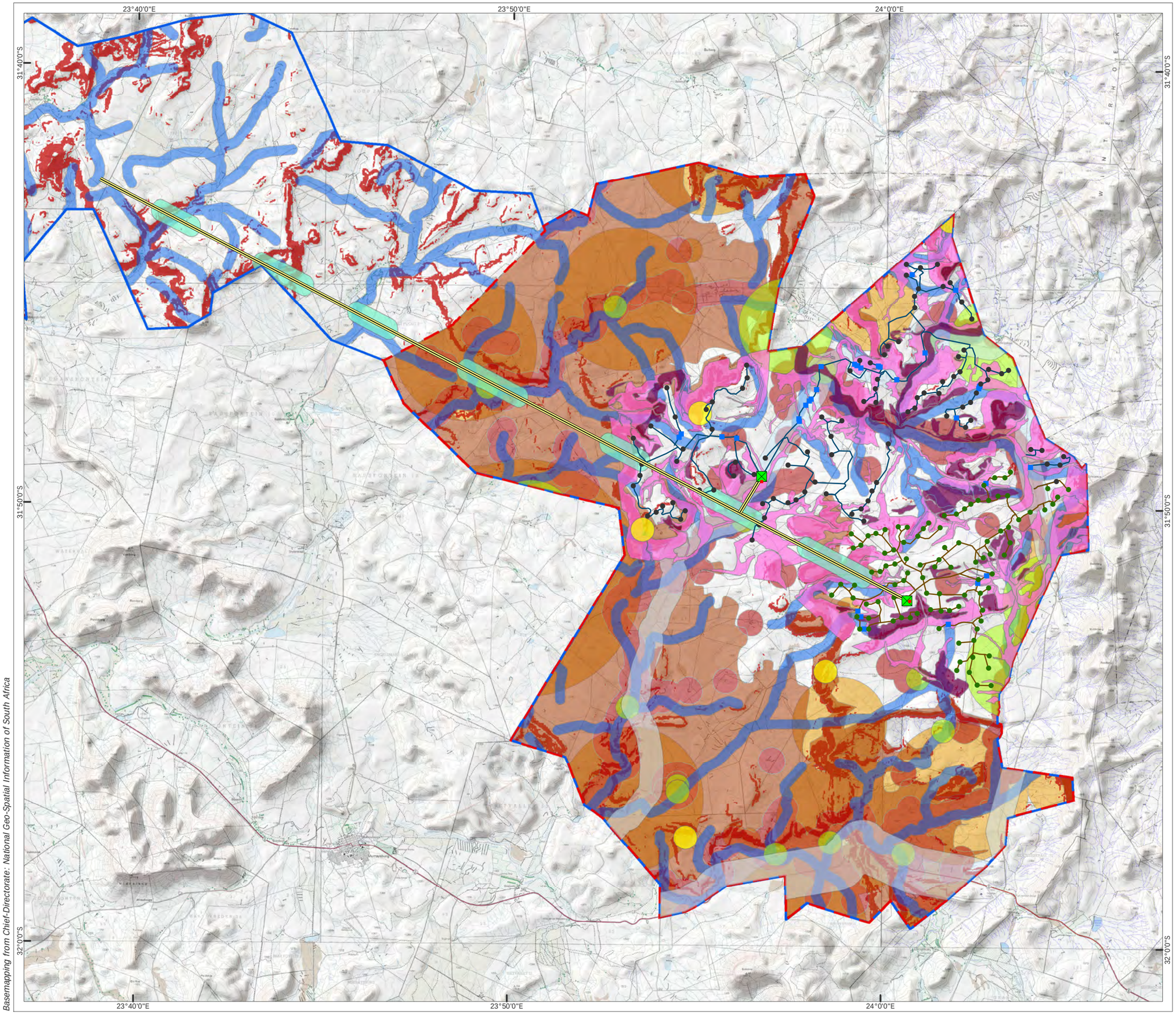
0 4 8 km

Produced: AT Reviewed: SC Approved: AB	Ref: 2146/REP/032
	Date: 06/01/2016

Environmental Constraints
Figure 6.6

Umsinde Emoyeni WEF
Grid Connection Phase 2
Draft EIA Report

Basemapping from Chief-Directorate: National Geo-Spatial Information of South Africa



ARCUS

- Grid Site Boundary
- WEF Site Boundary
- Proposed Grid Connection
- Proposed Turbine Phase 1
- Proposed Turbine Phase 2
- Proposed Substation
- Proposed Laydown Area
- Proposed Road Phase 1
- Proposed Road Phase 2
- Proposed Water Crossing
- Grid Mitigation Region
- 500 m River Buffer
- High Ecological Sensitivity
- High-Very High Ecological Sensitivity
- High Bat Sensitivity
- Medium - High Bat Sensitivity
- Nest Buffer
- 500 / 2000 m Farm Buffer
- 500 m Buffer of Peak
- 1 km / 500 m Buffer of National / Regional Road
- Slope 1:5

1:150,000 Scale @ A3

0 3.5 7 km

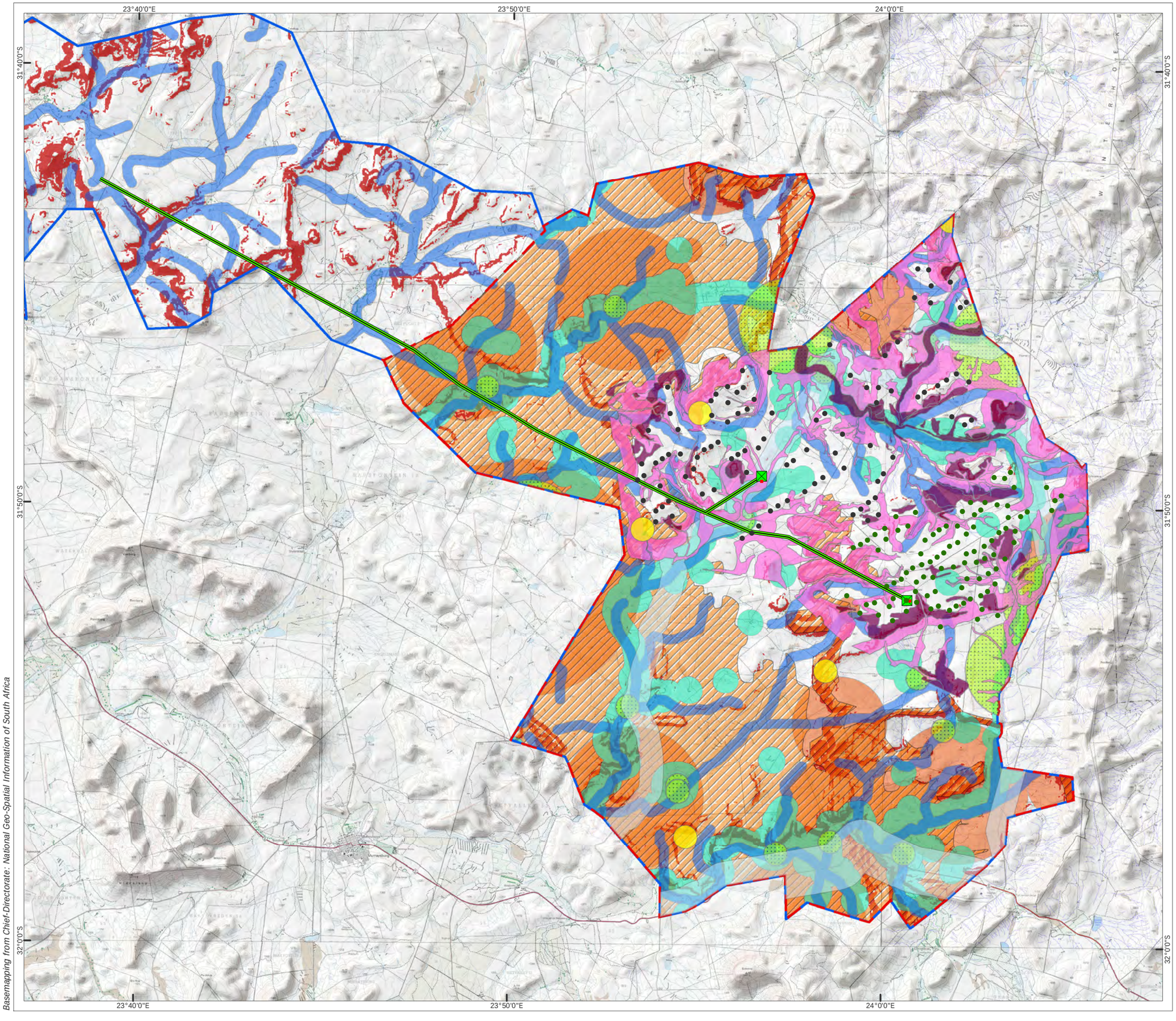
N

Produced: AT Reviewed: SC Approved: AB	Ref: 2146/REP/033
	Date: 05/01/2016

Site Sensitivity and Proposed Development Layout before Mitigation
Figure 6.7

Umsinde Emoyeni WEF
Grid Connection Phase 2
Draft EIA Report

Basemapping from Chief-Directorate: National Geo-Spatial Information of South Africa



ARCUS

- Grid Site Boundary
- WEF Site Boundary
- Proposed Turbine Phase 1
- Proposed Turbine Phase 2
- Proposed Grid Connection
- Proposed Substation
- Proposed Laydown Area
- 500 m River Buffer
- High Ecological Sensitivity
- High - Very High Ecological Sensitivity
- High Bat Sensitivity
- Medium - High Bat Sensitivity
- Nest Buffer
- 500 / 2000 m Farm Buffer
- 500 m Buffer of Peak
- National / Regional Road Buffer
- Slope 1:5

1:150,000 Scale @ A3

0 4 8 km

N

Produced: AT Reviewed: SC Approved: AB	Ref: 2146/REP/095
	Date: 12/01/2016

Site Sensitivity and Revised Development Layout With Mitigation
Figure 6.8

Umsinde Emoyeni WEF
Grid Connection Phase 2
Draft EIA Report

Basemapping from Chief-Directorate: National Geo-Spatial Information of South Africa

APPENDIX A

EAP CV & DECLARATION OF INDEPENDANCE

FOR THE PROPOSED
UMSINDE EMOYENI WIND ENERGY FACILITY GRID CONNECTION

PHASE 2

WESTERN AND NORTHERN CAPE PROVINCES

DEA REF: 14/12/16/3/3/2/685

On behalf of

Emoyeni Wind Farm Project Proprietary Limited

JANUARY 2016

CURRICULUM VITAE

Ashlin Bodasing

Environmental Impact Assessment Practitioner

South Africa

Specialisms

- Environmental Impact Assessment (EIA)
- Environmental Management Systems (EMS)
- Environmental Permitting and Consents
- Environmental Auditing for Due Diligence and Compliance

Summary of Experience

Ashlin Bodasing is a Senior Environmental Consultant at Arcus Consulting, located in Cape Town. Having obtained her Bachelor of Social Science Degree from the University of Kwa-Zulu Natal; she has 9 years' experience in the environmental consulting industry in southern Africa. She has gained extensive experience in the field of Integrated Environmental Management, environmental impact assessments and public participation through her former employment at Parsons Brinckerhoff and WSP Consulting in South Africa. She has also been actively involved in a number of industrial and infrastructural projects, including electricity power lines and substations; road and water infrastructure upgrades and the installation of telecommunication equipment and as well green field coal mines, as well as renewable energy facilities, both wind and solar. Ashlin has major project experience in the development of Environmental Impact Assessments, Environmental Management Plans and the monitoring of construction activities. Her areas of expertise include project management, environmental scoping and impact assessments, environmental management plans, environmental compliance monitoring and environmental feasibility studies. Experience also includes International Finance Corporation Performance Standards and World Bank Environmental Guidelines environmental reviews.

Professional History

2015 - present – Arcus Consultancy Services Ltd, South Africa.
2007-2015 – Senior Environmental Consultant, Parsons Brinckerhoff (Pty) Ltd, South Africa.
2005-2007 – Environmental Consultant, WSP Environmental (Pty) Ltd, South Africa.

Project Experience

(selected projects)

- Ncondezi Energy – Mozambique: Construction of 1800MW Thermal Power Plant
  The project involved the proposed construction of a mine mouth fed thermal power plant, in the Tete Province of Mozambique. Responsible for compilation of the Environmental and Social Impact Assessment for the Thermal Power Plant, as well as review of Specialist studies, and environmental management plans, for the construction of the plant.
- ArcelorMittal South Africa – Upgrade of the Metal Recovery Crushing and Screening Plant
  The project involved the upgrade / relocation of the existing metal recovery crushing and screening plant at the Vanderbijlpark works, the management of sub-consultants and the facilitation of the public participation process. Produced the scoping report and the EIA report.
- eThekwini Electricity
  Feasibility assessment of site alternative for the establishment of a wind farm within the eThekwini Municipality.
- Investec Wind Farm
  Compiled environmental feasibility report for the feasibility of wind farms in the Northern and Western Cape.
- Biotherm Energy
  Independent review of environmental impact assessment reports and management plans compiled for 3 wind farms in the Western Cape and 2 PV Solar Plants in the Northern Cape, to ensure compliance to IFC and World Bank Standards.
- MCA – Lesotho - Rehabilitation and Extension of Water Supply Infrastructure – Lesotho
  Compilation of EMP for pre- construction, construction, post construction and operational phases, for various sites around Lesotho for water pipeline rehabilitation and extension works.

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

The Environmental Assessment Practitioner

I, _____ , declare that –

General declaration:

I act as the independent environmental practitioner in this application;
I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
I declare that there are no circumstances that may compromise my objectivity in performing such work;
I have expertise in conducting environmental impact assessments, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
I will comply with the Act, Regulations and all other applicable legislation;
I will take into account, to the extent possible, the matters listed in regulation **8** of the Regulations when preparing the application and any report relating to the application;
I have no, and will not engage in, conflicting interests in the undertaking of the activity;
I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
I will ensure that information containing all relevant facts in respect of the application is distributed or made available to interested and affected parties and the public and that participation by interested and affected parties is facilitated in such a manner that all interested and affected parties will be provided with a reasonable opportunity to participate and to provide comments on documents that are produced to support the application;
I will ensure that the comments of all interested and affected parties are considered and recorded in reports that are submitted to the competent authority in respect of the application, provided that comments that are made by interested and affected parties in respect of a final report that will be submitted to the competent authority may be attached to the report without further amendment to the report;
I will keep a register of all interested and affected parties that participated in a public participation process;
I will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not;
all the particulars furnished by me in this form are true and correct;
will perform all other obligations as expected from an environmental assessment practitioner in terms of the Regulations; and
I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Disclosure of Vested Interest (delete whichever is not applicable)

I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations, 2010;

I have a vested interest in the proposed activity proceeding, such vested interest being:

_____

_____

_____

_____

_____

Signature of the environmental assessment practitioner:

_____

Name of company:

_____

Date:

APPENDIX B

DRAFT ENVIRONMENTAL MANAGEMENT PROGRAMME

FOR THE PROPOSED UMSINDE EMOYENI WIND ENERGY FACILITY GRID CONNECTION

PHASE 2

WESTERN AND NORTHERN CAPE PROVINCES

DEA REF: 14/12/16/3/3/2/685

On behalf of

Emoyeni Wind Farm Project Proprietary Limited

JANUARY 2016

Prepared By:

Arcus Consultancy Services
Registered in South Africa No. 2012/215000/10

Glossary of Terms

Construction Phase: The activities pertaining to the preparation for and the physical construction of the proposed development

Contractor: Persons/organisations contracted by the Developer to carry out parts of the work for the proposed project

Engineer / Project Director (PD): Person/organisation appointed by the Developer to oversee the work of all consultants, sub-developers, contractors, residents and visitors.

Environment: The environment is defined as the surroundings within which humans exist and that are made up of – the land, water and atmosphere of the earth; micro-organisms, plant and animal life; any part or combination of (i) and (ii) and the interrelationships among and between them; and the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being.

Environmental and Social Manager (ESM) also known as the Environmental Control Officer (ECO): Person/organisation appointed by the Developer who will provide direction to the Principal Agent concerning the activities within the Construction site. The ECO will also be responsible to liaise with the independent auditor who will conduct an environmental audit during the construction phase of the project according to the provisions of the Environmental Management Programme.

Independent Auditor: The person or entity who will conduct an environmental audit during the construction phase of the project according to the provisions of the Environmental Management Programme and Environmental Authorisation.

Environmental Management Programme (EMP): The EMP is a detailed plan for the implementation of the mitigation measures to minimise negative environmental impacts during the life-cycle of a project. The EMP contributes to the preparation of the contract documentation by developing clauses to which the contractor must adhere for the protection of the environment. The EMP specifies how the construction of the project is to be carried out and includes the actions required for the Post-Construction Phase to ensure that all the environmental impacts are managed for the duration of the project's life-cycle.

Therefore the EMP will be a working document, which will be reviewed when necessary, or if required by the authorities. A revision will be done once the detailed design of the proposed development has been completed.

Operational Phase (Post Construction): The period following the Construction Phase, during which the proposed development will be operational.

Pre-Construction Phase: The period prior to commencement of the Construction Phase, during which various activities associated with the preparation for the Construction Phase: detailed final designs, micro siting, etc. will be undertaken.

Rehabilitation: Rehabilitation is defined as the return of a disturbed area to a state which approximates the state (where possible) which it was before disruption. Rehabilitation for the purposes of this specification is aimed at post-reinstatement revegetation of a disturbed area and the insurance of a stable land surface. Revegetation should aim to accelerate the natural succession processes so that the plant community develops in the desired

way, i.e. promote rapid vegetation establishment.

Site Manager: The person, representing the Contractor, responsible for all the Contractor's activities on the site including supervision of the construction staff and activities associated with the Construction Phase.

Project Area: This refers to the authorised area for the proposed development to take place. Farm portions numbers are outline in the EMP.

Local Community: People residing or present in the region and near the construction activities, including the owners and/or managers of land affected by construction, workers on the land, and people in nearby towns and villages.

Public: Any individual or group concerned with or affected by the Project and its consequences, including the local community, local, regional, and national authorities, investors, workforce, customers, consumers, environmental interest groups, and the general public.

Construction Area / Site: The land on which the Project is to be located. It includes the site, construction campsite, access roads and tracks, as well as any other area affected or disturbed by construction activities. The EMP (particularly the specifications for rehabilitation) is relevant for all areas disturbed during construction.

Access Roads and Tracks: All newly established roads and tracks, and areas cleared or driven over to provide access to/from the construction areas, and for the transportation of the construction workforce, equipment and materials.

Environmental Impact: The effect of an activity on the environment, whether desirable or undesirable. Undesirable or negative environmental impacts will result in damage and/or pollution of, or detriment to the environment, or in danger to the public, whether immediate or delayed.

Environmental Incident: An unexpected or sudden occurrence related to the Project, including major emissions, spills, fires, explosions, floods or erosion leading to serious or potentially serious negative environmental impacts.

Fugitive Dust: Can be defined as natural and/or human-associated dust becoming airborne due to the forces of wind or human activity.

Fauna and Flora / Plants and Animals: Any individual or group of micro-organisms, plants or animals.

General Waste and Construction Rubble It includes waste paper, board, cardboard, benign organic and domestic waste and uncontaminated construction debris such as used bricks, wood, waste concrete, unused subsoil and rubble from excavations or demolished structures.

Heritage Sites and Artefacts: Heritage sites and artefacts can be defined as any object or site of cultural, historical, archaeological or palaeontological significance found in or on the land. Historical objects are objects older than 50 years with architectural, historical, scientific, cultural, social, spiritual, linguistic, technological or aesthetic value. For example: buildings or parts thereof, graves or burial sites, milestones, numismatic objects (i.e. coins and beads), and military objects.

Archaeological objects include material remains resulting from human activity which are older than 100 years and which are in a state of disuse, such as tools, artefacts, human and hominoid remains and artificial features and structures.

Palaeontological objects include any fossilised remains of animals or plants.

Hazardous Substances: Substances which are potentially dangerous and may affect human and/or environmental health. This would be because of the substances' inherent chemical and physical composition, which could be toxic, poisonous, flammable, explosive, carcinogenic or radioactive. Hazardous waste includes, but is not limited to: human excrement, the by-products and wastes associated will the use of hazardous substances (i.e. used fuel, oil, lubricants and solvents), as well as items such as spent batteries, old oil filters, light bulbs, tyres, circuit boards, etc. which requires special collection and handling. When left abandoned, even substances such as scrap metal, wire, tins, broken glass and plastic could be harmful to people, wild and domestic animals. For example: plastic could be ingested by animals; people and animals could be injured by broken glass or metal objects; and animals could get trapped in drums, tins and bottles or get entangled in plastic or metal wiring. Even if buried, such objects may become exposed over time due to wind erosion, scavengers or future human activities. Because of the sensitive nature of the area, these substances are all regarded as 'hazardous waste' for the purposes of this EMP.

Hydrological Features: Hydrological features include, but are not limited to:

- wetlands;
- open water;
- vegetated drainage channels;
- subterranean water;
- marine environments;
- estuarine environments.

Life Support Systems: Life support systems include, but are not limited to: an ecological system in which its outputs are vital for sustaining specialised habitats; an ecological system in which its outputs are vital for sustaining human life (e.g. water purification).

Mitigation: Environmental management measures designed to avoid, limit or remedy undesirable environmental impacts.

Monitoring: Structured observation, measurement and evaluation of environmental data over a period of time to assess the efficiency of environmental mitigation and rehabilitation measures.

Rehabilitation: Measures implemented to restore a damaged Environment.

Sensitive Sites: Environmentally sensitive sites include, but are not limited to:

- Areas with high conservation value due to the presence of important plant specimens, pristine habitats, high biodiversity, important water resources or heritage features and artefacts;
- Areas particularly prone to erosion once disturbed (i.e. steep slopes);
- Vulnerable areas with low potential for rehabilitation / slow rate of recovery (i.e. rock outcrops, steep slopes); and
- Areas in close proximity of sensitive receptors, such as farm homesteads, viewpoints or tourist stopovers.

Specialised habitats: Specialised habitats include, but are not limited to, areas which are:

- Priority breeding habitats;
- Refuge areas;
- Vital for species survival (important for, part, or all of its life cycle);
- Essential for species performance;
- Cryptic habitats, etc.

TABLE OF CONTENTS

1 INTRODUCTION

1.1 Background

Emoyeni Wind Farm Project Proprietary Limited (EWFP) are proposing the Umsinde Emoyeni Wind Energy Facility (WEF), and associated infrastructure including grid connection infrastructure located near the town of Murraysburg in the Western Cape and the Northern Cape Province.

There are four components to the proposed development, representing two development phases under separate applications:

- Umsinde Emoyeni WEF: Phase 1;
- **Electrical Grid Connection and Associated Infrastructure for Umsinde Emoyeni WEF Phase 1;**
- Umsinde Emoyeni WEF: Phase 2; and
- **Electrical Grid Connection and Associated Infrastructure for Umsinde Emoyeni WEF Phase 2.**

Arcus Consultancy Services Pty ('Arcus') have been appointed by EWFP to compile and submit Environmental Management Programmes (EMPr) to the Department of Environmental Affairs (DEA) as part of the Environmental Impact Assessment process for the Umsinde Emoyeni WEF and associated infrastructure including grid connection.

This document represents the Environmental Management Programme (EMPr) for the Electrical Grid Connection and Associated Infrastructure for Umsinde Emoyeni WEF Phase 1. A separate EMPr document has been produced for the Umsinde Emoyeni, Grid Connection Phase 2 and the WEF Phase 1 and 2.

1.2 Details of the Applicant and the Environmental Assessment Practitioner

Details of Applicant	
Project Applicant	Emoyeni Wind Farms Propriety Limited
Company Registration	
Contact Person	Peter Venn
Postal Address	Postnet Suite No 216. Private Bag X26 Tokai 7966, Cape Town
Telephone	021 701 1292
Fax	
Email	

Environmental Assessment Practitioner	
EAP	Arcus Consultancy Services Ltd
Contact Person	Ashlin Bodasing
Qualifications	BSocSci Geography and Environmental Management
Postal Address	
Telephone	021 412 1529
Fax	None
Email	Office@arcusconsulting.co.za

1.3 Purpose and Aims of this Document

According to the Western Cape's Department of Environmental Affairs and Development Planning, Guideline for Environmental Management Plan (2005), and Environmental Management Programme (EMPr) is defined as "an *environmental management tool used*

to ensure that undue or reasonably avoidable adverse impact of the construction, operation and decommissioning of a project are prevented or mitigated, and that the positive beneifits of the project are enhanced."

This EMPr outlines measures to be implemented in order to minimise adverse environmental degradation and enhance positive impacts associated with wind energy facility grid connections and associated infrastructure. It serves as a guide for the contractor and the workforce on their roles and responsibilities concerning environmental management on site, and it provides a framework for environmental monitoring throughout the construction and operational periods. The purpose of the EMPr is to:

- Encourage good management practices through planning and commitment to environmental issues;
- Define how the management of the environment is reported and performance evaluated;
- Provide rational and practical environmental guidelines to:
  - Minimise disturbance of the natural environment;
  - Prevent pollution of land, air and water;
  - Protect indigenous flora and fauna;
  - Prevent soil erosion and facilitate re-vegetation;
  - Comply with all applicable laws, regulations, standards and guidelines for the protection of the environment;
  - Adopt the best practicable means available to prevent or minimise adverse environmental impacts;
  - Identify and mitigate against any potential impact on ecology;
  - Describe all monitoring procedures required to identify impacts on the environment; and
  - Train employees and contractors with regard to environmental obligations.

2 PROJECT DESCRIPTION

The proposed grid connections are two of four components of the proposed Umsinde Emoyeni Wind Energy Facility (WEF), which comprises the following:

- Electrical Grid Connection and Associated Infrastructure for Umsinde Emoyeni WEF Phase 1 (14/12/16/3/3/2/684);
- Electrical Grid Connection and Associated Infrastructure for Umsinde Emoyeni WEF Phase 2 (14/12/16/3/3/2/685);
- Umsinde Emoyeni WEF: Phase 1 (14/12/16/3/3/2/686); and
- Umsinde Emoyeni WEF: Phase 2 (14/12/16/3/3/2/687).

The proposed grid connections and associated infrastructures each consist of an on-site substation and a 132 kV power line running from the on-site substation to the existing Gamma substation, or alternatively to the closer Ishwati Emoyeni substation, (should this be constructed), as well as a 400/132 kV substation yard at Gamma or Ishwati Emoyeni substation and possibly a new connection to the existing national grid.

The on-site substations will house electrical infrastructure such as transformers and switch gear to enable the energy to be transferred into the Eskom national grid. They will be placed on concrete foundations with the substation compound occupying an area of up to 200 m x 250 m. There will be an on-site office compound of up to 150 m x 80 m, including site offices, parking and an operation and maintenance facility.

Further technical details of the proposed grid connections are presented in Table 2.1.

Table 2.1: Technical Details of Proposed Grid Connections

Applicable DEA Request	Technical Detail
Area occupied by inverter/transformer stations/substations	200 x 250 m substation compound Single storey
Capacity of on-site substation	33 / 132 kV
Area occupied by both permanent and construction laydown areas	9 000 m^2 per phase
Area occupied by buildings	Maximum 200 m x 250 m = 5 hectares per phase
Height and type of fencing	Galvanised weldmesh around substations; may have security fencing around the substations
Transmission line	Power lines from the on-site substation to Gamma / Ishwati substation would be 132kV lines (single or double string) on single pole pylon (wooden, steel or concrete).
Servitude corridor	73 m width Phase 1: Length to Gamma: 62.6 km (= 457 ha) Length to Ishwati: 38.5 km (= 281 ha) Phase 2: Length to Phase 1 Grid: 1.8 km Length to Ishwati: 32.2 km Length to Gamma substation: 56.3 km
Lay down area and construction camp.	Adjacent to on-site substations 150 m x 60 m = 9 000 m^2 (0.9 ha) per phase

Electricity will be transferred from the on-site substations to Eskom's existing grid network in the area via 132 kV overhead power lines. This will either be by direct transfer to Eskom's existing Gamma substation, or should the approved Ishwati Emoyeni WEF be successful in the REIPPPP and be constructed, to the Ishwati Emoyeni substation. The Phase 2 power line will connect to the Phase 1 power line approximately 1.8 km from the Phase 2 substation.

From the Gamma substation the energy will be transferred to the national grid to be used.

The route for the 132 kV lines will include a servitude corridor of up to 73 m in width. At this stage it is recommended that the proposed route of the overhead line follows existing linear infrastructure as far as possible as this will potentially reduce the impacts associated with its construction and operation. The proposed route for the Phase 1 preferred alternative from the Phase 1 on-site substation to the Ishwati Emoyeni substation has a length of 38.5 km.

At the Ishwati Emoyeni Substation, the distribution overhead lines will connect into an existing feeder bay. At the Gamma Substation (400 / 132 kV), any works required for purposes of connecting would be done within the existing footprint of the site.

2.1 Construction Phase

2.1.1 Construction of On-site Substation

A 33 / 132 kV on-site substation will be constructed for each phase of the proposed development. This will require the clearance of vegetation over an area of 200 m x 250 m.

2.1.2 Establishment of a Servitude

A servitude is by definition "the right to use someone else's land for a specified purpose", in this case the right to erect, operate and maintain a power line, as well as access rights

to carry out these activities. Ownership of the land remains with the original landowner who signs a servitude agreement and keeps overall responsibility for the land.

A topographical survey will be conducted along the preferred alternative to inform the final route and design of the tower foundations, pylons and structures. Once the final servitude route has been confirmed construction of the power line begins. The servitude is generally cleared of wooded plant species and any protruding alien vegetation to reduce fire risk and prevent shortages with vegetation, in line with this EMPr and Eskom requirements and guidelines.

Although existing roads and tracks will be used as much as possible, access roads for minor vehicles may be created for the construction phase as well as for periodic maintenance, in negotiation with the relevant landowner.

2.1.3 Construction of Power Line Tower Structures

The type of structures which will support the overhead lines is yet to be determined and may include:

- Concrete, steel or wood monopoles;
- Guy line supported steel structures;
- Free standing metal lattice towers; or
- Multi-pole structures such as H-towers or K-towers.

The preferred type of tower is dependent on a variety of factors, including the terrain, cost, conductor size, live line compatibility and required electrical characteristics. Tower type selection will therefore be based on additional on-site investigations during the detailed design phase of the project. Similarly, the foundation size and type will depend on the type of tower selected as well as conditions of the local terrain. Tower steel is typically delivered on a 24-ton truck, or on smaller vehicles in difficult terrain. The tower structures are assembled on the ground and erected on the constructed foundations using an 8-ton crane truck. Following this the power lines and conductors are strung from tower to tower. The average span between two 132 kV towers is 200 m but can vary between 150 and 375 m depending on the terrain and ground profile.

2.1.4 Stringing High Voltage Cables

Power lines to be strung are delivered to the site on cable drums that are placed along the servitude at regular intervals. If the area is inaccessible these may be delivered by helicopter. A pilot cable is then lain down by a pilot tractor driven along the route of the power line. This is used to string the conductors between towers in sections from bend to bend by the means of a pulley system. The correct tension required to reduce sagging and comply with minimum clearance distances is then obtained before clamping the conductors and cutting off any excess cabling.

2.1.5 Rehabilitation of disturbed areas and protection of erosion sensitive areas

Following the construction of the substation and grid connection all areas outside of the servitude and other areas required for maintenance will be rehabilitated in accordance with this EMPr.

2.2 Operational Phase

The life span of the power line is approximately 25 years, during which time ongoing maintenance is required. Eskom will be responsible for the operational phase and decommissioning phase and must undertake maintenance in accordance with this EMPr and 'Eskom Standard for Bush Clearance and Maintenance within Overhead Powerline Servitudes' (Eskom 2003) and the Transmission Vegetation Management Guideline (Eskom

2009). The guideline promotes minimising the removal of vegetation other than alien vegetation unless it poses a fire hazard.

2.3 Decommissioning Phase

Eskom will be responsible for the decommissioning phase. This will include unstringing the power line cables, disassembling the towers, removing the foundations and rehabilitating the servitude according to this EMPr.

3 LEGAL FRAMEWORK

The following non-exhaustive list of legislation is applicable and was considered in this report:

- Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996);
- National Environmental Management Act, 1998 (Act No. 107 of 1998);
- Environmental Conservation Act, 1989 (Act No. 73 of 1989);
- National Heritage Resources Act, 1999 (Act No. 25 of 1999);
- National Environmental Management: Biodiversity Act, 2004 (Act No 10 of 2004);
- National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004);
- Conservation of Agricultural Resources Act, 1983(Act No. 43 of 1983);
- National Water Act, 1998 (Act No. 36 of 1998);
- Aviation Act, 1962 (Act No. 74 of 1962);
- National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008);
- National Forest Act, 1998 (Act No. 84 of 1998);
- National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003);
- National Roads Act, 1998 (Act No. 7 of 1998);
- Astronomy Geographic Advantage Act, 2007 (Act No. 21 of 2007);
- Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002);
- Performance Standards and Equator Principles, 2013 (IFC, June 2013);
- Independent Communications Authority of South Africa Act, 2000 (Act No. 13 of 2000; as amended).

An application for Environmental Authorisation, in term of the National Environmental Management Act, Act 107, 1998 (NEMA), Environmental Impact Assessment Regulations, 2010, was submitted to the Department of Environmental Affairs in April 2014 for:

- Electrical Grid Connection and Associated Infrastructure for Umsinde Emoyeni WEF Phase 1 (DEA Ref: 14/12/16/3/3/2/684);
- Electrical Grid Connection and Associated Infrastructure for Umsinde Emoyeni WEF Phase 2 (DEA Ref: 14/12/16/3/3/2/685).

These applications were submitted together with the applications for the Umsinde Emoyeni WEF Phase 1 and 2, triggering a full Scoping and EIA process for the proposed development. One combined Final Scoping Report was submitted for all four components of the development. As per request from the DEA four separate Environmental Impact Assessment Reports (EIAR) were prepared for the four components.

All listed activities which potentially form part of the proposed grid connections, and which require environmental authorisation, are included in the application for Environmental Authorisation prepared and submitted to the DEA. The activities are indicated in Table 3.1.

The EIA identified potentially significant environmental and social impacts of the proposed development. This EMPr incorporates the findings of the EIAR and its project specific recommendations and is in line with Regulation 33 of the 2010 EIA Regulations, which states the following:

'A draft environmental management programme must comply with section 24N of the Act and include:

- (a) Details of:
  - (i) the person who prepared the environmental management programme; and
  - (ii) the expertise of that person to prepare an environmental management programme;
- (b) Information on an any proposed management or mitigation measures that will be taken to address the environmental impacts that have been identified in a report contemplated by these Regulations, including environmental impacts or objectives in respect of
  - (i) planning and design;
  - (ii) pre-construction and construction activities;
  - (iii) operation or under taking of the activity;
  - (iv) rehabilitation of the environment; and
  - (v) closure, where relevant.
- (c) A detailed description of the aspects of the activity that are covered by the draft environmental management programme
- (d) An identification of the persons who will be responsible for the implementation of the measures contemplated in paragraph (b);
- (e) proposed mechanisms for monitoring compliance with and performance assessment against the environmental management programme and reporting thereon;
- (f) as far as is reasonably practicable, measures to rehabilitate the environment affected by the undertaking of any listed activity or specified activity to its natural or predetermined state or to a land use which conforms to the generally accepted principle of sustainable development, including, where appropriate, concurrent or progressive rehabilitation measures;
- (g) a description of the manner in which it intends to –
  - (i) modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation;
  - (ii) remedy the cause of pollution or degradation and migration of pollutants;
  - (iii) comply with any prescribed environmental management standards or practices
  - (iv) comply with any applicable provisions of the Act regarding closure, where applicable;
  - (v) comply with any provisions of the Act regarding financial provisions for rehabilitation, where applicable;
- (h) time periods within which the measures contemplated in the environmental management programme must be implemented;
- (i) The process for managing any environmental damage, pollution, pumping and treatment of extraneous water or ecological degradation as a result of undertaking a listed activity;
- (j) and environmental awareness plan describing the manner in which-
  - (i) the applicant intends to inform his or her employees of any environmental risk which may result from their work; and
  - (ii) risks must be dealt with in order to avoid pollution or the degradation of the environment;
- (k) where appropriate, closure plans, including closure objectives.

In addition this EMPr is based on the principles of Integrated Environmental Management (IEM), which promotes to achieve a balance between conservation and development. IEM prescribes a methodology which ensures the complete integration of environmental management principles into all stages of the development process. The basic principles of IEM as per Department of Environmental Affairs and Tourism (2004) are:

- Clarified accountability and responsibility
- Adaptive process and flexibilities
- Identify and define alternative option
- Community empowerment
- Continual improvement
- Dispute resolution
- Environmental justice
- Equity
- Global responsibilities
- Holistic decision-making
- Informed decision-making
- Institutional co-ordination
- Integrated approach
- Polluter pays
- Precautionary approach
- Rigour
- Stakeholder engagement
- Sustainability
- Transparency

The EMPr represents an environmental management tool as advocated by the IEM. It aims to ensure that the conditions of authorisation associated with the project are fulfilled and adhered to during all phases of the projects life cycle.

Table 3.1: Listed Activities that form part of the Umsinde Emoyeni Grid Connection Applications

NEMA EIA Regulations: Amended 18 June 2010			**NEMA EIA Regulations: Amended 04 December 2014**		
Activity No.(s)	**Listed Activity**	**Triggered**	**Activity No.(s)**	**Listed Activity**	**Triggered**
GN R.544 10 (i)	The construction of facilities or infrastructure for the transmission and distribution of electricity – (i) Outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kV.	**YES** The grid connection will require the installation of 132 kV overhead lines. The proposed development is outside urban areas.	GN R.983 11 (i)	The construction of facilities or infrastructure for the transmission and distribution of electricity – (i) Outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kV.	**YES** The grid connection will require the installation of 132 kV overhead lines. The proposed development is outside urban areas.
GN R.544 11 (iii), (x) and (xi)	The construction of: (iii) bridges; (x) buildings exceeding 50 m² in size; or (xi) infrastructure or structures covering 50 m² or more Where such construction occurs within a watercourse or within 32 m of a watercourse, measured from the edge of a watercourse, excluding where such construction will occur behind the development setback line.	**NO**	GN R.983 12 (iii) (x) and (xi)	The construction of- (iii) bridges exceeding 100 square meters in size; (x) buildings exceeding 100 square meters in size; (xii) infrastructure or structures with a physical footprint of 100 square meters or more; Where such development occurs – (a) within a watercourse; (b) in front of a development setback; or (c) if no developments setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse.	**NO**
GN R.544 13	The construction of facilities or infrastructure for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 but not exceeding 500 m³.	**NO** Storage of fuel during construction will be required, and transformer oils during operation of the substation, will be required but the volume stored will be less than 80 m³.	GN R.983 14	The construction of facilities or infrastructure for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 cubic metres but not exceeding 500 cubic metres.	**NO** Storage of fuel and transformer oils on site will be required but the volume stored will be less than 80 m³.

NEMA EIA Regulations: Amended 18 June 2010			NEMA EIA Regulations: Amended 04 December 2014		
Activity No.(s)	**Listed Activity**	**Triggered**	**Activity No.(s)**	**Listed Activity**	**Triggered**
GN R.544 18 (i)	The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock from (i) a watercourse	**NO** Commercial aggregate material will be used and will not be sourced on site. No bridges will be constructed for the grid connection.	GN R.983 19 (i)	The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock from (i) a watercourse	**NO** Commercial aggregate material will be used and will not be sourced on site. No bridges will be constructed for the grid connection.
GN R.544 23 (ii)	The transformation of undeveloped, vacant or derelict land to – (ii) residential, retail, commercial, recreational, industrial or institutional use, outside an urban area and where the total area to be transformed is bigger than 1 hectare but less than 20 hectares.	**NO** The grid connection infrastructure is located on currently undeveloped land. The substation compound covers 5 hectares that will be transformed. The servitude to Gamma would cover 457 hectares.	GN R.983 27	The clearance of an area of 1 hectares or more but less than 20 hectares of indigenous vegetation, except where such clearance is required for (i) the undertaking of a linear activity; or (ii) maintenance purposes undertaken in accordance with a maintenance management plan.	**YES** The substation compound covers 5 hectares that will be transformed. The servitude is a linear activity.
GN R.544 24	The transformation of land bigger than 1000 m² in size, to residential, retail, commercial, industrial or institutional use, where, at the time of the coming into effect of this Schedule such land was zoned open space, conservation or had an equivalent zoning.	**NO** The proposed development site does not include any areas zoned as open space, conservation or equivalent.	GN R.983 28 (ii)	Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture or afforestation on or after 01 April 1998 and where such development (ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare.	**YES** The proposed development site includes areas used for agriculture. The total land to be developed is bigger than 1 hectare.
GN R.544 26	Any process or activity identified in terms of section 53(1) of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004).	**Possibly** At present this section of the NEMBA is not yet defined so it does not apply at this time.	GN R.983 30	Any process or activity identified in terms of section 53(1) of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004).	**Possibly** At present this section of the NEMBA is not yet defined so it does not apply at this time.

NEMA EIA Regulations: Amended 18 June 2010			NEMA EIA Regulations: Amended 04 December 2014		
Activity No.(s)	**Listed Activity**	**Triggered**	**Activity No.(s)**	**Listed Activity**	**Triggered**
GN R.544 27 (ii)	The decommissioning of existing facilities or infrastructure, for – (ii) electricity transmission and distribution with a threshold of more than 132kV	**NO** No existing facilities or infrastructure will be decommissioned	GN R.983 (i), (ii) (iii), (iv) and (v)	The decommissioning of existing facilities or infrastructure for (i) any development and related operation activity or activities listed in this Notice, Listing Notice 2 of 2014 or Listing Notice 3 of 2014; (ii) any expansion and related operation activity or activities listed in this Notice, Listing Notice 2 of 2014 or Listing Notice 3 of 2014; (iii) any development and related operation activity or activities and expansion and related operation activity or activities listed in this Notice or Listing Notice 3 of 2014; or (v) any activity regardless the time the activity was commenced with, where such activity: (a) is similarly listed to an activity in (i), (ii), (iii), or (iv) above; and (b) is still in operation or development is still in progress	**NO** No existing facilities or infrastructure will be decommissioned
GN R.544 38	The expansion of facilities for the transmission and distribution of electricity where the expanded capacity will exceed 275 kilovolts and the development footprint will increase.	**NO** Expansion works at the existing Gamma or Ishwati substation (should it be constructed) will be required, however these will not increase the development footprint of the facility. The Gamma Substation is already a 400 kV substation, and the grid connection is 132kV.	GN R.983 47	The expansion of facilities for the transmission and distribution of electricity where the expanded capacity will exceed 275 kilovolts and the development footprint will increase.	**NO** Expansion works at the existing Gamma or Ishwati substation (should it be constructed) will be required, however these will not increase the development footprint of the facility. The Gamma Substation is already a 400 kV substation, and the grid connection is 132kV.

NEMA EIA Regulations: Amended 18 June 2010			NEMA EIA Regulations: Amended 04 December 2014		
Activity No.(s)	**Listed Activity**	**Triggered**	**Activity No.(s)**	**Listed Activity**	**Triggered**
GN R.544 39 (iii)	The expansion of: (iii) bridges within a watercourse or within 32 m of a watercourse, measured from the edge of a watercourse, where such expansion will result in an increased development footprint.	**NO** The construction of the grid connection will not require the expansion of any bridges.	GN R.983 48 (iii)	The expansion of (iii) bridges where the bridge is expanded by 100 square meters or more in size; where such development occurs – (a) within a watercourse; (b) in front of a development setback; or (c) if no developments setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse.	**NO** The construction of the grid connection will not require the expansion of any bridges.
GN R.544 47 (i) (ii)	The widening of a road by more than 6 m, or the lengthening of a road by more than 1 km – (i) where the existing reserve is wider than 13,5 m; or (ii) where no reserve exists, where the existing road is wider than 8 m	**NO** The construction of the grid connection will not require this.	GN R.983 56 (i) and (ii)	The widening of a road by more than 6 m, or the lengthening of a road by more than 1 kilometre – (i) where the existing reserve is wider than 13.,5 metres; or (ii) where no reserve exists, where the existing road is wider than 8 metres	**NO** The construction of the grid connection will not require this.
GN R.545 8	The construction of facilities or infrastructure for the transmission and distribution of electricity with a capacity of 275 kV or more, outside an urban area or industrial complex.	**YES** A 400 kV line will be required at least as a new turn-in from the Gamma substation to an existing Eskom 400 kV line.	GN R.984 9	The development of facilities or infrastructure for transmission and distribution of electricity with a capacity of 275 kilovolts or more, outside an urban area or industrial complex.	**YES** A 400 kV line will be required at least as a new turn-in from the Gamma substation to an existing Eskom 400 kV line.
GN R.545 15	Physical alteration of undeveloped, vacant or derelict land for residential, retail, commercial, recreational, industrial or institutional use where the total area to be transformed is 20 ha or more.	**YES** The footprint of the substation compound will be 5 hectares, but the servitude to be cleared can be 457 hectares.	GN R.984 15	The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for (i) the undertaking of a linear activity; or (ii)maintenance purposes undertaken in accordance with a maintenance plan.	**NO** The footprint of the substation compound will be 5 hectares, but the servitude to be cleared is a linear activity.

NEMA EIA Regulations: Amended 18 June 2010			NEMA EIA Regulations: Amended 04 December 2014		
Activity No.(s)	**Listed Activity**	**Triggered**	**Activity No.(s)**	**Listed Activity**	**Triggered**
GN R.546 4	The construction of a road wider than 4 m with a reserve less than 13.5 m (a) In Northern Cape (ii) Outside urban areas, in (bb) National Protected Area Expansion Strategy Focus, (cc) Sensitive areas as identified in an environmental management framework as contemplated in Chapter 5 of the Act and as adopted by the competent authority (ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans (d) In Western Cape: ii. All areas outside urban areas;	**NO** No roads wider than 4 m will be constructed.	GN R.985 4.	The development of a road wider than 4 metres with a reserve less than 13.5 metres (a) In Northern Cape (ii) Outside urban areas, in (bb) National Protected Area Expansion Strategy Focus, (cc) Sensitive areas as identified in an environmental management framework as contemplated in Chapter 5 of the Act and as adopted by the competent authority (ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans (f) in Western Cape: (i) areas outside urban areas; (aa) areas containing indigenous vegetation	**NO** No roads wider than 4 m will be constructed.
GN R.546 10	The construction of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 m^3 **(a) In Northern Cape Province:** ii. Outside urban areas, in: (ii) Areas on the watercourse side of the development setback line or within 100m from the edge of a watercourse where no such setback line has been determined.	**NO** Storage of fuel and transformer oil on the site will be required however the volume of this storage will not exceed 30 m^3.	GN R.985 10	The development of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 cubic metres (a) In Northern Cape (ii) Outside urban areas, in (bb) National Protected Area Expansion Strategy Focus, (cc) Sensitive areas as identified in an environmental management framework as contemplated in Chapter 5 of the Act and as adopted by the competent authority (ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the	**NO** Storage of fuel and transformer oil on the site will be required however the volume of this storage will not exceed 30 m^3.

NEMA EIA Regulations: Amended 18 June 2010			NEMA EIA Regulations: Amended 04 December 2014		
Activity No.(s)	**Listed Activity**	**Triggered**	**Activity No.(s)**	**Listed Activity**	**Triggered**
	(e) In Western Cape: ii. All areas outside urban areas;			competent authority or in bioregional plans g) In Western Cape: (i) All areas outside urban areas;	
GN R.546 12 (b)	The clearance of an area of 300 m² or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation. (b) Within critical biodiversity areas identified in bioregional plans	**YES** The 73 m wide servitude will run a short distance (~3 km) through a critical biodiversity area as identified in the flora and fauna specialist study.	GN R.985 12 (a) (ii) (b) (ii)	The clearance of an area of 300 square metres or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan. (a) In Eastern Cape, Free State, Gauteng, Limpopo, North West and Western Cape provinces*:* (ii) Within critical biodiversity areas identified in bioregional plans (b) In Northern Cape (ii) within critical biodiversity areas identified in bioregional plans	**YES** The 73 m wide servitude will run a short distance (~3 km) through a critical biodiversity area.
GN R.546 13 (2) (a)	The clearance of an area of 1 ha or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation in (a) critical biodiversity areas and ecological support areas as identified in systematic biodiversity plans adopted by the competent authority (b) National Protected Area Expansion Strategy Focus Areas	**YES** The site covers a small portion that falls within the Karoo Escarpment Grassland (NPAESFA) of the Western Cape Province. The servitude will run through critical biodiversity areas and ecological support areas.	GN R.985 15 (c) (i)	The transformation of land bigger than 1000 square metres in size, to residential, retail, commercial, industrial or institutional use, where, such land was zoned open space, conservation or had an equivalent zoning, on or after 02 August 2010 (c) in Western Cape: (i) Outside urban areas	**NO** The site is not zoned open space, conservation or equivalent.
GN R.546 14	The clearance of an area of 5 ha or more of vegetation where 75% or	**YES**	n/a		

NEMA EIA Regulations: Amended 18 June 2010			NEMA EIA Regulations: Amended 04 December 2014		
Activity No.(s)	**Listed Activity**	**Triggered**	**Activity No.(s)**	**Listed Activity**	**Triggered**
	more of the vegetative cover constitutes indigenous vegetation: (a) In the Northern Cape and Western Cape: i. All areas outside urban areas.	The site falls outside of urban areas.			
GN R.546 16 (iii) (a) and (iv)	The construction of: (iii) buildings with a footprint exceeding 10 m² in size; or (iv) infrastructure covering 10 m² or more where such construction occurs within a watercourse or within 32 m of a watercourse, measured from the edge of a watercourse. (a) In Northern Cape: (ii) outside urban areas, in: (bb) National Protected Area Expansion Focus areas; (dd) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority. (d) In the Western Cape: (ii). Outside urban areas, in: (bb) National Protected Area Expansion Strategy Focus Areas (NPAESFA); (dd) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act	**NO** A 32 m construction buffer has been applied by the around watercourses.	GN R.985 14 (iii) (x) and (xi) (a) and (c) (f) (i) (bb) and (ff)	The development of (x) buildings exceeding 10 square metres in size and (xii) infrastructure or structures with a physical footprint of 10 square metres or more where such development occurs – (a) within a watercourse and (c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse (a) In Northern Cape: (ii) Outside urban areas, in: (bb) National Protected Area Expansion Strategy Focus; (dd) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority; (ff) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; (f) In Western Cape: (i) outside urban areas, in: (bb) National Protected Area Expansion	**NO** A 32 m construction buffer has been applied by the around watercourses.

NEMA EIA Regulations: Amended 18 June 2010			NEMA EIA Regulations: Amended 04 December 2014		
Activity No.(s)	**Listed Activity**	**Triggered**	**Activity No.(s)**	**Listed Activity**	**Triggered**
	and as adopted by the competent authority; (ff) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans			Strategy Focus (ff) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans	
GN. R.546 19	The widening of a road by more than 4 m, or the lengthening of a road by more than 1 km (a) In the Northern Cape: (ii) Outside urban areas, in: (ii) Areas on the watercourse side of the development setback line or within 100m from the edge of a watercourse where no such setback line has been determined; (d) In the Western Cape: (ii) All areas outside urban areas.	**NO** No roads will need to be widened by more than 4 meters.	GN R.985 18 (a)	The widening of a road by more than 4 metres; or the lengthening of a road by more than 1 kilometre (a) In [...] Northern Cape provinces: (ii) outside urban areas, in: (bb) National Protected Area Expansion Strategy Focus areas, (ee) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; (f) In Western Cape: (i) All areas outside urban areas: (aa) Areas containing indigenous vegetation.	**NO** No roads will need to be widened by more than 4 meters.

4 ENVIRONMENTAL IMPACT ASSESSMENT

The EMPr has been developed based on the findings and recommendations of the EIA (Arcus, 2015).

4.1 Summary of Findings

During the EIA process, impacts on both the biophysical and socio-economic environments were assessed. The following specialist's studies were commissioned based on the sensitivities of the site and the potential impacts of the proposed development:

- Visual;
- Terrestrial Ecology (Flora and Fauna);
- Bats;
- Wetlands and Freshwater;
- Birds;
- Soils, Land Use and Agricultural Potential;
- Heritage and Palaeontology;
- Noise; and
- Socio-Economic.

From the assessment, it is evident that the construction and the operation of the WEF and grid connections will have negative impacts both socially and environmentally but when appropriate mitigation measures applied negative impacts are outweighed by positive impacts. Overall the project has a positive economic impact regionally and for South Africa as a whole as power generated from the WEF will feed into the National Eskom grid, create job opportunities, and contribute to the local and regional economy.

Assessment of Alternatives

Different alternatives ranging from site location, transportation, design, turbine technologies, and the No Development alternative have all been considered for the proposed WEF. When considering the alternatives the applicant needs to consider environmental, social and economic factors and technical factors. Considering the above mentioned factors, EWFP intends to use the best available technology to satisfy these factors.

The preferred site was chosen based on the following: because the site is located within an area that has a good wind resource, the four components of the proposed development have been located in the sections of the site that are of low-medium areas of ecological sensitivity. The No Development alternative was identified as a high negative social cost to South Africa in terms of the country meeting its energy needs with clean, renewable energy, and a medium negative social cost in terms lost employment and business opportunities, and the benefits associated with the establishment of a Community Trust.

Relative to the proposed *grid connection*, the main implications of the No Development scenario is that the Umsinde Emoyeni WEF: Phase 1 cannot be constructed. This result will include the following:

- The land-use remains agricultural with no further benefits derived from the implementation of a complementary land use;
- There is no change in the current landscape or environmental baseline;
- Whilst no WEF development will occur on site, other wind energy projects go ahead as planned for other areas locally;
- No additional electricity will be generated onsite or supplied through means of renewable energy resources. This would have implications for the South African Government in achieving its proposed renewable energy target;

- There is no opportunity for additional employment (albeit temporary) in the local area where job creation is identified as a key priority; and
- The local Economic Development benefits associated with the WEF development's REIPPPP commitments will not be realised.
- The specialist social impact assessment found that the No Development option would result in a lost opportunity for South Africa to supplement it's current energy needs with clean, renewable energy; and a lost opportunity for Murraysburg and the Beaufort West Local Municipalitythe in terms of business and employment opportunities, and the benefits associated with the establishment of a Community Trust. The result would be a negative social cost of medium negative significance.

Therefore, the No Development alternative was not considered feasible in the context of the proposed development.

Summary of the Impact Assessment

Potential environmental impacts were evaluated according to their extent, duration, intensity and magnitude. Negative impacts of the proposed project on the biophysical environment include clearing of vegetation that leads to habitat fragmentation, potential loss of species of concern, soil erosion, surface water pollution; while social-economic impacts being minimal loss of agricultural land, disruption of social relations within the proposed area by the introduction of contractor workers from different areas, spread of diseases, loss of potential heritage resources and impact on sense of place.

All impacts have been identified and assessed at different stages (design/planning, construction, operation and decommission) and possible mitigation measures assigned to ensure low significance (for negative impacts) or high significance (for positive impacts) as outlined in the Environmental Management Programme (Appendix B). These impacts have been summarised in the tables below for construction phase and operational phase.

Construction Phase Impact	***Consequence***	***Probability***	***Significance***	***Status***	***Confidence***
Visual – No Mitigation	Low	Probable	Low	–ve	Medium
Visual – With Mitigation	Low	Probable	**LOW**	–ve	Medium
Vegetation and Listed/Protected Plant Species – No Mitigation	Medium	Definite	Medium	–ve	High
Vegetation and Listed/Protected Plant Species – With Mitigation	Medium	Definite	**MEDIUM**	–ve	High
Alien Plant Invasion – No Mitigation	Low	Improbable	Low	–ve	High
Alien Plant Invasion – With Mitigation	Low	Improbable	**LOW**	–ve	High
Increased Erosion Risk – No Mitigation	Low	Definite	Low	–ve	High
Increased Erosion Risk – With Mitigation	Very Low	Probable	**VERY LOW**	–ve	High
Bats – Roost Disturbance – Substation – No Mitigation	Medium	Probable	Medium	–ve	High
Bats – Roost Disturbance – Substation – With Mitigation	Very Low	Possible	**INSIGNIFICANT**	–ve	High

Construction Phase Impact	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Bats – Roost Disturbance – Power Line – No Mitigation	Medium	Possible	Low	–ve	Medium
Bats – Roost Disturbance – Power Line – With Mitigation	Very low	Possible	**INSIGNIFICANT**	–ve	Medium
Bats – Foraging Disturbance – Substation – No Mitigation	Medium	Definite	Medium	–ve	High
Bats – Foraging Disturbance – Substation – With Mitigation	Low	Definite	**LOW**	–ve	High
Bats – Foraging Disturbance – Power Line – No Mitigation	Low	Definite	Low	–ve	High
Bats – Foraging Disturbance – Power Line – With Mitigation	Very Low	Definite	**VERY LOW**	–ve	High
Avifauna – Habitat Destruction – No Mitigation	Medium	Definite	Medium	–ve	High
Avifauna – Habitat Destruction - With Mitigation	Very Low	Definite	**VERY LOW**	–ve	High
Avifauna – Disturbance & Displacement – No Mitigation	Low	Probable	Low	–ve	High
Avifauna –– Disturbance & Displacement – With Mitigation	Very Low	Probable	**VERY LOW**	–ve	High
Agriculture Potential & Land Capability – Construction of buildings and infrastructure – No Mitigation	Low	Definite	Low	–ve	High
Agriculture Potential & Land Capability – Construction of buildings and infrastructure – With Mitigation	Low	Definite	**LOW**	–ve	High
Agriculture Potential & Land Capability – Construction of Power Lines – No Mitigation	Low	Definite	Low	–ve	High
Agriculture Potential & Land Capability – Construction of Power Lines – With Mitigation	Low	Definite	**LOW**	–ve	High
Agriculture Potential & Land Capability – Vehicle Operation and Spillages – No Mitigation	Very Low	Definite	Low	–ve	High
Agriculture Potential & Land Capability – Vehicle Operation and Spillages – With Mitigation	Very Low	Improbable	**INSIGNIFICANT**	–ve	High
Agriculture Potential & Land Capability – Dust Generation – No Mitigation	Low	Definite	Low	–ve	High
Agriculture Potential & Land Capability – Dust Generation – No Mitigation	Very Low	Improbable	**INSIGNIFICANT**	–ve	High
Paleontology – No Mitigation	High	Possible	Medium	-ve	Medium
Paleontology – with Mitigation	Medium	Possible	**LOW**	-ve & +ve	Medium

Construction Phase Impact	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Archaeology – No Mitigation	Medium	Probable	Medium	-ve	High
Archaeology – with Mitigation	Low	Improbable	**VERY LOW**	Neutral	High
Colonial Period Heritage & Cultural Landscape – No Mitigation	High	Probable	High	-ve	High
Colonial Period Heritage & Cultural Landscape – with Mitigation	Low	Probable	**LOW**	-ve	High
Noise – No Mitigation	Low	Improbable	Very Low	-ve	High
Noise – with Mitigation	Low	Improbable	**VERY LOW**	-ve	High

Operational Phase Impact	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Visual – No Mitigation	High	Definite	High	–ve	High
Visual – With Mitigation	Medium	Probable	**MEDIUM**	–ve	Medium
Alien Plant Invasion – No Mitigation	Medium	Improbable	Low	–ve	High
Alien Plant Invasion – With Mitigation	Low	Improbable	**LOW**	–ve	High
Increased Erosion Risk – No Mitigation	Medium	Definite	Medium	–ve	High
Increased Erosion Risk – With Mitigation	Low	Probable	**LOW**	–ve	High
Bats – Collisions with Power Lines - No Mitigation Required	Low	Improbable	**VERY LOW**	-ve	High
Bats – Disturbance / Displacement by Power Lines – No Mitigation Required	Low	Improbable	**VERY LOW**	-ve	High
Avifauna – Disturbance & Displacement – No Mitigation	Low	Probable	Low	-ve	High
Avifauna – Disturbance & Displacement – With Mitigation	Low	Possible	**VERY LOW**	-ve	High
Avifauna – Electrocution – No Mitigation	High	Possible	Medium	-ve	High
Avifauna – Electrocution – With Mitigation	High	Improbable	**MEDIUM**	-ve	High
Avifauna – Power Line Collisions – No Mitigation	High	Probable	High	-ve	High
Avifauna – Power Line Collisions – With Mitigation	High	Possible	**MEDIUM**	-ve	High

Operational Phase Impact	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Agriculture Potential & Land Capability – Vehicle Operation and Spillages – No Mitigation	Very Low	Definite	Low	–ve	High
Agriculture Potential & Land Capability – Vehicle Operation and Spillages – With Mitigation	Very Low	Improbable	**INSIGNIFICANT**	–ve	High
Agriculture Potential & Land Capability – Dust Generation – No Mitigation	Low	Definite	Low	–ve	High
Agriculture Potential & Land Capability – Dust Generation – No Mitigation	Very Low	Improbable	**INSIGNIFICANT**	–ve	High
Noise – No Mitigation required	Low	Possible	**LOW**	-ve	High
Social – Sense of place – No Mitigation	High	Probable	High	-ve	High
Social – Sense of place – With Mitigation	Medium	Probable	**MEDIUM**	-ve	High

5 ENVIRONMENTAL MANAGEMENT PROGRAMME

This section forms the core of the EMPr and outlines the specific mitigation measures for those key impacts identified in the section above.

5.1 Environmental Awareness and Compliance

The philosophy that has been used for the compilation of this management programme is derived from the principles of the National Environmental Management Act (No. 107 of 1998) which states that development must be socially, economically and environmentally sustainable. Sustainable development requires that:

- The disturbance of ecosystems and loss of biodiversity are avoided (minimised or remedied);
- Pollution and degradation of the environment are avoided or minimised and remedied; Waste is avoided or minimised and re-used or re-cycled where possible and otherwise disposed of in a responsible manner;
- A risk averse and cautious approach is applied;
- Negative impacts on the environment and on people's environmental rights be anticipated; and, prevented and where they cannot altogether be prevented, are minimised and remedied.

The Act makes provision that anyone who causes pollution or degradation of the environment is responsible for preventing impacts occurring, continuing or recurring and for the costs of repair of the environment.

5.2 Roles and Responsibilities for Good Environmental Management

The developer, together with the each appointed contractor will be responsible for environmental management on site during the construction and operational phases of the proposed development. Specific roles and responsibilities are highlighted in the table below.

The Project Company

The Project Company is defined as the legal entity with ownership of the project. It is responsible for adherence to the conditions of the Environmental Authorisation (EA) issued by the DEA, as well as all any other licensing or permitting requirements and ultimately accountable. The Project Company appoints construction and operation managers. During the construction phase of the proposed grid connections the Project Company will be Emoyeni Wind Farm Project Pty Ltd. It is envisaged that ownership of the grid connections and associated infrastructure will then be transferred to Eskom Holdings SOC Limited, who will be responsible for the operation and decommissioning phases of the projects.

The Project Company is responsible for managing the construction of the proposed projects. It must appoint suitably experienced engineers who will oversee the management of all activities on site, as well as a suitably qualified Environmental Control Officer. It is responsible for ensuring that the engineers are aware of all EMPr requirements and that these are being correctly implemented and that the Contractor's activities are being monitored. It must ensure that the Contractor is aware of and contractually bound to the provisions of this EMPr. All relevant environmental management procedures required should be included in the tender documents. It must also ensure that the contractor remedies and environmental problems timeously and to the satisfaction of the authorities or ECO if necessary. The project company must notify the authorities should environmental problems not be remedied timeously.

The Contractor

The Contractor is responsible for project delivery, management of the construction programme and quality control. The contractor must inform employees and sub-contractors of their obligations to minimise any environmental impacts caused by their activities and ensure they are informed of the requirements of the EMPr and their implementation. It is the contractor's obligation to promote environmental awareness and an understanding of the environmental features of the construction site. This includes basic training in the identification of protected species as well as archaeological and paleontological objects that could occur on site. This EMPr must be made available to them by the contractor who is also responsible to implement safe, environmentally acceptable working methods, and compliance with Health, Safety and Environment (HSE) responsibilities.

Developer Representative – Environmental Manager

- Review and approve EMPr prior to authorisation by DEA.
- Review and approve any EMPr updates or amendments.
- Ensure environmental requirements are integrated into the project plans, method statements and tender processes.
- Support the site environmental control officer during the construction phase, to ensure implementation of the EMPr.
- Follow up and close out all environmental incidents and non-conformances.
- Appointment a suitably qualified independent environmental control officer during the construction phase.

Principal Contractor Representative - Environmental Control Officer

An independent environmental consultant will arrange for inspections of the construction activities and EMPr implementation throughout the construction phase. After each inspection, the ECO will produce a monitoring report that will be submitted to the client DEA and Western Cape Environmental Department (DEADP). Relevant sections of the minutes of customary (monthly) site meetings will be attached to the monitoring report.

The Environmental Control Officer (ECO) will be responsible for overseeing the implementation of the EMP during the construction and operations phases, and for

monitoring, reviewing and verifying compliance of the contractor with the EMP, record-keeping and updating of the EMP as and when necessary.

The ECO will:

- Be fully knowledgeable with the contents of the EMP;
- Be fully knowledgeable with the contents of all relevant environmental legislation and ensure compliance with them;
- Ensure that the contents of the EMP are communicated to the contractor, all site staff, and the contractor and /or site manager are made aware of the contents of the EMP, through presentations and discussions;
- Ensure that compliance to the EMP is monitored by regular and comprehensive inspection of the site and surrounding areas;
- Report on any incidents of non-compliance and ensure mitigation measure are implemented as soon as practical.

During *construction*, the Environmental Control Officer will be responsible for the following:

- Meeting on site with the Construction Manager prior to the commencement of construction activities to confirm the construction procedure and designated activity zones;
- Daily / weekly (depending on the extent of construction activities, at any given time) monitoring of site activities during construction to ensure adherence to the specifications contained in the EMP, using a monitoring checklist that is to be prepared by an independent environmental assessment practitioner at the start of the construction phase;
- Preparation of the monitoring report based on the site visit;
- Conducting an environmental inspection on completion of the construction period and signing off the construction process with the Construction Manager; and
- Maintain an Incidents Register and Complaints Register on site.

During *operation*, the Environmental Control Officer will be responsible for:

- Overseeing the implementation of the EMP for the operation phase;
- Ensure that the necessary environmental monitoring takes place as specified in the EMP;
- Update the EMP and ensure that records are kept of all monitoring activities and results; and
- Maintain an Incidents Register and Complaints Register on site.

During *decommissioning*, the Environmental Control Officer will be responsible for:

- Overseeing the implementation of the EMP for the decommissioning phase; and
- Conducting an environmental inspection on completion of decommissioning and "signing off" the site rehabilitation process.

5.3 Training and Induction of Employees

The contractor has a responsibility to ensure that all personnel involved in the project are aware of and are familiar with the environmental requirements for the project. The EMP shall be part of the terms of reference (ToR) for all contractors, sub-contractors and suppliers. All Contractors have to give some assurance that they understand the EMP and that they will undertake to comply with the conditions therein. All senior and supervisory staff members shall familiarise themselves with the full contents of the EMP. They shall know and understand the specifications of the EMP and be able to assist other staff members in matters relating to the EMP.

The Contractor must ensure that all staff working on site has an environmental induction. The presentation can include the following topics;

- What is meant by "Environment"?
- Why the environment needs to be protected and conserved.
- How construction activities can impact on the environment.
- What can be done to militate against such impacts?
- Awareness of emergency and spills response provisions.
- Social responsibility during construction e.g. being considerate to local residents.

A detailed environmental management and training program must be developed. The purpose of this is to ensure that all staff and workers understand what is required of them. The main components of the program can incorporate the following:

- Concept of sustainability and the reasons for good environmental management and practice
- Potential environmental impacts
- Mitigation measures
- Establishing a chain of responsibility and decision making
- Specific training requirements of certain staff, and the potential hazardous associated with the job.
- Methodologies to be used for field sampling
- Training in the use of field equipment
- Training in identification of non-compliance situations and procedures to be followed in such instances
- Reporting requirements
- Fire management
- HIV/AIDS

5.4 Complaints Register and Environmental Incidents Book

The Contractor must record any complaints received from the community. The complaint must be brought to the attention of the site manager and Environmental Control Officer, who will respond accordingly.

The following information will be recorded:

- Time, date and nature of the complaint;
- Response and investigation undertaken; and,
- Actions taken and by whom.

All complaints received will be investigated and a response (even if pending further investigation) will be given to the complainant within 7 days.

All environmental incidents occurring on the site will be recorded. The following information will be provided:

- Time, date, location and nature of the incident,
- Actions taken and by whom.

5.5 Construction Environmental Monitoring

Environmental audits must be undertaken by an independent environmental consultant who will act as the Environmental Control Officer twice monthly, and on a daily basis or what is deemed necessary by the ECO during times of heavy earth works and vegetation clearing, in order to ensure compliance of all aspects of the EMP.

In order to facilitate communication between the ECO and the Resident Engineer and Contractor, it is vital that a suitable chain of command is structured that will ensure that the ECO's recommendations have the full backing of the project team before being conveyed to the Contractor. In this way, penalties as a result of non-compliances with the EMP may be justified as failure to comply with instruction from the highest authority.

5.6 Dealing with Non Compliance with the EMP

There may be difficulties encountered with carrying out the mitigation measures within the EMPr, this may result in non-compliance with the EMP. It may be possible that the contractor and or the developer in place procedures to motivate staff members to comply with the EMPr and to deal with deal with non-compliance. The developer must make this known to the contractor at the earliest stage possible, even during the tender phase.

5.7 EMP Amendments and Instructions

No EMP amendments shall be allowed with the approval of the DEA. Amendments may be possible, following discussions with the relevant ECO or environmental consultant, who may propose EMP amendments on behalf of the developer or issue EMP instructions, either corrective actions, remediation or rehabilitation. These correction action must be completed within the specified timeframes.

6 DESIGN PHASE / PRE–CONSTRUCTION PHASE MITIGATION MEASURES

The objectives of the pre-construction phase are:

- To promote environmental awareness.
- To define roles and responsibilities for environmental management;
- To ensure suitable environmental training and induction to all contractors, sub-contractors and labourers; and
- To ensure that all legal obligations and contractual conditions have been met prior to commencing of construction.

Mitigation measures for Legal Compliance.

- Appoint an independent environmental control officer
- Appoint an internal environmental co-ordinator or environmental officer, to oversee day to day environmental activities.
- Staff should be educated as to the need to refrain from indiscriminate waste disposal and/or pollution of local soil and water resources and receive the necessary safety training.
- Before construction begins, all areas to be developed must be clearly demarcated with fencing, by a qualified surveyor.
- The contractor must ensure compliance with conditions described in the environmental authorisation.
- No construction camps are allowed on site. No workers are allowed to stay overnight in the construction area.
- Confirm with ECO, suitable sites for the construction camps (equipment and batching etc.) and storage areas for materials. All construction equipment must be stored within this construction camp and all associated oil changes etc. (no servicing) must take place within this camp.
- Unskilled labourers should be drawn from the local market.
- Training of site staff.
- Environmental awareness training for construction staff, concerning the prevention of accidental spillage of hazardous chemicals and oil; pollution of water resources (both

surface and groundwater), air pollution and litter control and identification of archaeological artefacts.
- Project Manager shall ensure that the training and capabilities of the Contractor's site staff are adequate to carry out the designated tasks.
- Staff operating equipment (such as excavators, loaders, etc.) shall be adequately trained and sensitised to any potential hazards associated with their tasks.
- No operator shall be permitted to operate critical items of mechanical equipment without having been trained by the Contractor and certified competent by the Project Manager.

The developer must ensure that the following mitigation measures are applied to the proposed project prior to the construction phase. These measures must be included in an updated EMPr to be submitted to the DEA for approval.

Prior to the submission of the final layout plan to the DEA for approval, the following specialists must visit the site to assist with the micro-siting the layout and do a walkthrough of all power lines:

- Flora and fauna specialists
- Avifaunal specialist
- Palaeontologist

Following the selection of turbine to be used for the project, the developer must update the layout plan for Phase 1, this together with the following management plans, to be developed, must be submitted to the DEA for approval:

- Traffic Management Plan – this plan will include the necessary arrangements to transport all equipment and infrastructure to site, including the necessary road transport permits.
- Construction Site Traffic Management Plan – this will be in the form of a site layout, showing the flow of traffic during the construction phase taking into consideration existing land users.
- Storm water Management Plan – once the final layout plan has been produced the appointed responsible engineers must produce a storm water management plan for the site, during the construction and operational phases of the project.
- A health and safety plan must be drawn up to ensure worker safety.

The construction of the WEF will result in water crossings for the expansion of existing and / the construction of new bridges over water courses. The developer must ensure that water use licences are applied for and approved for these, prior to the start of construction. All mitigation measures proposed in the water use licence must be adhered to and included in an updated EMPr and submitted to the DEA for approval.

Develop a Project Layout and Access Plan to show the intended use of the area. The plan shall clearly indicate and/or describe the location and details of:

- Servitudes.
- Areas and routes to be cleared – including the size / width of the cleared areas.
- The construction campsite and rest areas to be used during construction.
- Waste disposal sites to be used during construction.
- Sources of construction materials.
- Power supply during construction.
- Existing roads and tracks to be used as transportation routes, and routes to gain access to construction areas.
- New tracks deemed necessary to provide access to construction activities.
- Any informal residential structures found within the property.
- Affected land use, 1:50 year floodlines.
- Sensitive areas.

6.1 Method Statements

Prior to construction the developer must ensure that the contractor supply the following method statements:

- Vegetation clearing;
- Cement mixing;
- Hazardous waste management;
- Emergency preparedness and response;
- Hazardous spills clean up;
- Topsoil stockpiling management;
- Laydown area management;
- Hazardous materials management;

6.2 Site Establishment

The object of site establishment is to ensure that an appropriate site is selected for the construction camp/site office and that the site office is managed in an environmentally responsible manner with minimal impact on the environment.

Mitigation Measures

Before establishing the construction office areas, carefully plan the layout and develop a Construction Site Office Plan[1]. The Construction Site Office Plan shall provide a description of the site and shall show, on a reasonably scaled map, the intended use of the site. Indicate and/or describe the location, size / quantity / capacity and design of:

- Access routes;
- Ablution facilities (including details on the handling of sewage and wastewater);
- On-site waste management facilities (waste containers, etc.);
- Design of bunds and other structures for containment of hazardous substances;
- Fencing;
- Water storage and supply;
- Power supply (for cooking, space heating, lighting, etc.);
- Fire extinguishers, first aid kit and any other relevant safety equipment;
- Other structures and buildings (offices, storerooms, workshops, etc.);
- Other storage areas and stockpiles (i.e. topsoil, construction materials, equipment, etc.);

Location of areas to be reinstated upon completion of the construction period, providing measures to be used for reinstatement.

- An area within the site must be demarcated for a construction site office, which will include storage area. This area must be fenced off.
- Site establishment shall take place in an orderly manner and all required amenities shall be installed at the lay down area before the main workforce move onto site.
- The construction camp shall have the necessary ablution facilities with chemical toilets at commencement of construction.
- The Contractor shall inform all site staff to make use of supplied ablution facilities and under no circumstances shall indiscriminate sanitary activities be allowed other than in supplied facilities.

[1] To form part of the Project Layout and Access Plan.

- The Contractor shall supply waste collection bins and all solid waste collected shall be disposed of at a registered landfill.
- Potable water for use by on site workers must be made available on a daily basis at the site office and the working areas on site.
- A certificate of disposal shall be obtained by the Contractor and kept on file. Where a registered waste site is not available close to the construction site, the Contractor shall provide a method statement with regard to waste management.
- The disposal of waste shall be in accordance with all relevant legislation. Under no circumstances may solid waste be burnt or buried on site.

Siting, Establishing and Management of Storage Material and Facilities

- Choice of location for storage areas must take into account prevailing winds, distances to water bodies, general onsite topography and water erosion potential of the soil. Impervious surfaces must be provided where necessary.
- Storage areas must be designated, demarcated and fenced.
- Storage areas should be secure so as to minimize the risk of crime. They should also be safe from access by children / animals etc.
- Fire prevention facilities must be present at all storage facilities.
- Proper storage facilities for the storage of oils, paints, grease, fuels, chemicals and any hazardous materials to be used must be provided to prevent the migration of spillage into the ground and groundwater regime around the temporary storage area(s).
- These pollution prevention measures for storage should include a bund wall high enough to contain at least 110% of any stored volume, and this should be sited away from drainage lines in a site with the approval of the Engineer.
- Any water that collects in the bund must not be allowed to stand and must be removed immediately and the hydrocarbon digestion agent within must be replenished.
- All legal compliance requirements with respect to Fuel storage and dispensing must be met.
- All fuel storage tanks (temporary or permanent) and associated facilities must be designed and installed in accordance with the relevant oil industry standards, SANS codes and other relevant requirements.
- Areas for storage of fuels and other flammable materials must comply with standard fire safety regulations
- Flammable fuel and gas must be well separated from all welding workshops, assembly plants and loading bays where ignition of gas by an accidental spark may cause an explosion or fire.
- The tank must be erected at a safe distance from buildings, boundaries, welding sites and workshops and any other combustible or flammable materials.
- Symbolic safety signs depicting "No Smoking", "No Naked Flames" and "Danger" are to be prominently displayed in and around the fuel storage area.
- The capacity of the tank must be clearly displayed and the product contained within the tank clearly identified.
- There must be adequate fire-fighting equipment at the fuel storage and dispensing area or areas.
- The storage tank must be removed on completion of the construction phase of the project.
- All such tanks to be designed and constructed in accordance with a recognised code (international standard).
- The rated capacity of tanks must provide sufficient capacity to permit expansion of the product contained therein by the rise in temperature during storage.

- Only empty and externally clean tanks may be stored on the bare ground. All empty and externally dirty tanks must be sealed and stored in an area where the ground has been protected.
- Any electrical or petrol-driven pump must be equipped and positioned so as not to cause any danger of ignition of the product.
- If fuel is dispensed from 200 litre drums, the proper dispensing equipment must be used.
- The drum must not be tipped in order to dispense fuel. The dispensing mechanism of the fuel storage tank must be stored in a waterproof container when not in use.
- All waste fuel and chemical impregnated rags must be stored in leak-proof containers and disposed of at an approved hazardous waste site.
- The amounts of fuel and chemicals stored on site must be minimised.
- Storage sites must be provided with bunds to contain any spilled liquids and materials.
- These storage facilities (including any tanks) must be on an impermeable surface that is protected from the ingress of storm water from surrounding areas in order to ensure that accidental spillage does not pollute local soil or water resources.
- Clear signage must be placed at all storage areas containing hazardous substances / materials.
- Material Safety Data Sheets (MSDSs) shall be readily available on site for all chemicals and hazardous substances to be used on site. Where possible the available, MSDSs should additionally include information on ecological impacts and measures to minimise negative environmental impacts during accidental releases or escapes.
- Storage areas containing hazardous substances / materials must be clearly signed.
- Staff dealing with these materials / substances must be aware of their potential impacts and follow the appropriate safety measures.
- A suitable Waste Disposal Contractor must be employed to remove waste oil. These wastes should only be disposed of at licensed landfill sites designed to handle hazardous wastes.
- The contractor must ensure that its staff is made aware of the health risks associated with any hazardous substances used and has been provided with the appropriate protective clothing/equipment in case of spillages or accidents and have received the necessary training.
- All excess cement and concrete mixes are to be contained on the construction site prior to disposal off site.
- Any spillage, which may occur, shall be investigated and immediate action must be taken.

7 CONSTRUCTION PHASE MITIGATION MEASURES

The following sections form the core of the EMPr during the construction phase of the proposed development. The developer is to ensure that the contractor complies with all mitigation measures during the construction period. The major sources of potential impacts include, the turbine footprint construction, the construction of buildings and infrastructure, the construction of roads and bridges, and vehicle operation, and spillages.

The following is not allowed on site:

- No poaching of any animals or harvesting of any flora;
- No construction camp, for workforce accommodation is allowed on site; contractors are to ensure suitable housing for staff outside of the proposed development footprint.
- No cooking or fires allowed on site;
- No alcohol or drugs are allowed on site;

7.1 Potential Construction Phase Impacts

The following impacts are likely to occur during the construction of the proposed WEF. Specific mitigation measures for each impact is presented in the table below.

- The accidental, negligent, or deliberate spillage or inappropriate disposal of hazardous substances could result in air, soil and water pollution and may affect the health and well-being of people, plants and animals.
- Excessive noise could be made by the construction activity which would affect neighbouring communities.
- Potential damage to the soil structure, soil compaction and loss of soil fertility.
- Loss of the vegetation cover and increased erosion risks.
- Dust related problems.
- Safety hazards to the public, workers and animals in the area.
- Disturbance to local hydrology from construction activities.
- Pollution of surface water bodies
- Dust can be a nuisance to the construction workforce and to the public and can negatively affect the growth and recovery rate of plants. Potential sources of fugitive dust include, but are not limited to:
    - Demolition of concrete foundations and existing buildings;
    - Grading / movement of soil;
    - Transportation and unloading of construction materials;
    - Vehicular movement over unsurfaced roads and tracks; and,
    - Wind erosion of stockpiles.
- Construction activities will result in the exposure of the soil to erosive factors, i.e. wind and water, and the compaction of the soil in other areas;
- Illegal poaching and collection of animals and plant material.
- Loss of established indigenous and exotic habitat
- Unnecessary trampling of vegetation and harm to animals.
- Degradation of the scenic quality due to the major earthworks and any unsightly structures.
- Damage or loss of important cultural, historical or pre-historical sites and artefacts.
- Damage to existing roads and tracks, power lines, pipelines, etc.
- Dangerous conditions near road.
- Trespassing and illegal access onto land.

Table 7:1 Construction Phase Mitigation Measures

Mitigation Measure	Responsibility	Frequency
Route Clearing		
Off-road driving and the creation of new tracks, other than those described during Project Layout and Access Plan, are prohibited and will be regarded as unwanted tracks or unwarranted disturbed areas. All unwanted tracks or unwarranted disturbed areas shall be properly rehabilitated	Contractors engineer will be responsible for the creation of new roads. The ECO will be responsible for monitoring this activity	During site establishment Monthly thereafter.
When a new path is created: Carefully plan the route and have it clearly marked out so that drivers exactly know where to drive.	Site engineer/site manager ECO to monitor	Monthly
Establish the track by simply driving over the ground if there are no obvious obstacles (i.e. large rocks, high plants or rough terrain).	ECO to monitor Site engineer/site manager	
Keep tracks as narrow as possible and only drive on marked out routes (as per the Layout and Access Plan).		
No bulldozers will be used in bush clearing outside of the construction footprint. Only inflatable tyre earthmoving equipment must be used to reduce damage to vegetation.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
If obstacles are far enough apart, divert the track around obstacles. Only obstacles that could interfere with the safe construction and operation of the development need to be removed.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Where possible, remove obstacles by hand. Shrubs are to be cut or crushed rather than being completely uprooted in areas where landscaping or rehabilitation will be undertaken on completion of the construction. Leave vegetation in place wherever possible, especially around the perimeter of the site to provide screening and habitat. Indigenous plants can be planted to replace alien vegetation.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.

Mitigation Measure	Responsibility	Frequency
Only undertake earthworks in an area if it is unavoidable, and keep the size of platforms as small as possible.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Sensitive sites within the construction area must be demarcated to avoid accidental destruction of sensitive areas. The workforce must be made aware of these areas, and why they are sensitive.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Impacts on vegetation and listed or protected plant species resulting from construction activities		
Preconstruction walk-through of the facility in order to locate species of conservation concern that can be avoided or translocated as well as comply with the provincial permit conditions.	Developer / Site Engineer ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Vegetation clearing to commence only after walk through has been conducted and necessary permits obtained.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Preconstruction environmental induction for all construction staff on site to ensure that basic environmental principles are adhered to. This includes awareness as to no littering, appropriate handling of pollution and chemical spills, avoiding fire hazards, minimizing wildlife interactions, remaining within demarcated construction areas etc.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
ECO to provide supervision and oversight of vegetation clearing activities within sensitive areas such as near drainage areas.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Vegetation clearing to be kept to a minimum. No unnecessary vegetation to be cleared.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
All construction vehicles should adhere to clearly defined and demarcated roads. No off-road driving to be allowed outside of the construction area.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Temporary lay-down areas should be located within previously transformed areas or areas that have been identified as being of low sensitivity. These areas should be rehabilitated after use.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Alien Plant Invasion Risk		

Mitigation Measure	Responsibility	Frequency
Wherever excavation is necessary, topsoil should be set aside and replaced after construction to encourage natural regeneration of the local indigenous species.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
The recovery of the indigenous grass layer should be encouraged through leaving some areas intact through the construction phase to create a seed source for adjacent cleared areas.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Due to the disturbance at the site as well as the increased runoff generated by the hard infrastructure, alien plant species are likely to be a long-term problem at the site and a long-term control plan will need to be implemented.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Regular monitoring for alien plants within the development footprint as well as adjacent areas which receive runoff from the facility as there are also likely to be prone to invasion problems.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Regular alien clearing should be conducted using the best-practice methods for the species concerned. The use of herbicides should be avoided as far as possible.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Increased Erosion Risk		
Dust suppression and erosion management should be an integrated component of the construction approach.	ECO to monitor Site engineer/site manager	Weekly
Regular monitoring for erosion problems along the access roads and other cleared areas.	ECO to monitor Site engineer/site manager	Weekly
Erosion problems should be rectified on a regular basis.	ECO to monitor Site engineer/site manager	weekly
Sediment traps may be necessary to prevent erosion and soil movement if there are topsoil or other waste heaps present during the wet season	ECO to monitor Site engineer/site manager	monthly
A low cover of vegetation should be left wherever possible within the construction footprint to bind the soil, prevent erosion and promote post-disturbance recovery of an indigenous ground cover.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.

Mitigation Measure	Responsibility	Frequency
Disturbance near to drainage lines or the pan should be avoided and sensitive drainage areas near to the construction activities should demarcated as no-go areas.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Direct Faunal Impacts		
All personnel should undergo environmental induction with regards to fauna and in particular awareness about not harming or collecting species such as snakes, tortoises and owls which are often persecuted out of superstition.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Any fauna threatened by the construction activities should be removed to safety by the ECO or appropriately qualified environmental officer.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
All construction vehicles should adhere to a low speed limit to avoid collisions with susceptible species such as snakes and tortoises	ECO to monitor Site engineer/site manager / safety officer	During site establishment Monthly thereafter.
All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
If trenches need to be dug for water pipelines or electrical cabling, these should not be left open for extended periods of time as fauna may fall in and become trapped in them. Trenches which are standing open should have places where there are soil ramps allowing fauna to escape the trench.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Avifaunal Habitat Destruction		
Prior to construction, the avifaunal specialist must conduct a site walkthrough, covering the final road and power line routes as well as the final turbine positions, to identify any nests/breeding activity of sensitive species, as well as any additional sensitive habitats. The results of which may inform the final construction schedule, including abbreviating construction time, scheduling activities around avian breeding and/or movement of schedules, and lowering levels of associated noise.	ECO to monitor Site engineer/site manager	Prior to construction

Mitigation Measure	Responsibility	Frequency
During construction laydown areas and temporary access roads should be kept to a minimum in order to limit direct vegetation loss and habitat fragmentation, while designated no-go areas must be enforced i.e. no off road driving.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Any clearing of stands of alien trees on site should be approved first by an avifaunal specialist.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Following construction, rehabilitation of all areas disturbed (e.g. temporary access tracks and laydown areas) must be undertaken and to this end a habitat restoration plan is to be developed by and included within the EMPr.	ECO to monitor Site engineer/site manager	Post construction
All contractors are to adhere to the EMPr and should apply good environmental practice during construction.	ECO to monitor Site engineer/site manager	Throughout construction
Avifaunal Disturbance and Displacement		
A site specific Operational Environmental Management Plan (OEMP) must be implemented, which gives appropriate and detailed description of how operational and maintenance activities must be conducted to reduce unnecessary disturbance. All contractors are to adhere to the OEMP and should apply good environmental practice during all operations	ECO to monitor Site engineer/site manager	Monthly and when required.
Any grid connection power line/s must be of a design that minimizes electrocution risk by using adequately insulated 'bird friendly' monopole structures, with clearances between live components of 2 m or greater.		
The operational monitoring programme for the associated WEF site must be in line with the South African monitoring guidelines (Jenkins et al. 2015) and must include regular monitoring of the grid connection power line and all new associated substations for electrocution (and collision) mortalities. Any mortalities should be reported to the Endangered Wildlife Trust (EWT).		
Construct new power lines close to existing power lines where possible		

Mitigation Measure	Responsibility	Frequency
The proposed Grid Connection should be re-routed to avoid, by 2 km or more, the location of the Verreaux's Eagle nest located at (31°43'39.50"S; 23°40'44.07"E) by Smallie (2014).		
Install bird flight diverters as per the instructions of the specialist following the site walkthrough, which may include the need for modified BFDs fitted with solar powered LED lights on certain spans	ECO to monitor Site engineer/site manager	Pre-construction, post final design
An avifaunal specialist must conduct a site walk through of final grid connection route and pylon positions prior to construction to determine if, and where, bird flight diverters (BFDs) are required.	ECO to monitor Site engineer/site manager	As per specialist requirements.
Bat Roost disturbance and/or destruction		
No pylons to be built within 500 m of these potential roosts or 1 km from any known roost	ECO to monitor Site engineer/site manager	Design phase
Dust suppression measures to be used during the full construction phase		
Clearing of natural and agricultural areas be kept to a minimum.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Office, sub-station and lay-down areas should only be in areas of Low-Medium and Medium bat sensitivity	ECO to monitor Site engineer/site manager	During blasting activities
Dust suppression measures to be used during the full construction phase	ECO to monitor Site engineer/site manager	Weekly
Any new roosts discovered, should be reported and incorporated into the adaptive management plan.	ECO to monitor Site engineer/site manager	Monthly and as required during construction
Roost searches to continue during construction and operational phases.	ECO to monitor Site engineer/site manager	As required by the specialist
Loss of riparian systems and water courses		
Where water course crossings are required, the engineering team must provide an effective means to minimise the potential	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.

Mitigation Measure	Responsibility	Frequency
upstream and downstream effects of sedimentation and erosion (erosion protection) as well minimise the loss of riparian vegetation (small footprint).		
No vehicles to refuel within drainage lines/ riparian vegetation.	ECO to monitor Site engineer/site manager	Weekly
During the operational phase, monitor culverts to see if erosion issues arise and if any erosion control if required.	ECO to monitor Site engineer/site manager	monthly
Where possible culvert bases must be placed as close as possible with natural levels in mind so that these don't form additional steps / barriers.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Impact on riparian systems through the possible increase in surface water runoff from hard surfaces and or roads on riparian form and function		
Any stormwater within the site must be handled in a suitable manner, i.e. trap sediments, and reduce flow velocities.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Increase in sedimentation and erosion within the development footprint		
Any stormwater within the site must be handled in a suitable manner, i.e. trap sediments, and reduce flow velocities.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Impact on localized surface water quality		
Strict use and management of all hazardous materials used on site.	ECO to monitor Site engineer/site manager	Weekly
Strict management of potential sources of pollution (e.g. litter, hydrocarbons from vehicles & machinery, cement during construction, etc.).	ECO to monitor Site engineer/site manager	Weekly
Containment of all contaminated water by means of careful run-off management on the development site.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Strict control over the behaviour of construction workers.	ECO and safety to monitor Site engineer/site manager	Weekly
Working protocols incorporating pollution control measures (including approved method statements by the contractor)	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.

Mitigation Measure	Responsibility	Frequency
should be clearly set out in the EMPr for the project and strictly enforced.		
Appropriate ablution facilities should be provided for construction workers during construction and on-site staff during the operation of the facility.	ECO to monitor Site engineer/site manager	Weekly
Visual		
Access and haul roads to use existing farm tracks as far as possible.	ECO to monitor Site engineer/site manager	During site establishment Weekly
Construction camp, stockpiles and lay-down area to be located out of sight of district roads, possibly in the vicinity of the proposed substation and O&M buildings.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Disturbed areas rather than pristine or intact land to preferably be used for the construction camp. Construction camp and laydown areas to be limited in area to only that which is essential	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Measures to control wastes and litter to be included in the contract specification documents.	ECO to monitor Site engineer/site manager	During site establishment Weekly thereafter.
Provision to be made for rehabilitation/ re-vegetation of areas damaged by construction activities.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
Disturbance, damage or destruction of well-preserved fossils at or beneath the ground surface during the construction phase (especially due to bedrock excavations, ground clearance)		
Conduct a pre-disturbance inspection of any infrastructure that is to be positioned on sensitive geology. Sensitive specimens will need to be recorded and removed.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
The employment of a palaeontologist during the construction phase, establishment of on-site curation facilities and identification of a repository for specimens.	ECO to monitor Site engineer/site manager	During site establishment When required during construction.
During the construction phase a chance-finds procedure should be applied should substantial fossil remains such as vertebrate bones, teeth or trackways, plant-rich fossil lenses or dense fossil	Environmental Control Officer should safeguard the fossils, preferably *in situ*, and alert the responsible heritage management authority (Heritage Western Cape for the	When required during construction

Mitigation Measure	Responsibility	Frequency
burrow assemblages be exposed by excavation or discovered within the development footprint.	Western Cape, SAHRA for the Northern Cape) so that appropriate action can be taken by a professional palaeontologist	
archaeological material and rock engravings		
Conduct a final walk down of roads and check turbines positions for archaeological material.	ECO to monitor Site engineer/site manager	During site establishment Monthly thereafter.
In the improbable event of archaeological material being found, this will need to be subject to sampling and removal from site under a work plan (Heritage Western Cape) or a permit (Eastern Cape Heritage Authority)	ECO to monitor Site engineer/site manager	Throughout construction
Check dolerite clusters and flat dolerite rafts for rock engravings. Rock engravings must be assigned co-ordinates, photographed (so as to record detail) and moved out of harm's way, or the road adjusted to avoid them.	ECO to monitor Site engineer/site manager	Throughout construction
colonial period heritage		
Re-use and sensitive repair of abandoned farm houses would make a positive contribution to heritage conservation. Refurbishment should be done under the advice of a heritage architect/consultant.	ECO to monitor Site engineer/site manager	Design phase
Graves		
In the event of human bones being found on site, an archaeologist must be informed immediately and the remains removed under an emergency permit. This process will incur some expense as removal of human remains is at the cost of the developer. Time delays may result while application is made to the authorities and an archaeologist is appointed to do the work.	ECO to monitor Site engineer/site manager	Throughout construction
All identified grave yards must be mapped and co-ordinates given to the developer and the contractor. These areas must be avoided, as far a practical. The contractor is to ensure that the work force are aware of these areas, and buffers applied around them.	ECO to monitor Site engineer/site manager	Throughout construction

Mitigation Measure	Responsibility	Frequency
Employment and Business Creation Opportunities		
The alignment of the transmission power line should be done so as to ensure that it is not visible from Badsfontein Farm.		
An accredited training and skills development programme aimed at maximising to opportunity for local workers to be employed for the low and semi-skilled positions should be initiated prior to the initiation of the construction phase. The aim of the programme should be to maximise employment opportunities for members of the local community. In this regard the programme should be aimed at community members from Murraysburg, Beaufort West, Graaff-Reinet and Richmond. The programme should be developed in consultation with the Department of Labour and the BWLM. The recommended targets are 50% and 30% of low and semi-skilled positions respectively should be taken up by local community members. Due to the low skills levels in the area, the majority of semi-skilled and skilled posts are likely to be filled by people from outside the area;	Developer/ site manager	Pre-construction and throughout construction
The recruitment selection process for the training and skills development programme should seek to promote gender equality and the employment of women wherever possible;	Developer/ site manager	Pre-construction and throughout construction
Before the construction phase commences the proponent should meet with representatives from the BWLM to establish the existence of a skills database for the area. If such as database exists it should be made available to the contractors appointed for the construction phase;	Developer/ site manager	Pre-construction and throughout construction
The local authorities and relevant community representatives should be informed of the final decision regarding the project and the potential job opportunities for locals and the employment procedures that the proponent intends following for the construction phase of the project.	Developer/ site manager	Pre-construction and throughout construction
Where reasonable and practical the proponent should appoint local contractors and implement a 'locals first' policy, especially for semi and low-skilled job categories. Where feasible, efforts should be made to employ local contactors that are compliant	Developer/ site manager	Pre-construction and throughout construction

Mitigation Measure	Responsibility	Frequency
with Broad Based Black Economic Empowerment (BBBEE) criteria;		
The proponent should liaise with the BWLM with regards the establishment of a database of local companies, specifically BBBEE companies, which qualify as potential service providers (e.g. construction companies, catering companies, waste collection companies, security companies etc.) prior to the commencement of the tender process for construction contractors. These companies should be notified of the tender process and invited to bid for project-related work;	Developer/ site manager	Pre-construction and throughout construction
Where possible, the proponent should assist local BBBEE companies to complete and submit the required tender forms and associated information.	Developer/ site manager	Pre-construction and throughout construction
The BWLM, in conjunction with the local business sector and representatives from the local hospitality industry, should identify strategies aimed at maximising the potential benefits associated with the project.	Developer/ site manager	Pre-construction and throughout construction
The proponent in consultation with the contractor should hold a workshop/s with local farmers and representatives from the BWLM to discuss options for installing small-scale wind energy facilities and the technology and costs involved	Developer/ site manager	Pre-construction and throughout construction
The proponent in consultation with the contractor should investigate option of establishing a cell phone booster mast on the site.	Developer/ site manager	Pre-construction and throughout construction
impacts on family structures and social networks associated with the presence of construction workers		
An accredited training and skills development programme aimed at maximising to opportunity for local workers to be employed for the low and semi-skilled positions should be initiated prior to the initiation of the construction phase. The aim of the programme should be to maximise employment opportunities for members of the local community. In this regard the programme should be aimed at community members from Murraysburg, Beaufort West, Graaff-Reinet and Richmond. The programme should be developed in consultation with the Department of Labour and the BWLM. The recommended targets are 50% and	Developer/ site manager	Pre-construction and throughout construction

Mitigation Measure	Responsibility	Frequency
30% of low and semi-skilled positions respectively should be taken up by local community members. Due to the low skills levels in the area, the majority of semi-skilled and skilled posts are likely to be filled by people from outside the area; The recruitment selection process for the training and skills development programme should seek to promote gender equality and the employment of women wherever possible;		
The proponent should establish a Monitoring Forum (MF) in order to monitor the construction phase and the implementation of the recommended mitigation measures. The MF should be established before the construction phase commences, and should include key stakeholders, including representatives from the BWLM, farmers and the contractor(s). The MF should also be briefed on the potential risks to the local community and farm workers associated with construction workers;	Developer/ site manager	Pre-construction and throughout construction
The proponent and the contractor(s) should, in consultation with representatives from the MF, develop a code of conduct for the construction phase. The code should identify which types of behaviour and activities are not acceptable. Construction workers in breach of the code should be dismissed. All dismissals must comply with the South African labour legislation;	Developer/ site manager	Pre-construction and throughout construction
The proponent and contractor (s) should implement an HIV/AIDS awareness programme for all construction workers at the outset of the construction phase;	Developer/ site manager	Pre-construction and throughout construction
The contractor should provide transport to and from the site on a daily basis for low and semi-skilled construction workers. This will enable the contractor to effectively manage and monitor the movement of construction workers on and off the site;	Developer/ site manager	Pre-construction and throughout construction
The contractors should make the necessary arrangements to transport workers from Beaufort West, Graaff-Reinet and Richmond home over weekends. This will reduce the risk posed to local family structures and social networks in Murraysburg;	Developer/ site manager	Pre-construction and throughout construction
No construction workers, with the exception of security personnel, should be permitted to stay over-night on the site.	Developer/ site manager	Pre-construction and throughout construction

Mitigation Measure	Responsibility	Frequency
impacts on family structures, social networks and community services associated with the influx of job seekers		
The proponent should implement a "locals first" policy, specifically with regard to unskilled and low skilled opportunities;	Developer/ site manager	Pre-construction and throughout construction
The proponent should implement a policy that no employment will be available at the gate and or in Murraysburg (except for local residents).	Developer/ site manager	Pre-construction and throughout construction
risk to safety of farmers and farm workers, livestock and damage to farm infrastructure associated with the movement of construction workers on and to the site		
The proponent should enter into an agreement with the local farmers in the area whereby damages to farm property etc. during the construction phase proven to be associated with the construction activities for the WEF will be compensated for. The agreement should be signed before the construction phase commences;	Developer/ site manager	Pre-construction and throughout construction
The proponent should establish a MF (see above) that includes local farmers and develop a Code of Conduct for construction workers. This committee should be established prior to commencement of the construction phase. The Code of Conduct should be signed by the proponent and the contractors before the contractors move onto site.	Developer/ site manager	Pre-construction and throughout construction
The proponent should hold contractors liable for compensating farmers in full for any stock losses and/or damage to farm infrastructure that can be linked to construction workers. This should be contained in the Code of Conduct to be signed between the proponent, the contractors and neighbouring landowners. The agreement should also cover loses and costs associated with fires caused by construction workers or construction related activities.	Developer/ site manager	Pre-construction and throughout construction
The Environmental Management Programme (EMP) should outline procedures for managing and storing waste on site, specifically plastic waste that poses a threat to livestock if ingested;	Developer/ site manager ECO to monitor	Pre-construction and throughout construction

Mitigation Measure	Responsibility	Frequency
The contractors appointed by the proponent must ensure that all workers are informed at the outset of the construction phase of the conditions contained on the Code of Conduct, specifically consequences of stock theft and trespassing on adjacent farms.	Developer/ site manager Safety officer	Pre-construction and throughout construction
The contractors appointed by the proponent must ensure that construction workers who are found guilty of trespassing, stealing livestock and/or damaging farm infrastructure are dismissed and charged. This should be contained in the Code of Conduct. All dismissals must be in accordance with South African labour legislation;	Developer/ site manager Safety officer	Pre-construction and throughout construction
The housing of construction workers on the site should be strictly limited to security personnel.	Developer/ site manager Safety officer	Pre-construction and throughout construction
The contractors appointed by the proponent should provide daily transport for low and semi-skilled workers to and from the site. This would reduce the potential risk of trespassing on the remainder of the farm and adjacent properties;	Developer/ site manager Safety officer	Pre-construction and throughout construction
Potential loss of livestock, crops and houses, damage to farm infrastructure and threat to human life associated with increased incidence of grass fires		
The proponent should enter into an agreement with the local farmers in the area whereby damages to farm property etc. during the construction phase proven to be associated with the construction activities for the WEF will be compensated for. The agreement should be signed before the construction phase commences;	Developer/ site manager	Pre-construction and throughout construction
The contractor should provide adequate firefighting equipment on-site;	Site engineer/ site manager Safety officer	Pre-construction and throughout construction
Contractor should ensure that open fires on the site for cooking or heating are not allowed except in designated areas;		
The contractor should ensure that construction related activities that pose a potential fire risk, such as welding, are properly managed and are confined to areas where the risk of fires has been reduced. Measures to reduce the risk of fires include avoiding working in high wind conditions when the risk of fires is	Site engineer/ site manager Safety officer	Pre-construction and throughout construction

Mitigation Measure	Responsibility	Frequency
greater. In this regard special care should be taken during the high risk dry, windy winter months;		
The contractor should provide fire-fighting training to selected construction staff;	Site engineer/ site manager Safety officer	Pre-construction and throughout construction
No construction staff, with the exception of security staff, to be accommodated on site over night;	Site engineer/ site manager Safety officer	Pre-construction and throughout construction
As per the conditions of the Code of Conduct, in the event of a fire proven to be caused by construction workers and or construction activities, the appointed contractors must compensate farmers for any damage caused to their farms. The contractor should also compensate the firefighting costs borne by farmers and local authorities.	Site engineer/ site manager Safety officer	Pre-construction and throughout construction
Potential dust and safety impacts and damage to road surfaces associated with movement of construction related traffic to and from the site		
The contractor must ensure that damage caused by construction related traffic to the gravel road between Murraysburg and Richmond, the Swaelkranz Road and the Witteklip Road and local farm roads is repaired on a regular basis throughout the construction phase. The costs associated with the repair must be borne by the contractor. Experience for other renewable energy projects is that the maintenance for roads is the responsibility of the local district roads authority. In many instances the local district roads authority lack the resources to maintain the local road network. In addition, due to legal restrictions, it is not possible for the contractor to repair damage to public roads. This can result in damage to roads not being repaired before the construction phase is completed. This is an issue that should be addressed with the local district roads authority prior to the commencement of the construction phase; As far as possible, the transport of components to the site along the N10 should be planned to avoid weekends and holiday periods; Sections of the roads that are located adjacent to irrigated lands or farmsteads should be watered regular basis to reduce impact of dust;	Site engineer/ site manager Safety officer and ECO	Pre-construction and throughout construction

Mitigation Measure	Responsibility	Frequency
The contractor must ensure that all construction vehicles adhere to speed limits and vehicles used to transport sand and building materials must be fitted with tarpaulins or covers;	Site engineer/ site manager Safety officer and ECO	Pre-construction and throughout construction
All workers should receive training/ briefing on the reasons for and importance of closing farm gates and driving slowly; Speed limits must be applied. Construction vehicles limit of 40 km/hr on site.	Site engineer/ site manager Safety officer and ECO	Pre-construction and throughout construction. Monthly
All vehicles must be road-worthy and drivers must be qualified and made aware of the potential road safety issues and need for strict speed limits.	Site engineer/ site manager Safety officer and ECO	Pre-construction and throughout construction. Monthly
The Contractor should ensure that workers are informed that no waste can be thrown out of the windows while being transported to and from the site. Workers who throw waste out windows should be fined.	Site engineer/ site manager Safety officer and ECO	Daily. Pre-construction and throughout construction
The Contractor should be required to collect waste along the road reserve on a daily basis.	Site engineer/ site manager ECO	Daily. Pre-construction and throughout construction
Waste generated during the construction phase should be transported to the registered landfill.	Site engineer/ site manager ECO	Weekly throughput construction
EMP measures (and penalties) should be implemented to ensure farm gates are closed at all times.	Site engineer/ site manager Developer to implement ECO	Daily. Pre-construction and throughout construction
EMP measures (and penalties) should be implemented to ensure speed limits are adhered to at all times.	Site engineer/ site manager Developer to implement ECO	Daily. Pre-construction and throughout construction
impact on farmland due to construction related activities		
The location of wind turbines, access roads, laydown areas etc. should be informed by the findings of key specialist studies, including the soil and botanical study. In this regard areas of high potential agricultural soils should be avoided;	Site engineer/ site manager Developer to implement ECO	Weekly. Pre-construction and throughout construction

Mitigation Measure	Responsibility	Frequency
The location of wind turbines, access roads, laydown areas etc. should be discussed with the locally affected landowners in the finalisation process and inputs provided should be implemented in the layout as best as possible;	Site engineer/ site manager Developer to implement ECO	Weekly. Pre-construction and throughout construction
All areas disturbed by construction related activities, such as access roads on the site, construction platforms, workshop area etc., should be rehabilitated at the end of the construction phase. The rehabilitation plan should be informed by input from a botanist with experience in arid regions;	Site engineer/ site manager Developer to implement ECO	Weekly post construction
The implementation of a rehabilitation programme should be included in the terms of reference for the contractor/s appointed. The specifications for the rehabilitation programme should be drawn up the Environmental Consultants appointed to undertake the EIA;	Site engineer/ site manager Developer to implement ECO	Tender phase
The implementation of the Rehabilitation Programme should be monitored by the ECO;	Site engineer/ site manager Developer to implement ECO	Weekly
All workers should receive training/ briefing on the reasons for and importance of not driving in undesignated areas;	Site engineer/ site manager Developer to implement ECO	Pre-construction and throughout construction. Monthly
EMP measures (and penalties) should be implemented to strictly limit all vehicle traffic to designated roads and construction areas. Under no circumstances should vehicles be allowed to drive into the veld;	Site engineer/ site manager Developer to implement ECO	Pre-construction and throughout construction. Daily
Disturbance footprints should be reduced to the minimum.	Site engineer/ site manager Developer to implement ECO	Pre-construction and throughout construction. Monthly
The footprint areas for the establishment of individual wind turbines should be clearly demarcated prior to commencement of construction activities. All construction related activities should be confined to the demarcated area and minimised where possible;	Site engineer/ site manager Developer to implement ECO	Pre-construction and throughout construction. Monthly

Mitigation Measure	Responsibility	Frequency
General Construction Mitigation Measures		
Potable toilets must be supplied to the workforce in areas of activity. One toilet per 14 workers must be implemented. Females must have separate toilets. A licenced contractor must be appointed by the contractor to provide this facility, and ensure that wastes are correctly disposed of. Servicing must take place on a weekly basis, proof of which must be retained on site by the contractor.	Site engineer/ site manager Developer to implement ECO	Pre-construction and throughout construction. Weekly
Waste skips must be provided in areas of construction activity as well as within the lay down areas, along with waste bins. Wastes must be separated into the following categories: • General waste, compactable and non-compactable • Waste paper recycling • Scrap metal • Globes and fluorescent tubes • Rubber waste • Medical waste • Chemical waste • Hazardous waste	Site engineer/ site manager Developer to implement ECO	Pre-construction and throughout construction. Weekly
Health and Safety		
Implementation of safety measures, work procedures and first aid must be implemented on site.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. Weekly
Workers should be thoroughly trained in using potentially dangerous equipment	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. Weekly
Contractors must ensure that all equipment is maintained in a safe operating condition.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. Weekly

Mitigation Measure	Responsibility	Frequency
A safety officer must be appointed.	Developer to implement	Pre-construction
A record of health and safety incidents must be kept on site.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. Weekly
Any health and safety incidents must be reported to the project manager immediately.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction.
First aid facilities must be available on site at all times.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
Workers have the right to refuse work in unsafe conditions.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Daily
The contractor must ensure that all construction workers are well educated about HIV/ AIDS and the risks surrounding this disease. The location of the local clinic where more information and counselling is offered must be indicated to workers.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
Material stockpiles or stacks, such as, pipes must be stable and well secured to avoid collapse and possible injury to site workers / local residents	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
An STI and HIV/AIDS awareness campaign should be launched, which is not only directed at construction workers but also at the community as a whole.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
Condoms should be distributed by placing them at centrally located points and by ensuring that construction workers and community members are aware of the availability and location of condoms. The distribution of condoms should be approached with the necessary cultural sensitivity.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks

Mitigation Measure	Responsibility	Frequency
Access at the construction site should be controlled to prevent sex workers from either visiting and/or loitering at the construction camp.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. Daily
Ensure that the local community communicate their expectations of construction workers' behaviour with them.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
Personal Protective Equipment (PPE) must be made available to all construction staff and their usage must be compulsory. Hard hats and safety shoes must be worn at all times and other PPE worn were necessary i.e. dust masks, ear plugs etc.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
No person is to enter the site without the necessary PPE.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. Daily
Pre-construction, construction and operation activities should be undertaken during daylight working hours between the hours of 07:00 – 17:00 on weekdays and 07:00 – 13:00 on Saturdays. No activity will be allowed on Sundays	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
The workforce is to be provided with sufficient potable water and under no circumstances are they to use untreated water from the local watercourses for drinking.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
Noise		
Construction site yards and other noisy fixed facilities should be located well away from noise sensitive areas adjacent to the development sites.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
All construction vehicles and equipment are to be kept in good repair.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
Portable acoustic shields should be used in the case where noisy equipment is not stationary (for example drills, angle grinders, chipping hammers, poker vibrators).	Site engineer/ site manager Developer to implement	Pre-construction and throughout construction. Daily

Mitigation Measure	Responsibility	Frequency
	ECO and Safety Officer	
Construction staff working in areas where the 8-hour ambient noise levels exceed 75dBA should wear ear protection equipment.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. Daily
Blasting operations are to be strictly controlled with regard to the size of explosive charge in order to minimise noise and air blast, and timings of explosions. The number of blasts per day should be limited, blasting should be undertaken at the same times each day and no blasting should be allowed at night.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
With regard to unavoidable very noisy construction activities in the vicinity of noise sensitive areas, the contractor and ECO should liaise with local residents on how best to minimise impact, and the local population should be kept informed of the nature and duration of intended activities.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
Noise suppression measures must be applied to all construction equipment. Construction equipment must be kept in good working order and where appropriate fitted with silencers which are kept in good working order.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
Should the vehicles or equipment not be in good working order, the Contractor may be instructed to remove the offending vehicle or machinery from site.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
Where possible labour shall be transported to and from the site by the contractor or his Sub-Contractors by the contractors own transport.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. Daily
Construction activities are to be contained to reasonable hours during the day and early evening. Night-time activities near noise sensitive areas should not be allowed.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks
Construction activities should be undertaken during daylight working hours between the hours of 07:00 – 17:00 on weekdays and 07:00 – 13:00 on Saturdays. No activity will be allowed on Sundays.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. Daily

Mitigation Measure	Responsibility	Frequency
Should any equipment, such as generators on-site, generating excessive noise, they should be fitted with appropriate noise abatement measures.	Site engineer/ site manager Developer to implement ECO and Safety Officer	Pre-construction and throughout construction. monthly checks

8 ALIEN INVASIVE MANAGEMENT PLAN

8.1 Purpose of the Alien Invasive Management Plan

The purpose of the Umsinde Emoyeni WEF Alien Invasive Management Plan is to provide a framework for the management of alien and invasive plant species during the construction and operation of the Umsinde Emoyeni Wind Energy Facility. The broad objectives of the plan includes the following:

- Ensure alien plants do not become dominant in parts or the whole site through the control and management of alien and invasive species presence, dispersal & encroachment
- Initiate and implement a monitoring and eradication programme for alien and invasive species
- Promote the natural re-establishment and planting of indigenous species in order to retard erosion and alien plant invasion.

8.2 Problem Outline

Alien plants replace indigenous vegetation leading to severe loss of biodiversity and change in landscape function. Potential consequences include loss of biodiversity, loss of grazing resources, increased fire risk, increased erosion, loss of wetland function, impacts on drainage lines, increased water use etc.

In addition, the Conservation of Agricultural Resources Act (Act 43 of 1983), as amended in 2001, requires that land users clear *Declared Weeds* from their properties and prevent the spread of *Declared Invader Plants* on their properties.

Table 3 of CARA (the Conservation of Agricultural Resources Act) lists all declared weeds and invader plants. Alien plants are divided into 3 categories based on their risk as an invader.

- Category 1 - These plants must be removed and controlled by all land users. They may no longer be planted or propagated and all trade in these species is prohibited.
- Category 2 – These plants pose a threat to the environment but nevertheless have commercial value. These species are only allowed to occur in demarcated areas and a land user must obtain a water use licence as these plants consume large quantities of water.
- Category 3 – These plants have the potential of becoming invasive but are considered to have ornamental value. Existing plants do not have to be removed but no new plantings may occur and the plants may not be sold.

The following guide is a useful starting point for the identification of alien species: Bromilow, C. 2010. *Problem Plants and Alien Weeds of South Africa*. Briza, Pretoria.

8.3 Vulnerable Ecosystems and Habitats

Certain habitats and environments are more vulnerable to alien plant invasion and are likely to bear the brunt of alien plant invasion problems at the site. In addition, construction activities and changes in water distribution at the site following construction are also likely to increase and alter the vulnerability of the site to alien plant invasion.

Areas at the site which are likely to require specific attention include the following:

- Wetlands, drainage lines and other mesic areas
- Cleared and disturbed areas such as road verges, crane pads and construction footprints etc.
- Construction camps and lay-down areas which are cleared or are active for an extended period

8.3.1 Wetlands, drainage lines and other mesic areas

There are a relatively large number of drainage lines at the site as well as a number of artificial wetlands. Disturbance within these areas often results in alien plant invasion on account of the greater water and nutrient availability in this habitat. Although there are no turbines within such areas, numerous road crossings will be required. The disturbance footprint within such areas should be minimized and these areas should be checked for alien species more than the surrounding landscape.

8.3.2 Cleared and disturbed areas

Cleared and disturbed areas are clearly vulnerable to invasion on account of the lack of existing plant cover to resist invasion as well as the disturbance created during construction which promoted the germination and establishment of alien plant species.

8.3.3 Construction camps and laydown areas

Construction camps and lay down areas are either cleared of vegetation or prolonged activities in these areas result in negative impact on indigenous vegetation. In addition, repeated vehicle and human activity in these areas usually results in the import of alien plant seed on clothes, dirty vehicles or with construction machinery and materials

8.4 General Clearing and Guidance Principles

- Alien control programs are long-term management projects and should include a clearing plan which includes follow up actions for rehabilitation of the cleared area. Alien problems at the site should be identified during pre-construction surveys of the development footprint. This may occur simultaneously to other required reaches and surveys. The clearing plan should then form part of the pre-construction reporting requirements for the site.
- The plan should include a map showing the alien density & indicating dominant alien species in each area.
- Lighter infested areas should be cleared first to prevent the build-up of seed banks.
- Pre-existing dense mature stands ideally should be left for last, as they probably won't increase in density or pose a greater threat than they are currently.
- Collective management and planning with neighbours may be required in the case of large woody invaders as seeds of aliens are easily dispersed across boundaries by wind or water courses.
- All clearing actions should be monitored and documented to keep track of which areas are due for follow-up clearing.

8.4.1 Clearing Methods

- Different species require different clearing methods such as manual, chemical or biological methods or a combination of both.
- However care should be taken that the clearing methods used do not encourage further invasion. As such, regardless of the methods used, disturbance to the soil should be kept to a minimum. Fire is not a natural phenomenon in the area and fire should not be used for alien control or vegetation management at the site.
- The best-practice clearing method for each species identified should be used. The preferred clearing methods for most alien species can be obtained from the DWAF Working for Water Website. http://www.dwaf.gov.za/wfw/Control/

8.4.2 Use of Herbicide for Alien Control

Although it is usually preferable to use manual clearing methods where possible, such methods may create additional disturbance which stimulates alien invasion and may also

be ineffective for many woody species which re-sprout. Where herbicides are to be used, the impact of the operation on the natural environment should be minimised by observing the following:

- Area contamination must be minimised by careful, accurate application with a minimum amount of herbicide to achieve good control.
- All care must be taken to prevent contamination of any water bodies. This includes due care in storage, application, cleaning equipment and disposal of containers, product and spray mixtures.
- Equipment should be washed where there is no danger of contaminating water sources and washings carefully disposed of in a suitable site.
- To avoid damage to indigenous or other desirable vegetation, products should be selected that will have the least effect on non-target vegetation.
- Coarse droplet nozzles should be fitted to avoid drift onto neighbouring vegetation.
- The appropriate health and safety procedures should also be followed regarding the storage, handling and disposal of herbicides.

For all herbicide applications, the following guidelines should be followed:

Working for Water: Policy on the Use of Herbicides for the Control of Alien Vegetation.

8.5 Alien Plant Management Plan

8.5.1 Construction Phase Activities

The following management actions are aimed at reducing soil disturbance during the construction phase of the development, as well as reducing the likelihood that alien species will be brought onto site or otherwise encouraged.

Construction Phase Action	Frequency
The ECO is to provide permission prior to any vegetation being cleared for development.	Daily
Clearing of vegetation should be undertaken as the work front progresses – mass clearing should not occur unless the cleared areas are to be surfaced or prepared immediately afterwards.	Weekly
Where cleared areas will be exposed for some time, these areas should be protected with packed brush, or appropriately battered with fascine work. Alternatively, jute (Soil Saver) may be pegged over the soil to stabilise it.	Weekly
Cleared areas that have become invaded can be sprayed with appropriate herbicides provided that these are such that break down on contact with the soil. Residual herbicides should not be used.	Weekly
Although organic matter is frequently used to encourage regrowth of vegetation on cleared areas, no foreign material for this purpose should be brought onto site. Brush from cleared areas should be used as much as possible. The use of manure or other soil amendments is likely to encourage invasion.	Weekly
Clearing of vegetation is not allowed within 32 m of any wetland, 80 m of any wooded area, within 1:100 year floodlines, in conservation servitude areas or on slopes steeper than 1:3, unless permission is granted by the ECO for specifically allowed construction activities in these areas	Weekly
Care must be taken to avoid the introduction of alien plant species to the site and surrounding areas. (Particular attention must be paid to imported material such as building sand or dirty earth-moving equipment.) Stockpiles should be checked regularly and any weeds emerging from material stockpiles should be removed.	Weekly
Alien vegetation regrowth on areas disturbed by construction must be controlled throughout the entire site during the construction period.	Monthly

The alien plant removal and control method guidelines should adhere to best-practice for the species involved. Such information can be obtained from the DWAF Working for Water website.	Monthly
Clearing activities must be contained within the affected zones and may not spill over into demarcated No Go areas.	Daily
Pesticides may not be used. Herbicides may be used to control listed alien weeds and invaders only	Monthly
Wetlands and other sensitive areas should remain demarcated with appropriate fencing or hazard tape. These areas are no-go areas (this must be explained to all workers) that must be excluded from all development activities.	Daily

8.5.2 Monitoring Actions - Construction Phase

The following monitoring actions should be implemented during the construction phase of the development.

Monitoring Action	Indicator	Timeframe
Document alien species present at the site	List of alien species	Pre-construction
Document alien plant distribution	Alien plant distribution map within priority areas	3 Monthly
Document & record alien control measures implemented	Record of clearing activities	3 Monthly
Review & evaluation of control success rate	Decline in documented alien abundance over time	Biannually

8.5.3 Operational Phase Activities

The following management actions are aimed at reducing the abundance of alien species within the site and maintaining non-invaded areas clear of aliens.

Operational Phase Action	Frequency
Surveys for alien species should be conducted regularly. Every 6 months for the first two years after construction and annually thereafter. All aliens identified should be cleared.	Every 6 months for 2 years and annually thereafter
Where areas of natural vegetation have been disturbed by construction activities, revegetation with indigenous, locally occurring species should take place where the natural vegetation is slow to recover or where repeated invasion has taken place following disturbance.	Biannually, but revegetation should take place at the start of the rainy season
Areas of natural vegetation that need to be maintained or managed to reduce plant height or biomass, should be controlled using methods that leave the soil protected, such as using a weed-eater to mow above the soil level.	When necessary
No alien species should be cultivated on-site. If vegetation is required for esthetic purposes, then non-invasive, water-wise locally-occurring species should be used.	When necessary

8.5.4 Monitoring Actions - Operational Phase

The following monitoring actions should be implemented during the construction phase of the development.

Monitoring Action	Indicator	Timeframe
Document alien species distribution and abundance over time at the site	Alien plant distribution map	Biannually
Document alien plant control measures implemented & success rate achieved	Records of control measures and their success rate. A decline in alien distribution and cover over time at the site	Quarterly
Document rehabilitation measures implemented and success achieved in problem areas	Decline in vulnerable bare areas over time	Biannually

8.5.5 Decommissioning Phase Activities

The following management actions are aimed at preventing the invasion, by alien plant species, of the re-vegetated areas created during the decommissioning phase. Re-vegetation of the disturbed site is aimed at approximating as near as possible the natural vegetative conditions prevailing prior to operation.

Decommissioning Phase Action	Frequency
All damaged areas shall be rehabilitated if the infrastructure is removed and the facility is decommissioned	Once off
All natural areas must be rehabilitated with species indigenous to the area. Re-seed with locally-sourced seed of indigenous grass species that were recorded on site pre-construction.	Once off, with annual follow up re-vegetation where required
Maintain alien plant monitoring and removal programme for 3 years after rehabilitation.	Biannually

8.5.6 Monitoring Actions - Decommissioning Phase

The following monitoring and evaluation actions should take place during the decommissioning phase of the development

Monitoring Action	Indicator	Timeframe
Monitor newly disturbed areas where infrastructure has been removed to detect and quantify any aliens that may become established for 3 years after decommissioning and rehabilitation	Alien plant surveys and distribution map	Biannually until such time as the natural vegetation has recovered sufficiently to resist invasion.
Monitor re-vegetated areas to detect and quantify any aliens that may become established for 3 years after decommissioning and rehabilitation	Alien plant surveys and distribution map	Biannually for 3 years
Document alien plant control measures implemented & success rate achieved	Records of control measures and their success rate. A decline in alien distribution and cover over time at the site	Annually for 3 years

9 PLANT RESCUE AND PROTECTION PLAN

9.1 Purpose

The purpose of the plant rescue and protection plan is to implement avoidance and mitigation measures to reduce the impact of the development on listed and protected plant species and their habitats. Although this report identifies those species suitable for search and rescue at the site, it is important to note that a preconstruction walk-through of the site would also be important to refine the list of species identified for search and rescue, as well as locate such species prior to construction.

The objective of resuing plants on the project area is to prevent the loss of species either directly or through future extinction and minimising impacts of development on population dynamics of species of conservation concern.

Preserving the natural configuration of habitats as part of ecosystems, thus ensuring a diverse but stable hydrology, substrate and general environment for species to be able to become established and persist.

9.2 Effect of removing individual species of conservation concern

Species of conservation concern are declining either due to overexploitation or because their range of occupancy is limited and further infringed on by development. Most plant populations require a certain minimum number of individuals within a population or metapopulation to allow for sufficient genetic transfer between individuals. This prevents genetic erosion and hence weakening of the ability of individuals to persist in their environments. Similarly, where the distance between metapopulations is significantly increased due to fragmentation and the resultant loss of some populations, populations may suffer genetic decline due to restricted movement of pollen. Pollinators or other species that depend on a particular plant species for a specific microhabitat or food source may be equally affected because of the reduction of available resources. Therefore the aim of plant rescue actions are always to maintain as many individuals of a plant population in as close proximity to the original habitat as possible to minimise loss of individuals and fragmentation of populations to prevent the creation of future extinction debts of the development.

9.3 Plant Rescue and Protection

Successful plant rescue can only be achieved if:

- Species can be removed from their original habitat with minimal damage to the plant, especially the roots.
- All plants removed are safely stored and treated according to their specific requirements prior to being transplanted again.
- They are relocated into a suitable habitat and protected from further damage and all disturbances to aid their re-establishment.
- Timing of planting activities is planned with the onset of the growing season.
- Steps are taken where necessary to aid the initial establishment of vegetation, including occasional watering.

9.4 Time of Planting

- All planting shall be carried out as far as is practicable during the period most likely to produce beneficial results (i.e. during the peak growing season), but as soon as possible after completion of a section of earthworks.

- Drainage line rehabilitation preparation must be done during autumn, and planting of appropriate species in these areas should commence during early spring after the first rains.

9.5 Plant Search and Rescue

Prior to construction, once all the areas where topsoil will be removed or areas will be transformed have been demarcated, the ECO and contractor will be responsible to remove all bulbous species from the topsoil, as well as succulents and small indigenous shrubs that can be transplanted. These are to be kept in a raised, protected position in a designated area until they can be replanted again as part of the rehabilitation process. Further details are listed in the Re-vegetation and Habitat rehabilitation Plan.

10 RE-VEGETATION AND HABITAT REHABILITATION PLAN

The Revegetation and Habitat Rehabilitation Plan addresses the need to mitigate all impacts leading to disturbed vegetation, loss of species and/or agricultural potential, disturbed soil surfaces, and generally bare soils prone to erosion and further degradation on the proposed development site. The plan overlaps to some degree with the Erosion Management Plan, and for successful rehabilitation, it is imperative that this plan is at all times used in conjunction with other EMPs mentioned.

The objective of the plan is therefore to provide:

- Protocols for the removal, temporary storage and replanting of plant species of conservation concern Protocols for the rehabilitation of vegetative cover across the project area
- Tools for planning the rehabilitation work and responding to unforeseen events Guidelines on implementation and post-implementation tasks Criteria for evaluating rehabilitation success
- A summary of items to be included in the rehabilitation budget to ensure that there is sufficient allocation of resources on the project budget so that the scale of EMP-related activities is consistent with the significance of project impacts

The objective of rehabilitation and revegetation of the development area is:

- Preventing the loss of species either directly or through future extinction and minimising impacts of development on population dynamics of species of conservation concern.
- Preserving the natural configuration of habitats as part of ecosystems, thus ensuring a diverse but stable hydrology, substrate and general environment for species to be able to become established and persist.
- Preserving or re-creating the structural integrity of natural plant communities. Actively aid the improvement of indigenous biodiversity according to a desirable end state according to a previously recorded reference state. This reference state, if healthy, will be dynamic and able to recover after occasional disturbances without returning to a degraded state.
- Improving the ecosystem function of natural landscapes and their associated vegetation.
- Successful rehabilitation can only be achieved with: »A long-term commitment »Practical, adaptive management »Viable goals of desired outcomes

Prior to vegetation rehabilitation, all stakeholders involved should be consulted to determine:

- What the rehabilitation is ultimately aiming for– rehabilitation of cropping/grazing lands or rehabilitation of indigenous vegetation, after soil erosion and storm water management is in place and IAPs have been cleared?

- A clear definition of incompatible and compatible vegetation on and in the immediate surroundings of the development must be defined and maintained as such. No tree or shrubs shall be allowed to grow to a height in excess of the horizontal distance of that tree or shrub from the nearest newly developed structure or to grow in such a manner as to endanger the development or its operation
- Who will take long-term ownership and hence responsibility for the rehabilitation and its subsequent monitoring and management? Continued monitoring of vegetation establishment and composition, as well as erosion detection will have to be coupled with continued follow-up maintenance of rehabilitation and erosion control from commencement of activity up to the decommissioning phase.
- The ultimate objective for rehabilitation should focus on the stabilisation of soil erosion, retaining agricultural potential of transformed areas and /or the establishment of a dense and protective plant cover and the maintenance of habitats to enable vegetation to persist and flourish on rehabilitated areas indefinitely, ultimately relying only on environmental resources.

10.1 Map and create management areas

The entire project area must be mapped and divided into management areas indicating:

- Current land cover
    - Roads and residential
    - Areas with IAPs, subdivided further in sparse or dense infestations where applicable
    - Transformed areas
    - Untransformed indigenous vegetation

For every one of the management areas, the project proponent, in consultation with the land users, will have to decide what intervention will be necessary, desirable, and feasible to enable the development of the project and long-term sustainable maintenance of infrastructure. Thus for every management area there must be an operational outline on:

- what will happen there
- what needs to be mitigated – including storm water- and erosion management
- which management units need priority intervention/mitigation
- how will this mitigation / intervention be done (method statements) including schedule of work
- realistic and desirable end states including list of species that should be established to initiate rehabilitation after initial revegetation
- approximate timeframes
- monitoring protocol to evaluate success or failures of interventions
    - establish permanently marked transects and monitor with fixed-point photography who will be responsible for doing what how will different actions be integrated to achieve and maintain or improve the desirable end state of the environment of that management unit

Special attention will have to be given to drainage zones, as these not only have very active morphodynamics, but are also distributers of seeds – both indigenous and of IAPs. Thus clearing a downstream invasion of aliens to enable maintenance of the development will be futile if the upstream IAPs are not cleared or at least aggressively controlled.

Setting realistic rehabilitation goals

Rehabilitation efforts typically aim at improving ecosystem function that consists of a series of processes, which can in the end be evaluated against a desired outcome or reference state of the vegetation and environment.

Attainable goals of rehabilitation on the project area should be possible and viable for at least the following:

Attainable goals of rehabilitation on the project area should be possible and viable for at least the following:

- Stabilisation of soils
- Stabilisation of riparian areas
- Storm water reduction through management and wetland integrity
- Clearing of IAPs
    - The degree to which IAPs can be cleared from the project area needs to be determined according to desirability, available project funding, personnel and project requirements
- Restoring and/or rehabilitating vegetative cover on non-transformed areas to obtain an acceptable vegetation cover that can be maintained or persists on its own indefinitely

10.2 Remove or ameliorate the cause of degradation

This will include:

- Physical rehabilitation of topsoil where it has been removed.
- Topsoil on areas that have not been cultivated are considered as the upper 20 - 30 cm only. These contain the most important nutrients, micro flora and –fauna essential for nutrient cycling processes. Topsoils are also an important source of seeds.
- Subsoils and overburden substrata lack the above elements and will first have to be used for physical rehabilitation of landscapes as and where necessary, and then overlain with topsoils
- Stabilisation of topsoils and prevention of erosion – refer to the Erosion management pan
- Removal of all invasive vegetation – refer to the Alien Invasive Management Plan
    - Where it is desirable to use brush or logs of the cleared vegetation for soil stabilisation, such material must be free of regenerative material – e.g. seeds or root suckers

10.3 Initial Revegetation

Immediately after clearing of vegetation, the soil surface must be inspected for signs of erosion and stabilised as soon as possible. After completion of construction, such erosion stabilisation should preferably be with a cover of vegetation. A dense initial grass or other perennial cover will be desirable. The appropriate seed mix should be determined in consultation with an ecologist familiar with the area. The aim of the first vegetation cover is to form a protective, relatively dense indigenous layer to slow runoff, increase moisture infiltration into the soil, and gradually change the soil nutrient status in order for it to be more favourable for other desirable indigenous vegetation to become established.

10.3.1 Natural seed banks and improvement of plant structural and compositional diversity

It is expected that soil seed banks of indigenous vegetation will be present to initiate initial vegetation cover, but may not be sufficient to establish an acceptable cover of desirable species. After deciding which indigenous species should be re-introduced, seed should be ideally collected from site or an environmentally-matched site nearby.

Seed collection may be done throughout the year as seed ripens, but can also be restricted to summer, when a large amount of the perennial seed should have ripened. Seeds should

be stored in paper or canvas bags dusted with insecticide, and sown at the onset of the rainy season.

Alternatively, slower-growing perennials may be raised from seed or cuttings in a nursery and then transplanted once established. It will be beneficial to investigate if community members would be able to create and maintain such a nursery, or if there are nurseries in the area, that raise indigenous flora from the area.

The final vegetation cover should resemble the original (non-encroached) vegetation composition and structure as far as practicable possible or permissible within each management unit.

For drainage areas:

- First restore drainage line morphology following the guidelines of the Erosion Management Plan – without that ecological recovery cannot be initiated
- Determine if natural seed sources may be present further upstream
- If such upstream seed sources are still present, rehabilitation of riparian vegetation after soil erosion management will most likely occur naturally, PROVIDED that follow-up monitoring of the establishment of vegetation is carried out, and all invasive species eradicated as they emerge. This can only be achieved with a long-term commitment (> 5 years minimum)
- Should no upstream seed resources be available, suitable species (as determined in consultation with an ecologist) should be sown or planted.

10.4 Monitoring and follow-up action

Throughout the lifecycle of the development, regular monitoring and adaptive management must be in place to detect any new degradation of ecosystems affected by the development, and remedy these as soon as detected.

During the construction phase, the ECO and contractor will be responsible for initiating and maintaining a suitable monitoring system. Once the development is operational, the project proponent will have to identify a suitable entity that will be able to take over and maintain the monitoring cycle and initiate adaptive management as soon as it is required. Monitoring personnel must be adequately trained.

The following are the minimum criteria that should be monitored:

- Composition and density of replanted vegetation, distinguishing between species introduced for initial revegetation only and species that are part of the pre-determined desirable end state
- Associated nature and stability of surface soils
    - It is recommended that permanent transects are marked and surveyed annually according to the LFA technique (Tongway and Hindley 2004), adapted to integrate both surface soil characteristics and the vegetation to be monitored
- Re-emergence of IAPs
    - If noted, remedial action must be taken immediately according to Working for Water specifications
- Nature and dynamics of riparian zones
    - Stability of riparian vegetation
    - Any form of bank erosion, slumping or undercutting
    - Stability of channel form and width of streams – if this increases, it shows that vegetation on plains and/or riparian areas and upper drainage lines are not yet in

a stable enough state to be fully functional in reducing excess runoff and the ecosystem overall is losing valuable resources

10.5 Timeframes and duration

- Rehabilitation will occur during construction, as areas for the re-application of topsoil and revegetation become available or where revegetation can be initiated after clearing of invasives or to stabilise erosion.
- The initial revegetation period post construction is estimated to be over a period of 6 (minimum) to 12 months (maximum), or a time period specified by the Horticultural Landscape Contractor, particularly if planting of trees and shrubs occurs.
- The rehabilitation phase (including post seeding maintenance) should be at least 12 months (depending on time of seeding and rainfall) to ensure establishment of an acceptable plant cover is achieved (excluding invasive plant species or weeds).
- If the plants have not established and the acceptable plant cover is not achieved within the specified maintenance period, maintenance of these areas shall continue until at acceptable plant cover is achieved (excluding alien plant species or weeds).
- Additional seeding or planting may be necessary to achieve acceptable plant cover. Hydroseeding may have to be considered as an option in this case.
- Any plants that die, during the maintenance period, shall be replaced by the Horticultural Landscape Contractor (at the Horticultural Landscape Contractor's cost if it was due to insufficient maintenance).
- Succession of natural plant species should be encouraged
- Monitoring of rehabilitation success and follow-up adaptive management, together with clearing of emerging invasives shall be carried on until the decommissioning phase has been completed.

11 OPEN SPACE MANAGEMENT PLAN

The objective of open space management is to restore, enhance and rehabilitate open spaces, improve climate change adaptations through the minimisation of biodiversity loss, and mitigate against environmental degradation. Management actions consider open spaces and natural areas as well as community perceptions of these.

In the context of the proposed grid connections and substations the primary purpose of the open plan management plan is therefore to:

- Minimise visual impact on the character of the area; and
- Maintain biodiversity within the area to ensure that no long-term negative impacts occur on the local environment.

The proposed grid connection connections and associated infrastructure have the potential to impact negatively on the character of the area, as identified in the Visual Impact Assessment conducted during the EIA phase. The following actions must be implemented to minimise this visual impact:

- Grid connection route to avoid visually sensitive peaks, major ridgelines, scarp edges and slopes steeper than 1:5 gradient
- Substation to be sited in unobtrusive low-lying areas, away from roads and habitations, and screened by berms and/or tree-planting where feasible.
- Operations and maintenance buildings and parking areas to be located in an unobtrusive area and consolidated to avoid sprawl of buildings in the open landscape.
- Access roads to be in sympathy with the contours, avoid steep 1:5 slopes and drainage courses, and kept as narrow as possible.
- Access and haul roads to use existing farm tracks as far as possible.
- Construction camp, stockpiles and lay-down area to be located out of sight of district roads, possibly in the vicinity of the proposed substation and O&M buildings.

- Disturbed areas rather than pristine or intact land to preferably be used for the construction camp. Construction camp and laydown areas to be limited in area to only that which is essential.
- Measures to control wastes and litter to be included in the contract specification documents.
- Provision to be made for rehabilitation/ re-vegetation of areas damaged by construction activities.

In order to maintain biodiversity the Alien Invasive, Plant Rescue and Protection and Re-vegetation and Habitat Management Plans must be adhered to.

In addition the following actions should implemented by the Contractor and Project Company:

- Promote environmental awareness in all employees and sub-contractors and create an understanding of the environmental sensitivities of the project site;
- No waste, including organic matter may be disposed of anywhere on site, except in provided bins placed at convenient locations, especially during the construction period. Disciplinary actions should be taken against littering.
- Open spaces are to be kept free of alien plants and weeds;
- Indigenous plants may not be collected or removed from the site;
- Access to the facility should be strictly controlled
- All visitors and contractors should be required to sign-in
- Signage at the entrance should indicate that disturbance to fauna and flora is strictly prohibited

The following activities should not be permitted by anyone except the landowner or his representatives:

- No fires within the site
- No hunting, collecting or disturbance of fauna and flora, except where required for the safe operation of the facility and only by the Environmental Officer on duty and with the appropriate permits and landowner permission.
- No driving off of demarcated roads
- No interfering with livestock

11.1 Grazing Management

The development of the wind energy facility will not prevent the site from being used for its current land use of extensive livestock production. Extensive livestock grazing is compatible with biodiversity maintenance provided that it is implemented according to the basic principles of sustainable grazing management. While the majority of these are beyond the scope of the current plan, the following basic principles should be adhered to:

- A grazing management plan for the site should be developed in cooperation with Agricultural Extension services.
- The stocking rate applied should be within the recommended limits as identified by the Department of Agriculture.
- Livestock should be rotated through the different paddocks at the site in a manner which allows for the growth and recovery of the vegetation between grazing events.
- Precautions should be taken to ensure that the development of the site does not increase the risk of stock theft within the facility. These include access control as previously described, as well as security patrols.

12 TRAFFIC MANAGEMENT PLAN

The objective of the traffic management plan is the prevention of incidents from the use of vehicles and disturbance of local traffic on public roads during the construction, operation

and decommissioning phases of the proposed projects. Traffic volumes are most likely to increase during the construction phase. However, due to the remote location of the site, and the low volume of traffic on public roads in the area the impact is expected to be low.

Actions to be implemented by the Contractor and Project Company:

- Site-specific traffic plan to be developed and implemented during the detailed design phase prior to construction;
- Limit use of private cars by arranging mini bus transport service for workers;
- Monitor for overloading of vehicles;
- Use only well trained, suitably qualified and experienced drivers in possession of an appropriate and valid driver's license;
- All vehicles must be roadworthy and serviced regularly;
- Clear and visible signage must be placed on and around site, clearly demarcating safe entry and exit points;
- Require all drivers to abide by standard road and safety procedures on site;
- When travelling on public roads all speed limits and rules of the road must be adhered to; and
- Limit dust generation by applying dust suppressants and postponing dust generating activities during period of strong winds and enforcing a strict speed limit of 40 km/h on unpaved roads.

Monitoring actions to be conducted by the ECO

- Maintain incidents/complaints register for community complaints;
- Monitor dust generation and implementation of management actions detailed above;

13 TRANSPORTATION MANAGEMENT PLAN

The Transportation Management Plan aims to ensure the safe transportation of all components required for the construction of the proposed projects to the construction site. This includes the substation transformers, electrical cables and pylon structures.

The following actions should be implemented by the Project Company and Contractor:

- Apply for all relevant permits for abnormal loads and route clearances with the relevant authorities prior to construction;
- Appoint a qualified specialist to conduct a detailed site-specific Transport Risk Assessment during the detailed design phase and prior to construction;
- Determine the pre-construction condition of the road immediately prior to construction by carrying out a condition assessment or from recent pavement management system condition assessments if available from the Provincial Authorities;
- Public notices regarding any planned abnormal load transports must be placed at the construction site to inform affected parties;
- Abnormal loads must conform with legal maximum dimensions, and vehicles carrying abnormal loads must display sufficient signage;
- Any roads damaged during the transportation of components, or from other construction vehicles must be rehabilitated and returned to pre-construction conditions.

The following monitoring activities should be carried out by the ECO:

- Conduct site audits and report non-compliance with the above-mentioned conditions

14 STORM WATER MANAGEMENT PLAN

The objective of the storm water management plan (SWMP) is to prevent increased soil erosion, to contain any contaminated run-off and to avoid water logging and pollution. The

Erosion Management Plan (see below) must therefore be seen in conjunction with the SWMP. Actions are listed that will ensure that storm water is channelled in a controlled manner from roads and substations towards natural drainage lines, without impeded natural surface flows.

- Develop and implement a site-specific storm water management plan during the detailed design phase of the projects and prior to construction;
- In the detailed design phase of the project minimise any water crossings and utilise existing roads wherever possible;
- Enforce 32 m construction buffers of all rivers, streams and waterbodies;
- Should new roads be required to cross any banks or channels these must be secured with erosion protection (ie. gabions etc);
- Monitor for erosion during the clearing of vegetation;
- Avoid hard-engineered surfaces (ie. construct gravel roads and not asphalt roads wherever possible);
- Roads in steep areas must be equipped with side drainages and culverts that channel the run-off to natural drainage lines without gaining velocity and causing erosion;
- Construction camps and temporary ablution facilities must be located beyond the 1:100 year floodline;
- Stockpiles must be located on flat areas and protected from erosion;
- The substation site design must include side water outlets and an adequate slope to allow storm water run-off from the paved areas;
- Prevent surface run-off from areas of potential contamination

15 EROSION MANAGEMENT PLAN

15.1 Purpose

The purpose of the erosion management plan is to implement avoidance and mitigation measures to reduce the erosion potential and the likely impact of erosion associated with the construction and operational phases of the proposed facility. As part of the management plan, measures to protect hydrological features from erosion damage are included.

15.2 Scope and Limitations

This plan is intended at introducing measures aimed at reducing the negative impacts of erosion on biodiversity as well as reducing the vulnerability of the site to erosion problems during the construction and operational phases of the development. The focus is on managing runoff and reducing the construction phase impact on ecologically sensitive areas. The plan does not cover engineering-side issues which are of relevance to soil management and erosion. Therefore issues such as the potential presence of heaving clays, compressible soils, perched water tables, dispersive soils and corrosive groundwater at the site are beyond the general scope of this study and are not directly dealt with. These issues would need to be addressed and their relevance assessed during detailed geotechnical investigation of the site.

15.3 Background

15.3.1 Types of Erosion

Erosion comes in several forms, some of which are not immediately obvious. The major types of erosion are briefly described below:

Raindrop impact

This is the erosion that occurs due to the "bomb blast" effect of raindrop impact. Soil particles can be blasted more than a meter into the air. Apart from loosening soil particles, the effect can also break soil aggregates apart and form a clay seal on the surface which resists infiltration and results in increased levels of runoff. This effect is most important when large areas of exposed soils are present. If the site is cleared, then this effect will play an important role as it results in the soil surface becoming sealed which reduces infiltration and increases runoff, leading to erosion.

Sheet Erosion

This is the removal of a shallow and uniform layer of soil from the surface. It is caused initially by raindrop splash and then by runoff. Sheet erosion is often difficult to see as no perceptible channels are formed. Accumulated sediment at the bottom of the slope is often the only indicator. This is likely to be an important erosion type at the site given the gently sloping nature of the site and the susceptible soils.

Rill Erosion

This is the removal of soil from the surface whereby small channels or rills up to 300 mm are formed. It is caused by runoff concentrating into depressions, wheel tracks etc.

Gully Erosion

This is the removal of soil from the surface and sub-surface caused by concentrated runoff eroding channels greater than 300mm deep. Gully erosion often begins as rill erosion.

Wind Erosion

Wind erosion results from soil particles being picked up, bounced or moved by the wind. Wind erosion is primarily a problem in arid areas and may affect sands soils as well as fine-textured soils. Vegetation cover is usually an effective barrier to wind erosion, but large soils losses or degradation can occur in disturbed areas or on croplands.

15.3.2Promoting Factors

Rainfall characteristics

High-intensity, short-duration storm events have much greater erosion potential than low intensity, longer duration storm events with the same runoff volume. Intense storms produce larger raindrops, and are more likely to break up the soil and dislodge particles.

Soil erodibility

Soil erodibility is determined by the soils ability to resist detachment and transport due to rainfall, runoff and infiltration capacity. Well-structured soils with a high clay content are generally least erodible. Some clays are dispersible meaning that they break down when wet and become highly erodible. Silts and fine sands are highly erodible.

Length and Steepness of Slope

Steeper slopes cause runoff velocities to increase, resulting in increased erosion. As the slope length increases the opportunity for runoff to concentrate and achieve an erosive velocity increases.

Soil Surface Cover

Soil surface cover such as vegetation and mulch protect the soil surface from raindrop impact, reduce flow velocity, disperse flow, and promote infiltration and the deposition of

sediment. This is a basic principle underlying many erosion control approaches which aim to modify the surface characteristics in order to reduce the flow velocity and reduce the potential for erosion. In this regard it is important to note that many of the practices which are used to enhance rehabilitation potential are also useful in reducing erosion potential.

15.4 Erosion and Sediment Control Principles

The goals of erosion and sediment control during and after construction at the site should be to:

- Protect the land surface from erosion;
- Intercept and safely direct run-on water from undisturbed upslope areas through the site without allowing it to cause erosion within the site or become contaminated with sediment.
- Progressively revegetate or stabilise disturbed areas.
- Prevent damage to hydrological features such as drainage lines or wetlands, either within or adjacent to the site.

These goals can be achieved by applying the following principles:

1. Integrate project design with site constraints.
2. Plan and integrate erosion and sediment control with construction activities.
3. Minimise the extent and duration of disturbance.
4. Control stormwater flows onto, through and from the site in stable drainage structures.
5. Use erosion controls to prevent on-site damage.
6. Use sediment controls to prevent off-site damage.
7. Control erosion and sediment at the source.
8. Stabilise disturbed areas promptly.
9. Inspect and maintain control measures.

15.5 On-Site Erosion Management

Exposed and unprotected soils are the main cause of erosion in most situations. Therefore, the erosion management plan and the revegetation and rehabilitation plan should be closely linked to one another and should not operate independently, but should rather be seen as complementary activities within the broader environmental management of the site and should therefore be managed together.

General factors to consider regarding erosion risk at the site includes the following:

- Soil loss will be greater during wet periods than dry periods. Intense rainfall events outside of the wet season, such as occasional unseasonal showers can also however cause significant soil loss. Therefore precautions to prevent erosion should be present throughout the year.
- Soil loss is related to the length of time that soils are exposed prior to rehabilitation or stabilization. Therefore the gap between construction activities and rehabilitation should be minimized. Allied to this the fact that topsoil does not store well and should preferably be used within a month or at most within 3 months to aid in the revegetation and rehabilitation of disturbed areas.
- Phased construction and progressive rehabilitation are important elements of the erosion control strategy.
- The extent of disturbance will influence the risk and consequences of erosion. Therefore large areas should not be cleared at a time, especially in areas such as slopes where the risk of erosion is higher.

15.5.1 Concentration of flows into downstream areas

Road crossings over drainage lines, streams and wetlands can impact downstream wetland ecosystems. Crossings that result in narrowing of the downstream system can result in concentration of flows and channelisation downstream. This may result in a loss of wetland function, and result in the drying out and shrinkage of the wetland area. Erosion and increased vulnerability to invasion of drier banks by alien vegetation may occur.

- Culverts should be adequately spaced such that they do not result in shrinkage of downstream wetlands. Where roads cross minor drainage channels, a single culvert may be adequate, aligned with the downstream drainage line. Where more substantial wetland systems are intercepted by a road, sufficient culverts should be provided such that downstream shrinkage of wetland width does not occur. Moreover, culverts should be aligned, as far impossible, with existing, natural channels.
- All crossings of drainage systems should ensure that both surface and shallow subsurface flows can be accommodated where appropriate and that unnatural channelisation does not occur downstream.

15.5.2 Runoff Concentration

The increase in hardened surfaces associated with roads, and other infrastructure will elad to a significant increase in volume and velocity of flow generated from these areas during large rainfall events.

Runoff from road surfaces is usually channelled off of the road surface towards the downslope side of the road. On steep slopes, the volumes and velocity of runoff generated may result in erosion of the surrounding areas. Therefore specific measures to curb the speed of runoff water is usually required in such areas, such as rock beds or even gabions. In addition, these areas should be monitored for at least a year after construction to ensure that erosion is not being initiated in the receiving areas. Once erosion on steep slopes has been initiated, it can be very difficult to arrest.

15.5.3 Diversion of Flows

Diversion of flows from natural drainage channels may occur when roads interrupt natural drainage lines, and water is forced to run in channels along the manipulated road edge to formalized crossing points. Even slight diversion from the natural drainage line can result in excessive downstream erosion, as the new channel cuts across the slope to reach the valley bottom. Should the access road to the site traverse any major drainage lines, the following principles should apply

- Adequate culverts should be provided along the length of all roads to prevent diversion of flow from natural drainage lines.
- Culverts should be carefully located, such that outlet areas do in fact align with drainage lines.
- The downstream velocity of runoff should be managed, such that it does not result in downstream erosion – on steep slopes, where roads have been constructed on cut areas, allowance should be made for culverts to daylight sufficiently far down the slope that their velocities are managed and erosion does not occur.
- Where necessary, anti-erosion structures should be installed downstream of road drains – these may comprise appropriate planting, simple riprap or more formal gabion or other structures.
- Roads and their drainage system should be subject to regular monitoring and inspection, particularly during the wet season, so that areas where head cut erosion is observed can be addressed at an early stage.

15.5.4Monitoring Requirements

15.5.4.1 Construction Phase

The following monitoring actions should be implemented during the construction phase of the development

Monitoring Action	Indicator	Timeframe
Identify all river and drainage line crossings affected by the development	Map of sites of potential concern	Preconstruction
Monitor cleared areas for erosion problems	Record of monitoring site, problems encountered and remedial actions implemented	Monthly during the rainy season and following significant rainfall events otherwise
Monitor vegetation clearing activities near sensitive areas such as wetlands or drainage lines	Activity log of monitoring actions and any mitigation and avoidance measures implemented	Monthly during the rainy season and following significant rainfall events otherwise
Monitor revegetated and stabilised areas	Record of monitoring site, problems encountered and remedial actions implemented	Monthly during the rainy season and following significant rainfall events otherwise

15.5.4.2 Operational Phase

The following monitoring actions should be implemented during the operational phase of the development:

Monitoring Action	Indicator	Timeframe
Monitor for the development of new erosion problems across the site, with a focus on areas where water has been diverted or collected from upslope onto downslope areas	Map of erosion problem areas	Quarterly
Document erosion control measures implemented	Records of control measures and their success rate.	Quarterly
Document the extent of erosion at the site and the remedial actions implemented	Decline in erosion and vulnerable bare areas over time	Biannually

16 FIRE MANAGEMENT PLAN

The National Veld and Forest Fires Act states that it is the landowner's responsibility to ensure that the appropriate equipment as well as trained personnel are available to combat fires.

Although fires are not a regular occurrence at the site, fires may occasionally occur under the right circumstances. Ignition risk sources in the area include the following:

- Lightning strikes
- The railway line which runs through the facility
- Personnel within the facility

- Infrastructure such as transmission lines

16.1 Firebreaks

Extensive firebreaks are not recommended as a fire risk management strategy at the site. The site is very large compared to the extent of the infrastructure and the maintenance of firebreaks would impose a large management burden on the operation of the facility. In addition, the risk of fires is not distributed equally across the site and within many of the lowlands of the site, there is not sufficient biomass to carry fires and the risk of fires within these areas is very low. Rather targeted risk management should be implemented around vulnerable or sensitive elements of the facility such as substations or other high risk components. Within such areas, the extent over which management action needs to be applied is relatively limited and it is recommended that firebreaks are created by mowing and that burning to create firebreaks is not used as this in itself poses a risk of runaway fires. Where such firebreaks need to be built such as around substations, a strip of vegetation 5 10 m wide can be cleared manually and maintained relatively free of vegetation through manual clearing on an annual basis. However if alien species colonise these areas, more regular clearing should be implemented.

17 FUEL STORAGE MEASURES

17.1 Storage Tanks

The storage tanks will be within contained areas to prevent spills contaminating soil and water, and with a design to capture and contain a volume of spill of at least 110% of the volume of stored fuel. These containers can be built in concrete and painted with anti-corrosive paint. The floor of the container must be inclined to permit the collection of the spilled liquids.

The storage tanks must also have a cover protection on top, prepared for drainage and collection of runoff.

17.2 GENERAL PROCEDURES

- Transport routes for the transport of fuel will be clearly indicated;
- Pollution control equipment (spill and leak cleaning kits) must be readily available;
- Ensure personnel training, including: measures to prevent fuel spills, to treat/clean fuel spills, how to react on spill of flammable liquids on clothing and in the inhalation of vapours, leaks simulations; fuel vapour recovery processes, etc. Keep records of all training;
- Maintain the premises and equipment in a clean and tidy state;
- Regularly clean outdoor areas with a broom;
- Wastewater from outside areas must be directed to the contaminated water drainage system, and not enter the storm water system;
- Used oils (waste oil) will be collected, re-used, stored and disposed of in line with disposal procedures for hazardous wastes;
- Ensure the proper management of other hazardous wastes (contaminated soils, used spilling kits, waste lube, etc).

FILLING OPERATIONS

- Isolate the area by cones and a rope;
- Prohibit refuelling operations during tank filling operations;
- Avoiding having people who are not involved in the operation within a 10 metre radius;

- Prohibit smoking and the use of mobile telephones or any other ignition sources during tank filling operations or vehicle refuelling, within a 3 metre radius;
- Use a tight-fill cap to completely seal off the connections between the tubing and the truck's and station's tanks;
- Engines must be turned off during refuelling;
- Prevent overflowing and spilling situations when the storage tanks are being filled (verify filling sensors and be aware of overflow alarms).

Preventing Accidents with fuel mixtures

- Establish a procedure to deal with the potential occurrence of these situations, such as:
- The chemicals and reaction mechanisms associated with the substances mixed or blended must be well understood and documented
- Chemical and process hazards must be understood and addressed and the facilities should ensure that process equipment, controls, and procedures are designed, installed and maintained to safely operate the process
- All employees should understand the chemical and process hazards
- Facilities should establish a system for Standard Operating Procedures and ensure that they are understood and followed
- Display clear and informative messages for users of the station, as to how to deal with this situation;
- Prepare a procedure to suitably dispose of wastes recovered from the batches of fuel mixture.

Spill Kits

- Emergency spill kits of absorbent material (e.g. sand) must be provided and stored next to the higher risk sites, and must be easily-accessible, ideally outside, in order to allow an immediate response when a spill occurs. This will be clearly labelled and ready for use.
- Drums for the storage of contaminated material must be provided.
- An accurate drawing of the local drainage system shall be posted next to the spill kit.

Closure Phase

- During the closure phase, there may be loss of product into the soil, as a result of a deliberate or accidental release during closure and removal of tanks and tubing. In addition, this risk may arise outside of the facility site, if the tanks and/or tubing are not properly disposed of.
- In the closure phase, it is important to remove all tanks and pipes. A risk may arise if the tanks are left on site with residual products. As the integrity of the equipment will no longer be ensured or monitored.
- During closure, it must be ensured that facilities do not present a risk to the environment, health or safety. Measures must be taken to ensure that the closure does not result in an unacceptable risk, including:
    - Any and all waste products will be removed from the tanks. Care will be taken to ensure that no product is lost into the soil. Tank closure must be carried out safely, with the removal of explosive vapours, for example by filling the tanks with water or inert gases. All tanks will be safe prior to their removal from the ground. Similar methods will be employed prior to the removal of the pipes.
    - Water used in this process will be contaminated with residual product, and thus a water contamination risk may arise if the contaminated water is not disposed of in a way which is appropriate for hydrocarbon contamination. This would normally imply the removal to a suitable waste handling facility.

- According to best environmental practices, the tanks, tubing and distributors will be disposed of. However, if the tanks remain in situ, it will be ensured that the procedure is safe. After making the tanks inert and safe, they will be filled in with sand, concrete, inert mud or hydrophobic foam.
- The tanks and associated tubing which are no longer considered appropriate or safe for fuel storage will not be used for storage of other hydrocarbons, without first ensuring their integrity.
- The oil/water separators will be removed for disposal, off the facility site. Otherwise they will be filled in a similar way to the tanks. Regardless of the fate of the oil/water separator, all liquid and mud waste will be removed (off the facility site) and all the inlets and outlets will be sealed.
- Whatever drainage system left behind will be modified to ensure that it does not serve as a path for pollutants to reach groundwater or other waters.
- If the deactivation is temporary, product can be left in the tanks. In this case, all monitoring procedures will be carried out as if the facility were in operation. If for any reason the monitoring cannot carry on, the tanks will be emptied and made inert.
- Personnel involved in the closure of a filling and fuel station will be aware and respect obligations with regards to waste disposal, in line with the best practices described above.

Environmental Aspect	**Action or Measure**
Prevent accidental spills from entering the stormwater drainage system	Provide cleaning equipment conceived specifically to deal with minor spills as may occur at the station. Place a clearly-identified spill kit in a visible location for each fuelling line.
	Develop a step-by-step guide to use of the spill kit.
	Develop an evacuation plan and/or response procedures for emergencies involving large fuel spills.
	Train the whole team in the emergency response procedures. Make sure that all staff knows where the emergency equipment is to be found and is acquainted with its maintenance.
	Label all of the stormwater drains on site in the proximity of the facilities as "Clean Water Only".
	Inspect the fuel distribution area in order to confirm that rainwater drained or emptied from the roof doesn't enter the areas marked out.
	Check whether the embankment around the fuel distribution area is in good condition and has the capacity to contain a fuel leak in the event of an emergency.
Minimise the risks of environmental contamination and from issues of workers' health and safety	Provide training to the staff regarding the disposal of material contaminated with fuel, such as absorbent material from the spill kit, soaked in fuel.
	Ensure that the product safety cards for all fuels and oils are up-to-date and accessible at all times.
Minimise the risks of fuel leaks as may result in	Check if there is fuel, from a possible leak, in the spill containment sumps installed at the tank's discharge nozzle.

Environmental Aspect	Action or Measure
pollution of the sub-soil and groundwater	Check if there is fuel, from a possible leak, in the all tanks containment sumps, installed on the manhole to the storage tanks. In the event of suspected leakage, report it immediately.
	Check if there is fuel or lube, from a possible leak in the containment sumps installed under the tanks.
Minimise the risks of fuel leaks as this may result in pollution of the sub-soil and groundwater	Check if there is fuel, from a possible leak, in the chambers of the containment sumps installed under the pumps
Minimise the risks of harmful emissions to the atmosphere and the loss of fuel	Check that lids, flanges and connections are closed.
	Confirm that the ventilation conduits are not blocked.
	Supervise the fuel deliveries.
Minimise the risks of water pollution	Carry out an Oil-Water Separator inspection to ensure effective treatment.
Integrity control	Adequate maintenance and calibration of the monitoring equipment

18 DECOMMISSIONING PHASE

Should the transmission line be decommissioned a decommissioning plan must be produced. The plan must include details on the decommissioning and dismantling of the lines, taking in consideration the potential environmental impact associated with it. Environmental monitoring plans must be produced so ensure no pollution occurs during this phase. The plan must include the steps that will be taken to rehabilitate the area after the lines are dismantled, as well as recycling options of the equipment and structures.

19 CONCLUSION

In terms of the National Environmental Management Act 107 of 1998 everyone is required to take reasonable measures to ensure that they do not pollute the environment. Reasonable measures include informing and educating employees about the environmental risks of their work and training them to operate in an environmentally acceptable manner.

Furthermore, in terms of the 'Act', the cost to repair any environmental damage shall be borne by the person responsible for the damage.

It is therefore imperative that the management plan is successfully implemented, as a failure to comply could have legal implications.

The environmental impacts on the site will not be significant if the construction management is well implemented, and a set of operational guidelines are developed by the long term site management body.