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ECOLOGY & BIODIVERSITY

PROPOSED POFADDER WIND ENERGY FACILITY 1 (WEF 1)

TERRESTRIAL ECOLOGICAL ASSESSMENT

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DECLARATION OF CONSULTANT INDEPENDENCE

The consultants hereby declare that they:

- act/ed as the independent specialist in this application;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and
- do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act;
- have and will not have any vested interest in the proposed activity proceeding;
- have disclosed, to the applicant, EAP and competent authority, any material information that has or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act;
- have provided the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not; and
- am aware that a false declaration is an offense in terms of regulation 48 of GN No. R. 326.

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August 2022

STATEMENT OF WORK

» This study has been executed in accordance with and meet the responsibilities in terms of:
  - NEMA, the Environmental Impact Assessment Regulations, 2014 (specifically in terms of regulation 13 of GN No. R. 326);
  - The "newly" Gazetted Protocols 3(a),(c) and (d) in terms of Section 24(5)(a) and 24(5)(h) of NEMA (Published on the 20th of March 2020);
  - The Aquatic Biodiversity Protocol published in GN NO. 1105 of 30 October 2020

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1. INTRODUCTION

1.1. Applicant

Pofadder Wind Facility 1 (Pty) Ltd.

1.2. Proposed Activity

The applicant Pofadder Wind Facility 1 (Pty) Ltd is proposing the development of a commercial Wind Energy Facility (WEF) and associated infrastructure on a site located approximately 20km South East of Pofadder within the Kai !Garib Local Municipality and the Z F Mgcawu District Municipality in the Northern Cape Province.

A preferred project site with an extent of approximately 3600ha has been identified as a technically suitable area for the development of the Pofadder WEF 1, which will comprise of up to 30 turbines with a combined contracted capacity of up to 228MW. The project site is located on the following properties:

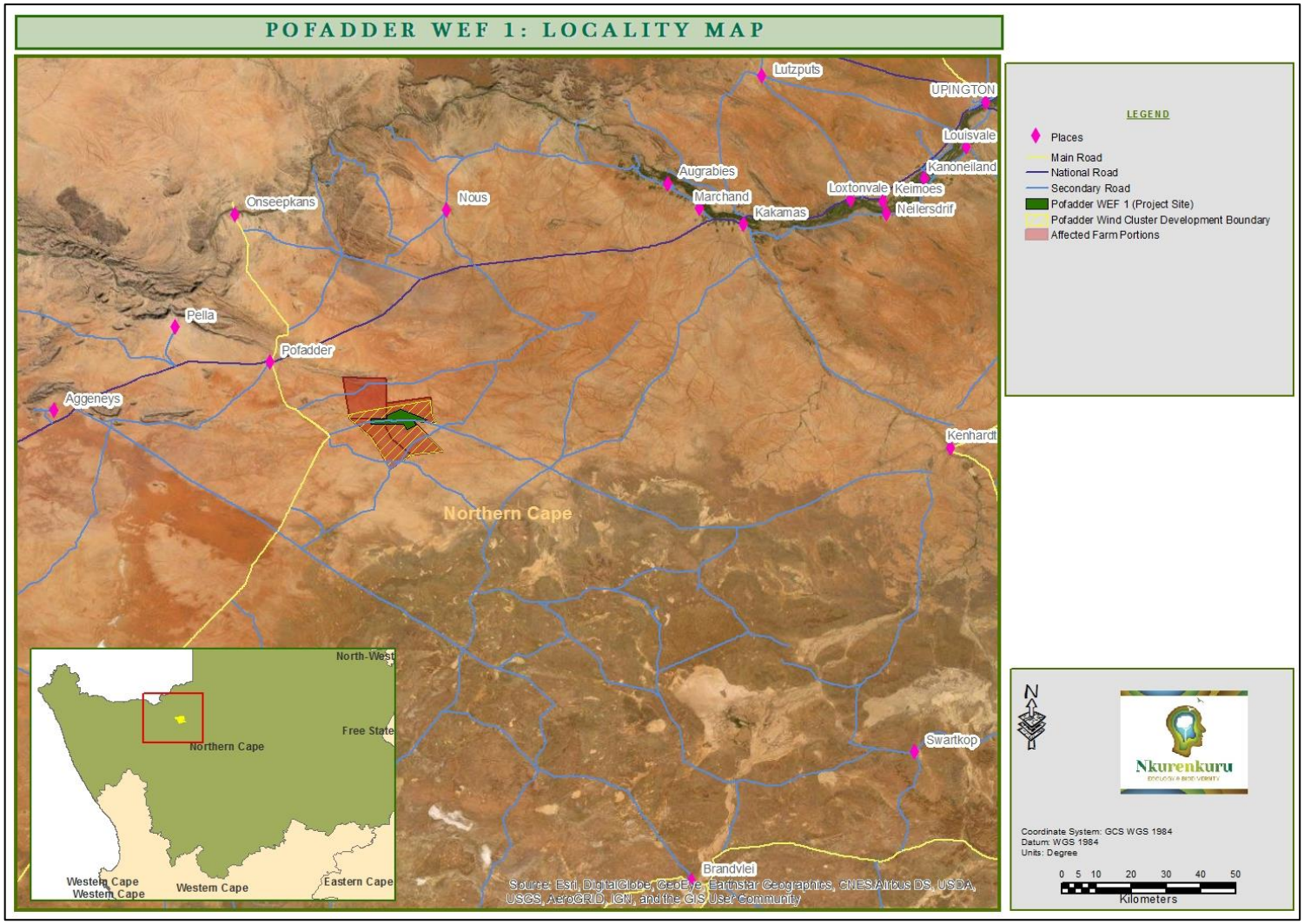
- The Farm Ganna-Poort 202;
- The Farm Lovedale 201; and
- Portion 3 of the Farm Sand Gat 150.

Two additional WEF's are concurrently being considered on the properties and are assessed by way of separate impact assessment processes contained in the 2014 Environmental Impact Assessment Regulations (GN No. R982, as amended) for listed activities contained Listing Notices 1, 2 and 3 (GN R983, R984 and R985, as amended). These projects are known as Pofadder Wind Energy Facility 2 and Pofadder Wind Energy Facility 3. The Pofadder WEF 1 project site is proposed to accommodate the following infrastructure, which will enable the wind farm to supply a contracted capacity of up to 224MW:

- Up to 28 wind turbines, each with a maximum of 8 MW output per turbine, with a maximum export capacity of approximately 224 MW. This will be subject to allowable limits in terms of the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP). The final number of turbines and layout of the WEF will, however, be dependent on the outcome of the Specialist Studies conducted during the EIA process;
- Each wind turbine will have a maximum hub height and rotor diameter of up to 200 m;
- Concrete turbine foundations and turbine hardstands;
- Each turbine will have a circular foundation with a diameter of up to 32 m and this will be placed alongside the 45 m wide hardstand resulting in an area of about 45 m x 32 m that will be permanently disturbed for the turbine foundation. The combined permanent footprint for the turbines will be approximately 4.2 ha;
- Each turbine will have a crane hardstand of approximately 70 m x 45 m. The permanent footprint for turbine crane hardstands will be approximately 9 ha;

- Each turbine will have a blade hardstand of approximately 80 m x 45 m (3 600 m^2). The combined permanent footprint for blade hardstands will be approximately 10 ha;
- One new 33/132 kV on-site substation occupying an area of approximately 1.6 ha;
- The wind turbines will be connected to the proposed on-site substation via medium voltage (33 kV) underground cables, which will mainly run alongside the access roads. Where burying of cables is not possible due to technical, geological, environmental or topographical constraints, cables will be overhead via 33 kV monopoles;
- The main access road will be 8 – 12 m wide (to allow vehicles to pass);
- Internal roads with a width of 6 – 8 m will provide access to each wind turbine. Existing farm roads will be upgraded and used wherever possible, although new site roads will be constructed where necessary;
- A 12 m wide corridor may be temporarily impacted during construction and rehabilitated to 6 m wide corridor after construction. The internal gravel roads will have an approximate 6 – 8 m wide surface and there will be up to 12 m wide impacted during the construction phase, with additional space required for cut and fill, side drains and other stormwater control measures, turning areas and vertical and horizontal turning radii to ensure safe delivery of the turbine components;
- Pofadder WEF 1 will have a total road network of approximately 48 km;
- One construction laydown / staging area of up to approximately 7 ha (to be rehabilitated following construction). It should be noted that no on-site labour camps will be required in order to house workers overnight as all workers will be accommodated in the nearby towns, and transported daily to site (by bus);
- The gate house and security house will occupy an area of up to 0.5 ha.
- Battery Energy Storage System (BESS) of approximately 3.6 ha;
- One permanent Operation and Maintenance (O&M) building (including offices, warehouses, workshops, canteen, visitors centre and staff lockers) occupying an area of up to 1 ha;
- A temporary site camp establishment and concrete batching plant occupying an area of up to 1.6 ha; and
- Galvanized palisade fencing to be used at the substations with the maximum height of the fencing to be up to 3.5 m.
- Water will either be sourced from either the Local Municipality, supplied from a private contractor and trucked in, from existing boreholes located within the application site or from a new borehole if none of these options are available.

The EA applications for the three wind farm projects and gridline are being undertaken in parallel as they are co-dependent, i.e. one will not be developed without the other.



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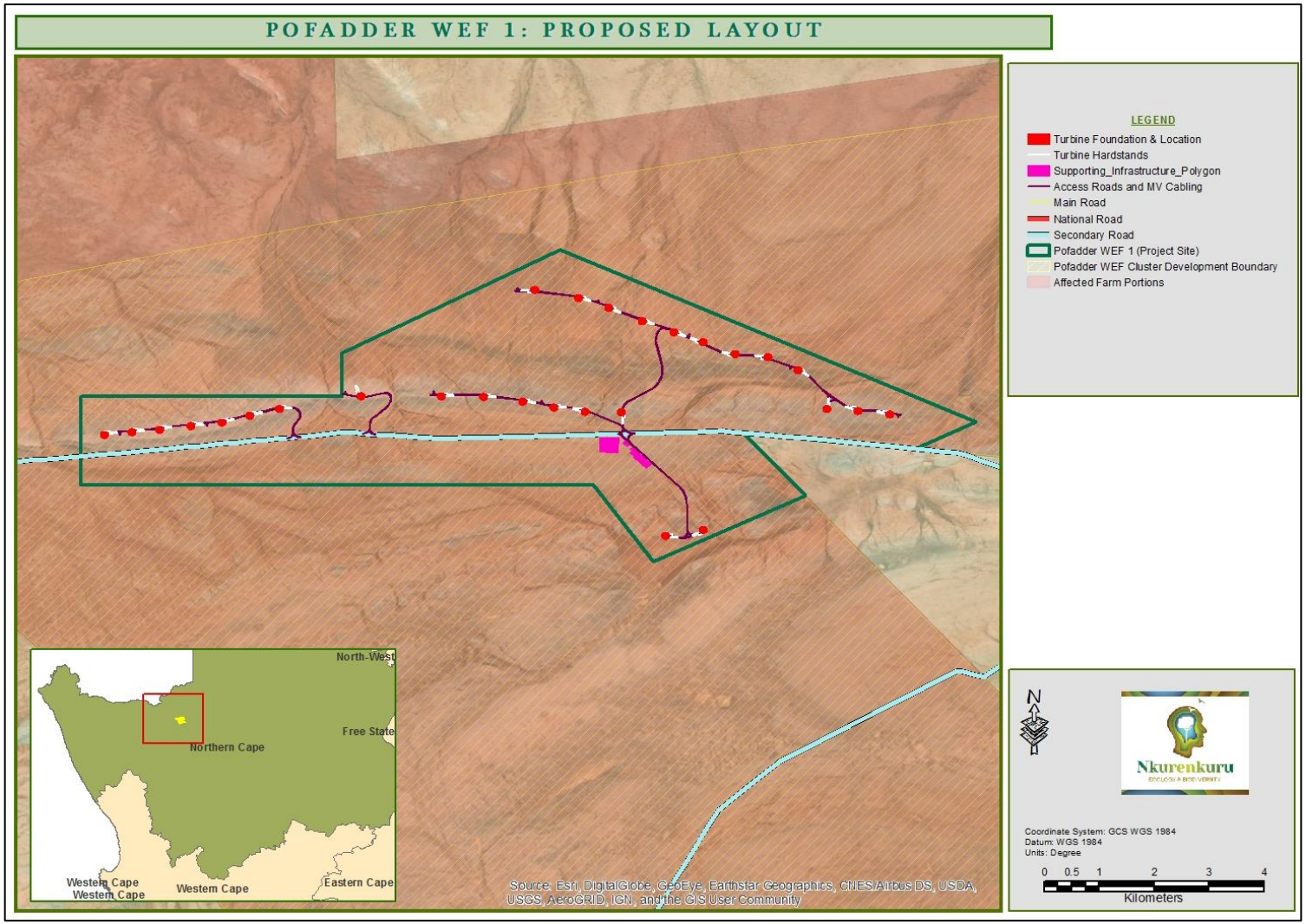


Figure 2: Proposed layout of the Pofadder WEF 1. There are two access roads: one to the west coming from the direction of Pofadder, and one to the east coming from the direction of Kenhardt.

1.3. Terms of Reference (ToR)

To conduct a detailed site terrestrial biodiversity sensitivity and impact assessment, including the following:

» Desktop analysis;
» On-site investigation;
» Detailed compilation of an ecological impact assessment report which adheres to the following (this list is not exhaustive):
    - An Ecological Sensitivity and Impact report meeting the requirements for environmental themes in terms of section 24(5)(a) and (h) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA, 2020);
    - Identification of any discrepancies with the environmental sensitivity as identified on the national web based environmental screening tool;
    - Refine / confirm the delineation of the CBA;
    - Identification of sensitive areas to be avoided (including corresponding spatial data);
    - Identification of sensitive species (Species of Conservation Concern and Protected Species) that occur on site;
    - An assessment of all potential impacts associated with the development, including impact significance ratings;
    - Recommendations regarding potential development areas for solar PV within the project site (including acceptable footprint limit); and
    - Recommendations regarding the scope and timeframe for further assessment.

1.4. Conditions of this Report

Findings, recommendations, and conclusions provided in this report are based on the authors' best scientific and professional knowledge and information available at the time of compilation. No form of this report may be amended or extended without the prior written consent of the author. Any recommendations, statements, or conclusions drawn from or based on this report must clearly cite or refer to this report. Whenever such recommendations, statements or conclusions form part of the main report relating to the current investigation, this report must be included in its entirety.

1.5. Relevant Legislation

The following legislation was taken into account whilst compiling this report:

1.5.1. Provincial

Northern Cape Nature Conservation Act No. 9 of 2009, with special reference to:

- Schedule 1: Specially Protected Species.

- Schedule 2: Protected Species.
- Schedule 6: Invasive Species.

The above-mentioned Nature Conservation Act is regarded by Northern Cape Provincial Legislature, as the legally binding provincial document, providing regulations, guidelines, and procedures for the sustainable utilisation of wild animals, aquatic biota and plants, the implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora, and also, the general conservation of flora and fauna, and the destruction of problematic (vermin and invasive) species.

1.5.2. National

» National Environmental Management Act / NEMA (Act No 107 of 1998), and all amendments and supplementary listings and/or regulations.
» Environment Conservation Act (ECA) (No 73 of 1989) and amendments.
» National Environmental Management Act: Biodiversity Act / NEMA:BA (Act No. 10 of 2004) and amendments.
» National Forest Act 1998 / NFA (No 84 of 1998).
» National Veld and Forest Fire Act (Act No. 101 of 1998).
» Conservation of Agricultural Resources Act / CARA (Act No. 43 of 1983) and amendments.

1.5.3. International

» Convention on International Trade in Endangered Species of Fauna and Flora (CITES; https://cites.org/eng).
» The Convention on Biological Diversity (CBD; https://www.cbd.int/).
» The Convention on the Conservation of Migratory Species of Wild Animals (CMS; https://www.cms.int/).

2. METHODOLOGY

2.1. Assessment Approach and Philosophy

The assessment was conducted according to the 2014 EIA Regulations, as amended 7 April 2017, as well as within the best-practice guidelines and principles for biodiversity assessment (Brownlie et al., 2006; de Villiers et al., 2005).

This includes adherence to the following broad principles:

» That a precautionary and risk-averse approach be adopted towards projects which may result in substantial detrimental impacts on biodiversity and ecosystems, especially the irreversible loss of habitat and ecological functioning in threatened ecosystems or designated sensitive areas: i.e., Critical Biodiversity Areas (as identified by systematic

conservation plans, Biodiversity Sector Plans or Bioregional Plans), and Freshwater Ecosystem Priority Areas.

» Demonstrate how the proponent intends on complying with the principles contained in section 2 of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended (NEMA), which, amongst other things, indicates that environmental management should, in order of priority aim to:

- Avoid, minimise or remedy disturbance of ecosystems and loss of biodiversity;
- Avoid degradation of the environment;
- Avoid jeopardising ecosystem integrity;
- Pursue the best practicable environmental option by means of integrated environmental management;
- Protect the environment as the people's common heritage;
- Control and minimise environmental damage; and
- Pay specific attention to management and planning procedures pertaining to sensitive, vulnerable, highly dynamic, or stressed ecosystems.

These principles serve as guidelines for all decision-making concerning matters that may affect the environment. As such, it is incumbent upon the proponent to show how proposed activities would comply with these principles and thereby contribute towards the achievement of sustainable development as defined by NEMA.

In order to adhere to the above principles and best-practice guidelines, the basis for the study approach and assessment philosophy included baseline data collection, desktop studies, and site walkovers/field surveys of the property, describing:

» The broad botanical characteristics of the site and its surrounds in terms of any mapped spatial components of ecological processes and/or patchiness, patch size, relative isolation of patches, connectivity, corridors, disturbance regimes, ecotones, buffering, viability, etc.

In terms of pattern, the following was studied:

Community and ecosystem level:

» The main vegetation types and plant communities (Dayaram et al., 2018; Mucina and Rutherford, 2006), their aerial extents, and interaction with neighbouring types, soils, or topography.
» Threatened or Vulnerable ecosystems (cf. new South African vegetation map/National Spatial Biodiversity Assessment1, fine-scale systematic conservation plans, etc) (South African National Biodiversity Institute, 2019).

Species-level:

» Species of Conservation Concern (SoCC: Red List and protected species), giving GPS location, if possible (Raimondo et al., 2009).
» Estimated population sizes and viabilities of SoCC present on site (including the degree of confidence in prediction based on availability of information and specialist knowledge; i.e., High = 70 – 100% confident, Medium = 40 – 70% confident, Low = 0 – 40% confident).
» Probability of other SoCC occurring in the region of the site (include degree of confidence).

Other pattern issues:

» Any significant landscape features, or rare or important vegetation associations, such as seasonal wetlands, alluvium, seeps, sandstone outcroppings, steep southern aspects, drainage lines etc. in the vicinity.
» The extent of alien plant cover within the site, and whether any infestations are the result of prior soil disturbance, such as ploughing or quarrying (alien cover resulting from disturbance is generally more difficult to restore than an infestation of undisturbed sites).
» The condition of the site in terms of current or previous land uses.

In terms of process, the following was studied:

» The key ecological "drivers" of ecosystems on the site and in the vicinity.
» Any mapped spatial components of ecological processes that may occur on site or in the vicinity (i.e., corridors such as watercourses, upland-lowland gradients, migration routes, coastal linkages or inland-trending dunes, and vegetation boundaries such as edaphic interfaces, upland-lowland interfaces, or biome boundaries).
» Any possible changes in key processes e.g., increased fire frequency or drainage/artificial recharge of aquatic systems.

Any further studies that may be required during or after the EIA process will be outlined, together with all relevant legislation, permits, and standards that would apply to the development.

The opportunities and constraints for development is described and shown graphically on an aerial photograph, satellite image, or map delineated at an appropriate level of spatial accuracy.

2.2. Data Scouring and Review

Data sources from the literature and GIS spatial information was consulted and used where necessary in the study and include the following (see Figure 3 for the area used to compile a plant and animal species list, and Table 1 for a summary):

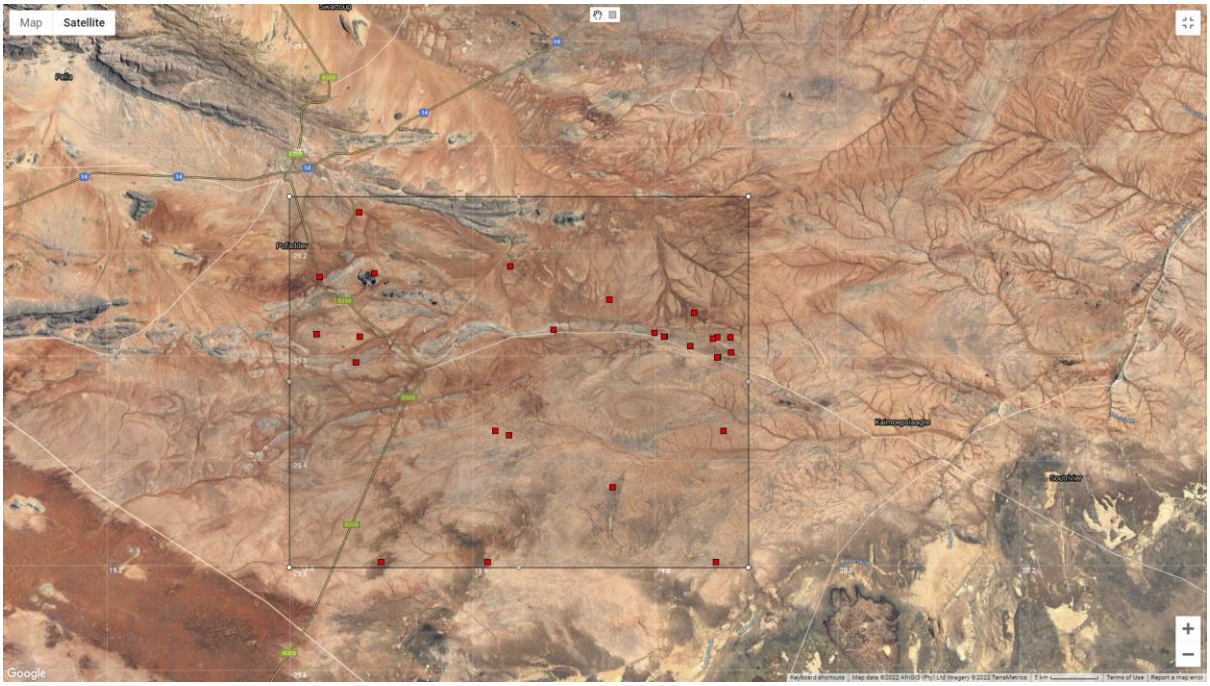


Figure 3: Site locality (red) and area indicating the extent of data extraction from POSA. Extracted data was used to compile a list of plant species that may potentially occur within the site, as well is the surrounding area, and provide an indication of potential Species of Conservation Concern that may be found within this area

Vegetation:

- » South African National Vegetation Map (SANBI, 2018); (Mucina & Rutherford, 2006) and National List of Threatened Ecosystems (NEM:BA, 2011): vegetation types and their respective conservation statuses. The latest version of the National Vegetation Map was also consulted to check for any updates of the respective regions (Dayaram, et al., 2019); (SANBI, 2018).
- » Botanical Database of Southern Africa (BODATSA), hosted by the South African National Biodiversity Institute (SANBI; https://posa.sanbi.org; also referred as POSA: Plants of Southern Africa): information on plant species recorded for the Quarter Degree Squares 2919BA, 2919BB, 2919BD and 2920AA. This is a larger area than required and is a conservative approach that ensures all species possibly occurring within the site have been represented. It also accounts for the fact that the site itself might not be well represented in national databases.
- » Threatened Species Programme, Red List of South African Plants (SANBI, 2021): The IUCN conservation statuses of all listed species were extracted from this database.

Ecosystem:

- » Freshwater and wetland information was extracted from the National Freshwater Ecosystem Priority Areas assessment (Nel, et al., 2011). This includes rivers, wetlands, and catchments defined in the study area.
- » Important catchments and protected areas expansion areas were extracted from the National Protected Areas Expansion Strategy 2008 (Government of South Africa, 2008).
- » Critical Biodiversity Areas for the site and surroundings (CBA Map for Northern Cape; obtained from SANBI Biodiversity GIS (BGIS), specifically http://bgis.sanbi.org/Projects/Detail/203.

Fauna:

The list of mammal and herpetofauna species predicted to occur in the region and their respective likelihood of occurrence within the study area was generated based on known distributions and habitat suitability, based on online and literature sources such as MammalMap, ReptileMap, FrogMap and the ReptileAtlas as well as field guides such as, Skinner & Chimimba (2005), Apps (ed. 2012), Stuart & Stuart (1998), Bates *et al* (2014), Minter *et al*. (2004), Branch (2009) and Du Preez and Carruthers (2009). The literature study focussed on querying the online database to generate species lists for the relevant Quarter Degree Squares (QDS).

The predicted list is typically heavily influenced by factors other than just distribution or biome type. Factors such as habitat suitability, current land use, current levels of disturbance and structural integrity of the habitats all influence the potential for predicted species to occur in the vicinity of the study area. There is a high likelihood that not all mammal species known to occur within the region will be located within the study area and surrounding areas. Therefore, a 'Likelihood of Occurrence' (LOO) and a 'Species of Conservation Concern' review will be applied to any potential omissions in the data set. For the LOO analysis, a full summary of Red List faunal species (IUCN, 2021); (SANBI, 2021), as well as other SCC will be tabulated, with a LOO applied.

Likelihood of Occurrences will be based upon available spatial imagery and will be based on:

- » Habitat suitability;
- » Overlap with known distributions;
- » Rarity of the species; and
- » Current Impacts.

Mammal distribution data were obtained from the following sources:

- » The Mammals of the Southern African Subregion (Skinner & Chimimba, 2005);
- » The 2016 Red List of Mammals of South Africa, Lesotho and Swaziland (www.ewt.org.za) (EWT, 2016);
- » Animal Demography Unit (ADU) - MammalMap Category (MammalMap, 2017) (mammalmap.adu.org.za);

» Stuarts' Field Guide to Mammals of Southern Africa – Including Angola, Zambia & Malawi (Suart & Stuart, 2015)
» A Field Guide to the Tracks and Signs of Southern, Central and East African Wildlife (Stuart & Stuart, 2013).
» Smither's Mammals of Southern Africa (Apps, ed. 2012)

Herpetofauna distribution and species data were obtained from the following sources:

» South African Reptile Conservation Assessment (SARCA) (sarca.adu.org);
» A Guide to the Reptiles of Southern Africa (Alexander & Marais, 2007);
» Field guide to Snakes and other Reptiles of Southern Africa (Branch, 1998);
» Atlas and Red list of Reptiles of South Africa, Lesotho and Swaziland (Bates et al.,
» 2014);
» A Complete Guide to the Frogs of Southern Africa (du Preez & Carruthers, 2009);
» Animal Demography Unit (ADU) - FrogMAP (frogmap.adu.org.za);
» Atlas and Red Data Book of Frogs of South Africa, Lesotho and Swaziland (Mintner et
» al., 2004); and
» Ensuring a future for South Africa's frogs (Measey, 2011).

Table 1: Information and data coverages used to inform the ecological assessment.

	Data/Coverage Type	Relevance	Source
Biophysical Context	**Colour Aerial Photography**	Desktop mapping of habitat/ecological features	National Geo-Spatial Information (NGI)
	Latest Google Earth™ imagery	To supplement available aerial photography	Google Earth™ On-line
	1:50 000 River Line (GIS Coverage)	Highlight potential on-site and local rivers and wetlands and map local drainage network.	CSIR (2011)
	National Land-Cover	Shows the land-use and disturbances/transformations within and around the impacted zone.	DEA (2015)
	South African Vegetation Map (GIS Coverage)	Classify vegetation types and determination of reference primary vegetation	Mucina & Rutherford (2012; 2018); Dayaram et al., 2018
	NFEPA: river and wetland inventories (GIS Coverage)	Highlight potential on-site and local rivers and wetlands	CSIR (2011)
Conservation and Distribution Context	**National Biodiversity Assessment – Threatened Ecosystems** (GIS Coverage)	Determination of national threat status of local vegetation types	SANBI (2011)
	Northern Cape Biodiversity Conservation Plan (GIS Coverage)	Determination of provincial terrestrial/freshwater conservation priorities and biodiversity buffers	SANBI (2016)
	SANBI's PRECIS (National Herbarium Pretoria Computerized Information	Determination of plant species composition within the region as	http://posa.sanbi.org 2020-01-20_181608464-BRAHMSOnlineData

	System) electronic database	well as potential conservation important plants.	
	Red Data Books (Red Data Lists of Plants, Mammals, Reptiles, and Amphibians	Determination of endangered and threatened plants, mammals, reptiles and amphibians	Various sources
	Animal Demography Unit	Determination of faunal species composition within the region as well as potential conservation important faunal species.	ADU, 2019
	Smither's Mammals of Southern Africa	Compilation of a species list.	Apps (ed.) 2012
	The Mammals of the Southern African Subregion	Compilation of a species list.	Skinner & Chimimba (2005)
	Field guide to snakes and other reptiles of southern Africa	Compilation of a species list.	Branch (1998)

2.3. Botany: Methods followed during Field Sampling and Assessment

The sites were inspected over the course of 10 – 12 June 2021 (winter) and 26 – 27 November (summer and active growing season). During the inspections the vegetation was in an optimal survey condition, with the majority of plants being easily identifiable, even during the winter assessment.

Prior to the site visit, the vegetation was delineated into homogenous units using satellite imagery, existing land cover maps and a SRTM DEM. Sampling of floristic (Flora SCC) and habitat data was done simultaneously by combining to scientifically recognised methods, namely the plot method and the timed random meanders, wherein a timed meander will be conducted and at a specified time plot sampling (all floristic data including cover-abundance) will be conducted.

The timed random meander method is a highly efficient method for conducting floristic analysis specifically in detecting flora SCC and maximising floristic coverage. In addition, the method is time and cost effective and highly suited for compiling flora species lists and therefore gives a rapid indication of flora diversity. The timed meander search was performed based on, as mentioned a slight adaptation (addition of plots) of the original technique described by Goff et al. (1982). Suitable habitat for SCC were identified according to Raimondo et al. (2009) and targeted as part of the timed meanders.

In terms of plot/relevè sampling the guidelines for phytosociological classifications and descriptions of vegetation in southern Africa (Brown et al., 2013) was followed. At several sites (plots) within each homogeneous unit, a survey of total visible floristic composition and the relative cover percentage of each species were recorded, following established vegetation survey techniques (Mueller-Dombois & Ellenberg 1974; Westhoff & Van der Maarel 1978). These vegetation survey methods have been used as the basis of a national vegetation survey of South Africa (Mucina et al. 2000) and are considered an efficient method of describing

vegetation and capturing species information. Notes were additionally made of the general habitat and any other features, biotic and abiotic, that might have an influence on the composition of landscape components and functioning of the landscape. All floristic and environmental data was captured using Braun-Blanquet Data Sheets.

Phytosociological analysis was carried out using the standard TurboVeg phytosociological database (Hennekens and Schaminée 2001) and TWINSPAN classification techniques with JUICE (Tichý 2002). The assessment did not cover an extensive area necessary to fully describe plant communities; hence, the vegetation is simply described in terms of 'vegetation units', which may be associations within plant communities. Extrapolation of vegetation units from survey sites to entire sample area was done by traversing the larger area without doing additional surveys as such and mapping this on Google Earth satellite data.

Plant species nomenclature follows Germishuizen and Meyer (2003), Henderson (2001) and Bromilow (2010).

2.4. Fauna: Methods followed during Field Sampling and Assessment

The sites were inspected over the course of 11 – 14 October 2021 (Spring) and 12 – 14 March 2022. Conditions for the faunal survey was regarded as acceptable.

Mammal Assessment:

Likelihood of Occurrence

There is a high likelihood that not all mammal species known to occur within the study area and surrounding areas will be located during the survey. Therefore, a 'Likelihood of Occurrence' (LOO) and a 'Species of Special Consideration (SCC)' review was applied to any potential omissions in the data set. For the LOO analysis, a full summary of Red List mammals (IUCN, 2017), as well as other SCC was tabulated, with a LOO applied. The relevant species of special consideration were addressed separately based on the data collected during the fieldwork, in context to the development and the effects on the species (both ecologically and spatially).

Likelihood of Occurrences are based upon:

- Habitat suitability;
- Overlap with known distributions;
- Rarity of the species; and
- Current Impacts.

Spoor Tracking

Spoor tracking enabled detailed sampling of mammalian species without the need for trapping or direct observation. All spoor, including footprints, den sites, burrows, hairs, scrapings and diggings were recorded and documented by detailed geo-referenced photography. Spoor tracking took place during general fieldwork, during specific timed spoor tracking drives/transects and at carefully chosen locations such as roads and other areas with highly trackable substrates. In addition, all camera trap sites (see below) were subjected to spoor tracking.

Camera trapping

The use of camera trapping has long been considered as a valuable ecological census tool in the field of African Mammalogy and this method was a primary focus of the field study. Baited cameras were deployed during survey. Bait stations were chosen based on available cover around the area, the presence of any promising signs (e.g. tracks, scats, tree scrapings) and the likelihood of possible habitat for important species. The baits used consisted of a mixture of pilchards and oats that was pureed to a fine pulp. Cameras were set to record 3 images, with a 40 second delay between events. Four cameras were deployed.

Nocturnal surveys and daytime observations

Nocturnal Surveys: This technique is an essential tool in mammalian sampling, simply because most of the target species are only active after dark. A high-powered spotlight was used from the vehicle to illuminate nocturnal species. Some mammal species were located from vocalisations. Two, night drives of 2 hours each was carried out during the study (one during the winter survey and one during the summer survey).

Direct Observations: All mammals observed during the sampling period, their geographic coordinates and the surrounding habitat were recorded. This data was used to supplement the overall habitat analysis to give context to the area. Animals were encountered through driving, normal routine movement through the study area, active searching of refugia and finally, through spotlighting at night.

Sherman Trapping

Sherman trapping was done for three trap nights. Four trap lines were deployed and traps were placed on the ground and baited with a mixture of peanut butter, olive oil, oats and marmite. Four trap lines were set out and comprised of 20 traps each. The distance between each trap varied between 15 and 25 meters and was dependent on the transition between habitats. Each trap line was situated within a single habitat type. Captured animals were moved from the traps into clear plastic bags, identified, photographed and then released unharmed. The specific period of sampling is regarded as a moderately acceptable period for sampling.

Herpetofaunal Assessment:

Due to the limited time available for the field survey, no trapping was performed in order to maximise prime active searching time by eliminating the need to install, service and dismantle the traps. Instead, the survey aimed to focus on intensive active searching.

Active Searching

Reptiles were searched for on foot within the study area during the day and night. Specific habitat types were selected, beforehand, where active sampling was focused intently (point samples). The habitat of these point samples was described and photographs were taken. Active searching for reptiles occurred for approximately 30 minutes per point sample and involved:

- Photographing active reptiles from a distance with a telephoto lens (300m telephoto lens);
- Lifting up and searching under debris, rocks or logs (rocks and logs were always returned to their original positions);
- Scanning for any signs of reptiles such as shed skins, the positive identification of which was taken as an observation of that species; and
- Catching observed reptiles by hand. All captured reptiles were photographed and released unharmed.

Nocturnal herpetofauna were searched for by driving slowly on the roads during a single night. Amphibians (frogs and toads) are nocturnal and were searched for by torchlight during a single night at and around the ephemeral watercourses. Each amphibian encountered at a particular site was identified and photographed where possible. Positive identification of acoustic signals (males call to attract females) was also used as a means of identifying amphibians.

Opportunistic Sampling

Reptiles, especially snakes, are incredibly elusive and difficult to observe. Consequently, all possible opportunities to observe reptiles were taken in order to augment the standard sampling procedures described above. As a result, the other participating biodiversity specialists assisted through opportunistically taking photographs of reptiles and amphibians within the study area. These images were copied for proper identification and added to the list of random observations unless a specific location of the observation was provided.

2.5. Assessing Species of Conservation Concern

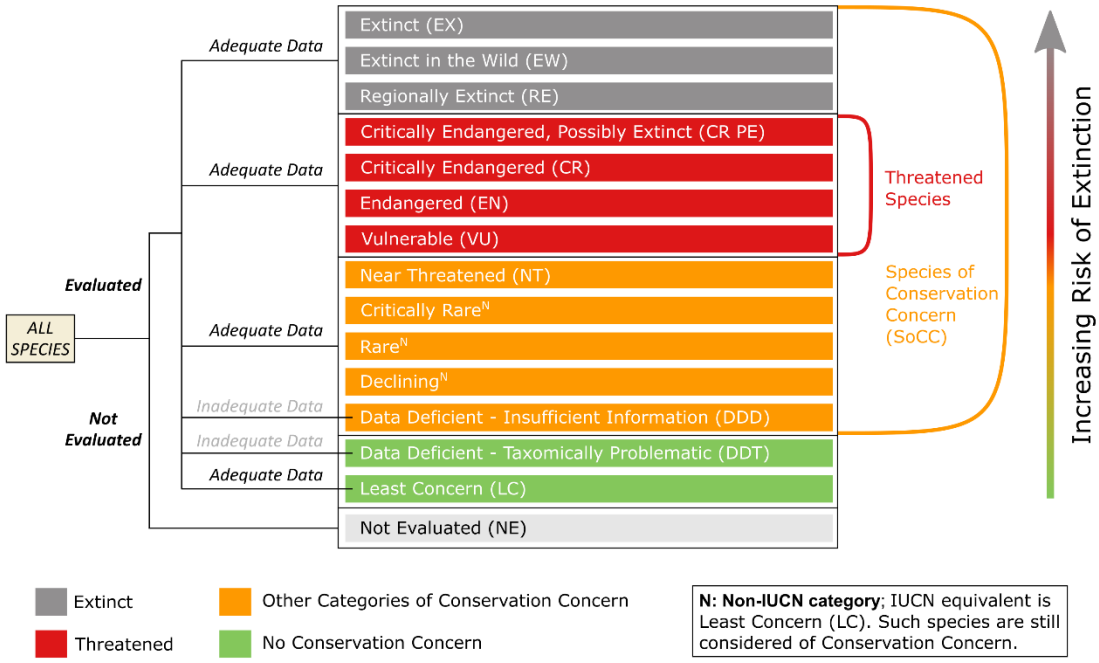


Figure 4: Red List categories used in this report, delineated according to SANBI's Red List of South African Plants (version 2020; http://redlist.sanbi.org/redcat.php).

Species of Conservation Concern (SoCC) are taxa (plants or animals) that have a significant conservation importance in terms of preserving South Africa's high biological diversity. They include threatened species — i.e., Red List species — that have been classified as "at high risk of extinction in the wild" (i.e., Critically Endangered [CR], Endangered [EN], Vulnerable [VU]), as well as those classified in the categories Near Threatened (NT), Critically Rare, Rare, Declining, and Data Deficient (Figure 4). SoCC also include protected species listed in international conventions, national acts, and provincial ordinances that regulate activities such as the hunting, collecting, and trading of such species. A population of an SoCC occurring on a proposed development site serves to indicate that the proposed activities could result in significant loss of biodiversity, knowing that the loss of such subpopulations will either increase the species' extinction risk, or may even contribute to its extinction. A description of the different SANBI Red List categories (http://redlist.sanbi.org/) is provided, below (Table 2).

Table 2: South African Red List Categories for species of conservation significance (adapted from http://redlist.sanbi.org/redcat.php).

Present State			
Species of Conservation Concern (SoCC)		Extinct (EX)	A species is Extinct when there is no reasonable doubt that the last individual has died. Species are classified as Extinct only after exhaustive surveys throughout the species' known range have failed to record an individual.
		Extinct in the Wild (EW)	A species is Extinct in the Wild when it is known to survive only in cultivation or as a naturalized population (or populations) well outside of its natural and historical range.
		Regionally Extinct (RE)	A species is Regionally Extinct when it is extinct within the region assessed (in this case South Africa), but wild populations can still be found in areas outside the region.
	Threatened Species	Critically Endangered, Possibly Extinct (CR PE)	Possibly Extinct is a special tag associated with the category Critically Endangered, for species that are highly likely to be extinct, but exhaustive surveys required for classifying the species as Extinct have not yet been completed. A small chance remains that such species may still be rediscovered.
		Critically Endangered (CR)	A species is Critically Endangered when the best available evidence indicates that it meets at least one of the five IUCN criteria for Critically Endangered, indicating that the species is facing an extremely high risk of extinction.
		Endangered (EN)	A species is Endangered when the best available evidence indicates that it meets at least one of the five IUCN criteria for Endangered, indicating that the species is facing a very high risk of extinction.
		Vulnerable (VU)	A species is Vulnerable when the best available evidence indicates that it meets at least one of the five IUCN criteria for Vulnerable, indicating that the species is facing a high risk of extinction.
		Near Threatened (NT)	A species is Near Threatened when available evidence indicates that it almost meets any one of the IUCN criteria for Vulnerable, and is, therefore, likely to become at risk of extinction in the near future.
		Critically Rare [non-IUCN]	A species is Critically Rare when it is known to occur at a single site, but is not exposed to any direct or plausible potential threat and does not otherwise qualify for a category of threat according to one of the five IUCN criteria.
		Rare [non-IUCN]	A species is Rare when it meets at least one of four South African criteria for rarity, but is not exposed to any direct or plausible potential threat, and does not qualify for a category of threat according to one of the five IUCN criteria.
		Declining	A species is Declining when it does not meet or almost meet any one of the five IUCN criteria, and does not qualify for Critically Endangered, Endangered, Vulnerable, or Near Threatened, but there are threatening processes causing a continuing decline of the species.
		Data Deficient – Insufficient Information (DDD)	A species is DDD when there is inadequate information to make an assessment of its extinction risk, but the species is well defined. Listing of species in this category indicates that more information is required and that future research could show that a threatened classification is appropriate.
Other		Data Deficient – Taxonomically Problematic (DDT)	A species is DDT when taxonomic problems hinder its distribution range and habitat from being well defined so that an assessment of risk of extinction is not possible.
		Least Concern (LC)	A species is Least Concern when it has been evaluated against the IUCN criteria and does not qualify for any of the above categories. Species classified as Least Concern are considered at low risk of extinction. Widespread and abundant species are typically classified in this category.
		Not Evaluated (NE)	A species is Not Evaluated when it has not been evaluated against the criteria. The national Red List of South African plants is a comprehensive assessment of all South African indigenous plants, and therefore all species are assessed

			and given a national Red List status. However, some species included in Plants of southern Africa: an Online Checklist, are species that do not qualify for national listing because they are naturalized aliens, hybrids (natural or cultivated), or synonyms. These species are given the status Not Evaluated and the reasons why they have not been assessed are included in the assessment justification.

SoCC likely to occur in the various habitats of the study area were assessed at a desktop level using the outputs of BODATSA, hosted by the South African National Biodiversity Institute (SANBI; https://posa.sanbi.org). This information was used to identify potential habitats in the project area that could support these species. Special attention was given to the identification of any Red List species and suitable habitats for Red List species observed during field investigations.

2.6. Ecological Mapping

Mapping was done by comparing georeferenced ground survey data to available Google-Earth Satellite Imagery, thus extrapolating survey reference points to the entire study area. Due to the intricate mosaics and often gradual mergers of vegetation units, generalisations were made and delineations are therefore approximate. Mapped units thus indicate dominant vegetation, but smaller vegetation types invariably exist within dominant units, and could not be mapped separately. The latter would require a supervised classification of georeferenced raw SPOT or similar satellite imagery (with full reflectance data), which was not available for this project due to a limited budget. Maps were created with QGIS (version 3.20).

2.7. Sensitivity Analysis and Criteria

Aspects of biodiversity that were used to guide the interpretation and assessment of the study area are summarized below (Table 3).

Table 3: Summary of the different aspects of biodiversity considered in the assessment of the study site.

Intrinsic / Ecological Values
Species-Level Aspects of Biodiversity
» Protected flora and fauna;
» Threatened Species (Red List);
» Keystone species performing a key ecological role;
» Large or congregatory species populations;
» Endemic species or species with restricted ranges;
» Previously unknown species.
Community and Ecosystem-Level Aspects of Biodiversity
» Distinct or diverse communities or ecosystems;
» Unique ecosystems;
» Locally adapted communities or assemblages;
» Species-rich or diverse ecosystems;
» Communities with a high proportion of endemic species or species with restricted ranges;

» Communities with a high proportion of threatened and/or declining species; » The main uses and users of the area and its ecosystem goods and services: important ecosystem services, valued ecosystem goods, valued cultural areas.
Landscape-Level Aspects of Biodiversity
» Key ecological processes (e.g., seed dispersal, pollination, primary production, carbon sequestration); » Areas with large congregations or species and/or breeding grounds; » Migration routes/corridors; » Importance as a link or corridor to other fragments of the same habitat, to protected or threatened or valued biodiversity areas; » Importance and role in the landscape with regards to arrangement of spatial components of ecological processes, comprising processes tied to fixed physical features (e.g., soil or vegetation interfaces, river or sand movement corridors, upland-lowland interfaces) and flexible processes (e.g., upland-lowland gradients and macro-climatic gradients), as well as important movement or migration corridor for species.

The determination of specific ecosystem services and the sensitivity of ecosystem components, both biotic and abiotic, is complex and no single overarching criterion applies to all habitats studied. The main aspects of an ecosystem that require incorporation into a sensitivity analysis, however, include the following (see Kremen 2005):

- Describing the nature and number of species present, taking into consideration their conservation value, as well as the probability of such species to survive or re-establish following disturbances (of various magnitudes), and alterations to their specific habitats.
- Identifying species or habitat features that are "key ecosystem providers", and characterising their functional relationships.
- Determining the aspects of community structure that influence function, especially aspects influencing stability or rapid decline of communities.
- Assessing key environmental factors that influence the provision of services.
- Gaining knowledge about the spatial-temporal scales over which these aspects operate.

This implies that, in a sensitivity analysis, aspects that currently prevail in the project area should be taken into consideration. The possibility of fully restoring the original environment and its biota, or at least rehabilitating ecosystem services, after significant disturbance, as close as possible to the original state, should also be considered.

According to the above, sensitivity classes are summarised as follows:

Table 4: Explanation of sensitivity rating

Sensitivity	Factors contributing to sensitivity	Examples of qualifying features
VERY HIGH	Indigenous natural areas that are highly positive for any of the following: » Critical habitat for range restricted species of conservation concern that have a distribution range of less than 10 km^2	» CBA 1 areas » Remaining areas of vegetation type listed in Draft Ecosystem List of NEM:BA as Critically Endangered,

Sensitivity	Factors contributing to sensitivity	Examples of qualifying features
	» Presence of species of conservation concern listed on the IUCN Red List of Threatened Species or South Africa's National Red List website as Critically Endangered, Endangered or Vulnerable according to the IUCN Red List 3.1. Categories and Criteria or listed as Nationally Rare » Habitats/Vegetation types with high conservation status (low proportion remaining intact, highly fragmented, habitat for species that are at risk). » Protected habitats (areas protected according to national/provincial legislation, e.g. National Forests Act, Draft Ecosystem List of NEM:BA, Integrated Coastal Zone Management Act, Mountain Catchment Areas, Lake Areas Development Act). These areas/habitats are irreplaceable in terms of species of conservation concern May also be positive for the following: » High intrinsic biodiversity value (high species richness and/or turnover, unique ecosystems) » High value ecological goods and services (e.g. water supply, erosion control, soil formation, carbon storage, pollination, refugia, food production, raw materials, genetic resources, cultural value) » Low ability to respond to disturbance (low resilience, dominant species very old).	Endangered, or Vulnerable. » Protected forest patches. » Confirmed presence of populations of species of conservation concern (Critically Endangered, Endangered, Vulnerable & Rare)
HIGH	Indigenous natural areas that are positive for any of the following: » High intrinsic biodiversity value (moderate/high species richness and/or turnover). » Confirmed habitat highly suitable for species of conservation concern (Those species listed on the IUCN Red List of Threatened Species or South Africa's National Red List website as Critically Endangered, Endangered or Vulnerable according to the IUCN Red List 3.1. Categories and Criteria). » Moderate ability to respond to disturbance (moderate resilience, dominant species of intermediate age). » Moderate conservation status (moderate proportion remaining intact, moderately fragmented, habitat for species that are at risk). » Moderate to high value ecological goods & services (e.g. water supply, erosion control,	» CBA 2 "critical biodiversity areas". » Confirmed habitat where species of conservation concern could potentially occur (habitat is suitable, but no confirmed records). » Habitat containing individuals of extreme age. » Habitat with low ability to recover from disturbance. » Habitat with exceptionally high diversity (richness or turnover). » Habitat with unique species composition and narrow distribution.

Sensitivity	Factors contributing to sensitivity	Examples of qualifying features
	soil formation, carbon storage, pollination, refugia, food production, raw materials, genetic resources, cultural value). These areas/habitats are unsuitable for development due to a very likely impact on species of conservation concern May also be positive for the following: » Protected habitats (areas protected according to national/provincial legislation, e.g. National Forests Act, Draft Coastal Zone Management Act, Mountain Catchment Areas Act, Lake Areas Development Act)	» Ecosystem providing high value ecosystem goods and services.
Medium	Indigenous natural areas that are positive for: » Suspected habitat for species of conservation concern based either on there being records for this species collected I the past prior to 2002 or being a natural area included in a habitat suitability model (Those species listed on the IUCN Red List of Threatened Species or South Africa's National Red List website as Critically Endangered, Endangered or Vulnerable according to the IUCN Red List 3.1. Categories and Criteria). Indigenous natural areas that are positive for one or two of the factors listed below, » Moderate intrinsic biodiversity value (moderate species richness and/or turnover). » Moderate to moderate low ability to respond to disturbance (moderate resilience, dominant species of intermediate age). » Moderate conservation status (moderate proportion remaining intact, moderately fragmented, habitat for species that are at risk). » Moderate value ecological goods & services (e.g. water supply, erosion control, soil formation, carbon storage, pollination, refugia, food production, raw materials, genetic resources, cultural value).	» CBA 2 "corridor areas", ESA 1 and ESA2. » Habitat with moderate diversity (richness or turnover). » Suspected habitat for species of conservation concern.
Low	Degraded or disturbed indigenous natural vegetation No Natural habitat remaining	

2.8. Impact Assessment and Criteria

Refer to Appendix 1 for the Environmental Impact Assessment (EIA) Method statement as provided by SiVest.

2.9. Assumptions and Limitations

This report deals exclusively with a specifically defined area, and the impacts upon plant biodiversity and natural ecosystems in that area. As such:

- All relevant project information provided by the applicant and engineering design team to the ecological specialist was correct and valid at the time that it was provided.
- Probably the most significant potential limitation associated with such a sampling approach is the narrow temporal window of sampling.

Temporal variation plays an important role in the structure and patterns of plant biodiversity, communities, and species occurrences. One site visit might, therefore, not fully catalogue plant species diversity in an area (for example, due to seasonal variation of vegetation). The site was surveyed in the dry (winter) period as well as the wet and active growing period (summer) and furthermore the conditions during both surveys can be described as optimal and acceptable. Thus, the biodiversity of the area has most likely been well documented.

Nevertheless, some annual, short-lived, ephemeral (plants surviving unfavourable conditions as seeds), geophytic (species with underground storage organs), or other cryptic species might not have been observed/detected. For example, some plant species of the families Amaryllidaceae, Colchicaceae, Eriospermaceae, Hyacinthaceae, Hypoxidaceae, Iridaceae, and Orchidaceae, among others, are known to completely die back during certain times of the year, depending on respective life strategies. Thus, such species remain unobservable/undetectable and survive only as dormant bulbs, corms, tubers, or rhizomes below the soil surface. Moreover, rare and threatened plant species are generally uncommon and/or localised, and can easily be overlooked. Even multiple site visits might therefore fail to locate such species.

Furthermore, flowers and fruits are crucial for the complete and accurate identification of plant species, and any absence of such flowers and fruits might prevent the complete and accurate identification of such plant species. Flowering and fruiting times are species specific and there would invariably have been some plant species that were not flowering and/or fruiting during surveying.

Finally, in principle, it is impossible to survey any site to its full extent, both physically and temporally. The total number of plant species thus recorded on any site is therefore almost always an underestimate of the potential number of species that could occur on site (although, in this instance it is expected that the majority of plant species have been documented).

In light of all of the aforementioned, the authors declare a gap in knowledge as to the potential presence of plant species that might not have been observable/detectable on site as a result of their potential annual, short-lived, dormant, cryptic, or ephemeral nature during the time of surveying, their rare and localised distributions on site, and also the incomplete and inaccurate identification of plant species which lacked flowers and/or fruits and/or other characteristic features during the time of surveying. A list of Species of Conservation Concern

known to occur in the area (as per SANBI online databases) was used to supplement the list of species recorded during the site visit(s). This final combined list is likely to be sufficiently conservative and cautious to account for the aforementioned study limitations.

3. THE IMPORTANCE OF BIODIVERSITY AND CONSERVATION

The term "biodiversity" is used to describe the wide variety (richness and abundance) of plant and animal species occurring in their natural environment or "habitat". Biodiversity not only encompasses all living things but also the series of interactions that sustain them, which are termed "ecological processes". South Africa's biodiversity provides an important basis for economic growth and development; keeping biodiversity intact is thus vital for ensuring the on-going provision of ecosystem services, for example the production of clean water through comprehensive catchment management practices. The role of biodiversity in combating climate change is also well recognised and further emphasises the key role that biodiversity management plays on a global scale (South African National Biodiversity Institute, 2019). Typical pressures that natural ecosystems face from human activities include the loss and degradation of natural habitat, invasive alien species, pollution and waste, and climate change (South African National Biodiversity Institute, 2019). High levels of infrastructural and agricultural development typically restrict the connectivity of natural ecosystems, and maintaining connectivity is considered critical for the long-term persistence of both ecosystems and species, in the face of human development and global climate change. Biodiversity loss places aspects of South Africa's economy and quality of life at risk, and reduces socioeconomic options for future generations. In essence, then, sustainable development is not possible without a healthy biodiversity.

4. STUDY AREA

4.1. Land Use

Land use within the project site is mostly for farming. Farming practices consist of livestock farming (sheep) farming with some "free" roaming small game.

Due to the aridity of the area large tracts of land is still fairly natural. Infrastructure are mostly in the form of powerlines, earthen dams, kraals, water points, boreholes, fences, twin tracks, larger dirt roads and small dwellings.

The site lies in an area considered to be a Hot Desert Climate (BWh according to Köppen-Geiger Climate Classification). The site thus falls within arid area, with a mean annual temperature of 19.4°C and a mean annual precipitation of 108mm (predominantly late summer with its peak in March).

4.2. Conservation Planning / Context

Understanding the conservation context and importance of the study area and surroundings is important to inform decision making regarding the management of the aquatic resources in the area. In this regard, available national, provincial, and regional conservation planning information was used to obtain an overview of the study site (

Table 5).

Table 5: Information and data coverages used to inform the ecological assessment.

Conservation Planning Dataset		Relevant Conservation Feature	Location in Relationship to Project Site	Conservation Planning Status
NATIONAL LEVEL CONSERVATION PLANNING	**National Protected Areas Expansion Strategy**	Focus Area	Two NPAES Focus Areas include portions of the project site: » A total of 43% of the project site falls within the focus areas. » However, according to the current layout only a small portion will be directly impacted by the Pofadder WEF1 Development.	Both NPAES Focus Areas classified as: Kamiesberg-Bushmanland-Agurabies Focus Areas
	Protected Areas and Conservation Areas (PACA) Database	South African Conservation Area (SACA) and South African Protected Area (SAPA)	Well outside of any SACA and SAPA: » Nearest SAPA (Augrabies Falls National Park) located approximately 74 km to the north-east. » Nearest SACA (Hantam National Botanical Garden) located approximately 215 km to the south.	Not Classified
	Vegetation Types	Bushmanland Arid Grassland	Vegetation of Study Area	Least Threatened
		Bushmanland Basin Shrubland		Least Threatened
		Bushmanland Inselberg Shrubland		Least Threatened
	Threatened Ecosystems	Not listed	N/A	N/A

Conservation and Distribution Context	**NCBSP: Critical Biodiversity Areas**	Ecological Support Areas ESA1	» Larger Non-FEPA River Features and 500m buffer areas. » A total of 4% of the project site is classified as ESA. » Only one turbines and a very limited extent of access roads and cabling located within ESA.	ESA
		Other Natural Areas	» Natural vegetation representative of • Bushmanland Arid Grassland; • Bushmanland Basin Shrubland; • Remaining extent of Bushmanland Inselberg Shrubland not included within the CBA1. » Remainder of the project site	Other

4.2.1. National Protected Areas Expansion Strategy

Land-based protected area expansion targets include large, intact, and unfragmented areas of high importance for biodiversity representation and ecological persistence, which are suitable for the creation or expansion of large protected areas. Such areas were identified through a systematic biodiversity planning process undertaken as part of the development of the National Protected Area Expansion Strategy 2008 (NPAES). They present the best opportunities for meeting the ecosystem-specific protected area targets set in the NPAES, and were designed with a strong emphasis on climate change resilience and requirements for protecting terrestrial and freshwater ecosystems (FEPA: Freshwater Ecosystem Priority Areas). These areas should not be seen as future boundaries of protected areas, since in many cases only a portion of a particular focus area would be required to meet the protected area targets set in NPAES. They are also not a replacement for fine-scale planning, which may identify a range of different priority sites based on local requirements, constraints, and opportunities.

Two NPAES Focus Areas include portions of the project site. Both of these focus areas are classified as Kameisberg-Busmanland-Augrabies Focus Areas and are 13862- and 24933 hectares in size respectively (Figure 6). Four- and two percent of these focus areas are, respectively, located within the project site respectively. Furthermore, 43.1% of the project site falls within the focus areas. However, according to the current layout only a small portion will be directly impacted by the Pofadder WEF 1 Development.

Furthermore, due to the nature of this type of development, the integrity and conservation targets set out for these Focus Areas will not be threatened.

However, mitigation measures should still be considered for the development of the WEF within these focus areas, as these areas may still be considered as valuable and contribute to

the national conservation targets (even with the development of the WEF): Thus, the following management plans and mitigation measures should be considered;

- » Storm Water and Erosion Management Plan;
- » A Plant Rehabilitation and Invasive Alien Plant Management Plan;
- » Mitigation measures that allow/maintain landscape connectivity.

In terms of Protected (SAPA) and Conservation (SACA) Areas, the site is not located within any SACAs and SAPAs. The nearest SAPA (Augrabies Falls National Park) is located approximately 74 km to the north-east, whilst the nearest SACA (Hantam National Botanical Garden) is located approximately 215 km to the south.

The proposed development won't have an impact on any protected- and conservation areas and will furthermore, with the implementation of applicable mitigation measures, not have a significant impact on national conservation focus areas and targets.

4.2.2. National Level of Conservation Priorities (Threatened Ecosystems)

South Africa's vegetation types have been assigned a conservation status according to their respective degrees of transformation and rates of conservation. The conservation status of a habitat or vegetation type is based on the amount of its original area that currently remains intact relative to various thresholds. On a national scale, these thresholds are arranged from Least Threatened to Critically Endangered (Figure 5), as determined by the best available scientific approaches (Driver et al., 2005; South African National Biodiversity Institute, 2019). The level at which an ecosystem becomes Critically Endangered depends on biodiversity targets, and therefore differs from one ecosystem to another, varying from 16% to 36%.

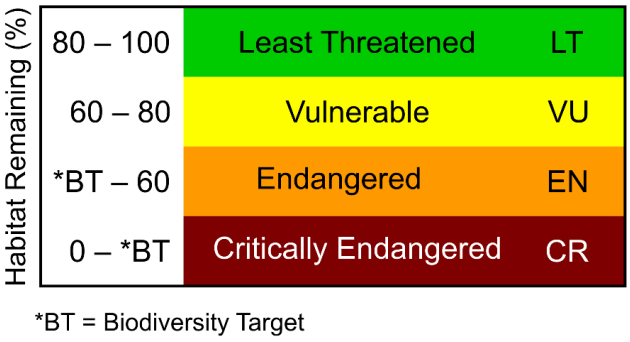


Figure 5: Ecosystem threat status categories (Driver et al., 2005). The biodiversity target represents the minimum conservation requirement.

Nationally, threatened ecosystems that are currently under threat of being transformed by other land uses have been identified and listed. The first national list of threatened terrestrial ecosystems for South Africa was gazetted on 9 December 2011 (NEM:BA National list of ecosystems that are threatened and in need of protection, G 34809, GoN 1002, 9 December

2011). The primary purpose of listing threatened ecosystems is to reduce the rate of ecosystem and species extinction by preventing further degradation and loss of structure, function, and composition of threatened ecosystems (SANBI, 2011). NEM:BA lists threatened or protected ecosystems in one of five categories: Critically Endangered (CR), Endangered (EN), Vulnerable (VU), or protected; Least Threatened ecosystems are not listed. There are four main implications of listing ecosystems:

- » Planning related implications which are linked to the requirement in the Biodiversity Act (Act 10 of 2004) for listed ecosystems to be taken into account in municipal IDPs and SDFs;
- » Environmental authorisation implications in terms of NEMA and the EIA regulations;
- » Proactive management implications in terms of the National Biodiversity Act;
- » Monitoring and reporting implications in terms of the Biodiversity Act.

The site includes three vegetation types, as currently mapped by the National Vegetation Map 2018 (see section 5.1.1 as well as Figure 6), namely;

- » Bushmanland Arid Grassland,
- » Bushmanland Basin Shrubland,
- » Bushmanland Inselberg Shrubland, and

All three vegetation types are listed as Least Threatened (Figure 6), and thus no listed ecosystems occur on site.

Bushmanland Arid Grassland: The unit is classified as Least Threatened with a target of protection of 21%. Very little of this vegetation unit is currently protected (0.4%), however it is estimated that 99% of this vegetation unit is still intact. Only a small portion is statutorily conserved in Augrabies Falls National Park and Goegab Nature Reserve (Mucina & Rutherford, 2006). The rate of transformation is very low, however the invasive alien plant, Prosopis sp. is regarded as a potential significant threat. Erosion is generally very low (82%). The unit is currently mapped to cover an extensive area size of approximately 45479 km2 (SANBI, 2018).

Bushmanland Basin Shrubland: The unit is currently classified as Least Threatened with a conservation target of 21%, with none conserved in statutory conservation areas. However, less than 1% of this vegetation type has been lost/transformed (99.5% still intact) (Mucina & Rutherford, 2006). There are no signs of serious transformation, but Prosopis spp. can be problematic, with some dense localised infestations within this vegetation type. This vegetation type is currently mapped to cover an extensive area size of approximately 41250 km2 (SANBI, 2018).

Bushmanland Inselberg Shrubland: The unit is currently classified as Least Threatened with a conservation target of 34%. It has no statutorily conservation areas. There are no signs of serious large-scale transformation or invasive alien plants, with an estimated 99.8% of this vegetation type still intact (Mucina & Rutherford, 2006). This is the smallest of the vegetation types covered and is currently mapped to cover an area size of approximately 638 km2 (SANBI, 2018).

Table 6: Conservation status of the vegetation type occurring in and around the study area.

Vegetation Type	Target (%)	Transformed (%)	Conserved (Statutorily & other reserves)	Conservation Status	
				Driver *et al.*, 2005; Mucina & Rutherford, 2006	National Ecosystem List (NEMA:BA)
Bushmanland Arid Grassland	21%	1%	0.4%	Least Threatened	Not Listed
Bushmanland Basin Shrubland	21%	0.5%	0%	Least Threatened	Not Listed
Bushmanland Inselberg Shrubland	34%	0.2%	0%	Least Threatened	Not Listed
Namaqualand Klipkoppe Shrubland	28%	5%	5.8%	Least Threatened	Not Listed

It is highly unlikely that this development will have an impact on the status of the Ecosystems as well as Vegetation Types.

- Due to the vast extent of intact, natural vegetation still present within all four mentioned vegetation types;
- Due to the extent and nature of the development.

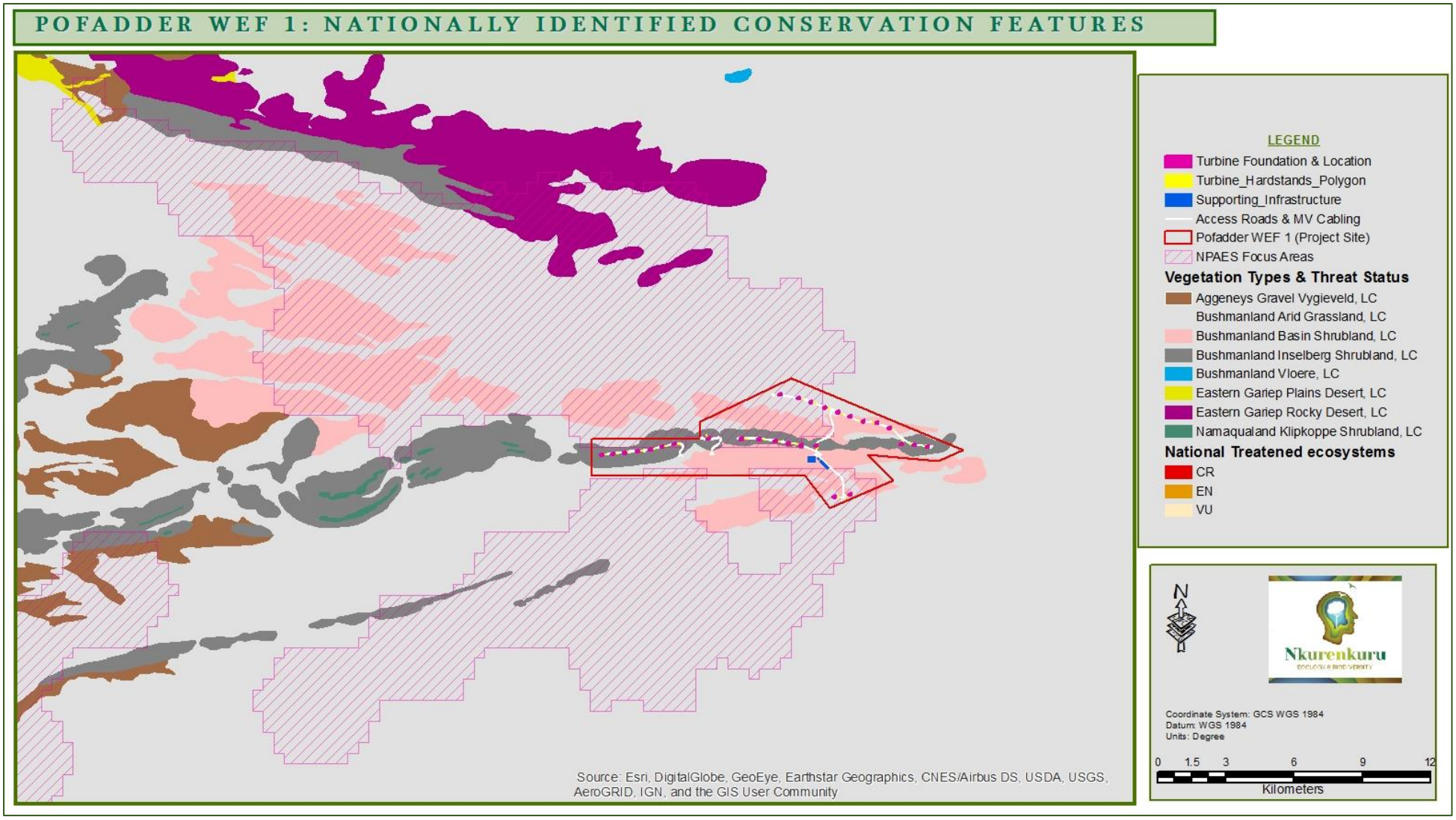


Figure 6: Nationally identified conservation priority areas found within the greater surroundings of the Pofadder 1 WEF.

Conservation Planning / Context

Critical Biodiversity Areas (CBA) have been identified for all municipal areas of the Northern Cape Province and are published by SANBI (http://bgis.sanbi.org/). This biodiversity assessment identifies CBAs representing biodiversity priority areas that should be maintained in a natural to near-natural state. CBA maps show the most efficient selection and classification of land portions to be safeguarded so that ecosystem functioning is maintained and national biodiversity objectives are met (see Table 7 for CBA land management objectives).

Table 7: Relationship between Critical Biodiversity Areas categories (CBAs) and land management objectives.

CBA category	Land Management Objective
Protected Areas (PA) & CBA 1	***Natural landscapes:*** » Ecosystems and species are fully intact and undisturbed. » Areas with high irreplaceability or low flexibility in terms of meeting biodiversity pattern targets. If the biodiversity features targeted in these areas are lost then targets will not be met. » Landscapes that are at or past their limits of acceptable change.
CBA 2	***Near-natural landscapes:*** » Ecosystems and species largely intact and undisturbed. » Areas with intermediate irreplaceability or some flexibility in terms of the area required to meet biodiversity targets. There are options for loss of some components of biodiversity in these landscapes without compromising the ability to achieve targets. » Landscapes that are approaching but have not passed their limits of acceptable change.
ESA	***Functional landscapes:*** » Ecosystem moderately to significantly disturbed but still able to maintain basic functionality. » Individual species or other biodiversity indicators may be severely disturbed or reduced. » Areas with low irreplaceability with respect to biodiversity pattern targets only.
ONA (Other Natural Areas) and Transformed	***Production landscapes***: » Manage land to optimise sustainable utilisation of natural resources.

The majority of the project site has been classified as Other Natural Areas (ONAs) (96%), whilst only 4% of the project site is listed as ESA (Figure 7). A description of the biodiversity categories located within the project site as well as the features underlying these categories and remarks based on a detailed site visit, are provided below in Table 8 below.

Table 8: Reasons underlying the CBA1 and CBA2 status of the affected property.

Feature	CBA 1	CBA 2	ESA	Other	Remarks
Larger River Features (1:500 000) and 500m Buffers			**X**		» The Non-FEPA river flowing in a north-eastern direction (across the eastern portion of the project site), as well as its 500m buffer areas. » All primary and larger ephemeral washes and alluvial floodplains along with their buffer areas have been classified either as Very High or High Sensitive areas that should be regarded as "No-Go" areas. » 100m Buffers around the primary and larger ephemeral washes was determined to be acceptable, and will allow for the persistence of the current present ecological status as well as functions and services provided by these aquatic features. » According to the current layout, very limited infrastructure is planned within this ESA, as well as any other freshwater resource features: • Only one turbine planned within the associated 500m buffer area. » Furthermore, a small portion of ESA will be impacted through the use/construction of access routes and the lying of underground cabling. » The following recommendations are provided regarding development within or near these larger watercourse features: • The use/upgrade of existing roads and watercourse crossings is acceptable and should be the preferred options (rather than the construction of new road infrastructure); • Where no suitable existing roads and watercourse crossings exist, the construction of new access roads and watercourse crossings can be allowed, however this should be deemed as a last resort. • All underground cabling should be laid either within access roads or next to access roads (as close as possible). • Any other activities and infrastructure, other than the above-mentioned infrastructure (roads and cabling), may not occur/be located within these watercourse features as well as their associated buffer areas. ▪ Subsequently, these watercourse features and their associated buffers should be regarded as "No-Go" areas for these activities and infrastructure. ▪ The pylon located within the Non-FEPA watercourse (ESA) is relocated to an acceptable area outside of the watercourse as well as its associated 100m buffer area.

					» With the implementation of the above-mentioned recommendation measures, it is highly unlikely that the proposed development will threaten the ESA as well as the other delineated watercourse features' integrity, as well as functions and services.

According to the current layout of the Pofadder 1 WEF, a very limited area of ESA will be impacted. It is unlikely that this development will have a significant impact on this ESA located within the project site, and it is furthermore highly unlikely that this development will impact the province's conservation targets.

The majority of activities will be restricted within the ONAs, and based on the findings of the screening survey, development within these ONAs are regarded as acceptable

With the necessary mitigation measures in place the impacts associated with the proposed development will be reduced even furthermore. Refer to Sections 7, 8 & 9 for a description of the site sensitivity and suitability.

To conclude, based on the screening site-visit, no CBA1 or CBA2 will be impacted. Furthermore, a very small/limited impact is planned to occur within an ESA and will lead to a very limited loss of ESA (with the necessary mitigation measures in place). However, this loss of ESA is regarded as acceptable and will not threaten the province's conservation targets.

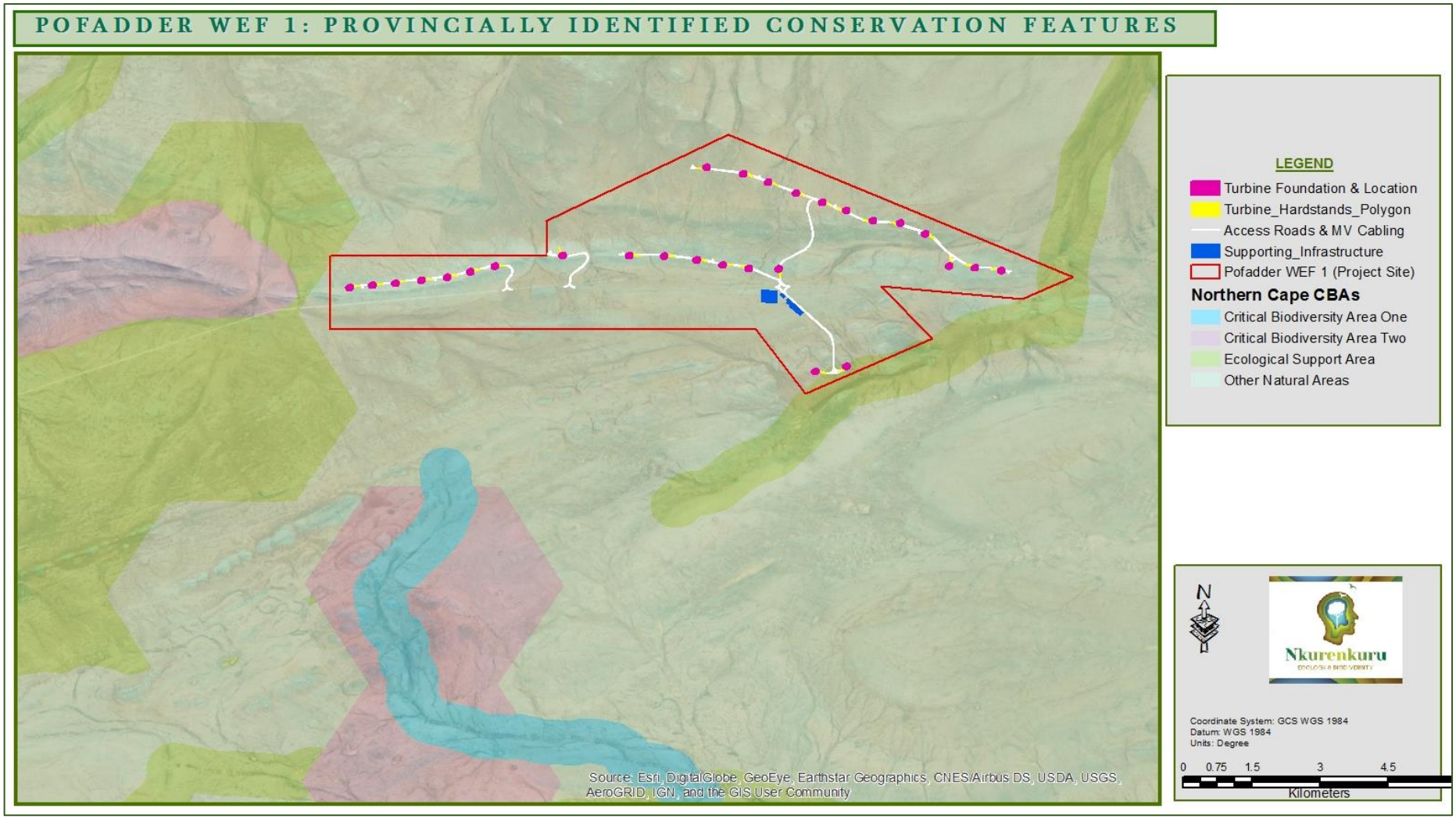


Figure 7: Critical biodiversity areas (CBA) found within the project site for the Pofadder WEF1 development.

5. BASELINE ASSESSMENT RESULTS

5.1. Botanical Screening Assessment

5.1.1. Broadscale Vegetation Patterns: National Vegetation Map of Southern Africa

This section deals with vegetation types as described in the National Vegetation Map of Southern Africa, which will be used interchangeably with the term "VegMap" ((Dayaram, et al., 2019), (SANBI, 2018), (Mucina & Rutherford, 2006); these references are the rest of this section).

The largest portion of the project site has been classified as Bushmanland Arid Grassland (81.2%). Bushmanland Basin Shrubland is mostly confined to the deeper sandier pediments surrounding the narrow ridge system, and only cover approximately 12.5% of the site. The narrow, west to east running ridge located within the northern portion of the site has been classified as Bushmanland Inselberg Shrubland and covers an area of around 6.4%. Namakwa Klipkoppe Shrubland is the smallest vegetation unit within the project site and cover less than 1% of the project site (Table 9 and Figure 6).

Table 9: Total area sizes (approximately) for vegetation types as mapped by the National Vegetation Map 2018.

Vegetation Type	Total extent (km^2)	Total area within project site (km^2)	Total area of vegetation unit being impacted (%)
Bushmanland Basin Shrubland	41251	13.256	0.0006%%
Bushmanland Arid Grassland	45479	20.909	0.0008%
Bushmanland Inselberg Shrubland	638	11.285	0.009%

Due to the vast extent of intact, natural vegetation still present within all three mentioned vegetation types and the fact that only a very small extent of these vegetation types are located within the project site along with the fact that the development footprint itself will be much smaller, it is highly unlikely that this development will have an impact on the status and conservation targets set out for these vegetation types.

During the site-visit it was found that the VegMap provide a relatively rough reflections of the vegetation patterns found within the project site, with is slightly more heterogenous than the VegMap suggests. The primary drivers of vegetation differentiation at the site are edaphic and soil moisture. Rocky outcrops, ridges, koppies, drainage lines alluvial washes and floodplains all contribute to the heterogeneity of the site, especially within the northern half of the project site. These areas tend to accommodate different plant species compositions, then that of the adjacent plains. A general habitat map has been compiled, based on the finding of the site visit, and is illustrated in Figure 8. A more detailed description of the vegetation units/communities characterizing the various habitat types are provided in Section 9.

(i) Bushmanland Arid Grassland

This unit falls within the Nama-Karoo Biome and Bushmanland and West Griqualand Bioregion and occurs in the Northern Cape Province between Aggeneys in the west to Prieska in the east. The Southern border of the unit is formed by edges of the Bushmanland Basin while in the north-west this vegetation unit borders on desert vegetation. The northern border (in the vicinity of Upington) and the eastern border (between Upington and Prieska) are formed with often intermingling units of Lower Gariep Broken Veld, Kalahari Karroid Shrubland and Gordonia Duneveld. The unit has an altitudinal range of 600 m – 1200 m, and is characterised by extensive to irregular plains on a slightly sloping plateau sparsely vegetated by grassland dominated by white grasses (Stipagrostis species). In places low shrubs of Salsola change the vegetation structure.

A third of the area is covered by recent (Quaternary) alluvium and calcrete. Superficial deposits of Kalahari Group are also present in the east. The extensive Palaeozoic diamictites of the Dwyka Group also outcrop in the area as do gneisses and metasediments of Mokolian age. The soils of most of the area are red-yellow apedal soils, freely drained, with high base status and moderately to shallow in depth (<300 mm). Only about one fifth of the area may contained soils deeper than 300 mm. Soils are typical of the Ag and Ae land types.

The unit is arid with a Mean Annual Precipitation (MAP) of around 70 mm in the west to 200 mm in the east, peaking in late summer/early autumn. The Mean Annual Temperature (MAT) is 17.4°C with a frost incidence of around 10 days in the northwest to about 35 days in the east. Whirl winds are common on hot summer days.

Table 10: *Key species associated with Bushmanland Arid Grassland.*

DOMINANT SPECIES	
Growth Form (d = Dominant)	**Key Species**
Succulent Shrubs	*Kleinia longiflora, Lycium bosciifolium, Salsola tuberculata, Salsola glabrescens,*
Low shrubs	*Aptosimum spinescens, Hermannia spinosa, Pentzia spinescens, Aizoon asbestinum, Aizoon schellenbergii, Aptosimum elongatum, Aptosimum lineare, Aptosimum marlothii, Barleria rigida, Berkheya annectens, Blepharis mitrata, Eriocephalus ambiguus, Eriocephalus spinescens, Limeum aethiopicum, Lophiocarpus polystachyus, Monechma incanum, Monechma spartioides, Pentzia pinnatisecta, Phaeoptilum spinosum, Polygala seminuda, Pteronia leucoclada, Pteronia mucronata, Pteronia sordida, Rosenia humilis, Senecio niveus, Sericocoma avolans, Solanum capense, Talinum arnotii, Tetragonia arbuscula, Zygophyllum microphyllum*
Small Tree	*Acacia mellifera subsp. detinens, Boscia foetida subsp. foetida*
Tall Shrubs	*Lycium cinereum* (d), *Rhigozum trichotomum* (d), *Cadaba aphylla, Parkinsonia africana*
Herbs	*Acanthopsis hoffmannseggiana, Aizoon canariense, Amaranthus praetermissus, Barleria lichtensteiniana, Chamaesyce inaequilatera, Dicoma capensis,*

	Indigastrum argyraeum, Lotononis platycarpa, Sesamum capense, Tribulus pterophorus, Tribulus terrestris, Vahlia capensis
Geophytic Herbs	*Moraea venenata*
Succulent Herbs	*Gisekia pharnaceoides, Psilocaulon coriarium, Trianthema parvifolia*
Graminoids	*Aristida adscensionis* (d), *Aristida congesta* (d), *Enneapogon desvauxii* (d), *Eragrostis nindensis* (d), *Schmidtia kalahariensis* (d), *Stipagrostis ciliata* (d), *Stipagrostis obtusa* (d), *Cenchrus ciliaris, Enneapogon scaber, Eragrostis annulata, Eragrostis porosa, Eragrostis procumbens, Panicum lanipes, Setaria verticillata, Sporobolus nervosus, Stipagrostis brevifolia, Stipagrostis uniplumis, Tragus berteronianus, Tragus racemosus*
BIOGEOGRAPHICALLY IMPORTANT SPECIES	
Growth Form	**Key Species**
Succulent Herbs	*Tridentea dwequensis*
ENDEMIC SPECIES	
Growth Form	**Key Species**
Succulent Shrubs	*Dinteranthus pole-evansii, Larryleachia dinteri, Larryleachia marlothii, Ruschia kenhardtensis*
Herbs	*Lotononis oligocephala, Nemesia maxii*

(ii) Bushmanland Basin Shrubland

This unit falls within the Nama-Karoo Biome and Bushmanland and West Griqualand Bioregion and is distributed in the Northern Cape Province with the large Bushmanland Basin centred on the Brandvlei and Van Wyksvlei area, spanning from Granaatboskolk in the west to Copperton in the east, and Kenhardt in the north to Williston in the south. Its altitudinal range is 800 m – 1 200 m, and it is characterised by slightly irregular plains with dwarf shrubland dominated by a mixture of low sturdy and spiny shrubs (Rhigozum, Salsola, Pentzia, Eriocephalus), "white" grasses (Stipagrostis), as well as abundant annuals, when rains are good, such as Gazania and Leysera.

Mudstones and shales of the Ecca Group (Prince Albert and Volksrust Formations) and Dwyka tillites predominate in this unit. Soils are shallow Glenrosa and Mispah forms, with lime often present (Fc land type), as well as some occasional red-yellow apedal, freely drained soils with a high base status and usually <15% clay (Ah and Ai land types). These soils have a very high salt content.

Rainfall occurs in late summer and early autumn, in contrast to the winter rainfall units, and MAP is about 100 – 200 mm, with high maximum monthly temperatures of about 39.6°C.

The unit is currently classified as Least Threatened with a conservation target of 21%, with none conserved in statutory conservation areas, but the total extent of the unit is extensive. Luckily, there are no signs of serious transformation, but Prosopis spp. can be problematic, with some dense localised infestations along the eastern border of the unit

with Northern Upper Karoo (east of Van Wyksvlei). Erosion is moderate (56%) and low (34%).

A number of endorheic pans (vloere) and extensive systems of intermittent river channels (including that of the Sak River) occur in this unit. In comparison to the bordering Bushmanland Arid Grassland in the north, the Bushmanland Basin shows an increased presence of shrubs (especially succulents) and plants indicative of the high salt content of the soil.

Table 11: Key species associated with Bushmanland Basin Shrubland.

DOMINANT SPECIES	
Growth Form (d = Dominant)	**Key Species**
Tall Shrubs	*Lycium cinereum (d), Rhigozum trichotomum (d). Low Shrubs: Aptosimum spinescens (d), Hermannia spinosa (d), Pentzia spinescens (d), Zygophyllum microphyllum (d), Aptosimum elongatum, A. marlothii, Berkheya annectens, Eriocephalus microphyllus var. pubescens, E. pauperrimus, E. spinescens, Felicia clavipilosa subsp. clavipilosa, Limeum aethiopicum, Osteospermum armatum, O. spinescens, Pegolettia retrofracta, Phaeoptilum spinosum, Plinthus karooicus, Polygala seminuda, Pteronia glauca, P. inflexa, P. leucoclada, P. mucronata, P. sordida, Rosenia humilis, Selago albida, Senecio niveus, Tetragonia arbuscula, Zygophyllum lichtensteinianum.*
Succulent Shrubs	*Salsola tuberculata (d), Aridaria noctiflora subsp. straminea, Brownanthus ciliatus subsp. ciliatus, Galenia sarcophylla, Lycium bosciifolium, Ruschia intricata, Salsola namibica, Sarcocaulon patersonii, S. salmoniflorum, Tripteris sinuata var. linearis, Zygophyllum flexuosum.*
Semiparasitic Shrub	*Thesium hystrix.*
Herbs	*Gazania lichtensteinii (d), Leysera tenella (d), Amaranthus praetermissus, Chamaesyce inaequilatera, Dicoma capensis, Indigastrum argyraeum, Lepidium desertorum, Monsonia umbellata, Radyera urens, Sesamum capense, Tribulus terrestris, T. zeyheri.*
Succulent Herbs	*Mesembryanthemum crystallinum, M. stenandrum, Trianthema parvifolia, Zygophyllum simplex.*
Graminoids	*Aristida adscensionis (d), Enneapogon desvauxii (d), Stipagrostis ciliata (d), S. obtusa (d), Aristida congesta, Enneapogon scaber, Stipagrostis anomala, Tragus berteronianus, T. racemosus.*
BIOGEOGRAPHICALLY IMPORTANT SPECIES (BUSHMANLAND ENDEMIC)	
Growth Form	**Key Species**
Succulent Herb	*Tridentea dwequensis.*
ENDEMIC SPECIES	
Growth Form	**Key Species**
Herb	*Cromidon minutum.*
Geophytic Herbs	*Ornithogalum bicornutum, O. ovatum subsp. oliverorum.*

(iii) Bushmanland Inselberg Shrubland

This unit is located within the Succulent Karoo Biome and the Richtersveld Bioregion and is distributed in the Northern Cape Province where it is restricted to a group of prominent solitary mountains (inselbergs) and smaller koppies towering over surrounding flat plains, predominantly within the northern Bushmanland in the Aggeneys and Pofadder regions. It has an altitudinal range of 600 m – 1 180 m, with most of this vegetation type located between 700 m and 1 120 m.

The vegetation of this unit is of extrazonal nature and is part of the Succulent Karoo embedded within a region with transitional winter/summer -rainfall regime of the surrounding Bushmanland Arid Grassland. The unit is characterised by a shrubland containing both succulent (Aizoaceae, Asphodelaceae, Crassulaceae, Didiereaceae, Euphorbiaceae, Zygophyllaceae) as well as no succulent (mainly Asteraceae) elements and with sparse grassy undergrowth (Aristida, Eragrostis, Stipagrostis) on steep slopes of the iselbergs.

Inselbergs of high-grade metamorphic rocks on a broad alluvial plain consist of clastic sediments, volcanics and intrusive rocks of Mokolian age that were metamorphosed during the Namaqualand Metamorphic Event. Ib and IC land types are dominant in the area.

The unit has erratic and very low patterns (MAP below 100 mm, range 70-120 mm), occurring mainly in the form of thunderstorms in late summer from February to April. Around 20 days of frost per year (range 10-30 days). MAT is 16.9 °C with a high incidence of frost.

Table 12: Key species associated with Bushmanland Inselberg Shrubland.

DOMINANT SPECIES	
Growth Form (d = Dominant)	**Key Species**
Succulent Shrubs	*Adromischus diabolicus, Euphorbia gregaria, Ihlenfeldtia vanzylii, Ruschia divaricata, Schwantesia pillansii, Tylecodon sulphureus, Tylecodon sulphureus, Euphorbia gariepina, Kleinia longiflora, Othonna euphorbioides, Psilocaulon subnodosum, Tetragonia reduplicata, Tylecodon rubrovenosus,*
Tall Shrub	*Boscia foetida*
Low Shrubs	*Eriocephalus pauperrimus, Pteronia unguiculata*
Woody Climber	*Sarcostemma viminale*
Herbs	*Acanthopsis hoffmannseggiana*
Succulent Herbs	*Anacampseros baeseckei, Anacampseros karasmontana, Avonia ruschii, Conophytum fulleri, Avonia quinaria subsp. alstonii, Conophytum marginatum var. haramoepense*
Graminoids	*Aristida adscensionis, Eragrostis annulata, Stipagrostis obtusa*
BIOGEOGRAPHICALLY IMPORTANT SPECIES	

Growth Form	Key Species
Succulent Shrub	*Ceraria fruticulosa, Cheiridopsis pillansii, Hoodia alstonii*
Geophytic Herb	*Whiteheadia bifolia*
ENDEMIC SPECIES	
Growth Form	**Key Species**
Geophytic Herbs	*Huernia barbata subsp. ingeae*

5.1.2. POSA Plant Species Observations

A list was obtained from the SANBI database (POSA — Plants of southern Africa; http://posa.sanbi.org/) containing all plant species that have been recorded to date from the surroundings of the study area. POSA generated species lists also contain updated Red Data information according to the Red List of South African Plants (Raimondo et al., 2009; updated online version: http://redlist.sanbi.org/). Species listed as protected were also identified in the list. Therefore, only SoCC that may potentially occur in the study area have been listed within the baseline study section of this report. The field surveys were aimed at confirming which of these species actually occur within the study area, and also whether any additional species that may not yet have been recorded in official databases, are present on site (see section 7.2).

According to the SANBI database a total of 116 species have been recorded within the broader area based on the online plant search. Of this, Asteraceae was the most prominent (25 species), followed by Aizoaceae with 14 species and then Poaceae with 12 species. This list comprised of 111 indigenous species, of which fourteen are South African Endemics namely

- *Conophytum fulleri,*
- *Conophytum praesectum,*
- *Drosanthemum latipetalum,*
- *Ihlenfeldtia excavata,*
- *Tetragonia nigrescens,*
- *Gazania jurineifolia,*
- *Othonna auriculifolia,*
- *Wahlenbergia divergens,*
- *Tylecodon sulphureus,*
- *Calobota lotononoides,*
- *Limeum aethiopicum,*
- *Nemesia maxii,*
- *Zaluzianskya sanorum,*
- *Tetraena chrysopteros*

Furthermore, one alien plant species was recorded within the extracted area, and furthermore this species is also listed as an invasive species within NEM:BA Act No. 10 of 2004 (Alien and Invasive Species List, 2016) namely:

» *Salsolla kali* (Category 1b)

5.1.3. Species of Conservation Concern

Only one Red List species were present in the list obtained online from the SANBI POSA database, namely *Calobota lotonoides*. However, 22 protected species were listed (Table 13), all of them under Schedule 2 of the Northern Cape Nature Conservation Act No. 9 of 2009. Also, the online screening report revealed the occurrence of three other Species of Conservation Concern (Sensitive Species), namely Species 1157, 854 and 144; these species will not be made public in order to protect them from illegal activities.

Table 13: Species of Conservation Concern that have been recorded within the broader region surrounding the study site, as per the SANBI POSA online database.

Family	Species	Status	Likelihood of Occurance
Fabaceae	Calobota lotonoides	Near Threatened	Low
Aizoaceae	Conophytum fulleri	Protected & Range Restricted	Moderate - High
Aizoaceae	Conophytum praesectum	Protected & Range Restricted	Moderate
Aizoaceae	Conophytum sp.	Protected	
Aizoaceae	Drosanthemum latipetalum	Protected	Confirmed
Aizoaceae	Galenia sarcophylla	Protected	High
Aizoaceae	Ihlenfeldtia excavata	Protected	High
Aizoaceae	Mesembryanthemum crystallinum	Protected	High
Aizoaceae	Psilocaulon sp.	Protected	
Aizoaceae	Ruschia sp.	Protected	
Aizoaceae	Tetragonia arbuscula	Protected	Moderate
Aizoaceae	Tetragonia nigrescens	Protected	High
Aizoaceae	Trianthema parvifolia	Protected	High
Aizoaceae	Trichodiadema pomeridianum	Protected	Low
Amaryllidaceae	Hessea speciosa	Protected	Low
Anacampserotaceae	Anacampseros albissima	Protected	Confirmed
Apocynaceae	Fockea comaru	Protected	Moderate - High
Apocynaceae	Gomphocarpus filiformis	Protected	Confirmed

6. FINDINGS OF THE BOTANICAL ASSESSMENT

6.1. Site Specific Vegetation Description – Fine Scale Vegetation Patterns

In this section, the different habitats and vegetation patterns observed within the study site are described. As these are field-based observations taken directly from the site, they are of greater reliability and pertinence than the coarsely mapped results of the National Vegetation Map, which does not represent the finer details of the site adequately.

At the time of the survey, the area was still fairly dry, even though the area has received some precipitation prior to the site surveys. Subsequently the vegetation was in a fairly

poor condition preceding a prolonged drought, however the area was in the process of recovering somewhat as a result of a few good late summer/autumn downpours. The majority of the expected species were either absent or grazed short. Similarly, many of the dwarf shrubs were without any foliage and only a few were flowering. It can thus be expected that several additional species, mostly annuals and species resprouting from underground storage organs, can emerge throughout the study area during the following rainfall season.

Vegetation associations identified during this study are based on the overall similarity in vegetation structure, species composition, and abiotic features such as rivers, sand, inselbergs and quartz patches. However, phytosociological differences within each broadly grouped habitat/vegetation association is present. Vegetation associations occur in intricate mosaics throughout the study area, with edges of vegetation units generally very vague. Local species composition is primarily influenced by soil depth, soil surface texture and underlying geology. There is also a large degree of species overlap between the mapped edges of vegetation associations identified.

Briefly: a total of 109 plant species were found on site, which consisted of, 14 protected, 2 Northern Cape endemic, 11 alien, and 1 invasive species.

Table 14: Total area sizes (approximately) for the fine scale mapped vegetation types on Kluitjieskraal.

Vegetation Type	Total Area (ha)	Total Area (%)
Bushmanland Inselberg Shrubland (SKr18)		
Linear Ridge (mid and lower slopes) & smaller isolated ridges	1278.302	26.43
Linear Ridge (Upper slopes and steeper south facing slopes - structurally complex portions of Linear Ridge	143.92	3.05
Quartzite Outcrops	179.245	3.79
Subtotal	**1601.459**	**33.89%**
Bushmanland Arid Grassland (NKb3)		
Sandy Plain	211.838	4.48%
Irregular Plains	2648.86	56.05%
Subtotal	**2860.698**	**60.54%**
Washes and Drainage Features (Azonal)		
Drainage Lines	67.96	1.44%
Ephemeral Washes	189.16	4%
Depression Wetlands	0.395	0.01%
Subtotal	**257.515**	**5.45%**
Total	***4719.67***	***99.88%***

Table 15: Plant species summary statistics for the vegetation types found within the Pofadder Cluster Project Site. Unique species are those that were only found in the vegetation type in question, and not in the others. Shared species are species of the specific vegetation type that were shared with one or more of the other vegetation types. Thus, since some species were found in more than one vegetation type, the "Total" species numbers given below are not necessarily unique to each type. "Other" includes disturbed areas (e.g., manmade dams, kraals, etc.) that did not conform to specific vegetation types. VegType = Vegetation type (see text for vegetation type names); NCE = Northern Cape Endemic; NEM:BA = NEM:BA Alien and Invasive Species Regulations; N/A = Not Applicable.

	Total	Unique	%Unique	Shared	Red List	Protected	NCE	Alien	NEM:BA
VegType									
SKr18	57	37	65%	20	0	12	1	0	0
NKb3	36	14	39%	22	0	4	0	1	1
Azonal	42	24	57%	18	0	3	1	5	3
Other	7	7	100%	0	0	0	0	6	1
Site Totals									
	109	**N/A**	**N/A**	**N/A**	**0**	**15**	**2**	**11**	**1**

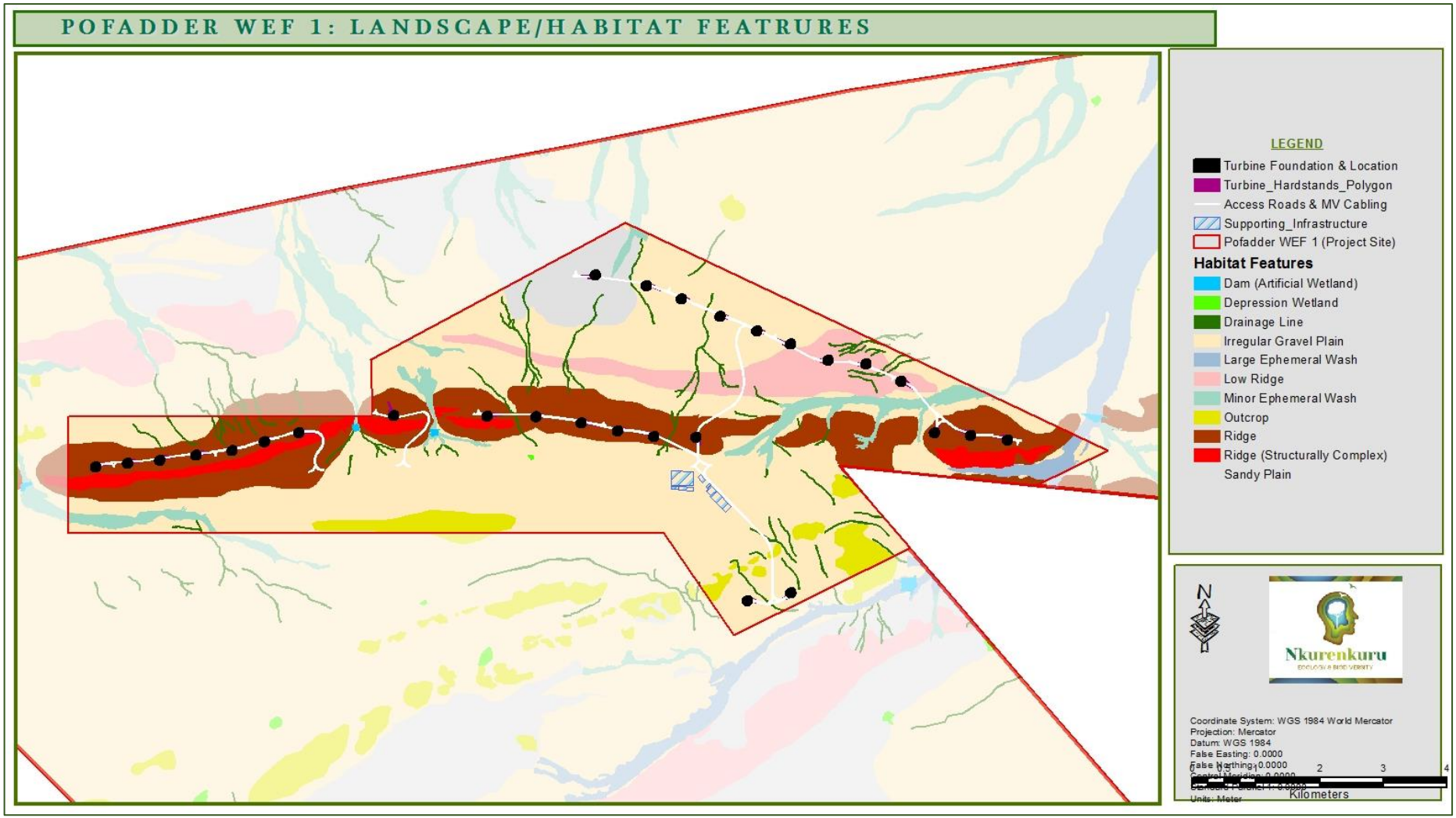


Figure 8: Landscape/habitat features found within the project site for the Pofadder WEF1 development.

6.1.1. Bushmanland Arid Grassland

Grassy plains are a distinctive feature of the region and the plains in the west and north of the study area. Bushmanland Arid Grassland was the largest vegetation type found on site, and include most of the areas that have been classified as Bushmanland Basin Shrubland within the National VegMap (2018). In total more than half of the site consisted of this unit (2860.698 ha; 60.54%). This vegetation type mainly occupies the flat (0-2% slope), low lying plains, covered by red sands of varying depth (±30 – 50cm). This vegetation type is fairly moderately covered by vegetation (60% coverage), and is dominated by graminoids/grasses (55% - 75% of the total vegetation coverage), mainly *Stipagrostis* and *Aristida* species. Spatial variation within this vegetation type has been found, with edaphic factors such as soil depth and the percentage coverage of surface stones and gravels being the primary driving factors. The arid grasslands were grazed with fairly high localised overgrazing noted in some areas.

The slightly higher lying (elevated) and more irregular slopes (Irregular Plains Habitat) are most exposed to wind and the sand here tends to be reduced to a fairly uniform and continuous covering of shallow red sand, comprising some surface stones and gravels, and with the underlying calcrete hardpan exposed sporadically. This habitat is characterized by a prominent grass layer (60%); however, dwarf shrubs are more diverse and contribute approximately 33% of the total vegetation coverage (compared to the Sandy Plains). Furthermore, this habitat is characterised by a fairly uniform and continuous dominance of four species, namely *Stipagrostis brevifolia, S. obtusa* and *S. ciliata* and the shrub *Rhigozum trichotomum*. Other dwarf shrubs frequently recorded within this habitat type include; *Asparagus capensis, Monechma incanum, Lebeckia spinescens, Asparagus retrofractus, Zygophyllum retrofactum Eriocephalus microphyllus var. pubescens,* with occasional larger *Lycium pumilum* shrubs. Patchiness does arise where the plain is interrupted by ephemeral washes, outcrops or any drainage line or where calcrete begins to appear on the surface. Where this occurs *Rhigozum* is replaced by *Salsola aphylla* as the dominant shrub.

In mid to bottom slope areas the red sand substrate becomes deeper, with less surface gravels and stones, and takes on a distinctive undulating appearance with low sandy hummocks and eroded slacks having an amplitude of less than 0.8m (Sandy Plains). Compared to the Irregular Plains, this habitat unit contains a sparser vegetation cover (55-60% coverage compared to the 65% coverage of the Irregular Plains). Furthermore, when compared to the vegetation of the Irregular Plains, this habitat type contains a lower coverage of dwarf shrubs, whilst the grass layer is more prominent (75%). The hummocks are dominated by *Stipagrostis brevifolia* and the slacks by *S. obtusa. S. ciliata* fills in the gaps and occurs in both habitats. The only shrub of any particular prominence is *Rhigozum trichotomum* which is restricted to the hummocks. The boundary between this vegetation unit and the previous one is quite diffuse and difficult to define precisely on the ground.

In some locations calcretes may become exposed, however exposed calcrete areas within the project site is not abundant. Much of the Bushmanland is underlain by a calcium-rich hard-pan layer of calcrete. Where ever this sand is eroded away exposes the white

calcrete horizon creating a habitat comprising a lag of calcrete pebbles and exposed solid calcrete hardpan within a matrix of red sand. The vegetation coverage of these calcrete patches a very similar to that of Irregular Plains with some minor differences.

Key plant species associated with this vegetation type include:

» *Salsola aphylla, Stipagrostis obtusa, Stipagrostis ciliata, Stipagrostis brevifolia, Stipagrostis anomala, Enneapogon desvauxii, Lebeckia spinescens, Asparagus capensis, Eriocephalus microphyllus var. pubescens, Zygophyllum retrofactum, Lycium cinereum, Gazania lichtensteinii, Heliophila cf. acuminata, Hypertelis salsoloides, Eragrostis annulata, Schmidtia kalahariensis, Rhigozum trichotomum, Galenia sarcophylla, Oxalis obtusa, Sesamum capense.*

Other plant species fairly frequently observed within this vegetation type include:

» *Monsonia parviflora, Cotula microglossa, Indigofera cf. auricoma, Eragrostis nindensis, Oropetium capense, Tribulus cf. zeyheri, Psilocaulon coriarium, Acanthopsis hoffmannseggiana, Galenia africana, Berkheya canescens, Dicoma capensis, Foveolina albida, Tephrosia dregeana, Aristida congesta subsp. congesta, Lycium prunus-spinosa, Hoodia gordonii Lycium eenii, Phaeoptilum spinosum, Hermannia spinosa, Hermannia gariepina, Aptosimum marlothii, Aptosimum spinescens, Manulea nervosa, Lyperia tristis, Tribulus cristatus, Tribulus terrestris, Arctotis leiocarpa, Dicoma capensis* and *Heliophila deserticola.*

This unit had the lowest species diversity of the vegetation types found on site: a total of 36 species were recorded, of which 22 were found only in this unit (39%) and 22 were shared with one or more of the other units. Furthermore, no highly range restricted and Red Data species were recorded within this vegetation type. Finally, a total of three protected species occurred in this unit namely; *Ebracteola fulleri, Psilocaulon coriarium, Hoodia gordonii* and *Ruschia spinosa.*

Only one alien species was observed. A few *Prosopis glandulosa* var. *torreyana*, trees/shrubs were recorded close to the larger ephemeral river. However, no transformation and no secondary vegetation was observed.

Bushmanland Arid Grassland is an extensive unit, and is currently mapped to an extent of 4 5479 km^2 (Table 9). Moreover, given its extensive area on site and its low overall number of species, more than half of which occur within other units, is the best unit within which development can proceed. However, erosion is likely be a problem in this unit given its deep and sandy soils. Subsequently this habitat (both vegetation variations) is considered medium sensitivity.

6.1.2. Bushmanland Inselberg Shrubland

This vegetation type is associated with the undulating, quartzite and quartzite-schist outcrops and ridges, with the linear quartzite ridge running through the central portion of the project site (west to east) forming the most prominent landscape feature associated with this vegetation type. Even though this ridge is fairly narrow and moderately low, it stretches across the landscape for just over 90km (to the west). Most of the other ridges and outcrops are relatively low and small in size. Spatial heterogeneity is regarded as moderate-high with north and south aspects, slopes, and varying soil and geological characteristics contributing to landscape heterogeneity.

Three main habitats can be distinguished;

- » steeper upper slopes of the linear ridge system (structurally complex portion of the linear ridge),
- » mid and lower slopes of the linear ridge as well as smaller isolated ridges, and
- » quartzite outcrops

Due to the high similarity, in vegetation, between the isolated quartzite outcrops and the less structurally complex portions of the ridges, these two features will be dealt with together.

In general, these quarzitic areas have fairly sparse vegetation coverages (30-50%) and are dominated by dwarf and succulent shrubs. Grass species are very limited within these habitats.

The upper slopes, especially the upper south facing slopes are steep and comprise larger boulders and stones. The vegetation associated with these areas are also fairly unique with some species restricted to these areas. The vegetation of this vegetation unit is characterised by leaf-succulent shrubs (*Aizoaceae and Asteraceae*) and leaf-deciduous shrubs (*Asteraceae*). Conspicuous by their absence or lack of dominance are perennial and annual grasses. This habitat type can be regarded as an outlier of Succulent Karoo vegetation. The combination of cooler, shadier slopes and availability of moisture in late autumn into winter (late summer rains with soil moisture carrying over into autumn) allow a vegetation type which differs from its surroundings.

Key plant species associated with the upper slopes of the linear ridge include:

- » *Acanthopsis hoffmannseggiana, Blepharis mitrata, Tetragonia spicata, Drosanthemum latipetalum, Phyllobolus latipetalus, Ruschia spinosa, Sericocoma avolans, Rhus undulata, Sarcostemma viminale, Berkheya canescens, Eriocephalus microphyllus var. pubescens, Eriocephalus scariosus, Euryops subcarnosus subsp. vulgaris, Felicia muricata, Osteospermum armatum, Pegolettia retrofracta, Pentzia lanata, Pteronia leucoclada, Senecio longiflora, Hirpicium alienatum, Cotyledon orbiculata var. orbiculata, Euphorbia spinea, Limeum aethiopicum subsp.*

namaense var. lanceolatum, Dyerophytum africanum, Panicum arbusculum, Hermannia spinosa, Chascanum garipense.

Other plant species fairly frequently observed within the upper slopes of the linear ridge include:

» *Monechma spartioides, Crassula muscosa var. muscosa, Crassula brevifolia subsp. brevifolia, Euphorbia gregaria, Sarcocaulon crassicaule, Stachys rugosa, Psilocaulon subnodosum, Hermbstaedtia spp., Aloidendron dichotomum, Anacampseros filamentosa, Anacampseros papyracea, Berkheya spinosissima subsp. spinosissima, Chrysocoma ciliata, Osteospermum scariosum, Othonna abrotanifolia, Senecio radicans, Adromischus alstonii, Enneapogon scaber*

The mid and lower slopes of the linear ridge as well as the other low quartzite ridges and outcrops, are still fairy heterogenous, although to a lesser extent than that of the upper slopes of the linear ridge. These areas are more gradual and contain very shallow soils, covered by quartzite gravels and stones. Large boulders and stones are scarce, however, some of the outcrops comprise of large stones. The vegetation cover is still fairly sparse, but denser than the upper slopes of the linear ridge, and is of variable composition; a mixture of low-growing grasses (*Eragrostis, Aristida, Enneapogon*); leaf-succulent karoo shrubs (*Ruschia, Drosanthemum, Psilocaulon, Euphorbia*), microphyllous and spinescent karoo shrubs (*Acanthaceae, Asteraceae*).

Key plant species associated with the mid and lower slopes of the linear ridge, quartzite outcrops and low ridges include:

» *Eragrostis nindensis, Enneapogon desvauxii, Oropetium capense, Aristida adscensionis, Chascanum garipense, Hermannia stricta, Aptosimum spinescens, Rogeria longiflora, Ruschia spinosa, Drosanthemum latipetalum, Euphorbia spinea, Euphorbia gregaria, Salsola aphylla, Rhigozum trichotomum, Helichrysum tomentosum subsp. aromaticum, Osteospermum armatum, Kleinia longiflora, Helichrysum herniarioides, Eriocephalus scariosus, Eriocephalus pauperrimus, Eriocephalus microphyllus var. pubescens, Eriocephalus ambiguus, Dicoma capensis, Aloe claviflora, Hoodia gordonii, Tetragonia nigrescens, Galenia fruticosa, Monechma spartioides, Blepharis pruinosa, Blepharis mitrata, Avonia papyracea, Anacampseros filamentosa, Sarcocaulon crassicaule,* and *Acanthopsis hoffmannseggiana.*

Other plant species fairly frequently observed within the upper slopes of the linear ridge include:

» *Monechma spartioides, Crassula muscosa var. muscosa, Crassula brevifolia subsp. brevifolia, Sarcocaulon crassicaule, Stachys rugosa, Psilocaulon subnodosum, Hermbstaedtia spp., Aloidendron dichotomum, Anacampseros filamentosa,*

Anacampseros payraceae, Berkheya spinosissima subsp. spinosissima, Chrysocoma ciliata, Osteospermum scariosum, Othonna abrotanifolia, Senecio radicans, Adromischus alstonii, Enneapogon scaber

This unit had the highest species diversity of the vegetation types found on site: a total of 57 species were recorded, of which 37 were found only in this unit (65%) and 20 were shared with one or more of the other units. A fair number of these unique species were restricted to upper, steeper slopes of the linear ridge system. Furthermore, one northern Cape endemic were found in this unit, namely *Tetragonia nigrescens*, including twelve protected species. The unit did not contain any Red List species; or highly range restricted species, however, it has the highest total number of protected species of all the vegetation types found on site.

Most of the vegetation is used for grazing. Especially the more gradual, lower slopes of the ridges have been exposed to grazing with some localised overgrazing present here and there. Several existing dirt roads as well as a few kraals, watering and feeding points have been noted withing this vegetation unit. Apart from these disturbances, and the localized patches of overgrazed areas, the remainder of the vegetation type is still in a natural state, and especially the steeper and more rugged terrain of the upper slopes have ensured that this area remain undisturbed, even form grazing. No alien plant species was observed.

A fairly sizeable part of this vegetation type occurs within the site, namely 1601.46ha (inclusive of the community variations). However, the total nationwide mapped extent of this unit is fairly moderate, covering about 638 km2. The more gradual, lower lying ridges are less sensitive to disturbances and development within these areas are acceptable. However, the upper slopes of the linear ridge as well as the quartzite outcrops scattered throughout the Bushmanland Arid Grassland, contributes to spatial heterogeneity and subsequently species and habitat diversity, within this area. Varied topography is recognised as one of the most powerful influences contributing to biodiversity. Such habitats composed of spatially heterogeneous abiotic conditions provide a greater diversity of potential niches for plants and animals than do the surrounding homogeneous landscapes.

These upper slopes of the linear ridge system and the rocky outcrops are characterised by higher spatial heterogeneity due to the range of differing aspects (north, south, and variations thereof), slopes and altitudes all resulting in differing soil (e.g. depth, moisture, temperature, drainage, nutrient content), light and hydrological conditions. Temperature and humidity regimes of microsites vary on both a seasonal and daily basis. Moist cool aspects are more conducive to leaching of nutrients than warmer drier slopes. Variation in aspect, soil drainage and elevation/altitude has been found to be especially important predictors of biodiversity. These quartzite ridges may also have a direct effect on temperature/radiation, surface airflow/wind, humidity and soil types. Ridges also influence fire in the landscape, offering protection for those species that can be described as "fire-avoiders". Due to the above-mentioned reasons, the structurally more complex, upper

slopes of the linear ridge, are regarded as more sensitive and it is recommended that this portion of the ridge be avoided as much as possible.

6.1.3. Azonal Vegetation: Washes, Drainage Features and Depressions

The low rainfall and low topography of the site means that the drainage features present are not well-developed. Typically, water drains from the low hills into the broad intervening low-lying areas and a well-defined drainage line are most often not present, but rather represents a broad area which receives runoff from the adjacent areas in which the vegetation is denser.

All of the freshwater resource features on and around the site are intermittent or ephemeral, being inundated only for brief periods each year, with periods of drought that are unpredictable in duration. Being exposed to periodic flooding, washes are naturally high disturbance habitats. Understandably the vegetation is characterized by some weedy species adapted to a high disturbance regime. Due to the arid climate, no definite riparian vegetation is present. However, the greater amount of ground water associated with these features promotes phreatophytic species (deep-rooted plants that obtain water from a permanent ground supply or from the water table), mainly large shrubs and the occasional larger tree. Alien plants most often make their appearance in the landscape in these habitats due to the high disturbance regime and availability of water.

The two alluvial floodplains or washes located to the east of the project site are regarded as the dominant drainage feature of the project site. These washes are characterised by multiple channels that traverse a floodplain, valley floor or alluvial fan. Surface water may flow along a particular channel in one year, but due to their being little topographic definition or gradient across the landscape, a parallel channel may be eroded the following year, leading to a network of channels. These larger washes are fed by numerous small drainage lines. They can be marginal in nature with discontinuous or poorly developed channels that represent swales due to poor channel development in arid areas with low rainfall, high evapotranspiration and high infiltration in areas with sandy soils. The vegetation of smaller drainage lines and washes tends to be fairly heterogeneous due to a spatially and temporally dynamic and heterogenous environment. For the most part the vegetation of smaller washes and drainage lines are most similar to that of the surrounding vegetation. Many species found growing on the surrounding plains or slopes can be found growing in the washes, usually larger specimens. The large wash systems and alluvial plains are however more heterogenous, mainly due to varying moisture gradients. These larger washes tend to also contain some of the surrounding "terrestrial vegetation" along with specialist species, those adapted to high disturbance regimes and those dependent on the water associated with washes.

Key plant species associated with the small wash systems and drainage line include:

» For drainage lines*: Plinthus cryptocarpus, Pentzia globosa, Lycium bosciifolium, Pentzia incana, Rhigozum trichotomum.*

» For small washes*: Lycium bosciifolium, Rhigozum trichotomum, Plinthus cryptocarpus, Pentzia globosa, Pentzia incana, Galenia africana, Sericocoma heterochiton, Setaria verticillata.*

Key plant species associated with the larger wash systems:

» *Rhigozum trichotomum, Lycium pumilum, Salsola rabieana, Rosenia humilis, Phaeoptilum spinosum, Asparagus bechuanicus, Stipagrostis ciliata, Salsola tuberculata, Eriocephalus pauperrimus, Pentzia incana, Plinthus cryptocarpus, Aristida congesta.*
» Areas with deeper soil deposits: *Rhigozum trichotomum, Salsola melanantha, Salsola tuberculata, Parkinsonia africana, Stipagrostis ciliata, Eriocephalus pauperrimus, Eriocephalus ericoides, Salsola namaqualandica, Lycium pumilum, Enneapogon desvauxii*

A few small to small-medium gravel dams are associated with the larger ephemeral washes, especially within the higher reaches and due to the dry and sometimes inconspicuous nature of these washes, a few dirt roads traverse these features. Most of the vegetation is used for grazing, with some localized overgrazing and trampling present. Even though the extent of invasion of alien plants are regarded as low some localised areas have been invaded by a few *Prosopis glandulosa* var. *torreyana* shrubs/small trees, together with occasional occurrences of alien *Argemone ochroleuca* subsp. *ochroleuca* and *Nicotiana glauca*.

Depression wetlands, also known as pans, form within shallowed-out basins within the flatter landscape areas and are generally closed systems that are inward draining (endorheic). Such depression wetlands are normally endorheic, i.e. isolated from other surface water ecosystems, usually with inflowing surface water but no outflow. There is generally little or no direct connection with groundwater, and these depressions tends to be fed by unchanneled overland flow and interflow following rainfall events. Inundation periods for these depressions tend to be very short-lived (days to a few weeks) following sufficient precipitation. Similarly, the frequency is highly variable, from less than once a year to once every few decades. The flat, central portion of these depression wetlands are mostly devoid of vegetation, with a zonation of plants occurring around the margins. Only one such depression wetland has been recorded within the project site and will not be impacted by the proposed development.

Key plant species associated with the depression wetland:

» *Rosenia spinescens, Salsola rabieana, Stipagrostis ciliata, Salsola tuberculata, Rosenia humilis, Monechma incanum, Lycium pumilum*

Impacts on these depression wetlands are restricted to grazing and have allowed for some encroachment of especially *Rhigozum trichotomum* as well as *Rosenia spinescens.* No alien plant species was observed.

Interestingly, these azonal habitats, combined, had the second highest species diversity of the vegetation types found on site: a total of 42 species were recorded, of which 24 were found only in this unit (57%) and 18 were shared with one or more of the other units. This high level of unique species is expected due to the nature of these habitats, as mentioned previously. Furthermore, only one northern Cape endemic was found in this unit, namely *Heliophila laciniata*. No Red List were observed here, but the unit did contain one protected species namely *Gomphocarpus filiformis*.

Although washes contain no species of conservation concern, they are important from an ecosystem process perspective. Washes are the major conduits of water in the landscape.

» Depression Wetlands:
  - Depression wetlands capture runoff due to their inward draining nature, reducing the volume of surface water that would either simply disappear into the soil or exit the area via drainage and stream channels.
  - This collection and retention of water, following rainfall events play an important role in the maintenance of biodiversity and the creation of special niche habitats.
  - Furthermore, temporary to ephemeral wet pans provide the opportunity for the precipitation of minerals including phosphate minerals because of the concentrating effects of evaporation. Additionally, Nitrogen recycling is also an important function of these wetlands.
» Smaller Ephemeral Washes/Streams and Drainage Features:
  - These systems convey floodwater into and out of the ecologically important and sensitive larger washes and subsequently play an important role in the maintenance of these, more important, system.
  - Furthermore, the vegetation of these drainage lines help reduces flood damage to downstream habitats and subsequently contribute to the maintenance of biological productivity of downstream environments.
» Major Ephemeral Washes:
  - The braided channel network and "vloere" of most of the washes contribute to diversity in vegetation and geomorphological structure but more significantly to patchiness.
  - The morphological heterogeneity of these features and their associated vegetation contribute to habitat diversity within the region and valuable resources, not only for floral species associated with these habitats, but for faunal species in general.
  - These systems provide inter alia the following ecosystem services
    - Convey floodwaters.
    - Help ameliorate flood damage.
    - Maintain water quality and quantity.
    - Provide habitat for plants, aquatic organisms, and wildlife; and determine the physical characteristics and biological productivity of downstream environments.

Due to the high importance of the primary ephemeral wash, this feature is regarded as Very High Sensitive. This feature will however be avoided by the proposed development, and direct impacts on this feature is highly unlikely. The smaller ephemeral washes and the depression wetland are slightly less important and is subsequently regarded as High Sensitive. Only one such ephemeral wash feature will be impacted by the proposed development, through a single access road and the laying of an underground mv cable. With the necessary mitigation measures in place, this watercourse crossing can be regarded as acceptable and will not impact the ecosystems integrity and ability to perform its important ecological functions and services. In terms of proposed impacts on the drainage lines, nine small drainage lines will be crossed by access roads and underground cables. This is deemed acceptable, with the necessary mitigation measures in place, as these crossings will not impact the more important downstream freshwater resource features. In terms of the depression wetland, this feature will however be avoided by the proposed development, direct impacts on this feature is highly unlikely.

6.2. Species of Conservation Concern

As mentioned in sections 2.3 and 5.1.3, a species list was obtained from the SANBI database (POSA) for the study area and surrounding environment. According to this list a total of 3 plant Species of Conservation Concern occur within the area. This included only Red Data Species (one species) and range restricted species (two species). Furthermore, twenty-two protected species were recorded within the region. However, the online screening report did reveal the occurrence of three Species of Conservation Concern, namely; Species 1157, 854 and 144). These species will not be made public in order to protect them from illegal activities).

Ground truthing confirmed no Species of Conservation Concern (SCC) within the affected property whilst 15 provincially protected species were confirmed to be present on site. Four of these protected species were present in the list obtained online (POSA) during the desktop phase, which proves the value of ground-truthing sites to validate and supplement such online species lists.

Table 16: Plant Species of Conservation Concern recorded within the project site. "NCNCA" = Northern Cape Nature Conservation Act.

Family	Species	Conservation Status	
		IUCN Red List	NCNCA (Schedule)
Aizoaceae	Ruschia spinosa,	LC	2
Aizoaceae	Drosanthemum latipetalum	LC	2
Aizoaceae	Psilocaulon subnodosum	LC	2
Aizoaceae	Phyllobolus latipetalus	LC	2
Aizoaceae	Ebracteola fulleri	LC	2
Aizoaceae	Psilocaulon coriarium	LC	2
Aizoaceae	*Tetragonia nigrescens*	LC	2
Euphorbiaceae	*Euphorbia spinea,*	LC	2
Euphorbiaceae	*Euphorbia gregaria*	LC	2
Anacampserotaceae	*Anacampseros filamentosa,*	LC	2

Anacampserotaceae	*Anacampseros payraceae*	LC	2
Apocynaceae	*Hoodia gordonii*	LC	2
Apocynaceae	*Gomphocarpus filiformis*	LC	2
Asphodelaceae	*Aloe claviflora*	LC	2
Asphodelaceae	*Aloidendron dichotomum*	LC	2

6.3. Alien Plant Species

Whilst one of the three of the vegetation types found on site were free from alien species, the other two vegetation types (Azonal and the Bushmanland Arid Grassland vegetation types) contained a few alien plant species. However, the extent of invasion within these vegetation types were low. However, especially the alien invasive *Prosopis glandulosa* var. *torreyana* pose a potential threat to the Azonal vegetation types. A total of 11 alien plant species were found on site. These were mostly associated manmade disturbances, for example dams, windmills, and kraals, which were scattered throughout the site.

Table 17: Alien plant species recorded in and around current mining areas 1 and 2.

Family	Species	NEM:BA Category
Amaranthaceae	*Atriplex lindleyi* subsp. *inflata*	
Amaranthaceae	*Atriplex semibaccata*	
Amaranthaceae	*Chenopodium murale* var. *murale*	
Amaranthaceae	*Salsola kali*	1b
Anacardiaceae	*Schinus molle*	
Cactaceae	*Opuntia ficus-indica*	1b
Fabaceae	*Prosopis glandulosa* var. *torreyana*	3
Malvaceae	*Malva parviflora* var. *parviflora*	
Papaveraceae	*Argemone ochroleuca* subsp. *ochroleuca*	1b
Poaceae	*Lolium perenne*	
Solanaceae	*Nicotiana glauca*	1b

A total of 5 of the 11 alien plants are listed as invasive species in the NEM:BA Alien & Invasive Species Regulations. *Opuntia ficus-indica* is listed as Category 1b, unless its fruits are used for human consumption, which does not appear to be the case here. Spineless cultivars and selections are not listed, but that is also not applicable here. Furthermore, the pods of *Prosopis glandulosa* var. *torreyana* is not listed if they are used for fodder.

6.4. Plant Habitat Sensitivity

The majority of the site can be considered as "Medium" sensitive. This classification coincides with the vegetation type Bushmanland Arid Grassland as well as the more homogenous and less structurally complex portions of the Bushmanland Inselberg Shrubland found within the project site. Although both these unit are undisturbed in its nature, the both have a fairly large extent of occurrence as mapped by the National Vegetation Map 2018. Both of these units were largely mapped as Other Natural Areas, and ground truthing verified it to conform to these standards. The Bushmanland Arid

Grassland unit, had the lowest species diversity of all vegetation types on site, and many of its species also occur within the other vegetation types. The Bushmanland Inselberg Shrubland as an entire, within the project site, contained the highest species diversity with more than half of the species restricted to this vegetation type. However, most of these "restricted" species were associated with the more heterogenous and structurally complex upper slopes of the linear ridge system. Both of these vegetation types are furthermore listed as "LC" in terms of ecosystem threat status. As such, these areas would be most preferable to house the proposed WEF.

The areas classified as "Very High" sensitivity coincide mostly with the azonal vegetation associated with the large, primary drainage feature (ephemeral alluvial wash). In order to avoid any detrimental impacts on these features' functions, services and ecological drivers a 100m buffer is recommended this freshwater resource feature. This buffer area is also subsequently regarded as "Very High" sensitive. This freshwater resource features will however be avoided and direct impacts on this feature is highly unlikely.

The "High" sensitivity areas coincide with the more heterogenous and structurally complex upper slopes of the linear ridge system and the isolated quartz outcrops (Bushmanland Inselberg Shrubland) as well as the smaller ephemeral washes (tributaries of the primary ephemeral wash) and depression wetlands.

These upper slopes of the linear ridge system and the rocky outcrops are characterised by higher spatial heterogeneity due to the range of differing aspects (north, south, and variations thereof), slopes and altitudes all resulting in differing soil (e.g. depth, moisture, temperature, drainage, nutrient content), light and hydrological conditions. Temperature and humidity regimes of microsites vary on both a seasonal and daily basis. Moist cool aspects are more conducive to leaching of nutrients than warmer drier slopes. Variation in aspect, soil drainage and elevation/altitude has been found to be especially important predictors of biodiversity. These quartzite ridges may also have a direct effect on temperature/radiation, surface airflow/wind, humidity and soil types. Ridges also influence fire in the landscape, offering protection for those species that can be described as "fire-avoiders". Due to the abovementioned reasons it is proposed that these areas be avoided as far as possible. According to the layout this highly sensitive portions of the linear ridge system will be avoided.

These smaller ephemeral washes and depression wetlands are slightly less important than the primary ephemeral wash. In order to avoid any detrimental impacts on these features' functions, services and ecological drivers a 50m buffer is recommended around the ephemeral washes, and 50m around the depression wetland. Development within these freshwater resource features as well as their buffer areas should be largely restricted. The use/upgrade of existing access routes and minimal construction of new routes and the laying of underground mv cables are the only activities allowed within these areas. According to the current layout, only one such feature will be impacted by the proposed development, through a single access road and the lying of an underground mv cable. With the necessary mitigation measures in place, this watercourse crossing can be

regarded as acceptable and will not impact the ecosystems integrity and ability to perform its important ecological functions and services.

7. FINDINGS OF THE FAUNAL ASSESSMENT

7.1. Mammals

7.1.1. Mammal Diversity and Habitats

The IUCN Red List Spatial Data lists 65 mammal species that could be expected to occur within the vicinity of the project site. This is regarded as a moderately-low species diversity.

Of these species, eight are medium to large conservation dependant species, or species that had a historical range that included the project area, but with natural populations since becoming locally "extinct" in these areas. These species are now generally restricted to protected areas such as game reserves and protected areas, with most of these species being re-introduced in these areas.

Examples of such species are:

- African Wild Dog – *Lycaon pictus* (Endangered);
- Spotted Hyaena – *Crocuta crocuta* (Near Threatened);
- Lion – *Panthera leo* (Vulnerable);
- Cheetah – *Acinonyx jubatus* (Vulnerable);
- Hook-lipped Rhinoceros – *Diceros bicornis bicornis* (Endangered);
- Red Hartebeest – *Alcelaphus caama* (Not Evaluated);
- African Savanna Buffalo – *Syncerus caffer* (Least Concern); and
- Hartmann's Mountain Zebra – *Equus zebra hartmannae* (Vulnerable)

These species are not expected to occur in the project site and are removed from the expected Species of Conservation Concern (SCC) list.

Of these 57 remaining mammals, only five species been previously recorded within the larger survey area (Quarter Degree Grids: 2919BA, 2919BB, 2919BD and 2920AA) according to the Animal Demographic Unit (ADU) database, indicating a significant undersupplying within the area (https://vmus.adu.org.za/vm_sp_list.php). These recorded species are;

- Steenbok - *Raphicerus campestris* (No. of Records: 1)
- Bat-eared Fox – *Otocyon megalotis* (No. of Records: 1);
- Aardwolf – *Proteles cristata* (No. of Records: 1);
- Acacia Thallomys - *Thallomys paedulcus* (No. of Records: 1);
- Striped Polecat – *Ictonyx striatus* (No. of Records: 1)

SITE VISIT OBSERVATIONS:

Of the remaining 57 small- to medium sized mammal species, sixteen (16) indigenous mammal species have been observed (refer to Table 18) through direct observations, camera trap photographs, Sherman traps, and/or the presence of visual tracks & signs. within the project site. These data represent strong evidence as to a potential low diverse and functional mammal assemblage populating the study area.

Based on the various sampling techniques, the following mammals were the most frequently observed within the project site:

- Bat-eared Fox (*Otocyon megalotis*): No of Records 8 (and digging/feeding signs);
- Cape Porcupine (*Hystrix africaeaustralis*): No of Records 4 (and numerous feeding/gnawing signs);
- Pygmy Hairy-footed Gerbil (*Desmodillus auricularis*): No physical records but numerous burrows);

Table 18: List of Mammalian species that has been observed within the project site.

Common Name	Scientific Name	Regional Status (2016)	Global Status (2015)	TOPS (NEMBA)	CITES	DENC	Endemic
Steenbok	*Raphicerus campestris*	LC	LC			II	
Gemsbok	*Oryx gazella*	LC					
Bat-eared Fox	*Otocyon megalotis*	LC	LC	Protected		I	
Cape Grey Mongoose	*Herpestes pulverulentus*	LC	LC			II	Near Endemic
Aardwolf	*Proteles cristatus*	LC	LC			I	
Cape Hare	*Lepus capensis*	LC	LC			II	
Cape Ground Squirrel	*Xerus inauris*	LC	LC				
Cape Porcupine	*Hystrix africaeaustralis*	LC	LC			II	
Western Rock Elephant Shrew	*Elephantulus rupestris*	LC	LC			II	
Namaqua Rock Mouse	*Aethomys namaquensis*	LC	LC			II	
Striped Mouse	*Rhabdomys pumilio*	LC	LC				
Short-tailed Gerbil	*Desmodillus auricularis*	LC	LC			II	
Hairy-footed Gerbil	*Gerbillurus paeba*	LC	LC			II	
African Wild Cat	*Felis silvestris*	LC	LC	Protected		I	
Back-backed Jackal	*Canis mesomelas*	LC	LC				
Springbok	*Antidorcas marsupialis*	LC	LC			II	

However, it must be reiterated that the poor trapping success (±1% trapping success rate) has likely deprived the habitat of its predicted total diversity. The low success rate of trapping can most likely be attributed to the extensive drought period that the area has experience up to recent. The prolonged drought conditions have most likely resulted in a population collapse to some degree, especially in terms of the more herbivorous rodents. The bulk of the small mammals that were trapped, where insectivores and adaptable omnivores. Abandoned stick lodges and shelters belonging to Namaqua Rock Mouse (*Micaelamys namaquensis*) as well as numerous old rodent (gerbil) burrows indicate that this area likely had a fairly strong small mammalian population, especially within and near

the alluvial washes. It is unclear to what extent and how long it will take for the small mammalian population to recover following the return of more preferable conditions. A stable and healthy small mammalian populations is crucial as these species along with invertebrates form the base of the trophic chain within this region. From the number of small meso-predators observed within the project site it is clear that these populations small mammals and invertebrates as well as small terrestrial/ground dwelling bird populations) are still however strong enough to sustain these mesopredators (Otocyon megalotis – *Bat-eared Fox*, Cape Grey Mongoose – *Herpestes pulverulentus*, African Wild Cat - *Felis sylvestris*).

Based on the various sampling techniques, the following mammals were the most frequently observed within the project site:

- Bat-eared Fox (*Otocyon megalotis*): No of Records 8 (and digging/feeding signs);
- Cape Porcupine (*Hystrix africaeaustralis*): No of Records 3 (and numerous feeding/gnawing signs); and
- Pygmy Hairy-footed Gerbil (*Desmodillus auricularis*): No of Records 4 (Sherman Traps).

Structural and compositional habitat/vegetation unit diversity can be described as moderately diverse within the project site. However, the bulk of the project site is dominated by low dwarf shrubland plains. The most significant habitat within the project site is the larger alluvial ephemeral washes. This habitat type is fairly diverse in terms of its structural geomorphological diversity allowing for most of the mammal diversity, observed within the project site, to inhabit this area. Second to the alluvial washes are the steep slopes and outcrops dominated by boulders and large rock which is also relatively structural complex.

7.1.2. Mammal Species of Conservation Concern (SCC)

SCCs include those species listed within the Regional Red Data List (2016), Global Red Data List (2015), that indicate severe recent population decline and those species or populations of species that are highly range restricted.

Of the remaining 57 small- to medium sized mammal species, that have a natural distribution range that include the project site and have a likelihood of occurring within the project site, five (5) are listed as being of conservation concern on a regional or global basis (Table 19).

The list of potential species includes:

- Two (2) that are listed as Vulnerable (VU) on a regional basis; and
- Three (3) that are listed as Near Threatened (NT) on a regional scale.

Table 19: List of mammal species of conservation concern that may occur in the project area as well as their global and regional conservation statuses (IUCN, 2017; SANBI, 2016)

Species	Common Name	Conservation Status			Likelihood of Occurrence
		Red Data	IUCN	TOPS	
Parotomys littledalei	Littledale's Whistling Rat	NT	LC		Moderate
Parahyaena brunnea	Brown Hyaena	NT	NT	Protected	High
Felis nigripes	Small Spotted Cat	VU	VU	Protected	Moderate
Panthera pardus	Leopard	VU	VU	VU	Low
Graphiurus ocularis	Spectacled Dormouse	NT	LC		Moderate

» *Paratomys littledalei* (Littledale's Whistling Rat) has a narrow, highly patchy distribution in the driest parts of southern Africa, and occurs in the South-West Africa Biotic Zone (Namib Desert and Karoo regions).

P. littledalei is a diurnal, herbivorous (only fresh plant material excluding seeds) species occurs in stable/climax shrubland and is more dependent on a stable ground cover. They avoid open habitats. It has a patchy habitat distribution, reflecting forage availability and the need for deep soils.

Listed, under a precautionary risk tolerance, as Near Threatened as it is suspected to be threatened by droughts and became locally extinct as a result of ongoing droughts. Thus, this species might be especially vulnerable to an increase in intensity and duration of droughts as a consequence of climate change. Additionally, habitat degradation from overgrazing of rangelands may threaten this species as it is reliant on a stable plant cover. However, it also has a wide distribution within its distribution region and occurs in several protected areas.

Only limited suitable habitat exist, restricted to sandy, alluvial planes fringing the ephemeral watercourses, and sandy pockets scattered throughout the rocky plains and plateaus. However, due to the relative scarcity of fresh plant material (due to the extensive drought period) within the rocky plains and plateaus, it is highly unlikely that this species will inhabit these areas and subsequently the larger drainage systems with suitable burrowing substrate and sufficient forage are the only suitable habitat within the project site. Furthermore, taking into account habitat requirements, the fact that they are fairly patchily distributed/rare within their range, and their vulnerability to ongoing severe drought conditions, it can be concluded that these species have a **moderate likelihood of occurrence** within the project site.

» *Felis nigripes* (Black-footed cat) is endemic to the arid regions of southern Africa, occurring widely across the western reaches of the assessment region, and have a relatively restricted and patchy distribution. This species is naturally rare, occur in low densities, has cryptic colouring, is small in size and is nocturnal. These factors have contributed to a lack of information on this species.

Black-footed Cats are strictly crepuscular and nocturnal and are active throughout the night. During the day, the cats make use of dens. The species prefers hollowed out abandoned termite mounds when available (especially for the kittens), but will use dens dug by other animals such as Springhares, Cape Ground Squirrels - *Xerus inauris*, and Aardvark - *Orycteropus afer*. It is a specialist of open, short grass areas with an abundance of small rodents and ground-roosting birds.

There is a general suspected continuing decline in population sizes due to the loss of prey base due to bushmeat poaching (especially Springhare - *Pedetes capensis*), persecution (direct or incidental), road collisions and predation by domestic pets. Livestock farming (especially small livestock), and inappropriate predator management has resulted in an increase in local Back-backed Jackal – *Canis mesomelas*, and Caracal – *Caracal caracal*, populations. The overabundance of such mesopredators is regarded as an important emerging threat to Black-footed Cat populations as a result of increasing interspecific competition, including intraguild predation. Perhaps the most serious long-term threat for Black-footed Cats is the loss of key resources, such as den sites and prey, from anthropogenic disturbance or habitat degradation (for example, from overgrazing). They are unable to create or maintain their own dens or burrows and rely on those made by other species. Thus, the localised removal of a sympatric species, Springhare with whom they have a crucial inquilistic relationship, can be detrimental to their continued existence in a region.

Taking availability/abundance of prey, burrows and sympatric species it is highly likely that this species may occur within the project site. Sandy areas along the alluvial planes and watercourses are regarded as the most suitable habitat for this species as this is the areas with the highest density of rodent, lagomorph and ground nesting bird (larks etc.) activity (food source), along with an abundance of burrows (dug mainly by Aardvark – *Orycteropodidae*, and Bat-eared Fox – *Otocyon megalotis*). Interspecific competition and intraguild predation within this habitat may however have an impact on the presence of Black-footed Cat within this habitat type. Burrows found within the deeper sandy patches within the calcrete plains may also be utilized, however, the abundance of prey may be a limiting factor within these plains. Subsequently based on the above-mentioned factors there is a **moderate likelihood of occurrence** for this species within the project area.

» *Panthera pardus* (Leopard) has a wide distributional range across Africa and Asia, however throughout their range there are extremely patchily distributed, having been lost from at least 37% of their historical range in sub-Saharan Africa 51% of their historical range in Southern Africa. The Leopard has a wide habitat tolerance, including woodland, grassland savannah and mountain habitats but also occur widely in coastal scrub, shrubland and semi-desert. Densely wooded and rocky areas are preferred as choice habitat types. Within the montane and rocky areas of the Western Cape and Northern Cape provinces, small prey such as Rock Hyraxes - *Procavia capensis,* and Klipspringer antelope - *Oreotragus oreotragus*, are

extensively utilised. Leopard densities vary with habitat, prey availability, and threat severity, from fewer than one individual/100 km² to over 30 individuals/100 km². Typically, population densities within the Western Cape/Northern Cape (south western and western portions of the Northern Cape) range from 0.25 to 2.3 individuals/100 km2.

Even though, being highly adaptable and having a natural wide distributional range, populations have become reduced and isolated, and they are now extirpated from large portions of their historic range. Impacts that have contributed to the decline in populations of this species include continued persecution by farmers, habitat fragmentation, increased illegal wildlife trade, excessive harvesting for ceremonial use of skins, prey base declines and poorly managed trophy hunting.

Although, known to occur and persist outside of formally protected areas, and previously recorded within the region densities in these areas are considered to be low. However suitable habitat and prey is available within the project site and surroundings and subsequently **likelihood of occurrence in the project area is low.**

» *Parahyaena brunnea* (Brown Hyaena) is endemic to southern Africa and has a widespread distribution throughout the region. Habitat types with which Brown Hyaena is typically associated with include; Desert areas with annual rainfall less than 100 mm, semi-desert, open scrub and open woodland savannah with a maximum rainfall up to about 700 mm. Furthermore, Brown Hyaena also shows an ability to survive close to urban areas. It requires some type of cover in which to lie up during the day. For this it favours rocky, mountainous areas with bush cover in the bushveld areas of South Africa. This species is primarily a scavenger consuming a wide range of vertebrate remains, which is supplemented by wild fruits, insects, birds, their eggs and the occasional small animal which is killed; and its impact on domestic livestock is usually small. Brown Hyaenas occupy a range of ranch land, but typically avoid agricultural and heavily urbanised habitats.

It faces multiple threats across unprotected areas, especially in regions dominated by livestock and game ranching. Despite the evidence of locally stable and increasing populations, the species does face persistent threats of direct and indirect persecution within the assessment region. Small isolated subpopulations in reserves surrounded by predator-proof fencing may be at risk of inbreeding depression impacting the populations.

This species is known to persist outside of protected areas and even within agricultural lands and as such the **likelihood of occurrence is regarded as high**.

SITE VISIT OBSERVATIONS:

During the site visit no Mammal SCC were recorded through active searching (diurnal and nocturnal surveys), camera trapping, Sherman trapping and through random observations. Based on the ecology and behaviour of the potential Mammal SCC that may occur within the region, as well as the general design and layout of the WEF (avoiding sandy alluvial washes and floodplains as well steep slopes and tall ridges) it is highly unlikely that this development will threaten local individual and populations of Mammal SCC.

7.1.3. Protected Mammal Species

These area species that are either protected nationally within TOPS (Threatened and Protected Species Issued in terms of Section 56(1) of the National Environmental Management: Biodiversity Act, 2004) or provincially within Schedule 1 and 2 of the Northern Cape Nature Conservation Act No 9 of 2009.

TOPS Regulations:

- The Threatened or Protected Species (TOPS) regulations, 2007, provide a national approach to sustainable use of species that are threatened with extinction, or in need of national protection, while ensuring the survival of the species in the wild, thus ensuring the conservation of the species.
- The TOPS regulations address multiple issues including: unethical hunting practices such as hunting in confined spaces, or hunting of tranquilised animals or by means of bait; activities related to the management of damage-causing animals; hybridisation and spreading diseases as a result of translocation; activities threatening cycad populations; and registration of captive breeding and keeping facilities.
- NEMBA enabled the Minister to prohibit activities that may impact on the survival of species in the wild, and to regulate activities to ensure sustainable use of indigenous biological resources.
- According to the definitions provided within the TOPS regulations (Section 56 (1)):
    - a Protected Species (56(1)(d)) is any indigenous species which are of high conservation value or national importance, or required regulation in order to ensure that the species are managed in an ecologically sustainable manner. Furthermore, all indigenous species listed within CITES (Conservation on International Trade in Endangered Species of Wild Fauna and Flora) are also automatically listed as a Protected Species within TOPS.

Schedule 1 and 2 of the Northern Cape Nature Conservation Act No 9 of 2009 (NCNCA):

- The aim/purpose of the Act is to provide for;
    - the sustainable utilisation of wild animals, aquatic biota and plants;
    - to provide for the implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora;

- to provide for offences and penalties for contravention of the Act;
- to provide for the appointment of nature conservators to implement the provisions of the Act;
- to provide for the issuing of permits and other authorisations; and
- to provide for matters connected therewith.

Table 20: List of Protected mammal species (according to national provincial regulations) that have a distribution that include the project site.

Species	Common Name	TOPS (NEM:BA)	CITES	NCNCA Schedule 1	NCNCA Schedule 2	Likelihood of Occurrence
Felis nigripes	Small Spotted Cat	Protected	I	I	Virtually all indigenous fauna which do not fall under Schedule 1 are classified under Schedule 2, except those species classified as pests. In terms of mammals most rodents, shrews, elephant shrews, bats, hares and rabbits, carnivores, antelope are included. The full list is contained within the Schedule and it is not repeated here.	Moderate
Felis sylvestris cafra	African Wild Cat	Protected	II	I		Confirmed
Otocyon megalotis	Bat-eared Fox	Protected		I		Confirmed
Vulpes chama	Cape Fox	Protected		I		High
Mellovora capensis	Honey Badger	Protected		I		Moderate
Parahyaena brunnea	Brown Hyaena	Protected		I		High
Panthera pardus	Leopard	VU	I	I		Low
Proteles cristatus	Aardwolf			I		Confirmed
Orycteropus afer	Aardvark			I		High
Ictonyx striatus	Striped Polecat			I		Moderate
Caracal caracal	Caracal		II			High
Papio ursinus	Chacma Baboon		II			Low

SITE VISIT OBSERVATIONS:

During the site visit three protected mammal species (within TOPS as well as Provincial Act) were recorded namely:

» African Wild Cat (*Felis sylvestris cafra*): 1 recording within the outer fringe of the alluvial wash.
» Bat-eared Fox (*Otocyon megalotis*): 8 recordings; 4 within the alluvial wash habitat, 4 within the sandy shrubland plains habitat. Numerous foraging/digging and foraging signs were recorded, especially within the sandier habitats.
» Aardwolf (*Proteles cristatus*): 1 recording within an alluvial wash habitat.

The most significant habitat for these protected species, are the alluvial washes along with its floodplains and woody/thicket patches. Most of the protected mammals recorded within the project site or which has a high likelihood of occurring within the project site, utilize burrows, and the deeper sandy substrates of these washes provide valuable burrowing sites. The higher rodent, small mammal and invertebrate activities within this habitat also makes this habitat a valuable forage/hunting area for potential protected species such as

Bat-eared Fox, Aardvark, Cape Fox and African Wild Cat and potentially for Honey Badger, Striped Polecat, and Aardwolf.

7.2. Reptiles

7.2.1. Reptile Diversity and Habitats

The IUCN Red List Spatial Data lists 41 reptile species that could be expected to occur within the vicinity of the project site and include one tortoise, 13 geckos, 16 lizards, 3 agamas, one chameleon and 15 snakes. This is comparatively moderate-low suggesting that reptile diversity at the site is likely to be fairly low.

Of these 41 reptile species, 15 have been previously recorded within the larger survey area (Quarter Degree Grids: 2919BA, 2919BB, 2919BD, and, 2920AA) according to the Animal Demographic Unit (ADU) database, indicating significant under sampling within the region. Species that has been frequently observed within the these QDGs are:

» Purchell's Gecko – *Pachydactylus prucelli* (No. of Records: 17); and
» Western Three-striped Skink – *Trachylepis occidentalis* (No. of Records: 4).

SITE VISIT OBSERVATIONS:

Of the 41 reptile species that have a distribution that include the project area, seven (7) indigenous reptile species have been observed (refer to **Error! Reference source not found.**) through direct observations, within the project site.

However, it must be reiterated that the low diversity observed within the project site can most likely be attributed unfavourable climatic conditions. However, the area is still none the less, regarded as containing a potentially moderate-low diverse and functional reptile assemblage populating

The following reptiles were the most frequently observed within the project site:

» Western Ground Agama (*Agama aculeata aculeata*): No of Records 14;
» Southern Karusa Lizard (*Karusasaurus polyzonus*): No of Records 12;

Table 21: List of Reptilian species that has been observed within the project site.

Common Name	Scientific Name	Regional Status (2016)	Global Status (2015)	TOPS (NEMBA)	CITES	DENC	Endemic
Agama aculeata aculeata	Western Ground Agama	LC	LC				
Karusasaurus polyzonus	Southern Karusa Lizard	LC	LC			I	Near Endemic

Common Name	Scientific Name	Regional Status (2016)	Global Status (2015)	TOPS (NEMBA)	CITES	DENC	Endemic
Ptenopus garrulus maculatus	Spotted Barking Gecko	LC	LC				
Psammobates tentorius verroxi	Tent Tortoise	NT	NT	Protected	II	I	
Pedioplanis namaquensis	Namaqua Sand Lizard	LC	LC			II	
Mabuya sulcata	Western Rock Skink	LC	LC				
Psammophis notostrictus	Karoo Sand Snake	LC	LC				

7.2.2. Reptile Species of Conservation Concern (SCC)

SCCs include those species listed within the Regional Red Data List (2017), Global Red Data List (2015), that indicate severe recent population decline and those species or populations of species that are highly range restricted.

Of the 41 reptile species that have a natural distribution range that include the project site, and have a likelihood of occurring within the project site, two (2) are listed as being of conservation concern on a regional or global basis (Table 22).

Table 22: List of reptile species of conservation concern that may occur in the project area as well as their global and regional conservation statuses (IUCN, 2017; SANBI, 2016)

Species	Common Name	Conservation Status		Likelihood of Occurrence
		Red Data	IUCN	
Psammobates tentorius verroxi	Tent Tortoise	NT	NT	Confirmed
Pachydactylus goodi	Good's Gecko	VU	VU	Low

» *Psammobates tentorius* (Karoo Dwarf Tortoise/Karoo Padloper) is restricted to South Africa and Namibia. The distribution ranges of the three recognized subspecies overlap, and there remains some uncertainty about their exact limits.

- *P. t. verroxii* has a wide distribution throughout the Nama Karoo in the Northern Cape and penetrates the Western Cape and possibly the Eastern Cape peripherally.
- *P. t. verroxii* occurs mainly on the inland plateau above 900 m, although its range may extend below the escarpment in the west, and rainfall in its range is predominantly in summer and generally unpredictable.

Although *P. tentorius* is widespread, population density is generally low throughout its range (Branch 2008), and populations appear to be declining slowly. Known threats for *P. tentorius* include road mortality, veld fires, electrocution by livestock/game fences, and overgrazing from domestic livestock as well as predation by small carnivores, eagles, honey badgers, goshawks, crows, monitor lizards, and ostriches. Available information indicates that Pied Crow (*Corvus albus*) predation on this taxon is increasingly severe, with anthropogenic facilitation

of Pied Crows having led to increased abundance in western South Africa, making increased predation highly likely. Threats for *P. t. verroxii* are however generally low because its distribution is wide and mainly in areas with low human density.

SITE VISIT OBSERVATIONS:

During the site visit the only Reptile SCC recorded was *Psammobates tentorius verroxii* (four individuals have been recorded within the project site). Three of the four specimens that were observed, were found within larger ephemeral washes whilst the fourth specimen was observed within a gravel plain. The combination of sandy substrates and denser shrubby vegetation, associated with the alluvial washes, make these habitats suitable for burrowing, egg lying and these species are known to spend their dormant periods (torpor) within these habitats. Especially during the drier periods, these species tend to move towards the surrounding drainage lines where their food source (plant material) tend the persist for longer periods of time (high moisture content).

In terms of the likely impacts of the development on these tortoise species, habitat loss is not likely to be highly significant as the direct footprint of the development is not likely to exceed a few hundred hectares and this would not be significant in context of the relatively homogenous and intact surrounding landscape. In some situations, the loss of vegetation cover associated with roads and grid line construction and other cleared areas can generate potential impact on these species as they may be vulnerable to predation while crossing such cleared areas, but as the site is arid, plant cover is already low.

7.2.3. Protected Reptile Species

These are species that are either protected nationally within TOPS (Threatened and Protected Species Issued in terms of Section 56(1) of the National Environmental Management: Biodiversity Act, 2004) or provincially within Schedule 1 and 2 of the Northern Cape Nature Conservation Act No 9 of 2009.

Table 23: List of Protected reptile species (according to national provincial regulations) that have a distribution that include the project site.

Species	Common Name	TOPS (NEM:BA)	NCNCA Schedule 1	NCNCA Schedule 2	CITES	Likelihood of Occurrence
Psammobates tentorius verroxi	Tent Tortoise	Protected		II	II	Confirmed
Karusasaurus polyzonus	Southern Karusa Lizard		I			Confirmed
Dasypeltis scabra	Rhombic Egg-eater			II		Moderate
Meroles knoxii	Knox's Desert Lizard			II		Moderate
Merolessuborbitalis	Spotted Desert Lizard			II		High
Nucras tessellata	Western Sandveld Lizard			II		Moderate
Pedioplanis laticeps	Karoo Sand Lizard			II		Moderate
Pedioplanis lineoocellata lineoocellata	Spotted Sand Lizard			II		Low

Species	Common Name	TOPS (NEM:BA)	NCNCA Schedule 1	NCNCA Schedule 2	CITES	Likelihood of Occurrence
Pedioplanis lineoocellata pulchella	Common Sand Lizard			II		Low
Pedioplanis namaquensis	Namaqua Sand Lizard			II		Confirmed
Boaedon capensis	Common House Snake			II		High
Lamprophis guttatus	Spotted Rock Snake			II		High

SCREENING SITE VISIT OBSERVATIONS:

During the site visit the only protected species confirmed, was *Psammobates tentorius verroxii* and *Pedioplanis namaquensis*. *P. t. verroxii* is expected to potentially inhabit any of the identified habitats. As mentioned, habitat loss and other likely impacts are not likely to be highly significant as the direct footprint of the development is not likely to exceed a few hundred hectares and this would not be significant in context of the relatively homogenous and intact surrounding landscape.

7.3. Amphibians

7.3.1. Amphibian Diversity and Habitats

The IUCN Red List Spatial Data lists only eight amphibian species that occur within the region. Given the aridity of the site and lack of surface water in the area, this low diversity of amphibians is not surprising.

Of these eight amphibian species, only one species has been previously recorded within the larger survey area (Quarter Degree Grids: 2919BA, 2919BB, 2919BD, 2920AA) according to the Animal Demographic Unit (ADU) database.

Common Caco – Cacosternum boettgeri (No. of Records: 1)

SCREENING SITE VISIT OBSERVATIONS:

No amphibian species have been recorded within the project area, however there are available habitat for these species and the likelihood of some of these species to occur

The most likely amphibian species to inhabit the project site include:

- Tandy's Sand Frog – *Tomopterna tandyi*; and
- Common Caco – *Cacosternum boettgeri*

Impacts on amphibians are likely to be low given the limited extent of the development as well as low likely density of amphibians in the area. Although there are some available

amphibian habitats these habitats are unlikely to be impacted by the proposed development.

Amphibian Species of Conservation Concern (SCC)

SCCs include those species listed within the Regional Red Data List (2017), Global Red Data List (2015), that indicate severe recent population decline and those species or populations of species that are highly range restricted.

Of the eight amphibian species that have a natural distribution range that include the project site, none are listed as being of conservation concern on a regional or global basis.

Protected Amphibian Species

These area species that are either protected nationally within TOPS (Threatened and Protected Species Issued in terms of Section 56(1) of the National Environmental Management: Biodiversity Act, 2004) or provincially within Schedule 1 and 2 of the Northern Cape Nature Conservation Act No 9 of 2009.

All indigenous amphibians which do not fall under Schedule 1 are classified under Schedule 2. Subsequently all amphibian species that have a distribution range that include the project site are included within Schedule 2. The full list is contained within the Schedule and it not repeated here.

7.4. Faunal Habitat Sensitivity

Faunal species are adapted to a particular niche with often comprises a unique set of environmental conditions creating optimal habitat. The reliance of fauna on species-specific plant resources indicates the interconnected nature between faunal and floristically diversity. These "micro-habitats" do not always correspond strictly to vegetation associations, but rather to a combination of vegetation structure and species composition, topography, land use, available food source and other factors. Landscape composed of spatially heterogeneous abiotic conditions create a greater diversity of potential niches for fauna species, providing both diverse forage as well as refuge areas. Habitat availability is often used to determine databases due to the often cryptic, nocturnal and highly mobile nature displayed by many fauna species.

The following faunal habitats have been identified within the project site (affected property):

- Arid grassland plains (Sandy) – Bushmanland Arid Grassland;
- Boulder/Rock Slopes and Outcrops - Upper slopes of linear ridge and quartz outcrops (Bushmanland Inselberg Shrubland);

- » Gravel/stony plains and low hills/ridges - Bushmanland Arid Grassland and lower lying ridges);
- » Alluvial washes, floodplains and depression wetlands

A summary of the sensitivity assessment is provided in Table 24

7.4.1. Arid Grassland Plains

The largest portion of the project site comprise of slightly broken sandy plains covered by a relative sparse, grass cover with some short to moderate tall shrub. This habitat appears to have been subjected to long-term/historical livestock grazing (predominantly sheep) with some areas having been slightly overgrazed. This area is largely homogenous with little structural and landscape variation (low number of micro-habitats and niche-space). The sandier substrates are however, more preferable for burrowing, but due to the low forage available within the habitat, only a few burrows (rodents and other small to medium sized mammals) were observed (less than expected). Low rocky outcrops do provide some landscape variation; however, such outcrops are small, and relative scarcely scattered throughout this habitat type. Due to the aforementioned reasons, faunal diversity was fairly low within this habitat and comprises largely of "generalists". However, this area is still fairly natural and is still fairly well connected to the other surrounding habitat types.

This habitat type can be regarded as "Medium" sensitive and development within this habitat type is regarded as acceptable. Although overall conservation value and sensitivity is medium, a Pre-Construction Faunal Walk-Through will have to be conducted in order to identify the presence of any potential sensitive faunal species (protected and SCC) that may occupy/inhabit the development footprints of the SEFs and to assist in the biodiversity permitting processes.

7.4.2. Boulder/Rock Slopes and Outcrops

These habitats tend to patchily distributed throughout the project site as well as the region and contributes significantly to habitat diversity. These boulder and rocky patches, within the project site, are mostly associated with the upper slopes of ridges and quartz outcrops. The upper, steeper slopes of the linear ridge system provides an exceptional form of this habitat type.

These habitat shows excellent potential for mammal and reptile species. Such rocky outcrops are mixed with rocky refugia (which provide structural complexity) to provide a highly sensitive habitat, especially for small mammals and reptiles. Species diversity within these habitats were fairly low, however most of the species recorded, are regarded as habitat specialists restricted to such habitats. The rock areas also provided excellent refugia for larger species (e.g. hyrax and porcupines and meso-predators such as black-backed jackal). The associated succulent and woody dwarf shrublands surrounding rock refugia provided cover and foraging habitat for potential herbivores such as small rodents,

rabbits, steenbok and duikers. Connectivity with similar habitats as well as other habitats are regarded as good.

The overall diversity, sensitivity and connectivity is considered to be "High". Disturbances of these outcrops and slopes should be avoided as far as possible. According to the layout very minimal development will occur within these areas and is restricted to short distances of access routes and mv cables crossing small portions of this highly sensitive portion of the linear ridge. It is not envisaged that the proposed development, with the implementation of necessary mitigation measures, will not impact the ecological integrity of this area, as well as functions and services provided by the ridge system, and as such the proposed development within these restricted areas are regarded as acceptable. These areas should be regarded as "No-Go" areas. The area that will be impacted should be inspected during a Pre-Construction Faunal Walk-Through in order to determine whether there are any sensitive, restricted species confined to these areas and at risk of being impacted by the proposed development.

7.4.3. Gravel/Stoney Plains and Low Hills/Ridges

These gravel/stony plains and low hills cover most of the eastern portion of the project site.

These plains are for large parts mostly homogenous with the exception of boulder/rock outcrops which do provide some variation. Similarly, to the sandy plains this habitat contains fairly little structural and landscape variation (low number of micro-habitats and niche-space). The boulder/rocky outcrops tend to be small, and relative scarcely scattered throughout this habitat type, especially along the upper slopes of the low ridges and along the drainage lines. Vegetation cover within this habitat is sparse, and comprise of short dwarf and succulent shrubs. Due to the aforementioned reasons, faunal diversity was low within this habitat and comprised of mainly "generalists". However, this area is still fairly natural and is still fairly well connected to the other surrounding habitat types.

This habitat type can be regarded as "Medium" sensitive. Development within these areas are regarded as acceptable.

7.4.4. Alluvial Washes, Floodplains and Depression Wetlands

These ephemeral freshwater resource features are probably the most significant faunal habitat (mammals, reptiles and also potentially for amphibians).

These freshwater resource systems along with their vegetation are heterogenous and provides highly structural complexity and breeding/foraging habitats for various mammal species. These features furthermore contribute to habitat heterogeneity within the area and as such increase habitat and niche diversity within the larger area. The highest diversity of smaller mammals as well as reptiles where recorded within this habitat. These smaller mammal species, e.g. rodents, form the basis of the trophic food chain and sustain

the local faunal meso-predators as well as raptors. Furthermore, these freshwater resource systems can be regarded as potentially important corridors for faunal movement and migration. Lateral and longitudinal connectivity is also regarded as fairly high.

The overall diversity, connectivity of these areas was regarded as high. The primary drainage feature along with the recommended buffer area (100m) is regarded as "Very High" in terms of sensitivity, whilst the smaller washes and depression wetlands are regarded as "High" sensitive. The primary ephemeral wash feature as well as the depression wetland will be avoided and direct impacts on these features is highly unlikely. Furthermore, according to the layout minimal development will occur within the smaller wash systems, and is restricted to short distances of access routes and mv cables crossing small portions of this highly sensitive portion of the linear ridge. It is not envisaged that the proposed development, with the implementation of necessary mitigation measures, will not impact the ecological integrity of this area, as well as functions and services provided by the ridge system, and as such the proposed development within these restricted areas are regarded as acceptable.

Table 24: Summary of the results of the faunal habitat sensitivity assessment.

	Faunal Habitats				
				Alluvial Washes and Flood Plains	
Sensitivity Summary	**Shrubland Plains**	**Boulder/Rock Slopes and Outcrops**	**Gravel/Stony Plains & Low Hills/Ridges**	**Smaller Ephemeral Washes and Depression Wetland**	**Primary Ephemeral Wash**
Observed Species Diversity	4 Reptiles; 10 Mammals	2 Reptiles; 6 Mammals	2 Reptiles; 8 Mammals	7 Reptiles; 10 Mammals	
Potential Species Diversity	Low to moderate	Low to Moderate	Low	Moderate to High	
Habitat Specialist	Mainly generalists	Mainly Habitat Specialists	Mainly generalists	A combinations of habitat specialists and generalists	
Observed Species of Conservation Concern	0	0	1 (*Psammobates tentorius verroxii)*	1 (*Psammobates tentorius verroxii)*	
Protected Species	2 Mammals	1 Mammal	1 Reptile; 1 Mammal	1 Reptile; 3 Mammals	
Structural Complexity (micro-habitat and niche space)	Low	Moderate to High	Low to Moderate	High	
Habitat Integrity	Moderate - Low	Moderate	Low	High	
Present Ecological Status	Largely natural with few modifications	Unmodified, natural	Largely natural with few modifications	Largely natural with few modifications	
Food Availability	Moderate to low	Moderate	Low	Moderate to High	

Sensitivity Summary	Faunal Habitats				
	Shrubland Plains	Boulder/Rock Slopes and Outcrops	Gravel/Stony Plains & Low Hills/Ridges	Alluvial Washes and Flood Plains	
				Smaller Ephemeral Washes and Depression Wetland	Primary Ephemeral Wash
Connectivity	Moderate to High	Moderate to High	Moderate to High	High	Very High
Important Structural and Landscape Elements					Important migration and movement corridors
Climate Resilience	Low	Moderate	Low	Low	Low
RATING	**Medium**	**High**	**Medium**	**High**	**Very High**

8. COMBINED SENSITIVITY (PLAN, ANIMAL AND TERRESTRIAL BIODIVERSITY THEMES)

The map below (Figure 9) illustrates the sensitivities identified within the faunal, floral and terrestrial biodiversity assessments.

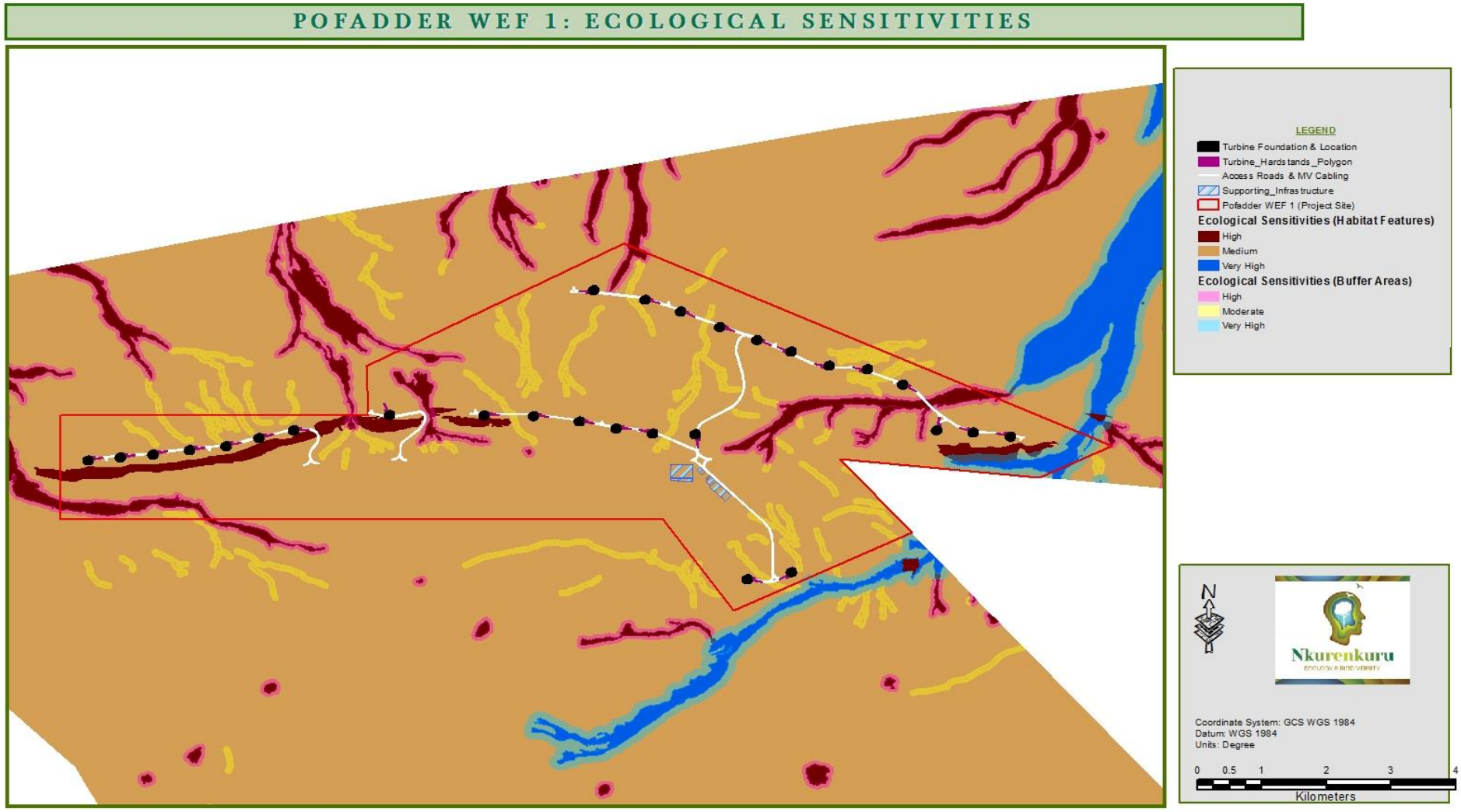


Figure 9: Sensitivity mapping of the Pofadder WEF 1's project site.

9. ASSESSMENT OF PROPOSED IMPACTS

9.1. Assumptions

The following is assumed and/or known:

» A thorough ecological walkthrough of all footprint areas will be conducted to, detect and map all protected species. These results should then be used during the permit application process, for the removal/relocation, destruction and disturbance of these protected species.

- Such an investigation should be carried out by a suitably qualified botanist prior to commencement of construction, and
- must be carried out at a time when the maximum amount of species is actively growing and thus visible, (preferably between February and April)

» Prior to development and after construction the development footprint will be routinely cleared of all alien invasive plants if detected.
» The construction phase itself will be associated with clearing of vegetation within the development footprint only.
» Where practically possible, the need for grading is expected to be minimal, limited mostly to contour buffer strips and/or small-scale levelling where necessary.
» All removal of vegetation for construction purposes will be done mechanically, without the use of herbicides for indigenous species and in the case of Invasive Alien Plant only were deemed absolutely necessary and with the authorisation of the EO.
» A continuous vegetation layer is the most important aspect of ecosystem functionality within and beyond the project site.

- A weakened or absent vegetation layer not only exposes the soil surface, but also lacks the binding and absorption capacity that creates the buffering functionality of vegetation to prevent or lessen erosion as a result of floods.

» All existing access and service roads will be used as far as possible.

9.2. Localised vs. cumulative impacts: some explanatory notes.

Ecosystems consist of a mosaic of many different patches. The size of natural patches affects the number, type and abundance of species they contain. At the periphery of patches, influences of neighbouring patches become apparent, known as the 'edge effect'. Patch edges may be subjected to increased levels of heat, dust, desiccation, disturbance, invasion of exotic species and other factors. Edges seldom contain species that are rare, habitat specialists or species that require larger tracts of undisturbed core habitat.

Fragmentation due to development reduces core habitat and greatly extends edge habitat, which causes a shift in the species composition, which in turn puts great pressure on the dynamics and functionality of ecosystems (Perlman & Milder 2005).

Cumulative impacts of developments on population viability of species can be reduced significantly if new developments are kept as close as possible to existing developed and/or transformed areas or, where such is not possible, different sections of a development be kept as close together as possible. Thus, new power lines should follow routes of existing servitudes if such exist. Renewable energy facilities should be constructed as close as possible to existing infrastructure or substations, and if several developments are planned within close proximity, these developments should be situated as close together as possible, not scattered throughout the landscape.

Existing renewable energy projects that were considered in terms of their potential cumulative terrestrial ecological impacts, that are in an approximate 30 km radius of the Pofadder WEF 1, are illustrated below in Figure 10. Apart from the other two Pofadder Wind Energy Facilities (WEF 2 and WEF 3), only four other renewable facilities are located within the 30km radius namely:

- The proposed 300MW Paulputs Wind Energy Facility to the north;
- The 100MW Poortjies Wind Energy Facility to the west;
- 140MW Khai-Mai Wind Energy Facility to the west; and
- Namies South Solar PV Facility to the west.

All four of these renewable facilities only encroach slightly into the 30km radius, with the bulk of their development footprints located outside of the 30km radius.

The combined, cumulative footprint of renewable energy projects (located within the 30km radius) is approximately 19492.515 ha, covering only 3.9% of the area within the 30km radius. Of the 3.9%, the Pofadder WEF 1 only contributes 0.94%.

Conclusion on cumulative impacts due to this and the surrounding developments:

- These renewable energy facilities (REFs) will impact a very small area of the 30km area and will subsequently result in minimal transformation of intact habitats. Subsequently the cumulative threat, posed by these developments, on the ecological functioning of these habitats are very small to insignificant and it is unlikely that these REFS will result in significant habitat fragmentation, disruption of landscape connectivity and impair the ability of these habitat types to respond to environmental fluctuations.
- Sensitive habitats have been largely avoided and as such the cumulative impact on such habitat types and the biodiversity they sustain will be very small.
- Excessive clearing of vegetation can and will influence runoff and stormwater flow patterns and dynamics, which could cause excessive accelerated erosion of plains,

and this could also have detrimental effects on the downslope freshwater resource systems.

- Rehabilitation and revegetation of all surfaces disturbed or altered during construction is desirable.
- Runoff from sealed surfaces or surfaces that need to be kept clear of vegetation to facilitate operation of a development needs to be monitored regularly to ensure that erosion control and stormwater management measures are adequate to prevent the degradation of the surrounding environment.

» Large-scale disturbance of indigenous vegetation creates a major opportunity for the establishment of invasive species and the uncontrolled spread of alien invasives into adjacent agricultural land and rangelands.

- A regular monitoring and eradication protocol must be part of all developments long term management plans.

» The loss of and transformation of intact habitats could compromise the status and ecological functioning of provincially identified CBAs. The Pofadder WEF 1 will not, however, contribute to this impact as this development's footprint excludes any CBAs as well as any other provincially and/or nationally identified conservation priority area.

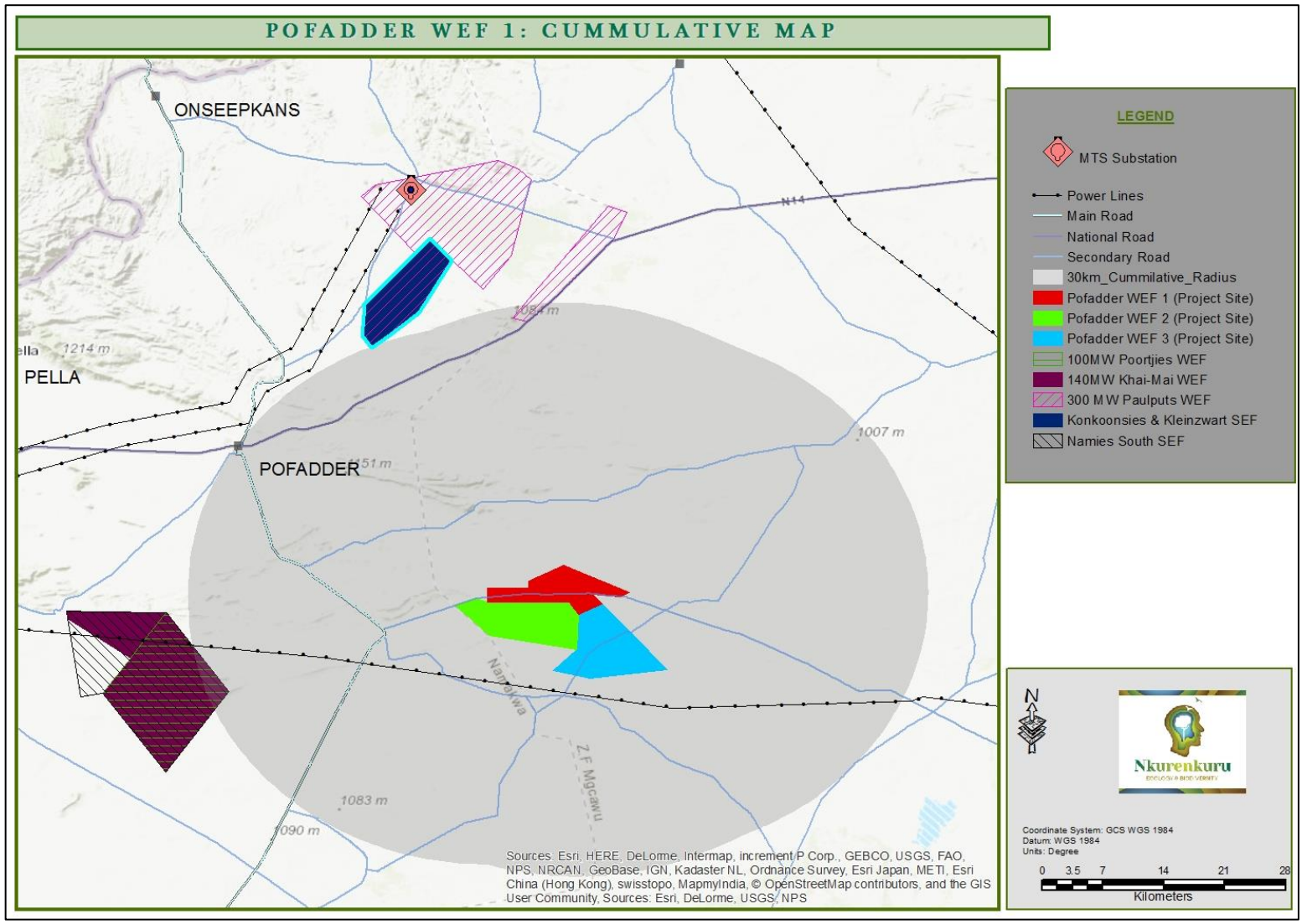


Figure 10: Location Map of the proposed Pofadder WEF 1relative to the other renewable facilities planned within a radius of 30 km.

9.3. Identification of Potential Terrestrial Ecological Impacts and Associated Activities.

Potential ecological impacts resulting from the proposed development would stem from a variety of different activities and risk factors associated with the construction and operation phases of the project including the following:

Construction Phase

- Human presence and uncontrolled access to the site may result in negative impacts on fauna and flora through poaching of fauna and uncontrolled collection of plants for traditional medicine or other purpose.
- Site clearing and exploration activities for site establishment.
- Vegetation clearing could impact listed plant species. Vegetation clearing would also lead to the loss of vegetation communities and habitats for fauna and avifauna and potentially the loss of faunal as well as avifaunal species, habitats and ecosystems. On a larger and cumulative scale (if numerous and uncontrolled developments are allowed to occur in the future) the loss of these vegetation communities and habitats may potentially lead to a change in the conservation status of the affected vegetation type as well as the ability of this vegetation type and associated features to fulfil its ecological responsibilities (functions). The above impact is most likely to be low due to the fact that most of the development area is situated within an area which has been somewhat degraded due to long term overgrazing.
- Soil compaction and increased erosion risk would occur due to the loss of plant cover and soil disturbance created during the construction phase. This may potentially impact the downstream watercourses, wetlands and aquatic habitats, mainly due to an increase of surface water and silt inflow from the surrounding disturbed areas (these potential impacts on downslope wetland features have been assessed within the freshwater resource study and assessment). These potential impacts may result in a reduction in the buffering capacities of the landscape during extreme weather events.
- Movement of construction vehicles and placement of infrastructure within the boundary of the drainage line may lead to the disturbance of these habitats, removal of vegetation cover and a potential increase in erosion which may eventually spread into downstream areas.
- Invasion by alien plants may be attributed to excessive disturbance to vegetation, creating a window of opportunity for the establishment of these alien invasive species. In addition, regenerative material of alien invasive species may be introduced to the project site by machinery traversing through areas with such plants or materials that may contain regenerative materials of such species.

- » Presence and operation of construction machinery on the project site. This will create a physical impact as well as generate noise, potential pollution and other forms of disturbance at the site.
- » Increased human presence can lead to poaching, illegal plant harvesting and other forms of disturbance such as fire.

Operation Phase

- » The facility will require management and if this is not done effectively, it could impact adjacent intact areas through impacts such as erosion and the invasion of alien plant species.

Decommission Phase

- » During decommissioning, the potential impacts will be very similar to that of the Construction Phase, although with slightly lower significance.

Cumulative Impacts

- » The loss of vegetation types on a cumulative basis from the broad area may impact the countries' ability to meet its conservation targets.
- » Transformation of intact, sensitive habitats could compromise the ecological functioning of these habitats and may contribute to the fragmentation of the landscape and would potentially disrupt the connectivity of the landscape for fauna and flora and impair their ability to respond to environmental fluctuations.
- » The loss of biodiversity may be exacerbated.
- » Invasion of exotics and invasive species into the broader area may also potentially be exacerbated.
- » The loss of and transformation of the Ecological Support Areas could impacting the Province's ability to meet its conservation targets.

The impacts identified above are assessed below, during the construction, operation and decommissioning phases of the facility as well as before and after mitigation.

The majority of impacts associated with the development would occur during the construction phase as a result of the disturbance associated with the operation of heavy machinery at the site and the presence of construction personnel. The major risk factors and contributing activities associated with the development are identified and briefly outlined and summarised below before the impacts are assessed. These are not necessarily a reflection of the impacts that would occur, but rather a discussion on overall potential impacts and/or extent of these potential impacts that would occur if mitigation measures are not considered and/ or sensitive areas not avoided. The assessment of these impacts is outlined in the following section.

Impact 1. Potential impacts on vegetation and listed or protected plant species

As already mentioned, the most likely and significant impact will be on the vegetation located within the development area and development footprint of the proposed facility. The proposed development may lead to a direct loss of vegetation. Some loss of vegetation is an inevitable consequence of the development.

At Vegetation Level:

Consequences of the impact occurring may include:

- general loss of habitat for sensitive species;
- loss in variation within sensitive habitats due to loss of portions of it;
- general reduction in biodiversity;
- increased fragmentation (depending on location of impact);
- disturbance to processes maintaining biodiversity and ecosystem goods and services; and
- loss of ecosystem goods and services.

Although the development will impact the described vegetation types at a small, local scale, it is highly unlikely that this development will impact on the status of this vegetation types (impact on a regional scale) due to the large extent of the vegetation types (most of which are still intact) outside of the development footprint. Only approximately 0.0006% of Bushmanland Arid Grassland, 0.0008% of Bushmanland Grassland and 0.01% of Bushmanland Inselberg Shrubland will be impacted by the proposed development.

Based on the fine scale vegetation assessment:

- The largest portion of the development (72.55ha or 52% of development footprint) will impact vegetation units, representing variations of the Bushmanland Inselberg Shrubland (linear quartz ridges and outcrops).
- Most of the remaining development footprint (67.15ha or 47% of development footprint), located outside of the aforementioned vegetation units, will be located within a vegetation unit, representing a form of Bushmanland Arid Grassland, occupying shallower, grittier soils (irregular plains).
- Both of these vegetation units are regarded as medium sensitive and development within these vegetation units/habitats as well as within the sandy plains (form of Bushmanland Arid Grassland occupying deeper, sandy soils), are regarded as acceptable as the vegetation cover associated with these vegetation units, are fairly common and widely distributed within the region.
- Furthermore, a total of nine (9) small drainage lines will be crossed (total of ±0.66ha) by access routes and underground cabling. These small drainage lines are regarded as medium sensitive features and the proposed 9 crossings are

regarded as acceptable, with the implementation of applicable mitigation measures, avoiding any secondary impacts on the larger downstream drainage systems.

- Vegetation associated within high sensitive habitats/units, such as larger drainage systems and the more structurally complex portions of the linear ridge system, will only be slightly impacted through access routes and mv cabling (only 0.44ha and 0.27ha respectively). This, minimal disturbance of vegetation, within these habitats are regarded as acceptable, with the necessary mitigation in place, and due to the nature of these infrastructures (linear infrastructure) it is unlikely that the loss/disturbance of vegetation within these small areas will impact these habitats' abilities to fulfil their ecological functions and services.
- With the necessary mitigations in place the above-mentioned consequences will be avoided, with minimal loss/disturbance of vegetation (total loss of approximately 145ha of natural vegetation) whilst sill allowing for maintenance of biodiversity, ecosystem goods and services.

<u>At species level:</u>

No Plant SCC were observed within the development site; however, the following protected species have been observed within the project site;

- *Hoodia gordonii,*
- *Aloe claviflora,*
- *Aloidendron dichotomum,*
- *Euphorbia gregaria,*
- *Euphorbia spinea,*
- *Anacampseros filamentosa,*
- *Anacampseros papyracea,*
- *Ruscha spinosa, and*
- *Drosanthemum latipetalum*

Furthermore, the following protected species were recorded within close proximity to the project site:

- *Boscia foetida subsp. foetida,*
- *Vachellia erioloba, and*
- *Psilocaulon spp.*

Red data, declining, and highly range restricted species (Species of Conservation Concern or SCC) are especially vulnerable to infrastructure development due to the fact that they cannot move out of the path of the construction activities, but are also affected by overall loss of habitat.

Due to the fact that no such plant SCC have been recorded within the project site, any impacts on such species/populations will be avoided.

The protected species recorded within the project site, are fairly abundant within the region, and some loss of these species are regarded as acceptable, and will not threaten important populations of these species. Furthermore, the nature and extent of impacts on these species can be evaluated, and the impacts can be mitigated to an extent through avoidance of identified sensitive areas, and the search-and-rescue of some of these protected species, that have the potential to establish successfully after relocation.

Impact 2. Direct Faunal impacts

Faunal species will primarily be affected by the overall loss of habitat. Increased levels of noise, disturbance, potential pollution 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 and species confined and dependant on specified habitats would not be able to avoid the construction activities and might be at risk. Some mammals and reptiles would be vulnerable to illegal collection or poaching during the construction phase as a result of the large number of construction personnel that are likely to be present. This impact is highly likely to occur during the construction phase and could also potentially occur with resident fauna within the facility after construction.

Threatened species (red data species) include those listed as critically endangered, endangered or vulnerable. For any other species a loss of individuals or localised populations is unlikely to lead to a change in the conservation status of the species. However, in the case of threatened animal species, loss of a population or individuals could lead to a direct change in the conservation status of the species and possible extinction. This may arise if the proposed infrastructure is located where it will impact on such individual or populations. Consequences may include:

- fragmentation of populations of affected species;
- reduction in the area of occupancy of affected species; and
- loss of genetic variation within the affected species.

These may all lead to a negative change in conservation status of the affected species, which implies a reduction in the chances of the species' overall survival.

As already mentioned, faunal diversity within the study area, and also within the surrounding environment, is fairly low.

- Only one animal SCC were observed within the development site, namely Psammobates tentorius verroxii (Near Threatened and Protected). A few individuals have been observed within the region, especially near the drainage systems. This

tortoise species is fairly widespread within the region with population densities being generally low throughout its range (populations furthermore appear to be declining slowly). In terms of the likely impacts of the development on these tortoise species, habitat loss is not likely to be highly significant as the direct footprint of the development is not likely to exceed a few hundred hectares and this would not be significant in context of the relatively homogenous and intact surrounding landscape. In some situations, the loss of vegetation cover associated with roads and grid line construction and other cleared areas can generate potential impact on these species as they may be vulnerable to predation while crossing such cleared areas, but as the site is arid, plant cover is already low.

- In terms of mammal SCC, based on the ecology and behaviour of such potential Mammal SCC that may occur within the region, as well as the general design and layout of the proposed WEF (avoiding sandy alluvial washes and floodplains as well steep slopes and tall ridges) it is highly unlikely that this development will threaten local individual and populations of Mammal SCC.
- Furthermore, impacts on the general mammal and reptile populations are likely to be low due to fairly small development footprint, the vast extent available natural habitats and the fact that very limited development will occur within "sensitive" faunal habitats (minor alluvial washes and the steeper, boulder strewn slopes). Development within these habitats are restricted to access roads and underground cabling. The extent of development that will occur within these habitats are regarded as acceptable (within the implementation of mitigation measures) and will not result in a reduction in local faunal biodiversity and the fragmentation of important faunal populations.
- Impacts on potential amphibian SCC are highly unlike due to the fact that no amphibian SCC have a natural distribution that include this region. Furthermore, impacts on the general amphibian population are likely to be very low given the limited extent of the development as well as the extremely low density of amphibians in the area. As already mentioned, although there are some available amphibian habitats within the region, these habitats are largely avoided.

During the construction phase noise generated may cause some temporary disturbances although it is expected that this will not deter these species.

Disturbance of faunal species can be maintained to a minimum and low significance by implementing effective mitigation measures. Most of the natural occurring species are mobile and will most likely move away from the development area during construction phase with some species likely to return during the operation phase. Less mobile species such as tortoises, snakes and potential amphibian species should be looked out for and where encountered should either be relocated as recommended by the ECO or be left undisturbed if the development will not affect the species (e.g. toads and frogs of nearby wetland habitats).

Impact 3. Soil erosion and associated degradation of ecosystems

This impact along with the loss of vegetation is probably the most significant impact that may occur due to the proposed development. Soil erosion is a frequent risk associated with WEFs on account of the vegetation clearing and disturbance associated with the construction phase of the development and may continue occurring throughout the operation phase. Service roads and installed infrastructure will generate increased direct runoff during intense rainfall events and may exacerbate the loss of topsoil and the effects of erosion. These eroded materials may enter the nearby watercourses and may potentially impact these systems through siltation and change in chemistry and turbidity of the water. Current erosion observed within the affected farm properties was low to moderate-low.

With effective mitigation measures in place including regular monitoring of the occurrence, spread and potential cumulative effects of erosion may be limited to an absolute minimum.

Impact 4. Alien Plant Invasions

Major factors contributing to invasion by alien invader plants includes habitat disturbance and associated destruction of indigenous vegetation. Consequences of this may include:

- » change in the vegetation structure leading to change in various habitat characteristics and loss of indigenous vegetation;
- » replacement of palatable species with unpalatable species therefore reducing the grazing capacity of the area;
- » change in the plant species composition;
- » change in soil chemistry properties;
- » loss of sensitive habitats (e.g. downstream watercourses and wetlands);
- » loss or disturbance to individuals of rare, endangered, endemic and/or protected species;
- » fragmentation of sensitive habitats;
- » change in flammability of vegetation, depending on alien species; and
- » impairment of wetland function.

The affected farm properties, mostly contain very low levels of IAPs, with the exception of a few watercourses that have been invaded with *Prosopis* trees. These species, along with other potential IAPs, may be a threat during the construction phase and throughout the operation phase and will require regular and careful attention. With affective and meticulous mitigation measures in place this can be achieved.

Impact 7. Impacts on broad-scale ecological processes

Ecological processes generally occupy larger areas than biodiversity pattern features. They are also more difficult to measure and map. For the purposes here inferred ecological processes are associated with whole habitats, specific habitat patches or any other part of the landscape that can be spatially defined and mapped.

Important ecological processes operating at the site include:

» Climate-change refuge habitats. These are areas or habitats that have moderated microclimates relative to the broader landscape and allow species to persist in a landscape that has otherwise incompatible climate. At the site such habitats include:

  - Steeper, south-facing slopes of the linear ridge system; and the
  - Structurally more complex portions (upper slopes) of the linear ridge system.

» Dry rivers/larger ephemeral washes have permanent sub-surface water flow which supports trees and taller shrubs in a landscape that is otherwise mostly devoid of trees. These trees are a keystone ecological resource for local biodiversity.
» Island biogeography. In nature size matters and larger patches of habitat support more species and are more resilient to ecological perturbation. Even though the linear ridge system, running from west to east, is fairly narrow ridge, this ridge covers a fairly extensive linear distance of approximately 94km and is, especially to the west, fairly closely associated (connected) to other similar ridge systems and inselbergs. This ridge systems furthermore comprise of few patches of habitats of potential conservation concern. Any activity that reduces the overall size of (quartzite on) this ridge systems or any of the important habitats will potentially have a disproportionately large regional ecological impact.
» Species movement. The linear ridge system as well as the larger ephemeral washes potentially function as important corridors for the movement of fauna as well as flora. Activities that reduce the ability of these habitats to facilitate species movement will have a potentially disproportionately large regional impact on species movement.

Due to current layout, mostly avoiding impacts on the sensitive habitats (impacts on areas regarded as "very high" sensitive have been completely avoided and impacts on slightly less sensitive habitats, restricted to infrastructure that will have a fairly low and limited impact on these more sensitive features, e.g. limited road and underground cable watercourse crossings), as well as the location and relative size of the development, relative to the sensitive habitats, the contribution of this development to the impacts on broad-scale ecological processes is regarded as very small. The presence of the wind turbines and daily operational activities at the site may however, deter certain species from the area, potentially resulting in a very small and insignificant loss in broad-scale landscape connectivity. This impact would persist for the life of the facility and is thus assessed for the operational phase of the wind farm.

9.4. Assessment of Impacts

CONSTRUCTION PHASE		
Impact 1: Potential impacts on vegetation and listed or protected plant species.		
Environmental Parameter	Vegetation and protected plant species	
Issue/Impact/Environmental Effect/Nature	Vegetation clearing for access roads, turbines and their service areas and other infrastructure will impact on vegetation and protected plant species. Impacts on vegetation and protected plant species would occur due to the construction of the facility and associated infrastructure. This impact is regarded as the most likely and significant impact and will lead to direct loss of vegetation including protected species. The most likely consequences include: » local loss of habitat (to an extent as a natural ground covering will be maintained where possible); » very small and local disturbance to processes maintaining local biodiversity and ecosystem goods and services; and » a potential loss of a few local protected species.	
	Pre-Mitigation Impact Rating	**Post Mitigation Impact Rating**
Extent	**1**	**1**
Probability	**4**	**4**
Reversibility	**2**	**2**
Irreplaceable loss	**2**	**1**
Duration	**3**	**3**
Intensity/Magnitude	**3**	**2**
Total	**33**	**20**
Status	**Negative**	**Negative**
Significance	**Medium**	**Low**
Mitigation Measures	» Preconstruction walk-through of the final development footprint for protected species that would be affected and that can be translocated. » Since a large proportion of the identified protected species at the site are succulents and geophytes, the potential for successful translocation is high. Before construction commences individuals of listed species within the development footprint that would be affected, should be counted and marked and translocated where deemed necessary by the ecologist conducting the pre-construction walk-through survey, and according to the recommended ratios. Permits from the relevant provincial authorities, will be required to relocate and/or disturb listed plant species. » Any individuals of protected species affected by and observed within the development footprint during construction should be translocated under	

	the supervision of the ECO and/or Contractor's Environmental Officer (EO). » Pre-construction environmental induction for all construction staff on site to ensure that basic environmental principles are adhered to. This includes awareness to no littering, appropriate handling of pollution and chemical spills, avoiding fire hazards, minimising wildlife interactions, remaining within demarcated construction areas etc. » Demarcate all areas to be cleared with construction tape or similar material where practical. However, caution should be exercised to avoid using material that might entangle fauna. » ECO and/or Contractor's EO to provide supervision and oversight of vegetation clearing activities and other activities which may cause damage to the environment, especially at the initiation of the project, when the majority of vegetation clearing is taking place. » Ensure that laydown areas, construction camps and other temporary use areas are located in areas of low and medium sensitivity and are properly fenced or demarcated as appropriate and practically possible. » All vehicles to remain on demarcated roads and no unnecessary driving in the veld outside these areas should be allowed. » Regular dust suppression during construction, if deemed necessary, especially along access roads. » No plants may be translocated or otherwise uprooted or disturbed for rehabilitation or other purpose without express permission from the ECO and or Contractor's EO. » No fires should be allowed on-site.
Impact 2: Direct Faunal Impacts.	
Environmental Parameter	Faunal impacts due to construction activities
Issue/Impact/Environmental Effect/Nature	Increased levels of noise, pollution, disturbance and human presence during construction 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 impact on fauna is highly likely to occur during construction.

	Pre-Mitigation Impact Rating	**Post Mitigation Impact Rating**
Extent	**2**	**2**
Probability	**3**	**2**
Reversibility	**2**	**2**
Irreplaceable loss	**2**	**1**
Duration	**4**	**2**
Intensity/Magnitude	**3**	**2**
Total	**39**	**18**
Status	**Negative**	**Negative**
Significance	**Medium**	**Low**

Mitigation Measures	» Site access should be controlled and no unauthorised persons should be allowed onto the site. » Any fauna directly threatened by the associated activities should be removed to a safe location by a suitably qualified person. » The collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden. Personnel should not be allowed to wander off the demarcated site. » Fires should not be allowed on site. » 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. » All construction vehicles should adhere to a low speed limit (30km/h) to avoid collisions with susceptible species such as snakes and tortoises. » Construction vehicles limited to a minimal footprint on site (no movement outside of the earmarked footprint).

OPERATIONAL PHASE		
Impact 3: Soil erosion and associated degradation of ecosystems.		
Environmental Parameter	Ecosystem integrity and the delivery of ecosystem services such as grazing and clean water.	
Issue/Impact/Environmental Effect/Nature	Following construction, there will be a lot of disturbed and loose soil at the site which will render the area vulnerable to erosion. Erosion is one of the greater risk factors associated with the development and it is therefore critically important that proper erosion control structures are built and maintained over the lifespan of the project.	
	Pre-Mitigation Impact Rating	**Post Mitigation Impact Rating**
Extent	**2**	**1**
Probability	**3**	**2**
Reversibility	**2**	**1**
Irreplaceable loss	**2**	**1**
Duration	**4**	**1**
Intensity/Magnitude	**3**	**2**
Total	**39**	**12**
Status	**Negative**	**Negative**
Significance	**Medium**	**Low**
Mitigation Measures	» Any erosion problems observed along access roads or any hardened/engineered surface should be rectified immediately and monitored thereafter to ensure that they do not re-occur. » All bare areas (excluding agricultural land and the development footprint), affected by the development, should be re-vegetated with	

	locally occurring species, to bind the soil and limit erosion potential where applicable. » Re-instate as much of the eroded area to its pre-disturbed, "natural" geometry (no change in elevation and any banks not to be steepened) where possible. » Roads and other disturbed areas should be regularly monitored for erosion problems and problem areas should receive follow-up monitoring by the EO to assess the success of the remediation. » Topsoil must be removed and stored separately from subsoil. Topsoil must be reapplied where appropriate as soon as possible in order to encourage and facilitate rapid regeneration of the natural vegetation on cleared areas. » Practical phased development and vegetation clearing must be practiced so that cleared areas are not left un-vegetated and vulnerable to erosion for extended periods of time.
Impact 4: Alien Plant Invasion.	
Environmental Parameter	Biodiversity, ecosystem integrity and the delivery of ecosystem services such as forage.
Issue/Impact/Environmental Effect/Nature	Increased alien plant invasion is one of the greatest risk factors associated with this development following the construction phase. The disturbed and bare ground that is likely to be present at the site during and after construction would leave the site vulnerable to alien plant invasion for some time if not managed. Furthermore, the National Environmental Management Biodiversity Act (Act No. 10 of 2004), as well as the Conservation of Agricultural Resources Act, (Act No. 43 of 1983) requires that listed alien species are controlled in accordance with the Act.

	Pre-Mitigation Impact Rating	**Post Mitigation Impact Rating**
Extent	**2**	**1**
Probability	**4**	**3**
Reversibility	**2**	**1**
Irreplaceable loss	**2**	**1**
Duration	**4**	**2**
Intensity/Magnitude	**3**	**1**
Total	**42**	**8**
Status	**Negative**	**Negative**
Significance	**Medium**	**Low**

Mitigation Measures	» The successful reduction in the treat (significance) posed by Alien Invasive Plants relies on a detailed; o Site-specific eradication and management programme for alien invasive plants; o Site-specific Vegetation Rehabilitation Management Plan; and o The meticulous implementation of this Management Plan.

	» Such an Alien Invasive and Vegetation Rehabilitation Management Plans must subsequently be included in the Environmental Management Programme (EMPr). » Regular monitoring by the operation and maintenance team for alien plants must occur and could be conducted simultaneously with erosion monitoring. » When alien plants are detected, these must be controlled and cleared using the recommended control measures for each species to ensure that the problem is not exacerbated or does not re-occur and increase to problematic levels. » Clearing methods must aim to keep disturbance to a minimum. » No planting or importing any listed invasive alien plant species (all Category 1a, 1b and 2 invasive species) to the site for landscaping, rehabilitation or any other purpose must be undertaken.
DECOMMISSIONING PHASE	
Impact 5: Direct Faunal Impacts.	
Environmental Parameter	Faunal impacts due to decommissioning activities
Issue/Impact/Environmental Effect/Nature	Increased levels of noise, pollution, disturbance and human presence during decommissioning will be detrimental to fauna. Sensitive and shy fauna would move away from the area during this 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 impact on fauna is highly likely to occur during construction.
	Pre-Mitigation Impact Rating / **Post Mitigation Impact Rating**
Extent	**2** / **2**
Probability	**3** / **2**
Reversibility	**2** / **2**
Irreplaceable loss	**1** / **1**
Duration	**2** / **2**
Intensity/Magnitude	**3** / **2**
Total	**30** / **18**
Status	**Negative** / **Negative**
Significance	**Medium** / **Low**
Mitigation Measures	» Site access should be controlled and no unauthorised persons should be allowed onto the site. » Any fauna directly threatened by the associated activities should be removed to a safe location by a suitably qualified person. » The collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden. Personnel should not be allowed to wander off the demarcated site. » Fires should not be allowed on site.

	» 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. » All vehicles should adhere to a low speed limit (30km/h) to avoid collisions with susceptible species such as snakes and tortoises. » Vehicles limited to a minimal footprint on site (no movement outside of the earmarked footprint).	
Impact 6: Soil erosion and associated degradation of ecosystems.		
Environmental Parameter	Ecosystem integrity and the delivery of ecosystem services such as grazing and clean water.	
Issue/Impact/Environmental Effect/Nature	Following decommission, there will be a lot of disturbed and loose soil at the site which will render the area vulnerable to erosion.	
	Pre-Mitigation Impact Rating	**Post Mitigation Impact Rating**
Extent	**2**	**1**
Probability	**4**	**2**
Reversibility	**2**	**1**
Irreplaceable loss	**2**	**1**
Duration	**4**	**1**
Intensity/Magnitude	**3**	**2**
Total	**42**	**12**
Status	**Negative**	**Negative**
Significance	**Medium**	**Low**
Mitigation Measures	» Any erosion problems observed should be rectified immediately and monitored thereafter to ensure that they do not re-occur. » There should be regular monitoring for erosion for at least 2 years after decommissioning by the applicant to ensure that no erosion problems develop as a result of the disturbance, and if they do, to immediately implement erosion control measures. » All bare areas, affected by the development, should be re-vegetated with locally occurring species, to bind the soil and limit erosion potential where applicable. » Re-instate as much of the eroded area to its pre-disturbed, "natural" geometry (no change in elevation and any banks not to be steepened) where possible.	
Impact 7: Alien Plant Invasion.		
Environmental Parameter	Biodiversity, ecosystem integrity and the delivery of ecosystem services such as forage.	
Issue/Impact/Environmental Effect/Nature	Increased alien plant invasion is one of the greatest risk factors associated with this development following the decommission phase. The disturbed and bare ground that is likely to be present at the site during and after	

	decommission would leave the site vulnerable to alien plant invasion for some time if not managed. Furthermore, the National Environmental Management Biodiversity Act (Act No. 10 of 2004), as well as the Conservation of Agricultural Resources Act, (Act No. 43 of 1983) requires that listed alien species are controlled in accordance with the Act.

	Pre-Mitigation Impact Rating	**Post Mitigation Impact Rating**
Extent	**2**	**1**
Probability	**4**	**3**
Reversibility	**2**	**1**
Irreplaceable loss	**2**	**1**
Duration	**4**	**2**
Intensity/Magnitude	**3**	**1**
Total	**42**	**8**
Status	**Negative**	**Negative**
Significance	**Medium**	**Low**

Mitigation Measures	» The successful reduction in the treat (significance) posed by Alien Invasive Plants relies on a detailed; o Site-specific eradication and management programme for alien invasive plants; o Site-specific Vegetation Rehabilitation Management Plan; and o The meticulous implementation of this Management Plan. » Such an Alien Invasive and Vegetation Rehabilitation Management Plans must subsequently be included in the Environmental Management Programme (EMPr). » Due to the disturbance at the site alien plant species are likely to be a long-term problem at the site following decommissioning and regular control will need to be implemented until a cover of indigenous species has returned. » When alien plants are detected, these must be controlled and cleared using the recommended control measures for each species to ensure that the problem is not exacerbated or does not re-occur and increase to problematic levels. » Clearing methods must aim to keep disturbance to a minimum. » No planting or importing any listed invasive alien plant species (all Category 1a, 1b and 2 invasive species) to the site for landscaping, rehabilitation or any other purpose must be undertaken.
CUMULATIVE IMPACTS	
Impact 8: Impact on Critical Biodiversity Areas and broad-scale ecological processes.	
Environmental Parameter	Broad-scale ecological processes, especially habitat fragmentation.
Issue/Impact/Environmental Effect/Nature	Transformation of intact habitats could potentially compromise ecological processes as well as ecological functioning of important habitats and would contribute to the fragmentation of the landscape and would potentially

	disrupt the connectivity of the landscape for fauna and flora and impair their ability to respond to environmental fluctuations.

	Pre-Mitigation Impact Rating	Post Mitigation Impact Rating
Extent	**2**	**2**
Probability	**2**	**1**
Reversibility	**2**	**2**
Irreplaceable loss	**2**	**1**
Duration	**4**	**3**
Intensity/Magnitude	**3**	**2**
Total	**36**	**18**
Status	**Negative**	**Negative**
Significance	**Medium**	**Low**

Mitigation Measures	» The development footprint should be kept to a minimum and natural vegetation should be encouraged to return to disturbed areas. » An open space management plan should be developed for the site, which should include management of biodiversity within the fenced area, as well as that in the adjacent rangeland. » Reduce the footprint of the facility within sensitive habitat types as much as possible.

10. CONDITIONS FOR INCLUSION IN THE EMPR

Impact/ Aspect	Mitigation/Management Actions	*Responsibility*	*Methodology*	Mitigation/Management Objectives and Outcomes	*Frequency*
Planning Phase					
Disturbance/loss of natural vegetation					
Disturbance and loss of vegetation	» Ensure that laydown areas, construction camps and other temporary use areas are located in areas of low and medium sensitivity and are properly fenced or demarcated as appropriate and practically possible. » The location of the construction equipment camp and other temporary use areas shall be approved by the project EO/ECO or the specialist doing the pre-commencement footprint investigation	Project Company and EO/ECO	» Design-Layout taking into account delineated habitat features and their ecological importance and sensitivity	» To ensure selection of best environmental option for positioning alignment of proposed infrastructure » Environmental sensitivities are taken into consideration and avoided as far as possible, thereby mitigating potential impacts	Once-off during the Design Phase
Disturbance and loss of sensitive Habitats.					
Disturbance and loss of vegetation within sensitive habitats	» For watercourse crossings, where it is possible the underground cables should be laid within the roads in order to avoid any unnecessary disturbance to the vegetation of the watercourses. » Furthermore, for all watercourse crossings, the engineering team must provide an effective means to minimise the loss of riparian vegetation (small as possible footprint).	Project Company	» Design-Layout taking into account the location, nature, morphology and ecological drivers of the watercourses to be crossed.	» To ensure selection of best environmental option for positioning alignment of proposed infrastructure » Environmental sensitivities are taken into consideration and avoided as far as possible, thereby mitigating potential impacts	Once-off during the Design Phase

	» Sites for storing, mixing, and handling topsoil piles (if necessary) or any introduced materials, including all machinery or processing implements, should be placed in an ecologically least sensitive area and at least 100 m from any drainage area. » Other components of the proposed development that may under no circumstance be located in or within 100 m of any drainage would include: • Man-camps and/or ablution facilities • Any form of waste/soil/overburden disposal • Any form of storage of materials or machinery • Offices, and • Substations and switching stations • Battery Energy Storage Facilities		» Design-Layout taking into account delineated sensitive habitat features and their ecological importance and sensitivity	» To ensure selection of best environmental option for positioning alignment of proposed infrastructure » Environmental sensitivities are taken into consideration and avoided as far as possible, thereby mitigating potential impacts	
Soil erosion and associated degradation of ecosystems					
Soil erosion and associated degradation of ecosystems	» Compile a comprehensive erosion control and stormwater management plan for the footprint area as part of the final design of the project	Project Company and relevant specialist	» Design-Layout taking into account the location and nature of the specific infrastructure as well as the location, nature and morphology of the area wherein the infrastructure will be placed	» To minimise impacts on the biophysical environment » To restrict any residual or cumulative impacts to the development footprint where these impacts are maintained to an absolute minimal/acceptable level.	Once-off during the Design Phase

	» Vegetation rehabilitation management plan. • Minimum requirements are listed under the Construction and Operational Phase EMPr		» Compilation of a Vegetation Rehabilitation plan taking into account the various vegetation units, patterns and key plant species, as identified within the terrestrial ecological report.	» To ensure optimal rehabilitation of temporary disturbed areas (post-construction), with a stable, natural occurring vegetation cover, resembling as far as possible the vegetation composition, patterns and structure of the surrounding vegetation cover. » To ensure optimal rehabilitation of development footprint (post-decommissioning), with a stable, natural occurring vegetation cover, resembling as far as possible the vegetation composition, patterns and structure of the surrounding vegetation cover.	

	» Where new watercourse crossings are required and/or where existing routes will have to be upgraded and widened, the engineering team must provide an effective means to minimise the potential effects of sedimentation and erosion (erosion protection). » Design and construct any necessary erosion protection works where the infrastructure intersects the channel banks in order to prevent scouring or outer-bank erosion. Protection works to be considered include gabions, reno mattresses or other stabilising structures to armour them. » Structures that cater for through flows (e.g. culverts) should not only allow for the maximum volume of flows but should distribute flows naturally so not to concentrate flows downstream, which could induce erosion/scouring.	Project Company	» Design-Layout taking into account the location, nature, morphology and ecological drivers of the watercourses to be crossed.	» To ensure selection of best environmental option for positioning alignment of proposed infrastructure » Environmental sensitivities are taken into consideration and avoided as far as possible, thereby mitigating potential impacts	Once-off during the Design Phase
	» Stormwater from hard stand areas, buildings and substation must be managed using appropriate channels and swales when located within steep areas. » No stormwater runoff must be allowed to discharge directly into the watercourses. » The runoff should rather be dissipated over a broad area covered by natural vegetation.		» Design-Layout taking into account the location and nature of the specific infrastructure as well as the location, nature and morphology of the area wherein the infrastructure will be placed		
Construction Phase					
Disturbance/loss of natural vegetation					

	» Demarcate all areas to be cleared with construction tape or similar material where practical. However, caution should be exercised to avoid using material that might entangle fauna. • Prevent unnecessary destructive activity within construction areas (prevent over-excavations and double handling) • Create specific turning points and parking areas for vehicles and heavy machinery as needed • Strictly prohibit any driving outside designated areas and roads.	Project Company, monitored by ECO/EO	» Taking into account the final design-layout, and any sensitive areas, demarcate the absolute minimal development footprint, and ensure that the appointed contractor is made aware of where what activities and impacts are allowed and disallowed.	» To minimise impacts on the biophysical environment » To prevent any residual or cumulative impacts arising.	Prior to commencement of construction activities

	» No unnecessary vegetation clearance may be allowed. » ECO and/or Contractor's EO to provide supervision and oversight of vegetation clearing activities and other activities which may cause damage to the environment, especially at the initiation of the project, when the majority of vegetation clearing is taking place. » All vehicles to remain on demarcated roads and no unnecessary driving in the veld outside these areas should be allowed. » Regular dust suppression during construction, if deemed necessary, especially along access roads. » No fires should be allowed on-site » No plants may be translocated or otherwise uprooted or disturbed for rehabilitation or other purpose without express permission from the ECO and or Contractor's EO.	Contractor/ ECO/EO	» At all times be acutely aware of the specified development footprint, and remain within this area avoiding any disturbance of vegetation outside of these areas. » Even within the development footprint, where vegetation can be allowed to persist undisturbed, this must be imposed. » The ECO will also need to prepare an induction and training programme to educate the contracting team on the EMPr commitments. » Contractor to develop an internal reporting structure to monitor compliance with the commitments given in the EMPr as construction progresses. » The EMPr should be enforced and monitored for compliance by a suitably qualified/trained ECO (Environmental Control Officer) with any additional supporting EO's (Environmental Officers) having the required competency skills and experience to ensure that environmental mitigation measures are being implemented and appropriate action is taken where potentially	» To minimise impacts on the biophysical environment » To prevent any residual or cumulative impacts arising.	EMPr induction and training: Prior to commencement of construction activities Rest of the mitigation measures: Throughout construction and decommissioning phases

			adverse environmental impacts are highlighted through monitoring and surveillance. » The ECO will need to be responsible for conducting regular site-inspections of the construction, processes, reporting back to the relevant environmental authorities with findings of these investigations.		
Disturbance of faunal species					
Disturbance of fauna.	» Site access should be controlled and no unauthorised persons should be allowed onto the site. » Any fauna directly threatened by the associated activities should be removed to a safe location by a suitably qualified person. » The collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden. Personnel should not be allowed to wander off the demarcated site. » Fires should not be allowed on site. » 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. » All construction vehicles should adhere to a low speed limit (30km/h) to avoid collisions with susceptible species such as snakes and tortoises. » Construction vehicles limited to a minimal footprint on site (no movement outside of the earmarked footprint).	Contractor/ ECO/EO Contractor/ ECO/EO	» At all times be acutely aware of the specified development footprint, and remain within this area avoiding any disturbance of vegetation outside of these areas. » The ECO will also need to prepare an induction and training programme to educate the contracting team on the EMPr commitments and how address/handle specific fauna when encountered. » Contractor to develop an internal reporting structure to monitor compliance with the commitments given in the EMPr as construction progresses. » The EMPr should be enforced and monitored for compliance by a suitably qualified/trained ECO (Environmental Control Officer) with any additional	» To minimise impacts on the biophysical environment » To prevent any residual or cumulative impacts arising. » Prevent mortality and injury of faunal species.	EMPr induction and training: Prior to commencement of construction activities Rest of the mitigation measures: Throughout construction and decommissioning phases Daily inspections throughout construction and decommissioning phases

	» All mammal, large reptiles and avifauna species found injured during construction will be taken to a suitably qualified veterinarian or rehabilitation centre to either be put down in a humane manner or cared for until it can be released again		supporting EO's (Environmental Officers) having the required competency skills and experience to ensure that environmental mitigation measures are being implemented and appropriate action is taken where potentially adverse environmental impacts are highlighted through monitoring and surveillance. » The ECO will need to be responsible for conducting regular site-inspections of the construction, reporting back to the relevant environmental authorities with findings of these investigations.		
	» All cable trenches, excavations should be checked on a daily basis for the presence of trapped animals. » Any animals found should be removed in a safe manner, unharmed, and placed in an area where the animal will be comfortable. » If the ECO or contractor is unable to assist in the movement of a fauna species, ensure a member of the conservation authorities assists with the translocation. » Note: the McGregor Museum in Kimberley could be approached for advice on relocating animals if required		» The ECO will also need to prepare an induction and training programme to educate the contracting team on the EMPr commitments and how address/handle specific fauna when encountered. » The EMPr should be enforced and monitored for compliance by a suitably qualified/trained ECO (Environmental Control Officer) with any additional supporting EO's (Environmental Officers) having the required competency skills and experience to ensure that		

			environmental mitigation measures are being implemented and appropriate action is taken where potentially adverse environmental impacts are highlighted through monitoring and surveillance. » The ECO will need to be responsible for conducting regular site-inspections of the construction, processes, reporting back to the relevant environmental authorities with findings of these investigations.		
Disturbance and loss of sensitive Habitats.					
Disturbance and loss of vegetation within sensitive habitats	» The working servitude within the watercourses must be demarcated on both sides using orange hazard netting prior to construction commencing.	Project Company, monitored by ECO/EO	» Taking into account the final design-layout, and any sensitive areas, demarcate the absolute minimal development footprint, and ensure that the appointed contractor is made aware of where what activities and impacts are allowed and disallowed.	» To minimise impacts on sensitive habitats. » To prevent any residual or cumulative impacts arising. » To ensure the persistence/maintenance of the REC	Prior to commencement of construction activities

	» All sensitive habitats outside of the demarcated construction area must be considered 'No-Go' areas for the duration of the construction phase. » For watercourse road and cable crossings, no physical damage should be done to any aspects of the channel and banks of watercourses other than those necessary to complete the works as specified. » Avoid stockpiling materials in vegetated areas that will not be cleared.	Contractor/ ECO/EO	» At all times be acutely aware of the specified development footprint, and remain within this area avoiding any disturbance of vegetation outside of these areas. » The ECO will also need to prepare an induction and training programme to educate the contracting team on the EMPr commitments. » Contractor to develop an internal reporting structure to monitor compliance with the commitments given in the EMPr as construction progresses. » The EMPr should be enforced and monitored for compliance by a suitably qualified/trained ECO (Environmental Control Officer) with any additional supporting EO's (Environmental Officers) having the required competency skills and experience to ensure that environmental mitigation measures are being implemented and appropriate action is taken where potentially adverse environmental impacts are highlighted through monitoring and surveillance. » The ECO will need to be responsible for conducting	» To minimise impacts on sensitive habitats » To prevent any residual or cumulative impacts arising. » To ensure the persistence/maintenance of the REC	Throughout construction and decommissioning Phases

			regular site-inspections of the construction, processes, reporting back to the relevant environmental authorities with findings of these investigations.		
Disturbance/Loss of Fauna and Flora SCC as well as protected species					
Disturbance and loss of Faunal and Floral Species of Conservation Concern (SCC) as well as protected species.	» Preconstruction walk-through of the final development footprint for protected species that would be affected and that can be translocated.	Project Company, carried out by a registered Ecologist	» Within the development footprint, Identify, mark (GPS), count, describe and map all populations/individuals of protected and fauna-, flora SCC. » All results to be incorporated in an Ecological Pre-construction Walk-through Report	» To ensure the persistence of healthy, viable populations of protected and SCC within the project site. » To ensure the acceptable rehabilitation of the development footprint.	Prior to commencement of construction activities
	» The above pre-construction footprint investigations will be used together with results from the ecological specialist report to draft the following: • A comprehensive search and rescue program for plants and possible burrowing animals • A comprehensive alien invasive species eradication and management plan		» Compile detailed reports, with achievable goals.		
	» Obtain permits for protected plant removal and relocation prior to commencement of any activity related to this development	Project Company, or contractor responsible for vegetation clearing, assisted by an EAP/Specialist	» Provide the relevant authorities with the necessary information and reports.	» To ensure the persistence of healthy, viable populations of protected and SCC within the project site	Prior to commencement of construction activities

	» Search and Rescue (S&R) of all SCC and protected plants that will be affected by the development, especially species occurring in long term and permanent, hard surface development footprints (i.e. all buildings, new roads and tracks, lay down areas, and turbine positions) should take place. • Plants that can be considered for rescue, and included in subsequent rehabilitation programs are all desirable geophytes and indigenous succulents » All rescued species should be transplanted immediately or bagged (or succulents left to first air-dry before planting) and kept in the horticulturist's or a designated on-site nursery, and should be returned to site or land portion once all construction is completed and rehabilitation of disturbed areas is required. » Replanting should occur in summer to early autumn once sufficient rains have fallen, in order to facilitate establishment.	Contractor monitored and approved by ECO/EO	» The ECO will also need to prepare an induction and training programme to educate the contracting team responsible for S&R on the species to be S&R, the commitments, and appropriate methodology. » S&R team to develop an internal reporting structure to record and monitor S&R. » S&R should be enforced and monitored by a suitably qualified/trained ECO (Environmental Control Officer) with any additional supporting EO's (Environmental Officers) having the required competency skills and experience to ensure that S&R activities are being implemented appropriately.	» To ensure the persistence of healthy, viable populations of protected and SCC within the project site	Initial S&R: Prior to commencement of construction activities Any additional species only observed after the initial S&R: Throughout the construction phase
	» Any additional individuals of protected species affected by and observed within the development footprint during construction (after the initial Search and Rescue) should be translocated under the supervision of the ECO and/or Contractor's Environmental Officer (EO).		» The ECO will need to be responsible for conducting regular site-inspections of the construction, processes, reporting back to the relevant environmental authorities with findings of these investigations.		
Soil erosion and associated degradation of ecosystems					
Soil erosion and associate	» Vegetation clearing should occur in a phased manner to minimise erosion and/or run-off. » No unnecessary vegetation clearance may be allowed.	Contractor, ECO to control	» At all times be acutely aware of the specified development footprint, and remain within this area avoiding any disturbance of	» To minimise erosion of soil from site during construction	Throughout construction and decommissioning Phases

	» Limit the physical footprint of the road and verges that would require clearing to a minimum. » No activities or disturbance/transformation permitted outside of the development area. » Any erosion problems observed along access roads or any hardened/ engineered surface should be rectified immediately and monitored thereafter to ensure that they do not re-occur. » Re-instate as much of the eroded area to its pre-disturbed, "natural" geometry (no change in elevation and any banks not to be steepened) where possible. » Implement best practice erosion protection and stormwater management during construction and operation; » Roads and other disturbed areas should be regularly monitored for erosion problems and problem areas should receive follow-up monitoring by the EO to assess the success of the remediation.		vegetation outside of these areas. » The ECO will also need to prepare an induction and training programme to educate the contracting team on the EMPr commitments. » Contractor to develop an internal reporting structure to monitor compliance with the commitments given in the EMPr as construction progresses. » The EMPr should be enforced and monitored for compliance by a suitably qualified/trained ECO (Environmental Control Officer) with any additional supporting EO's (Environmental Officers) having the required competency skills and experience to ensure that environmental mitigation measures are being implemented and appropriate action is taken where potentially adverse environmental impacts are highlighted through monitoring and surveillance. » The ECO will need to be responsible for conducting regular site-inspections of the construction, processes, reporting back to the relevant	» To minimise deposition of soil into downstream freshwater resource features. » To minimise damage to vegetation by erosion or deposition » No accelerated overland flow related surface erosion as a result of a loss of vegetation cover	

			environmental authorities with findings of these investigations.		
	» Any stormwater within the site must be handled in a suitable manner, i.e. trap sediments, and reduce flow velocities » Run-off generated from cleared and disturbed areas such as access roads and slopes that drain into rivers, streams or wetlands must be controlled using erosion control and sediment trapping measures. These control measures must be established at regular intervals perpendicular to the slope to break surface flow energy and reduce erosion as well as trap sediment. » Sediment barriers (e.g. silt fences, sandbags, hay bales, earthen filter berms or retaining walls) must be established to protect downstream watercourses from erosion and sedimentation impacts from upslope. Sediment barriers should be regularly maintained and cleared so as to ensure effective drainage.	Contractor, ECO to control	» Design-Layout taking into account the location and nature of the specific infrastructure as well as the location, nature and morphology of the area wherein the infrastructure will be placed. » Additionally, the ECO will need to be responsible for conducting regular site-inspections of the construction, and operation footprint areas, identifying any additional areas that will have to be addressed. » Prompt and appropriate response, form the contractor, following any additional recommendations from the ECO.	» To minimise erosion of soil from site during construction » To minimise deposition of soil into downslope freshwater resource features. » To minimise damage to vegetation by erosion or deposition » No accelerated overland flow related surface erosion as a result of a loss of vegetation cover » No reduction in the surface area or natural functionality of natural freshwater resource features as a result of the establishment of infrastructure » No increase in runoff into downslope freshwater resource featurs as a result of construction of project related infrastructure » No increase in runoff into downslope freshwater resource features as a result of road construction	Prior to commencement of construction activities and throughout the construction and decommissioning phases.
	» Topsoil must be removed and stored separately from subsoil. » Topsoils should be removed (and stored) under dry conditions to avoid excessive compaction whenever topsoil will have to be stored for longer than one year.	Contractor, ECO to control	» Prior to construction, site and soil conditions to be investigated and appropriate area for topsoil storage to be identified.	» To retain full biological activity and functionality of topsoil » Remove and store all topsoil on areas that are to be excavated; and use this topsoil in	Before and during construction phase

	» Topsoil to be stored in berms with a width of 150 – 200 cm, and a maximum height of 100 cm, preferably lower • Place berms along contours or perpendicular to the prevailing wind direction • Adhere to the following general rule: the larger the pile of topsoil storage needs to be, the shorter should be the time it is stored » Topsoil handling should be reduced to stripping, piling (once), and re-application. Between the piling and reapplication, stored topsoils should not undergo any further handling except control of erosion and (alien) invasive vegetation		» Ensure the appropriate removal and storage of topsoil as specified within the EMPr. » The EMPr should be enforced and monitored for compliance by a suitably qualified/trained ECO (Environmental Control Officer) with any additional supporting EO's (Environmental Officers) having the required competency skills and experience to ensure that environmental mitigation measures are being implemented and appropriate action is taken where potentially adverse environmental impacts are highlighted through monitoring and surveillance.	subsequent rehabilitation of disturbed areas	
	» Topsoil must be reapplied where appropriate as soon as possible in order to encourage and facilitate rapid regeneration of the natural vegetation on cleared areas. » Topsoils should be spread evenly over the ripped or trimmed surface, if possible, not deeper than the topsoil originally removed » The final prepared surface should not be smooth but furrowed to follow the natural contours of the land » The final prepared surface shall be free of any pollution or any kind of contamination » Care should be taken to prevent the compaction of topsoil		» Topsoil re-application and rehabilitation done in accordance with the EMPr and Site Rehabilitation Management Plan		During and prior to construction phase
Operational Phase					

Soil erosion and associated degradation of ecosystems					
Soil erosion and associated degradation of ecosystems Construction: Soil erosion and associated degradation of ecosystems	» Site access should be controlled and no unauthorised persons should be allowed onto the site. » Strictly prohibit any driving outside designated areas and roads	Contractor, ECO to control	» Strict access control and the implementation of standard operating procedures	» Prevent any additional disturbance of soil and vegetation outside of the development footprint	Throughout the operational phase
	» Access roads or any hardened/ engineered surface should be regularly monitored for erosion problems. » Any erosion problems observed should be rectified immediately and monitored thereafter to ensure that they do not re-occur. » Implement best practice erosion protection and stormwater management during operation;		» Frequent monitoring of the development site and infrastructure by the ECO/EO, identifying any additional areas that will have to be addressed. » Prompt and appropriate response, form the contractor, following any additional recommendations from the ECO.	» Recreate a non-invasive, acceptable vegetation cover that will facilitate the establishment of desirable and/or indigenous species » Prevent accelerated erosion of ecosystem degradation	After construction and throughout operational phase
	» Re-instate as much of the eroded area to its pre-disturbed, "natural" geometry (no change in elevation and any banks not to be steepened) where possible. » All bare/disturbed areas, affected by the development, should be rehabilitated and re-vegetated with locally occurring species, to bind the soil and limit erosion potential where applicable. » revegetation will be done according to an approved planting/landscaping plan, also indicating the desirable end states of permissible vegetation » The establishment and new growth of revegetated and replanted species shall be closely monitored		» The ECO will need to prepare an induction and training programme to educate the contracting team on the EMPr commitments relating to site rehabilitation. » Contractor to develop an internal reporting structure to monitor compliance with the commitments given in the EMPr as construction progresses. » The EMPr and Rehabilitation Management Plan should be enforced and monitored for compliance by a suitably qualified/trained ECO (Environmental Control Officer)		After construction and throughout operational phase as well as after the decommissioning phase

	» Where necessary, reseeding or replanting will have to be done if no acceptable plant cover has been created » Monitor success of rehabilitation and revegetation and take remedial actions as needed according to the respective plan » Erosion shall be monitored at all times and measures taken as soon as detected » Where necessary, reseeding or replanting will have to be done if no acceptable plant cover has been created		with any additional supporting EO's (Environmental Officers) having the required competency skills and experience to ensure that environmental mitigation measures are being implemented and appropriate action is taken where potentially adverse environmental impacts are highlighted through monitoring and surveillance. » The ECO will need to be responsible for conducting regular site-inspections of the construction, and operational processes, reporting back to the relevant environmental authorities with findings of these investigations.		
	» Keep disturbance of indigenous vegetation to a minimum » Rehabilitate disturbed areas as quickly as possible » The meticulous implementation of the IAP and Rehabilitation Management Plans. » Regular monitoring by the operation and maintenance team for alien plants must occur and could be conducted simultaneously with erosion monitoring. » When alien plants are detected, these must be controlled and cleared using the recommended control measures for each species to ensure that the problem is not exacerbated or does not re-occur and increase to problematic levels.	Contractor, monitored by ECO	» The ECO will need to prepare an induction and training programme to educate the contracting team on the EMPr commitments relating to the management/eradication of AIPs. » Contractor to develop an internal reporting structure to monitor compliance with the commitments given in the EMPr as construction progresses. » The EMPr and IAP Managment Plan should be enforced and monitored for compliance by a	» The successful reduction in the treat (significance) posed by Alien Invasive Plants. » Recreate a non-invasive, acceptable vegetation cover that will facilitate the establishment of desirable and/or indigenous species	Throughout construction and operational phase as well as after the decommissioning phase

	» Clearing methods must aim to keep disturbance to a minimum. » No planting or importing any listed invasive alien plant species (all Category 1a, 1b and 2 invasive species) to the site for landscaping, rehabilitation or any other purpose must be undertaken.		suitably qualified/trained ECO (Environmental Control Officer) with any additional supporting EO's (Environmental Officers) having the required competency skills and experience to ensure that environmental mitigation measures are being implemented and appropriate action is taken where potentially adverse environmental impacts are highlighted through monitoring and surveillance. » The ECO will need to be responsible for conducting regular site-inspections of the construction, and operational processes, reporting back to the relevant environmental authorities with findings of these investigations.		

11. CONCLUSION

This study aimed to conduct a terrestrial ecological and biodiversity assessment of the projects site to:

- Identify any ecological sensitive areas (freshwater and terrestrial);
- Identify sensitive areas to be avoided (including corresponding spatial data);
- Provide recommendations regarding the areas available for the development of wind energy facilities; and
- Provide recommendations regarding any further assessments required.

As part of this Assessment a survey of the terrestrial features was conducted in October 2021 and March 2022.

The outcome of this report is a terrestrial ecological sensitivity map visually illustrating the findings and results which will then aid in the initial planning and design phase with the purpose of avoiding any sensitive areas.

Habitat sensitivity classification was based on available GIS coverages including various terrestrial ecosystems and biodiversity data, recent on-site surveys, and the expert's mapping from Google Earth satellite imagery (altitude 1 to 2 km).

The affected properties are currently used for livestock (cattle and sheep) farming. Infrastructure within the property is minimal and consists of kraals, homesteads, boreholes, small reservoirs, feeding and drinking points, stores, and power line infrastructure.

A summary of the sensitivities of the identified/delineated terrestrial resource features as well as general development recommendations for each feature are provided below in Table 25

Overall, no significant ecological as well as surface hydrological flaws that could pose a risk to the proposed WEF development were identified during the scoping phase assessment; this will however, be confirmed during a detailed field study of the vegetation of the area.

With mitigation measures in place, impacts on terrestrial ecological resource integrity and functioning can be potentially reduced to a sufficiently low level. This would be best achieved by incorporating the recommended management & mitigation measures into an Environmental Management Programme (EMPr) for the site, together with appropriate rehabilitation guidelines and ecological monitoring recommendations.

Based on the outcomes of this study it is my considered opinion that the proposed project detailed in this report could be authorised from a terrestrial ecological perspective.

Table 25: Summary of the EIA phase sensitivity assessment.

Feature	Scoping Phase Sensitivity	Remarks
Bushmanland Arid Grassland and Bushmanland Basin Shrubland on slightly broken/irregular sandy and gravel plains	**Medium**	» Development within these habitats are regarded as acceptable. » Care should be taken when developing in thus unit, since some of these areas are characterised by deeper sandier soils, that may be prone to erosion. » Therefore, erosion should be carefully monitored and mitigated wherever possible. » A pre-Construction Botanical and Faunal Walk-Through will have to be conducted in order to identify the presence of any potential sensitive species (protected and SCC) that may occupy/inhabit the development footprints of the WEF and to assist in the biodiversity permitting processes.
Structurally, less complex portions of Bushmanland Inselberg Shrublands	**Medium**	» Development within these medium sensitive portions of the Bushmanland Inselberg Shrubland are regarded as acceptable. » Erosion would likely not be a problem in this unit, given the shallow and rocky nature of the soils; however, the sandier pediments surrounding some of the larger ridges and outcrops may be vulnerable to erosion, and as such stormwater runoff from the disturbed areas should be mitigated in order to avoid unnatural runoff patterns within the disturbed areas, affecting the lower lying sandier areas. » Proposed Mitigation Measures includes: • A detailed Storm Water and Erosion Management Plan; • A detailed Plant Rehabilitation and Invasive Alien Plant Management Plan • A Pre-Construction Fauna and Flora Walk-Through conducted by a suitable qualified specialist. • will be required in order to determine whether there are any sensitive, restricted species confined to these areas and at risk of being impacted by the proposed development. • No activities may be allowed outside of the development area. • Implement appropriate measures to ensure strict control over the behaviour of construction workers.
Structurally complex portion of the Bushmanland Inselberg Shrublands	**High**	» According to the layout, these highly sensitive features of the linear ridge system will be avoided. » It is envisaged that the proposed development will not impact these sensitive areas.
Drainage Lines and 35m Buffers	**Medium**	» Nine small drainage lines will be crossed by access roads and underground cables. » This is deemed acceptable, with the necessary mitigation measures in place, as these crossings will not impact the more important downstream freshwater resource features. » Proposed Mitigation Measures includes:

		• Undertake construction activities in the dry season. • A detailed Storm Water and Erosion Management Plan; • A detailed Plant Rehabilitation and Invasive Alien Plant Management Plan • No activities may be allowed outside of the development area. • Implement appropriate measures to ensure strict control over the behaviour of construction workers. • The working servitude within these habitats must be demarcated on both sides using orange hazard netting prior to construction commencing and no activities may be allowed outside of the demarcated area. • All freshwater habitats outside of the demarcated construction area must be considered 'No-Go • Watercourse crossing should allow for the natural movement of water across the road crossing, without inhibiting the natural movement of water and may not result in changes to flow volumes and velocities, or create artificially inundated areas, but allow for the free-flow movement of water. • No unnecessary vegetation clearance may be allowed. • Any erosion observed to be associated with the project infrastructure should be rectified as soon as possible and monitored thereafter to ensure that they do not re-occur. • Construction of gabions and other stabilisation features to prevent erosion if deemed necessary.
Depression Wetlands and 50m buffers	**High**	» This, feature will be avoided by the proposed development. » Direct impacts on this feature is highly unlikely
Minor Ephemeral Washes and 50m Buffer Areas	**High**	» Only one such feature will be crossed by an access road and underground cables. » This is deemed acceptable, with the necessary mitigation measures in place, as these crossings will not impact the more important downstream freshwater resource features. » Proposed Mitigation Measures includes: • Undertake construction activities in the dry season. • A detailed Storm Water and Erosion Management Plan; • A detailed Plant Rehabilitation and Invasive Alien Plant Management Plan • No activities may be allowed outside of the development area. • Implement appropriate measures to ensure strict control over the behaviour of construction workers. • The working servitude within these habitats must be demarcated on both sides using orange hazard netting prior to construction commencing and no activities may be allowed outside of the demarcated area. • All freshwater habitats outside of the demarcated construction area must be considered 'No-Go • Watercourse crossing should allow for the natural movement of water across the road crossing, without inhibiting the natural movement of water and may not result in changes to flow volumes and velocities, or create artificially inundated areas, but allow for the free-flow movement of water.

		• No unnecessary vegetation clearance may be allowed. • Any erosion observed to be associated with the project infrastructure should be rectified as soon as possible and monitored thereafter to ensure that they do not re-occur. • Construction of gabions and other stabilisation features to prevent erosion if deemed necessary.
Primary and Larger Ephemeral Washes and 100m Buffer Areas	**Very High**	» This, feature will be avoided by the proposed development. » Direct impacts on this feature is highly unlikely

REFERENCES

Apps, P. (ed.). 2012. *Smither's Mammals of Southern Africa*. A field guide. Random House Struik, Cape Town, RSA

Alexander, G. & Marais, J. 2007. *A Guide to the Reptiles of Southern Africa*. Struik Nature, Cape Town.

Anhaeusser, C.R., Johnson, M.R., Thomas, R.J. (2008). The Geology of South Africa. Council for Geosciences.

Bates, M.F., Branch, W.R., Bauer, A.M., Burger, M., Marais, J., Alexander, G.J. & de Villiers, M. S. 2014. A*tlas and Red List of the Reptiles of South Africa, Lesotho, and Swaziland*. Strelitzia 32. SANBI, Pretoria.

Branch W.R. 1998. *Field guide to snakes and other reptiles of southern Africa*. Struik, Cape Town.

Cobbing, J.E. 2017. *An updated water balance for the Grootfontein aquifer near Mahikeng*. Water SA, **44 (1)**: 54 – 64.

CRITICAL BIODIVERSITY AREAS MAPS (PER MUNICIPALITY) AND GIS DATA AVAILABLE FROM: Biodiversity GIS (BGIS), South African National Biodiversity Institute, Tel. +27 21 799 8739 or CapeNature, Tel. +27 21 866 8000. Or on the web at: http://bgis.sanbi.org/fsp/project.asp

Department of Environmental Affairs and Tourism, 2007. National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004): Publication of lists of Critically Endangered, Endangered, Vulnerable and Protected Species. Government Gazette, Republic of South Africa

Department of Water and Sanitation. 2014. A Desktop Assessment of the Present Ecological State, Ecological Importance and Ecological Sensitivity per Sub Quaternary Reaches for Secondary Catchments in South Africa. Secondary: [W5 (for example)]. Compiled by RQIS DM:

https://www.dwa.gov.za/iwqs/rhp/eco/peseismodel.aspx accessed on 7/10/2018.

De Wit, M.C.J. 2016. *Early Permian diamond-bearing proximal eskers in the Lichtenburg/Ventersdorp area of the North West Province, South Africa*. S Afr J Geol., **119 (4)**: 585 - 606

Du Preez, L. & Carruthers, V. 2009. *A Complete Guide to the Frogs of Southern Africa*. Struik Nature., Cape Town.

Friedmann, Y. & Daly, B. 2004. Red data book of the mammals of South Africa, a conservation assessment. Johannesburg, Endangered Wildlife Trust.

Hoare, D. 2012. David Hoare Consulting cc (2012). Impact Assessment Report: Specialist ecological study on the potential impacts of the proposed Hidden Valley Wind Energy Facility Project near Matjiesfontein, Northern Cape.

Marais, J. 2004. *Complete Guide to the Snakes of Southern Africa.* Struik Nature, Cape Town.

Meyer, R. 2014. *Hydrogeology of Ground Water Region 10: The Karst Belt*. Water Research Commission, WRC Report No. TT553/15.

Morris, J.W. 1976. *Automatic classification of the highveld grassland of Lichtenburg, North-western Transvaal*. Bothalia, **12(4)**: 267 - 292

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

Minter LR, Burger M, Harrison JA, Braack HH, Bishop PJ & Kloepfer D (eds). 2004. *Atlas and Red Data book of the frogs of South Africa, Lesotho and Swaziland.* SI/MAB Series no. 9. Smithsonian Institution, Washington, D.C.

Raimondo, D., Von Staden, L., Foden, W., Victor, J.E., Helme, N.A., Turner, R.C. Kamundi, D.A. & Manyama, P.A. (Eds.). 2009. *Red list of South African plants* 2009. Strelitzia 25:1-668

Skinner, J.D. & Chimimba, C.T. 2005. The mammals of the Southern African Subregion. Cambridge University Press, Cambridge.

Strohbach, M. 2013. Mitigation of ecological impacts of renewable energy facilities in South Africa. The Sustainable Energy Resource Handbook (Renewable Energy) South Africa 4: 41 – 47.

Strohbach, M. 2013. Savannah Environmental (2013) Ecological Scoping Report: Proposed Gihon Solar Energy Facility South of Bela-Bela, Limpopo Province.

Tessema, A & Nzotta, U. 2014. Multi-Data Integration Approach in Groundwater Resource Potential Mapping: A Case Study from the North West Province, South Africa. WRC Report No. 2055/1/13. Water Research Commision.

Todd, S. 2015. Simon Todd Consulting (2015). Terrestrial Fauna & Flora Specialist Impact Assessment: Proposed Wolmaransstad 75 MW Solar Energy Facility in the North West Province.

Wilson, M.G.C., Henry, G. & Marshall, T.R. 2016. *A review of the alluvial diamond industry and the gravels of the North West Province, South Africa*. S Afr J Geol., **109**: 301 – 314.

Websites:

AGIS, 2007. Agricultural Geo-Referenced Information System, accessed from: www.agis.agric.za

ADU, 2012. Animal Demography Unit, Department of Zoology, University of Cape Town. http://www.adu.org.za

BGIS: http://bgis.sanbi.org/website.asp

SANBI databases:

South African National Biodiversity Institute. 2016. Botanical Database of Southern Africa (BODATSA) [2018-07-13_235408064-BRAHMSOnlineData].

http://SIBIS.sanbi.org

Climate:

http://en.climate-data.org/location/10658/

APPENDICES

Appendix 1 Methodology: Environmental Impact Assessment (SiVest)

The Environmental Impact Assessment (EIA) Methodology assists in evaluating the overall effect of a proposed activity on the environment. Determining of the significance of an environmental impact on an environmental parameter is determined through a systematic analysis.

Determination of Significance of Impacts

Significance is determined through a synthesis of impact characteristics which include context and intensity of an impact. Context refers to the geographical scale (i.e. site, local, national or global), whereas intensity is defined by the severity of the impact e.g. the magnitude of deviation from background conditions, the size of the area affected, the duration of the impact and the overall probability of occurrence. Significance is calculated as shown in Table 26.

Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The total number of points scored for each impact indicates the level of significance of the impact.

Impact Rating System

The impact assessment must take account of the nature, scale and duration of effects on the environment and whether such effects are positive (beneficial) or negative (detrimental). Each issue / impact is also assessed according to the various project stages, as follows:

- Planning;
- Construction;
- Operation; and
- Decommissioning.

Where necessary, the proposal for mitigation or optimisation of an impact should be detailed. A brief discussion of the impact and the rationale behind the assessment of its significance has also been included.

The significance of Cumulative Impacts should also be rated.

Rating System Used to Classify Impacts

The rating system is applied to the potential impact on the receiving environment and includes an objective evaluation of the possible mitigation of the impact. Impacts have been consolidated into one

(1) rating. In assessing the significance of each issue the following criteria (including an allocated point system) is used:

Table 26: Rating of impacts criteria

ENVIRONMENTAL PARAMETER		
A brief description of the environmental aspect likely to be affected by the proposed activity (e.g. Surface Water).		
ISSUE / IMPACT / ENVIRONMENTAL EFFECT / NATURE		
Include a brief description of the impact of environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted upon by a particular action or activity (e.g. oil spill in surface water).		
EXTENT (E)		
This is defined as the area over which the impact will be expressed. Typically, the severity and significance of an impact have different scales and as such bracketing ranges are often required. This is often useful during the detailed assessment of a project in terms of further defining the determined.		
1	Site	The impact will only affect the site
2	Local/district	Will affect the local area or district
3	Province/region	Will affect the entire province or region
4	International and National	Will affect the entire country
PROBABILITY (P)		
This describes the chance of occurrence of an impact		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).
REVERSIBILITY (R)		
This describes the degree to which an impact on an environmental parameter can be successfully reversed upon completion of the proposed activity.		
1	Completely reversible	The impact is reversible with implementation of minor mitigation measures
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible and no mitigation measures exist.

IRREPLACEABLE LOSS OF RESOURCES (L)		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource.	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.
4	Complete loss of resources	The impact is result in a complete loss of all resources.
DURATION (D)		
This describes the duration of the impacts on the environmental parameter. Duration indicates the lifetime of the impact as a result of the proposed activity.		
1	Short term	The impact and its effects will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase (0 – 1 years), or the impact and its effects will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact and its effects will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 50 years).
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered transient (Indefinite).
INTENSITY / MAGNITUDE (I / M)		
Describes the severity of an impact (i.e. whether the impact has the ability to alter the functionality or quality of a system permanently or temporarily).		
1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component but system/ component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.
4	Very high	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired (system collapse). Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.
SIGNIFICANCE (S)		

Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. This describes the significance of the impact on the environmental parameter. The calculation of the significance of an impact uses the following formula:

Significance = (Extent + probability + reversibility + irreplaceability + duration) x magnitude/intensity.

The summation of the different criteria will produce a non-weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.

Points	Impact Significance Rating	Description
5 to 23	Negative Low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
5 to 23	Positive Low impact	The anticipated impact will have minor positive effects.
24 to 42	Negative Medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
24 to 42	Positive Medium impact	The anticipated impact will have moderate positive effects.
43 to 61	Negative High impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
43 to 61	Positive High impact	The anticipated impact will have significant positive effects.
62 to 80	Negative Very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
62 to 80	Positive Very high impact	The anticipated impact will have highly significant positive effects.

Appendix 2 Ecological Environmental Management Plan

Note: The designation 'Contractor' generally applies to all contractors as well as all subcontractors as relevant involved at any level in the development of this Energy Facility, unless specifically stated otherwise.

Design Phase

Optimal design and pre-commencement activities

OBJECTIVE 1: Ensure the selection of the best environmental option for the alignment of the development areas and access roads

OBJECTIVE 2: Ensure all environmental sensitivities and possible impacts are fully accounted for and methods in place for mitigation prior to commencement of activity

The largest portion of the project site has been classified as Bushmanland Arid Grassland (81.2%) according to the National VegMap (2018). Bushmanland Basin Shrubland is mostly confined to the deeper sandier pediments surrounding the narrow ridge system, and only cover approximately 12.5% of the site. The narrow, west to east running ridge located within the northern portion of the site has been classified as Bushmanland Inselberg Shrubland and covers an area of around 6.4%.

During the site-visit it was found that the VegMap provide a relatively rough reflections of the vegetation patterns found within the project site, with is slightly more heterogenous than the VegMap suggests. It was determined that Bushmanland Arid Grassland as well as Bushmanland Inselberg Shrubland was present within the project area however spatial variations were identified within these vegetation types. Bushmanland Basin Shrubland were not present within the project site. Furthermore, numerous azonal vegetation features were identified within the project site and mostly comprised of fairly diffuse, ephemeral, alluvial drainage systems. Only one depression wetland was identified within the project site.

The primary drivers of vegetation differentiation at the site are edaphic and soil moisture. Rocky outcrops, ridges, koppies, drainage lines alluvial washes and floodplains all contribute to the heterogeneity of the site, especially within the northern half of the project site. These areas tend to accommodate different plant species compositions, then that of the adjacent plains.

Whilst no Red Data species or highly range restricted species (Plant Species of Conservation Concern) were recorded within the project site, several protected plant species occur in the project site. Clearing of large indigenous shrubs should be kept at the absolute minimum possible (regardless of protection status), whilst many of the succulent and geophytic protected species can be relocated with relative ease.

Opportunities to mitigate the negative impacts of large-scale wind energy developments largely arise during the planning and design stages. The correct choice of footprint location and layout is paramount, thus ecosystem components such as biodiversity and ecosystem function should be given full consideration during the design phase, as determined by the Environmental Impact

Assessments. The timing of pre-commencement, construction, maintenance and decommissioning activities also provides opportunities to reduce negative impacts on biodiversity.

Once the layout has been finalised, a detailed investigation of the footprint area, during the optimal growing season and as described below should be conducted before activity commences. The footprint investigation can still be used for micro-siting where desirable.

Project Component/s	» Up to 28 wind turbines, » Concrete turbine foundations and turbine hardstands; » Crane hardstand; » Blade hardstand; » 33/132 kV on-site substation; » Medium voltage (33 kV) underground cables; » The main access road; » Internal roads. » Existing farm roads that will be upgraded and used wherever possible; » One construction laydown / staging area; » Gate house and security house. » Battery Energy Storage System (BESS); » Operation and Maintenance (O&M) building (including offices, warehouses, workshops, canteen, visitors centre and staff lockers); » A temporary site camp; and » Galvanized palisade fencing to be used at the substations.
Potential Impact	» Placement that damages and degrades the environment unnecessarily, particularly with respect to habitat destruction, loss of indigenous flora and fauna, damage to rocky niche habitats, establishment, and persistence of alien invasive plants, and erosion.
Activities/Risk Sources	» Positioning WEF components and internal access routes » Positioning of workshop, guardhouses, substation and other related infrastructure » Alignment of mv cables » Alignment of access roads to development » Positioning of temporary sites
Mitigation: Target/Objective	» To ensure selection of best environmental option for positioning alignment of proposed infrastructure » Environmental sensitivities are taken into consideration and avoided as far as possible, thereby mitigating potential impacts

Mitigation: Action/Control	**Responsibility**	**Timeframe**
No-Go Areas: » All very high sensitive features and associated buffer areas Avoid where possible: » All vegetation and habitats with high and very high sensitivity » New disturbance to riparian vegetation where such may be crossed	Project Company	Design phase

Mitigation: Action/Control	Responsibility	Timeframe
Components of the proposed development that may under no circumstance be located in or within 100 m of any drainage would include: » Ablution facilities » Any form of waste/soil/overburden disposal » Any form of storage of materials or machinery » Any infrastructure that will be sensitive to inundation in case of an extreme (rainfall) event » Offices, and » Substations and switching stations		
Undertake pre-construction walkthrough survey of the footprint area for protected flora and burrowing terrestrial vertebrates: The final footprint investigation (walkthrough) is aimed to fully inform the Project Company, responsible conservation authority (that will issue the relevant permits and authorisations), contractors, EO and ECO about: » Potential micro-siting requirements » Protected and red data species that will be affected by the development o indicating the red-data and protection status of each species observed (what red-data classification, which legislation) » Location of protected plant species within the footprint area – either individually mapped or approximate areas of occurrence, especially dense patches (alternatively, for linear structures, between which structures or other markers) » Identification of the affected species by providing a representative photo record that enables EO/ECOs and contractors to identify such plants » How many specimens per species may be affected –estimate based on random transect surveys? » Which species can be successfully relocated, which and how many will have to be destroyed? » Location and nature of any nesting sites or active burrows of vertebrate species (birds, amphibians, reptiles and mammals), that will have to be inspected and cleared/relocated prior to construction by the contractor or duly appointed person(s) o GPS coordinates should be provided for such burrows and nests observed, **with clear photographs** that will enable the EO/ECO and contracting staff to identify more that will most likely be on the footprint area » Approximate location and nature of any alien invasive species that will have to be cleared by the contractor o Also assess alien invasives along all neighbouring and main transport routes that may be introduced to the site o Provide clear photographs of all alien invasive species that occur on site or could potentially be introduced to enable the EO/ECO and contracting staff to identify these » Location and nature of any other significant environmental concerns, e.g. extreme gully erosion, that will need to be addressed by the contractor to prevent any unnecessary (further) degradation of the development footprint » Note: should more than 1000 specimens of any critically endangered or endangered species be affected, as risk assessment report for that species should be prepared according	Project Company, carried out by Specialist	Design review phase

Mitigation: Action/Control	Responsibility	Timeframe
to Section 15 of the NEMA:BA Draft Threatened or Protected Species Regulations, Gazetted General Notice 388 of 2013.		
The above pre-construction footprint investigations will be used together with results from the ecological specialist report to draft the following: » A comprehensive search and rescue program for plants and possible burrowing animals » A comprehensive alien invasive species eradication and management plan o Minimum requirements are listed under the Construction and Operational Phase EMPr » Update and finalise the rehabilitation and revegetation plan o This should include a topsoil management plan if required » Update and finalise the erosion control management plan	Project Company, carried out by Specialist	Design review phase
Obtain permits for protected plant removal and relocation prior to commencement of any activity related to this development » As a minimum, permits will be required to remove all or some of the species listed under section 5.4	Project Company, or contractor responsible for vegetation clearing	Pre-commence-ment
Use design-level mitigation measures recommended in respect of habitat and ecosystem intactness and prevention of species loss as detailed within the EIA Report » This includes positioning components of the development as close as possible together and as much as possible on the medium sensitivity portions of the study area » Strictly adhere to existing tracks/roads where ever possible to gain access to the site » Sites for storing, mixing, and handling topsoil piles (if necessary) or any introduced materials, including all machinery or processing implements, should be placed in an ecologically least sensitive area and at least 100 m from any type of wetland. Such sites should be clearly indicated in site plans and the drafting of relevant detailed method statements and/or management plans requested from the relevant contractor or environmental firm. o For topsoil stockpiles: the Project Company and EPC contractor should indicate these in the original application and layout already, also approximate volumes and areas affected	Project Company	Prior to submission of final construction layout plan
Access roads and machinery turning points should be planned to minimise the impacted area, avoid the initiation of accelerated soil erosion and prevent unnecessary compaction and disturbance of topsoils, prevent obstruction or alteration of natural water flow	Project Company	Design phase
Compile a comprehensive erosion control and stormwater management plan for the footprint area as part of the final design of the project » Minimum requirements are listed under the Construction and Operational Phase EMPr	Project Company and relevant specialist	Design phase
Vegetation rehabilitation management plan. » Minimum requirements are listed under the Construction and Operational Phase EMPr	Project Company and	Design phase

Mitigation: Action/Control	Responsibility	Timeframe
	relevant specialist	
A response and management plan should be drafted and available to deal with accidental breakages and potential release of harmful substances. This plan should include as a minimum: » Specifications of harmful substances that could be released from accidental breakages or leakage of project components » How such harmful substances can best be salvaged and removed as soon as an accidental breakage has occurred? » How and where broken components and potentially harmful substances can be disposed of – it should also be indicated if any material can be recycled, and where materials should then be taken for recycling o The above will have to be incorporated into the waste management plan	Project Company and relevant waste management specialist	Design phase

Performance Indicator	» Internal grid connection, mv cables and road alignments meet environmental objectives. » WEF components and all associated temporary and permanent infrastructure and access road alignments meet environmental objectives » Ecosystem fragmentation is kept to a minimum » Ecosystem functionality is retained and any unjustified disturbance and degradation prevented
Monitoring	» Ensure that the design implemented meets the objectives and mitigation measures in the EIA Report through review of the design by the Project Manager, and the ECO prior to the commencement of activity.

Construction and Operational Phase

The expected lifetime of the development ranges between 25 to 30 years after construction. After that, the development will either be decommissioned or, more likely, upgraded with newer available technology to remain functional and economical. These timeframes are sufficient to cause an irreversible negative shift in natural biodiversity composition and associated loss of ecosystem functionality if impacts are not maximally mitigated and any degradation of the environment prevented from the start and continuously monitored and mitigated until decommissioning.

The management options below specify the minimum requirements to mitigate the impacts of the proposed development on the biodiversity and overall ecology of the area to be developed. More specific management options will need to be created/updated once the exact layout of project components and construction plans are known.

For the optimal implementation and updating of the management plans, it is recommended that the ecological specialist who is familiar with the site or at least did the pre-commencement footprint investigation, visit the site soon after construction has started or immediately after all site preparation earthworks have been completed, and at least once when rehabilitation work is under way. This would be not only to fully inform and support the EO and/or ECO, but to ensure that minimum requirements of the mitigation plans are sufficient to retain enough functionality of the ecosystem to prevent any undue further degradation of the development site and beyond.

The ECO will most likely only be present on site for the duration of construction activities. Where continued monitoring and possible mitigation will be required during the operational phase, an EO, or suitable staff should be appointed. It is recommended that the current EMPr be revised after completion of the design, again after construction and then as necessary, and a new set of EMPs be drafted for the decommissioning phase to continue with mitigations and prevention of all related environmental impacts.

Species search and rescue

OBJECTIVE: Minimise loss of indigenous biodiversity, including plants of conservation concern

Prior to commencement of any activity, including earthworks (grading, road construction, etc.) within areas of natural vegetation a plant Search and Rescue program should be developed and implemented, preceded by a meticulous investigation of all footprint areas by a suitably qualified botanist, conducted during the optimal growing season (late January to April) along the entire footprint area as specified in.

Project Component/s	» Up to 28 wind turbines, » Concrete turbine foundations and turbine hardstands; » Crane hardstand; » Blade hardstand; » 33/132 kV on-site substation;

	» Medium voltage (33 kV) underground cables; » The main access road; » Internal roads. » Existing farm roads that will be upgraded and used wherever possible; » One construction laydown / staging area; » Gate house and security house. » Battery Energy Storage System (BESS); » Operation and Maintenance (O&M) building (including offices, warehouses, workshops, canteen, visitors centre and staff lockers); » A temporary site camp; and » Galvanized palisade fencing to be used at the substations.
Potential Impact	» Substantially increased loss of species of conservation concern and other natural vegetation at construction phase, waste of on-site plant resources, lack of locally sourced material for rehabilitation of disturbed areas; » Increased cost of rehabilitation
Activities/Risk Sources	» Construction related loss and damage to remaining natural and semi-natural vegetation
Mitigation: Target/Objective	» Rescue, maintenance and subsequent replanting of at least all bulbous protected plant species within the specific land portion

Mitigation: Action/Control	Responsibility	Timeframe
Ecological footprint investigation and recording by GPS of localities of all red data species and indication of presence of other species of conservation concern as described in within the (Design Phase)	Ecologist	Prior to commence-ment of activity
» Search and Rescue (S&R) of all protected plants that will be affected by the development, especially species occurring in long term and permanent, hard surface development footprints (i.e. all buildings, new roads and tracks, lay down areas, and turbine positions) should take place. o The necessary permits should be in place » Plants that can be considered for rescue and included in subsequent rehabilitation programs are all desirable geophytes[1] and indigenous succulents » All development footprints should be surveyed and pegged out as soon as possible, after which a local horticulturist or community members with Search and Rescue experience should be appointed to undertake the S&R. » All rescued species should be transplanted immediately or bagged (or succulents left to first air-dry before planting) and kept in the horticulturist's or a designated on-site nursery, and should be returned to site or land portion once all construction is completed and rehabilitation of disturbed areas is required.	Horticultural Contractor/EO monitored and approved by ECO	Prior to construction

[1] *Desirable* geophytes would include only those that are of conservation concern and non-invasive; the reduction of toxic geophytes that increase exponentially where natural rangelands are degraded would rather be a positive impact

Mitigation: Action/Control	Responsibility	Timeframe
» Replanting should occur in summer to early autumn once sufficient rains have fallen, in order to facilitate establishment.		
A minimum percentage cover of vegetation should be established and permanently maintained post construction	Project Company and horticultural contractor/EO	After construction, throughout operational phase
All cable trenches, excavations, etc., through sensitive areas should be excavated carefully in order to minimise damage to surrounding areas and biodiversity. » The trenches should be checked on a daily basis for the presence of trapped animals. » Any animals found should be removed in a safe manner, unharmed, and placed in an area where the animal will be comfortable. » If the ECO or contractor is unable to assist in the movement of a fauna species, ensure a member of the conservation authorities assists with the translocation. o Note: the McGregor Museum in Kimberley could be approached for *advice* on relocating animals if required » All mammal, large reptiles and avifauna species found injured during construction will be taken to a suitably qualified veterinarian or rehabilitation centre to either be put down in a humane manner or cared for until it can be released again Note: Excavated material that needs to be discarded should be used to fill up and permanently close the old prospecting pits on the property	Contractor / ECO	Duration of construction

Performance Indicator	» Rescue of species of conservation concern » No damage or injury to fauna » Re-establishment of rescued species
Monitoring	» ECO to monitor Search and Rescue, assist with the continuation of search and rescue operations during the construction process where it becomes necessary after the initial S&R (e.g. geophytes that emerge later in the season) » It may be possible that geophytic species may emerge during construction that were not accounted for in the original S&R plan – once observed the ECO should consult the botanists on the identification and possible S&R for those plant species

Management of temporary construction sites

OBJECTIVE1: Environmentally sensitive location of construction equipment camps and all other temporary structures on site to limit impacts

OBJECTIVE2: Environmentally sensitive movement of equipment, machinery, vehicles and materials to, on and from site to limit impacts

It is expected that all construction staff will reside within accommodation that will be provided in man camps that will be established for the development. Construction equipment and machinery may need to be stored at an appropriate location on the site for the duration of the construction period. However, washing of vehicles and machinery may only take place in designated ares, whilst repairs vehicles on site is only permissible in emergency situations. Servicing of vehicles should is not permissible on site, but rather in nearby towns.

Project Component/s	Project components affecting the objective: » Construction equipment camps, » Laydown areas » Facilities for storing, mixing and general handling of materials » Access roads » Crane areas, » Batching areas, » Trenching areas.
Potential Impact	» Damage to indigenous natural fauna and flora; » Damage to and/or loss of topsoil; » Initiation of accelerated erosion; » Compacting of ground; and » Pollution of the surrounding environment due to excessive dust, inadequate and/or inappropriate facilities provided or procedures implemented
Activities/Risk Sources	» Vegetation clearing and levelling of temporary construction or storage area/s; » Transport to and from the temporary construction or storage area/s; » Types of materials or equipment and the manner in which they are stored or handled; » Dust emissions
Mitigation: Target/Objective	» To minimise impacts on the biophysical environment » To prevent any residual or cumulative impacts arising from temporary construction or storage areas

Mitigation: Action/Control	Responsibility	Timeframe
» Site access should be controlled and no unauthorised persons should be allowed onto the site. » All construction vehicles should adhere to a low speed limit (30km/h) » The location of the construction equipment camp and all access routes will take cognisance of any ecologically sensitive areas identified.	Contractor/ECO	Pre-construction

Mitigation: Action/Control	Responsibility	Timeframe
» The location of this construction equipment camp shall be approved by the project ECO or the specialist doing the pre-commencement footprint investigation		
No temporary site camps will be allowed outside the footprint of the development area. » To minimise the footprint, temporary storage of equipment and materials on site should be kept at a minimum	Contractor, monitored by ECO	Construction
As far as possible, minimise clearing of natural vegetation for equipment storage areas. » Aim to locate the temporary construction camps on already disturbed areas	Contractor, monitored by ECO	During site establishment
Staff shall be supplied with adequate facilities aimed at preventing any kind of pollution » Cooking on open fires should be prohibited, if staff need cooking/kitchen facilities on site, such should be provided by the contractor	Contractor, monitored by ECO	Construction, Operational phase
Identify and demarcate construction areas, servitudes, and access for general construction work and restrict construction activity to these areas. » Prevent unnecessary destructive activity within construction areas (prevent over-excavations and double handling) » Create specific turning points and parking areas for vehicles and heavy machinery as needed » Strictly prohibit any driving outside designated areas and roads » Control dust. » Where the high sensitive ridge and ephemeral wash will be crossed by access roads and underground cabling, the construction footprint should be clearly demarcated with and no activities or disturbances may be allowed outside of these demarcated areas.	Contractor, ECO to control	Before and during construction, operational phase
To limit the possible distribution of undesirable species and possible pollutants onto site: » Regularly check clothing and vehicles for mud and seed and clear in an appropriate manner (see invasive plant management for more details) » Do not wash down any machinery or vehicle within the farm portion, including the footprint area » No vehicles shall be serviced on the affected land portion » All materials moved onto the development site should be free of weeds or any other undesirable organisms or pollutants » It is recommended that fuels, lubricants and other chemicals only be stored on site if absolutely necessary, and then in a manner that prevents any accidental spillage	Contractor, ECO to control	Before and during construction, operational phase
Rehabilitate and revegetate all disturbed areas at the construction equipment camp as soon as construction is complete within an area and mitigate erosion where required as per specific management plans	Contractor, rehabilitation contractor, monitored by ECO	Construction, operational phase

Performance Indicator	» No visible erosion scars or any pollution once construction in an area is completed » All damaged areas successfully rehabilitated one year after completion » No damage to drainage lines or other types of azonal wetlands » Appropriate waste management
Monitoring	» Regular monitoring and audits of the construction camps and temporary structures on site by the ECO » A photographic record should be established before, during and after mitigation » An incident reporting system should be used to record non-conformances to the EMPr, followed by the necessary action from the Project Company to ensure full compliance

Retaining agricultural and ecological potential of the site

OBJECTIVE: To avoid and/or minimise the potential negative impact on current and future farming activities during the construction and operational phase.

Construction and operational activities of the proposed facility could lead to the loss of productive farm land. This could be either due to extensive loss of topsoil, soil seed banks, natural vegetation, erosion, or pollution. It is recommended that once it has been determined what the staffing requirements will be during construction and operation of the proposed facility, an open space management plan be drafted in addition to all other management plans related to ecosystem integrity to ensure the safeguarding of the lands productivity and the functionality of the ecosystem on and beyond the development site.

Project component/s	» Up to 28 wind turbines, » Concrete turbine foundations and turbine hardstands; » Crane hardstand; » Blade hardstand; » 33/132 kV on-site substation; » Medium voltage (33 kV) underground cables; » The main access road; » Internal roads. » Existing farm roads that will be upgraded and used wherever possible; » One construction laydown / staging area; » Gate house and security house. » Battery Energy Storage System (BESS); » Operation and Maintenance (O&M) building (including offices, warehouses, workshops, canteen, visitors centre and staff lockers); » A temporary site camp; and » Galvanized palisade fencing to be used at the substations.
Potential Impact	» A largely reduced vegetation cover will cause the ecosystem be more prone to erosion and irreversible degradation » Disturbance of indigenous vegetation creates opportunities for the establishment of invasive vegetation or creation of surfaces that do not support the permanent (re-) establishment of vegetation » Accidental release of harmful substances could potentially cause extensive pollution of water resources on and beyond the farm portion if not contained immediately

Activities/risk sources	» The footprint taken up by the development » Clearing of vegetation and landscaping on footprint area » Introduction and/or further distribution of invasive plant species » Excessive fragmentation of habitats » Accelerated erosion with extensive loss of topsoils and associated natural seed banks and nutrients
Mitigation: Target/Objective	» To minimise the loss of land and desirable indigenous vegetation by the construction of the development and to enable selected farming activities (e.g. grazing by small livestock) to continue where possible

Mitigation: Action/control	Responsibility	Timeframe
Minimise the footprint of the development where possible, at the same time avoid impacting on sensitive habitats » The footprint for *all* development components should be defined before the construction phase commences » Where the high sensitive ridge and ephemeral wash will be crossed by access roads and underground cabling, the construction footprint should be clearly demarcated with and no activities or disturbances may be allowed outside of these demarcated areas. » The specific EMPs shall provide for the mitigations of the impacts of the different types of development components, e.g. if topsoil will have to be stored, a topsoil management plan will have to be drafted o Note: topsoil shall at all times be treated as a valuable agricultural resource	Contractor and relevant specialists, to be monitored by ECO	Before and during construction, operational phase
Rehabilitate disturbed areas on completion of the construction phase. Details of the rehabilitation programme should be contained in the relevant EMPr. » Rehabilitation targets should be set according to the original vegetation as described in the ecological specialist report	Contractor, rehabilitation specialist, to be monitored and approved by ECO	Ongoing during construction phase
Monitor erosion and manage all occurrences according to the erosion management plan	Contractor, to be monitored and approved by ECO and EO	Ongoing, from construction to decom-missioning
Eradicate all weeds and indigenous and alien invasive plants as far as practically possible » Continually monitor the re-emergence of these species and manage according to the invasive species management plan	Contractor, to be monitored and approved by ECO and EO	Ongoing, from construction to decom-missioning

Performance Indicator	» Footprint of development components included in the Construction Phase EMPr » All relevant and specific EMPs also agreed upon by the land owner and then diligently implemented by the contractor and Project Company » Stable vegetation cover throughout the development area as determined desirable to curb erosion and maintain ecosystem functionality, alternatively a

	protective gravel or stone cover over areas that cannot be revegetated, the latter should be fully permeable
Monitoring	» Regular monitoring and audits of construction activities and the footprint area by the ECO to prevent any degradation of the ecosystem » A photographic record should be established before, during and after mitigation » An incident reporting system should be used to record non-conformances to the EMPr, followed by the necessary action from the Project Company to ensure full compliance

Topsoil management

OBJECTIVE: Minimisation of disturbance to and loss of topsoil

Topsoil conservation is an integral part of rehabilitation efforts and helps to maintain the productive capability and ecological functionality of rangelands.

Removal of topsoil should be done where:

- Areas will be excavated
- Areas will be severely compacted
- Areas will be buried with excavated material
- Areas will be permanently covered with altered surfaces

Topsoil should at all times be treated as a valuable natural resource, and may thus not be discarded or degraded. In many sections of the development area, topsoils are very shallow or rocky, which would make topsoil removal difficult. Grading in such areas should be kept as low as possible.

Project Component/s	» Up to 28 wind turbines, » Concrete turbine foundations and turbine hardstands; » Crane hardstand; » Blade hardstand; » 33/132 kV on-site substation; » Medium voltage (33 kV) underground cables; » The main access road; » Internal roads. » Existing farm roads that will be upgraded and used wherever possible; » One construction laydown / staging area; » Gate house and security house. » Battery Energy Storage System (BESS); » Operation and Maintenance (O&M) building (including offices, warehouses, workshops, canteen, visitors centre and staff lockers); » A temporary site camp; and » Galvanized palisade fencing to be used at the substations. »
Potential Impact	» Loss of topsoil and natural resources and biological activity within the topsoil » Loss of natural regeneration potential of soils » Loss of agricultural potential of soils.

Activity/Risk Source	» Site preparation and earthworks » Excavation of foundations and trenches » Construction of site access road » CSP construction activities » Stockpiling of topsoil, subsoil and spoil material.
Mitigation: Target/Objective	» To retain full biological activity and functionality of topsoil » To retain desirable natural vegetation, where possible » To minimise footprints of disturbance of vegetation/habitats » Remove and store all topsoil on areas that are to be excavated; and use this topsoil in subsequent rehabilitation of disturbed areas » Minimise spoil material

Mitigation: Action/Control	Responsibility	Timeframe
Areas to be cleared should be clearly marked on-site to eliminate the potential for unnecessary disturbance. » All woody material cleared should be shredded to coarse chips and use as mulch	Contractor in consultation with Specialist	Pre-construction
Construction activities should be restricted to demarcated areas so that impact on topsoil is minimised. Where the high sensitive ridge and ephemeral wash will be crossed by access roads and underground cabling, the construction footprint should be clearly demarcated with and no activities or disturbances may be allowed outside of these demarcated areas.	Contractor, ECO to control	Before and during construction, operational phase
Salvaging topsoil: » Topsoil should always be salvaged and stored separately from subsoil and lower-lying parent rock or other spoil material. o Topsoil stripping removes up to 30 cm or less of the upper soils. o In cultivated areas, depth of topsoil may increase and needs to be confirmed with the land owner » Prior to salvaging topsoil the depth, quality and characteristics of topsoil should be known for every management area. o This will give an indication of total volumes of topsoil that need to be stored to enable the proper planning and placement of topsoil storage. o Different types of topsoil – rocky soils and sands or loams should be stored separately » Topsoils should be removed (and stored) under dry conditions to avoid excessive compaction whenever topsoil will have to be stored for longer than one year.	Contractor, ECO to control	Before and during construction
Storing topsoil: » Viability of stored topsoil depends on moisture, temperature, oxygen, nutrients and time stored. » Rapid decomposition of organic material in warm, moist topsoils rapidly decreases microbial activity necessary for nutrient cycling, and reduces the amount of beneficial micro-organisms in the soil. » Stockpile location if not adjacent to a linear development: o At least 50 m from highly sensitive vegetation, wetland or watering point o Ideally a disturbed but weed-free area	Contractor, ECO to control	Before and during construction

Mitigation: Action/Control	Responsibility	Timeframe
» *Topsoil is typically stored in berms with a width of 150 – 200 cm, and a maximum height of 100 cm, preferably lower* o Place berms along contours or perpendicular to the prevailing wind direction o Adhere to the following general rule: the larger the pile of topsoil storage needs to be, the shorter should be the time it is stored » Topsoil handling should be reduced to stripping, piling (once), and re-application. Between the piling and reapplication, stored topsoils should not undergo any further handling except control of erosion and (alien) invasive vegetation » Where topsoil can be reapplied within six months to one year after excavation, it will be useful to store the topsoil as close as possible to the area of excavation and re-application, e.g. next to cabling trenches o In such case, use one side of the linear development for machinery and access only o Place topsoil on the other/far side of this development, followed by the subsoil (also on geotextiles) o If there will be a need for long-term storage of topsoil in specified stockpiles, this should be indicated in the design phase already and accompanied by a detailed topsoil stockpile management plan » In cases where topsoil has to be stored longer than 6 months or during the rainy season, soils should be kept as dry as possible and protected from erosion and degradation by: o Preventing puddling on or between heaps of topsoil o Or covering topsoil berms o Preventing all forms of contamination or pollution o Preventing any form of compaction o Monitoring establishment of all invasive vegetation and removing such if it appears o Keeping slopes of topsoil at a maximal 2:1 ratio o Monitoring and mitigating erosion where it appears o Where topsoil needs to be stored in excess of one year, it is recommended to either cover the topsoil or allow an indigenous grass cover to grow on it – if this does not happen spontaneously, seeding should be considered		
Reapplying topsoils: » Spoil materials and subsoil should be back-filled first, then covered with topsoil o It is recommended that where feasible, spoil materials be used to fill in and close old prospecting pits in the development area that currently pose a great safety risk to man and animals » Generally, topsoils should be re-applied to a depth equal to slightly greater than the topsoil horizon of a pre-selected undisturbed reference site » The minimum depth of topsoil needed for revegetation to be successful is approximately 20 cm » If the amount of topsoil available is limited, a strategy should be worked to out to optimise revegetation efforts with the topsoil available » Reapplied topsoils should be landscaped in a way that creates a variable micro topography of small ridges and valleys that run	Contractor, ECO to control	Before and during construction

Mitigation: Action/Control	Responsibility	Timeframe
parallel to existing contours of the landscape. The valleys become catch-basins for seeds and act as run-on zones for rainfall, increasing moisture levels where the seeds are likely to be more concentrated. This greatly improves the success rate of revegetation efforts. » To stabilise reapplied topsoils and minimise raindrop impact and erosion: o Use organic material from cleared and shredded woody vegetation where possible o Alternatively, suitable geotextiles or organic erosion mats can be used as necessary » Continued monitoring will be necessary to detect any sign of erosion early enough to allow timeous mitigation		
Re-applied topsoils need to be re-vegetated as soon as possible, following the revegetation and rehabilitation plan.	Contractor, ECO to control	Before and during construction, monitored during operational phase

Performance Indicator	» Minimal disturbance outside of designated work areas. » Topsoil appropriately stored, managed, and rehabilitated. » No signs of accelerated erosion[2] from construction to completion of decommissioning
Monitoring	» Monitoring of appropriate methods of vegetation clearing and soil management activities by ECO throughout construction phase. » An incident reporting system will be used to record non-conformances to the EMPr. » Regular monitoring of topsoil after construction by Project Company until such topsoil can be regarded as fully rehabilitated, stable and no longer prone to accelerated erosion

[2]Accelerated soil erosion: Soil erosion induced by human activities and ultimately leading to irreversible degradation of the ecosystem and loss of ecosystem functionality

Erosion management

OBJECTIVE: Prevention and early mitigation of all erosion and loss of topsoil and ecosystem integrity

Compacted and/or denuded and disturbed soils are usually prone to surface capping – even more so if the soils have a fine texture due to higher clay or loam contents. Such capped soils are prone to accelerated erosion, creating a dysfunctional landscape and ecosystem that rapidly loses soil, nutrients and seeds from the ecosystem.

Naturally occurring herbaceous and low shrubby vegetation not only protects the soil surface from direct raindrop impact, but a high portion of biomass in the upper 20 – 50 cm of the soil significantly increases rapid infiltration of rainwater, whilst also binding soil particles and thus preventing erosion. A highly disturbed or reduced vegetation layer will thus naturally be accompanied by higher runoff levels and accelerated erosion, most noticeably during extreme weather events.

The measures below indicate the minimum mitigation that will be required for erosion and storm water control. A more specific erosion management plan will be possible after the final layouts of project components are known.

Project Component/s	» Up to 28 wind turbines, » Concrete turbine foundations and turbine hardstands; » Crane hardstand; » Blade hardstand; » 33/132 kV on-site substation; » Medium voltage (33 kV) underground cables; » The main access road; » Internal roads. » Existing farm roads that will be upgraded and used wherever possible; » One construction laydown / staging area; » Gate house and security house. » Battery Energy Storage System (BESS); » Operation and Maintenance (O&M) building (including offices, warehouses, workshops, canteen, visitors centre and staff lockers); » A temporary site camp; and » Galvanized palisade fencing to be used at the substations. »
Potential Impact	» Loss of topsoil and natural resources and biological activity within the topsoil » Loss of natural regeneration potential of soils » Loss of agricultural potential of soils.
Activity/Risk Source	» Rainfall and wind erosion of disturbed areas » Excavation, stockpiling and compaction of soil » Concentrated discharge of water from construction activity and new infrastructure » Storm water run-off from sealed, altered or bare surfaces » Construction equipment and vehicle movement on site » Cabling and road construction activities » Roadside drainage ditches

	» Premature abandonment of follow-up monitoring and adaptive management of rehabilitation
Mitigation: Target/Objective	» To minimise erosion of soil from site during construction » To minimise deposition of soil into drainage lines or pans » To minimise damage to vegetation by erosion or deposition » To minimise damage to rock, soil, animals and vegetation by construction activity » No accelerated overland flow related surface erosion as a result of a loss of vegetation cover » No reduction in the surface area or natural functionality of natural drainage lines or other wetland areas as a result of the establishment of infrastructure » Minimal loss of vegetation cover due to construction related activities » No increase in runoff into drainage lines or pans as a result of construction of project related infrastructure » No increase in runoff into drainage lines or pans as a result of road construction

Mitigation: Action/Control	Responsibility	Timeframe
Identify and demarcate construction areas for general construction work and restrict construction activity to these areas. Prevent unnecessary destructive activity within construction areas (prevent over-excavations and double handling). Where the high sensitive ridge and ephemeral wash will be crossed by access roads and underground cabling, the construction footprint should be clearly demarcated with and no activities or disturbances may be allowed outside of these demarcated areas.	Contractor, ECO to control	Before and during construction
New access roads and other servitudes to be carefully planned and constructed to minimise the impacted area and prevent unnecessary excavation, placement, and compaction of soil. Special attention to be given to roads and tracks that cross drainage lines.	Contractor, ECO to control	Before and during construction
Rehabilitate disturbance areas as soon as construction in an area is completed as per the rehabilitation plan.	Contractor, ECO to control	Immediately after construction, monitored during operational phase
General Erosion control measures: » Runoff control and attenuation can be achieved by using any or a combination of sand bags, logs, silt fences, storm water channels and catch-pits, shade nets, geofabrics, seeding or mulching as needed on and around cleared and disturbed areas o Ensure that all soil surfaces are protected by vegetation or a covering to avoid the surface being eroded by wind or water. » Ensure that heavy machinery does not compact areas that are not meant to be compacted as this will result in compacted hydrophobic, water repellent soils which increase the erosion potential of the area. » Prevent the concentration or flow of surface water or storm water down cut or fill slopes or along pipeline routes or roads and	Contractor, ECO to control	Construction, operational phase

Mitigation: Action/Control	Responsibility	Timeframe
ensure measures to prevent erosion are in place prior to construction. » Storm water and any runoff generated by hard impervious surfaces should be discharged into retention swales or areas with rock rip-rap. These areas should be grassed with indigenous vegetation. These energy dissipation structures should be placed in a manner that flows are managed prior to being discharged back into the natural water courses, thus not only preventing erosion, but also supporting the maintenance of natural base flows within these systems, i.e. hydrological regime (water quantity and quality) is maintained. » Mitigate against siltation and sedimentation of wetlands using the above-mentioned structures and ensure that no structures cause erosion. » Minimise and restrict site clearing to areas required for construction purposes only and restrict disturbance to adjacent undisturbed natural vegetation. » Vegetation clearing should occur in parallel with the construction progress to minimise erosion and/or run-off. Large tracts of bare soil will either cause dust pollution or quickly erode and then cause sedimentation in the lower portions of the catchment » If implementing dust control measures, prevent over-wetting, saturation, and run-off that may cause erosion and sedimentation » Water course / river crossings should not trap any run-off, thereby creating inundated areas, but allow for free-flowing water		
Control depth of excavations and stability of cut faces/sidewalls	Contractor, to be monitored by ECO	Site establishment & duration of contract
Compile a comprehensive storm water management method statement, as part of the final design of the project and implement during construction and operation.	Project Company, Contractor, to be monitored by ECO	Site establishment & duration of contract
Where access roads cross natural drainage lines or azonal wetlands, culverts (or other appropriate measures) should be designed to allow free flow. Regular maintenance should be carried out.	Contractor, ECO to control	Construction phase Operational phase, monitored throughout
All vehicles on site should be appropriate to access the site. No off-road driving is permitted unless authorised by the ECO.	Contractor, to be monitored by ECO	Pre-construction, Construction & operation
4x4's or diff lock vehicles should be used in wet slippery conditions to reduce the erosion on the roads and the surrounding area.	Contractor, to be monitored by ECO	Pre-construction, Construction & operation

Performance Indicator	» Minimal level of soil erosion around site » Minimal level of increased siltation in drainage lines or pans » Minimal level of soil degradation » Acceptable state of excavations, as determined by EO & ECO » Progressive return of disturbed and rehabilitated areas to the desired end state (Refer also to the Plant Rescue and Rehabilitation Plan)
Monitoring	» Fortnightly inspections of the site by ECO » Fortnightly inspections of sediment control devices by ECO » Fortnightly inspections of surroundings, including drainage lines by ECO » Immediate reporting of ineffective sediment control systems » An incident reporting system should record non-conformances according to the EMPr. » After construction, a continued bi-annual monitoring of the entire development until the completion of decommissioning for signs of erosion

Rehabilitation and revegetation

OBJECTIVE: Minimisation of disturbance to and loss of topsoil and ecosystem functionality

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 perennial vegetation cover of at least 30%, preferably more, will be desirable (on all areas where vegetation is permissible).

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.

The first vegetation layer should be developed further until a desirable end state, as determined during the design phase and taking the original vegetation description as guideline, is established.

Project Component/s	» Up to 28 wind turbines, » Concrete turbine foundations and turbine hardstands; » Crane hardstand; » Blade hardstand; » 33/132 kV on-site substation; » Medium voltage (33 kV) underground cables; » The main access road; » Internal roads. » Existing farm roads that will be upgraded and used wherever possible; » One construction laydown / staging area; » Gate house and security house. » Battery Energy Storage System (BESS);

	» Operation and Maintenance (O&M) building (including offices, warehouses, workshops, canteen, visitors centre and staff lockers); » A temporary site camp; and » Galvanized palisade fencing to be used at the substations.
Potential Impact	» Within the footprint, a change of plant species composition with lower productivity and agricultural potential can be expected due to removal, disturbance and continued long-term shading of vegetation » A largely reduced vegetation cover will cause the ecosystem to be more prone to erosion and irreversible degradation » Disturbance of indigenous vegetation creates opportunities for the establishment of invasive vegetation or creation of surfaces that do not support the permanent (re-) establishment of vegetation » Loss of natural regeneration potential of soils » Loss of agricultural potential of soils.
Activity/Risk Source	» Site preparation and earthworks » Excavation of foundations and trenches » Construction of site access road » WEF construction activities » Stockpiling of topsoil, subsoil and spoil material.
Mitigation: Target/Objective	» Recreate a non-invasive, acceptable vegetation cover that will facilitate the establishment of desirable and/or indigenous species » Prevent and accelerated erosion of ecosystem degradation

Mitigation: Action/Control	**Responsibility**	**Timeframe**
Rehabilitation of surface		
Prior to the application of topsoil » subsoil shall be shaped and trimmed to blend in with the surrounding landscape or used for erosion mitigation measures » ground surface or shaped subsoil shall be ripped or scarified with a mechanical ripper or by hand to a depth of 15 – 20 cm » compacted soil shall be ripped to a depth greater than 25 cm and the trimmed by hand to prevent re-compacting the soil » any foreign objects, concrete remnants, steel remnants or other objects introduced to the site during the construction process shall be cleared before ripping, or shaping and trimming of any landscapes to be rehabilitated takes place » shaping will be to roughly round off cuts and fills and any other earthworks to stable forms, sympathetic to the natural surrounding landscapes	Contractor, ECO to control	During and after construction
Application of topsoil » topsoils shall be spread evenly over the ripped or trimmed surface, if possible, not deeper than the topsoil originally removed » the final prepared surface shall not be smooth but furrowed to follow the natural contours of the land » the final prepared surface shall be free of any pollution or any kind of contamination » care shall be taken to prevent the compaction of topsoil	Contractor, ECO to control	During and after construction

Mitigation: Action/Control	Responsibility	Timeframe
Soil stabilisation » mulch, if available from shredded vegetation, shall be applied by hand to achieve a layer of uniform thickness » mulch shall be rotovated into the upper 10 cm layer of soil o this operation shall not be attempted if the wind strength is such as to remove the mulch before it can be incorporated into the topsoil » measures shall be taken to protect all areas susceptible to erosion by installing temporary and permanent drainage work as soon as possible o where natural water flow-paths can be identified, subsurface drains or suitable surface drains and chutes need to be installed » additional measures shall be taken to prevent surface water from being concentrated in streams and from scouring slopes, banks or other areas » runnels or erosion channels developing shall be back-filled and restored to a proper condition o such measures shall be affected immediately before erosion develops at a large scale » where erosion cannot be remedied with available mulch or rocks, geojute or other geotextiles shall be used to curtail erosion	Contractor, ECO to control	Construction phase Operational phase, followed up until desired end state is reached
Revegetation		
» revegetation of the final prepared area is expected to occur spontaneously to some degree where topsoils could be re-applied within 6 months » revegetation will be done according to an approved planting/landscaping plan, also indicating the desirable end states of permissible vegetation	Contractor, ECO to control	Construction phase Operational phase, followed up until desired end state is reached
Re-seeding » revegetation can be increased where necessary by hand- seeding indigenous species o previously collected and stored seeds shall be sown evenly over the designated areas, and be covered by means of rakes or other hand tools o commercially available seed of grass species naturally occurring on site can be used as alternative » re-seeding shall occur at the recommended time to take advantage of the growing season » in the absence of sufficient follow-up rains after seeds started germinating, irrigation of the new vegetation cover until it is established shall become necessary to avoid loss of this vegetative cover and the associated seed bank	Contractor, ECO to control	Construction phase Operational phase, followed up until desired end state is reached
Planting of species » the composition of the final acceptable vegetation will be according to the vegetation descriptions of the original ecological EIA and final footprint investigations, and will include rescued plant material » during transplanting care shall be taken to limit or prevent damage to roots	Contractor, ECO to control	Construction phase Operational phase, followed up until desired end state is reached

Mitigation: Action/Control	Responsibility	Timeframe
» plants should be watered immediately after transplanting to help bind soil particles to the roots (or soil-ball around rooted plants) and so facilitate the new growth and functioning of roots		
Traffic on revegetated areas » designated tracks shall be created for pedestrian of vehicle traffic where necessary » Disturbance of vegetation and topsoil should be kept to a practical minimum, no unauthorised off road driving will be allowed » All livestock shall be excluded from newly revegetated areas, until vegetation is well established	Contractor, ECO to control	Construction phase Operational phase
Establishment » The establishment and new growth of revegetated and replanted species shall be closely monitored o Where necessary, reseeding or replanting will have to be done if no acceptable plant cover has been created	Contractor, ECO to control	Construction and Operational phase, followed up until desired end state is reached
Monitoring and follow-up treatments		
Monitor success of rehabilitation and revegetation and take remedial actions as needed according to the respective plan » Erosion shall be monitored at all times and measures taken as soon as detected » Where necessary, reseeding or replanting will have to be done if no acceptable plant cover has been created	ECO during construction, suitable designated person / contractor after that	Construction phase Operational phase
Weeding » It can be anticipated that invasive species and weeds will germinate on rehabilitated soils o These need to be hand-pulled before they are fully established and/or reaching a mature stage where they can regenerate o Where invasive shrubs re-grow, they will have to be eradicated according to the Working for Water specifications	Contractor	Construction phase Operational phase

Performance Indicator	» No activity in identified no-go areas » Natural configuration of habitats as part of ecosystems or cultivated land is retained or recreated, thus ensuring a diverse but stable hydrology, substrate and general environment for species to be able to become established and persist » The structural integrity and diversity of natural plant communities is recreated or maintained » Indigenous biodiversity continually improves according to the pre-determined desirable end state o This end state, if healthy, will be dynamic and able to recover by itself after occasional natural disturbances without returning to a degraded state » Ecosystem function of natural landscapes and their associated vegetation is improved or maintained
Monitoring	» Fortnightly inspections of the site by ECO during construction

	» An incident reporting system should record non-conformances to the EMPr. » Quarterly inspections and monitoring of the site by the ECO or personnel designated to the rehabilitation process until 80% of the desired plant species have become established o These inspections should be according to the monitoring protocol set out in the rehabilitation plan » Thereafter annual inspections according to the minimal monitoring protocol up to completion of decommissioning

Invasive plant management

OBJECTIVE: Manage and reduce the impact of invasive vegetation

Within the project area invasive species – indigenous and alien - occur, which all have a potential of reproducing to such an extent that the ecosystem within and beyond the project area could be impaired. Additional alien species grow along major transport routes to the area and thus could be potentially spread there as well.

Species likely to invades and establish within the area and that must be monitored and eradicated according to CARA and NEMA:BA:

- *Alternanthera pungens*
- *Argemone ochroleuca* (growing on embankments of railway track)
- *Datura* species (growing around watering points and along drainage lines)
- *Flaveria bidentis* (growing along most road reserves)
- *Nicotiana glauca* (growing in road reserves outside study area)
- *Opuntia ficus-indica*
- *Opuntia humifusa* (growing in road reserves outside study area)
- *Prosopis glandulosa* (but see notes above)
- *Salsola kali* (growing in road reserves outside study area)

Ruderal species that are easily distributed by vehicles or staff and should be eradicated when they become invasive:

- *Chenopodium album*
- *Laggera decurrens*
- *Setaria verticillata*
- *Tribulus terrestris*

Potentially invasive and/or toxic plants that will indicate degradation and will need to be eradicated from the development and associated infrastructure footprint to prevent their spread to neighbouring rangelands:

- » *Acacia mellifera s. detinens*
- » *Rhigozum trichotomum*

It can be expected that more species may be added after the pre-commencement walk-through survey. A detailed Invasives Management Plan need to be drafted after this walk-through. Operational standards should adhere to those set out by Working for Water. The use of chemicals may only commence with the approval of the relevant authorities.

Project Component/s	» Permanent and temporary infrastructure » Access roads
Potential Impact	» Impacts on natural vegetation » Impacts on soil » Impact on faunal habitats » Degradation and loss of agricultural potential
Activity/Risk Source	» Transport of construction materials to site » Movement of construction machinery and personnel » Site preparation and earthworks causing disturbance to indigenous vegetation » Construction of site access road » Stockpiling of topsoil, subsoil and spoil material » Routine maintenance work – especially vehicle movement
Mitigation: Target/Objective	» To significantly reduce the presence of weeds and eradicate alien invasive species » To avoid the introduction of additional alien invasive plants to the project control area » To avoid further distribution and thickening of existing alien plants and invasive shrubs on the project area » To complement existing alien plant eradication programs in gradually causing a significant reduction of alien plant species throughout the project control area

Mitigation: Action/Control	**Responsibility**	**Timeframe**
Compile a detailed invasive plant management and monitoring programme as guideline for the entire construction, operational and decommissioning phase » This plan should contain WfW-accepted species- specific eradication methods » It should also provide for a continuous monitoring programme to detect new infestations	Specialist	Pre-construction
Avoid creating conditions in which invasive plants may become established: » Keep disturbance of indigenous vegetation to a minimum » Rehabilitate disturbed areas as quickly as possible » Shred all non-seeding material from cleared invasive shrubs and other woody vegetation and use as mulch as part of the rehabilitation and revegetation plan	Contractor, monitored by ECO	Construction phase Operational phase

Mitigation: Action/Control	Responsibility	Timeframe
» Where possible, destroy seeding material of weeds and invasives by piling burning (in designated areas or suitable containers) » Do not import soil from areas with alien plants		
» Eradicate all invasive plants that occur within the development's temporary and permanent footprint areas » Ensure that material from invasive plants that can regenerate – seeds, suckers, plant parts are adequately destroyed and not further distributed	Contractor, monitored by ECO	Construction phase Operational phase
» Immediately control any alien plants that become newly established using registered control measures	Contractor, monitored by ECO	Construction phase Operational phase
Risks from alien invasives do not only arise from invasives present within the footprint area, but also from alien invasives along the verges of the major transport routes, especially invasive grasses and smaller weeds. Similarly, invasives can be spread by construction processes to surrounding areas. To avoid the distribution of weeds and invasive plants, establish a routine amongst contractors/all staff to regularly check: » that clothing and shoes are free of mud and seeds » that foot wells inside vehicles and mats are cleared of weed seed » radiator and grill, along wheel trims, around wheels, mud flaps, undercarriage of vehicle or other moving machinery for mud and seed	Contractor, monitored by ECO	Construction phase Operational phase

Performance Indicator	» Visible reduction of number and cover of alien invasive plants within the project area. » Improvement of vegetation cover from current dominance of invasive shrubs to dominance of perennial grasses and dwarf shrubs » No establishment of additional alien invasive species.
Monitoring	» Ongoing monitoring of area by ECO during construction. » Ongoing monitoring of area by EO during operation » Audit every two to three years by a suitably qualified botanist to assess the status of infestation and success of eradication measures » If new infestations are noted these should be recorded. A comprehensive eradication programme with the assistance of the WfW (Working for Water) Programme is advisable.

Appendix 3 NATIONAL WEB BASED ENVIRONMENTAL SCREENING TOOL.

Please take not the Site Screening Survey was conducted prior to the Scoping Phase Assessment and was accompanied by a Screen Survey Site Visit. All the findings and recommendations were made based on the information available at the time. The information provided within this Report as well as the Scoping Phase Report was used to finalize the layout of the facility in order to avoid all sensitive features as recommended within this report and the scoping phase report.

Introduction and summary of the Screening Tool and the link between this tool and the newly gazetted Protocols for specialists.

The Screening Tool, developed by the Department of Environmental Affairs ("DEA"), now Department Forestry and Fisheries of Environment, (DFFE), is a geospatial web-enabled application that aims to provide readily available information, known as 'spatial datasets', which enables applicants for Environmental Authorisation to screen their proposed site for environmental sensitivities.

The Screening Tool provides site specific information to assist an applicant throughout the EIA process. The information provided includes, for example, zoning identification, applicable Environmental Management Frameworks or bio-regional plans, project specific requirements such as specialist studies, and the minimum information to be included in the EIA report.

On 5 July 2019, the Minister of Environment, Forestry and Fisheries, Barbara Dallas Creecy, published a notice requiring that when submitting an application for environmental authorisation in terms of regulation 19 and regulation 21 of the Environmental Impact Assessment Regulations, 2014 (as amended) (the "EIA Regulations"), the applicant must submit the report generated by the National Web Based Screening Tool (the "Screening Tool") with the application. This notice came into effect in October 2019.

The South African National Biodiversity Institute (SANBI), through its Biodiversity and Land Use (BLU) Project and the Council for Scientific and Industrial Research (CSIR) has, since 2017, been supporting the Department of Environment Forestry and Fisheries (DEFF) in integrating biodiversity information into DEFF's web-based National Environmental Screening Tool (hereafter referred to as 'screening tool') and developing a set of biodiversity related protocols that an applicant needs to adhere to in the Environmental Authorisation (EA) process.

On 20 March 2020 the Minister of Forestry, Fisheries and the Environment gazetted Terrestrial and Aquatic Biodiversity Protocols for national implementation purposes.

The Screening Tool consists of a number of themes including agriculture, avifauna, terrestrial and aquatic biodiversity, plant and animal species, noise, defence and civil

aviation. Each of the themes consists of spatial datasets that correspond to the respective theme. Each dataset within the respective theme has been assigned a sensitivity level. Most of the themes within the Screening Tool make use of a four-tier sensitivity system, where delineated areas and features are assigned a sensitivity level of either "low (L)", "medium (M)", "high (H)" or "very high (VH)". Table 27 below describes the four sensitivity classes and their definitions.

Table 27: Summary of the sensitivity classes.

Assessment	Description
VERY HIGH	Area is rates as being extremely sensitivity to development and the risk of finding sensitive biodiversity features at the site is very high. Consequently, the area will either have very high conservation or socio-economic value.
High	Area is rated as being highly sensitive to development and the risk of finding sensitive biodiversity features at the site is high. Consequently. The area will either have high conservation or socio-economic value
Medium	Area is rated as being of medium sensitivity to development and there is a medium to moderate risk of finding sensitive biodiversity features at the site. Consequently, the area will either have medium conservation or socio-economic value.
Low	Area is considered to have low levels of sensitivity and there is low risk of finding sensitive biodiversity features at the site. Consequently, the area has a low conservation or socio-economic value.

A number of datasets were used for the biodiversity related themes. Table 28 identifies the datasets that underpin the various biodiversity related themes in the Screening Tool. For the Aquatic and Terrestrial Biodiversity Themes, all features that have known mapped features of sensitive biodiversity features are assigned a "very high" sensitivity. Where there are no known sensitive biodiversity features, a "low" sensitivity is assigned. Subsequently a two-tier sensitivity system has been applied to the Terrestrial Biodiversity Themes ("very high" and "low") and are based on the presence or absence of known sensitive biodiversity features respectively. In essence the "very high" and "low" sensitivity ratings should be interpreted as there being a greater and lower risk of finding important biodiversity in these areas respectively. It is important to note that all the "very high" delineated areas and features are sensitive but the degree to which these areas can be impacted upon is different for the different "very high" delineated areas and features, depending on the development type. The degree of impact on these areas can only be assessed with the EIA process.

Table 28: Summary of the datasets used to underpin the aquatic and terrestrial biodiversity themes and the sensitivity rating of these features.

Terrestrial & Aquatic Biodiversity Themes Datasets Used	Sensitivity
Protected Areas (Terrestrial)	**Very High**
Critical Biodiversity Areas – CBAs (Terrestrial and Aquatic)	**Very High**
Ecological Support Areas – ESAs (Terrestrial and Aquatic)	**Very High**
Strategic Water Source Areas (Terrestrial & Aquatic)	**Very High**
National Freshwater Priority Areas (FEPA) catchments (Terrestrial & Aquatic)	**Very High**
Priority Areas for Protected Area Expansion (Terrestrial)	**Very High**
Indigenous Forest (Terrestrial)	**Very High**
Rivers (Aquatic)	**Very High**
Wetlands (Aquatic)	**Very High**

Estuaries (Aquatic)	**Very High**
Absence of above listed features	**Low**

As for the Animal and Plant Species Themes, the four-tier sensitivity system have been implemented to the various data layers underpinning these themes, namely "Low", "Medium", "High" and "Very High". Species data have been separated from ecosystem/ landscape level data to provide for huge complexities in the species data, in addition to the high numbers of threatened species within South Africa that would need to be processed for inclusion into the screening tool. As such, it was decided to keep the species data separate for simpler integration within the Screening Tool. It should also be noted that the species guilds that will be covered in the Animal Species Protocol include mammals, reptiles, amphibians, butterflies and birds. A summary of the datasets used to underpin the Animal and Plant themes and their sensitivity rating are provided in Table 29 below.

Table 29: Summary of the datasets used to underpin animal and plant themes and the sensitivity rating of these features.

Plant and/or Animal Species Theme Data Sets Used	**Sensitivity**
Critical habitat for range restricted species of conservation concern that have a global range of less than 10km^2.	**Very High**
Confirmed habitat for species of conservation concern.	**High**
Suspected habitat for species of conservation concern based either on there being records for this species collected in the past prior to 2020 or being a natural area included in a habitat suitability model.	**Medium**
Areas where no natural habitat remains.	**Low**

Description/discussion of the sensitive features found within the project site, as identified within the screening tool and based on the findings of a site visit.

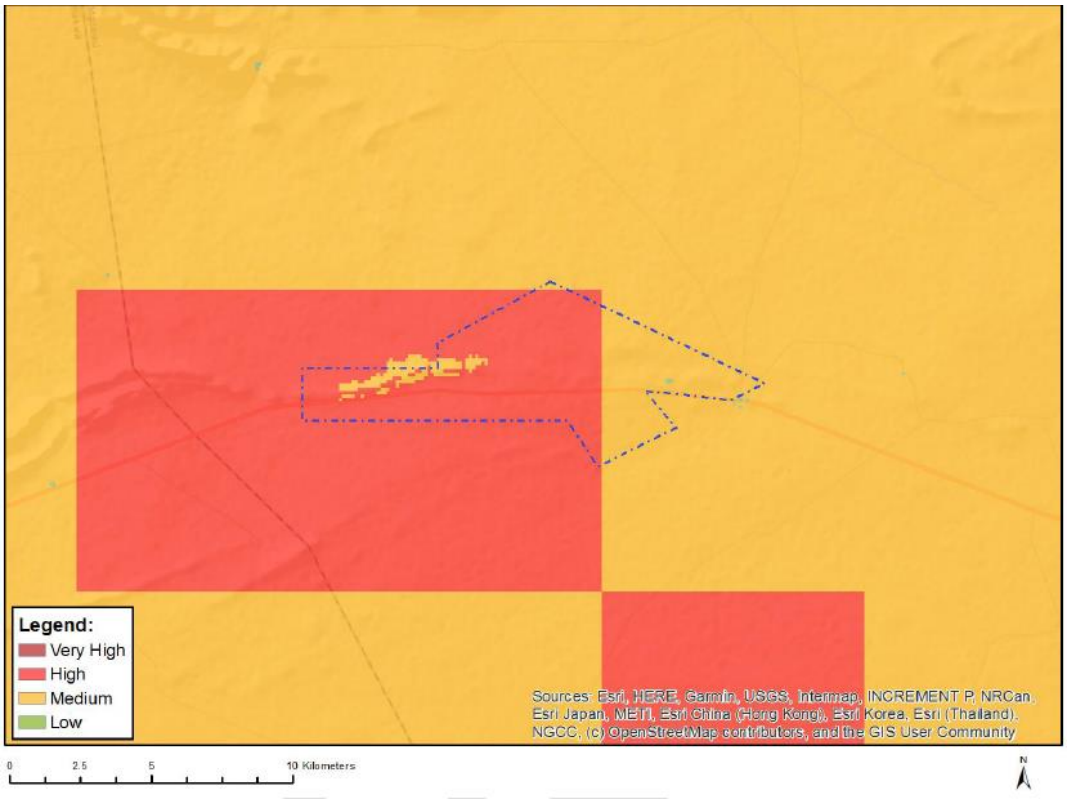
According to the Screening Report generated on the 20th of July 2022 (12:50:16) the following sensitivities (pertaining to terrestrial biodiversity) were identified within the project area:

Table 30: Summary of the development site's environmental sensitivities.

Theme	**Very High Sensitivity**	**High Sensitivity**	**Medium Sensitivity**	**Low Sensitivity**
Animal Species Theme		X		
Plant Species Theme			X	
Terrestrial Biodiversity Theme	X			

A description of the various applicable themes and their sensitivities are provided below as well the confirmation or refute of these sensitivities within the project site based on the findings of the site visit. Take note that this study and report addresses the terrestrial themes, however some of the terrestrial biodiversity themes relate to aquatic features such NFEPA rivers and sub-quaternary catchments and as such these aspects are addressed to some extent where relevant.

Animal Species Theme: Sensitivity



Feature	Sensitivity
Aves: *Neotis ludwigii* (Ludwig's Bustard, Ludwigse Pou)	**High**
Aves: *Neotis ludwigii* (Ludwig's Bustard, Ludwigse Pou)	**Medium**
Aves: *Aquila verreauxii* (Verreaux's Eagle)	**Medium**
Aves: *Saggitarius serpentarius* (Sektretarisvoël, Secretarybird)	**Medium**
Low	**Low Sensitivity**

DISCUSSION OF SENSITIVITY FEATURES BASED ON ON-SITE FINDINGS (FOLLOWING A SITE-VISIT)

Take note that the avifaunal aspect of this theme did not form part of this specific study as a separate avifaunal monitoring programme will be conducted wherein the presence of avifaunal SCC will be investigated/determined.

Apart from the avifaunal SCC that may potentially inhabit the project site, no other faunal SCC have been listed within Screening Report that may potentially inhabit the project site. Only one faunal species of conservation concern (SCC) was observed during the site-visit namely; Bushmanland Tent Tortoise - *Psammobates tentorius verroxii* (Near Threatened). In terms of the likely impacts of the development on these tortoise species, habitat loss is not likely to be highly significant as the direct footprint of the development is not likely to exceed a few hundred hectares and this would not be significant in context of the relatively

homogenous and intact surrounding landscape. In some situations, the loss of vegetation cover associated with roads and grid line construction and other cleared areas can generate potential impact on these species as they may be vulnerable to predation while crossing such cleared areas, but as the site is arid, plant cover is already low.

Due to a general low to moderate habitat and structural complexity as well as the fact that large tracts of land within the region being largely intact and undisturbed, the site is likely to have a moderate faunal diversity, including other potential SCC. Larger ephemeral washes associated floodplains and fringing shrubby vegetation are regarded as the most important and sensitive faunal habitats. Apart from *Psammobates tentorius verroxii,* other SCC which have a distribution that include the development site and are likely (moderate to high likelihood) to occur within the development site due to favourable habitat, include:

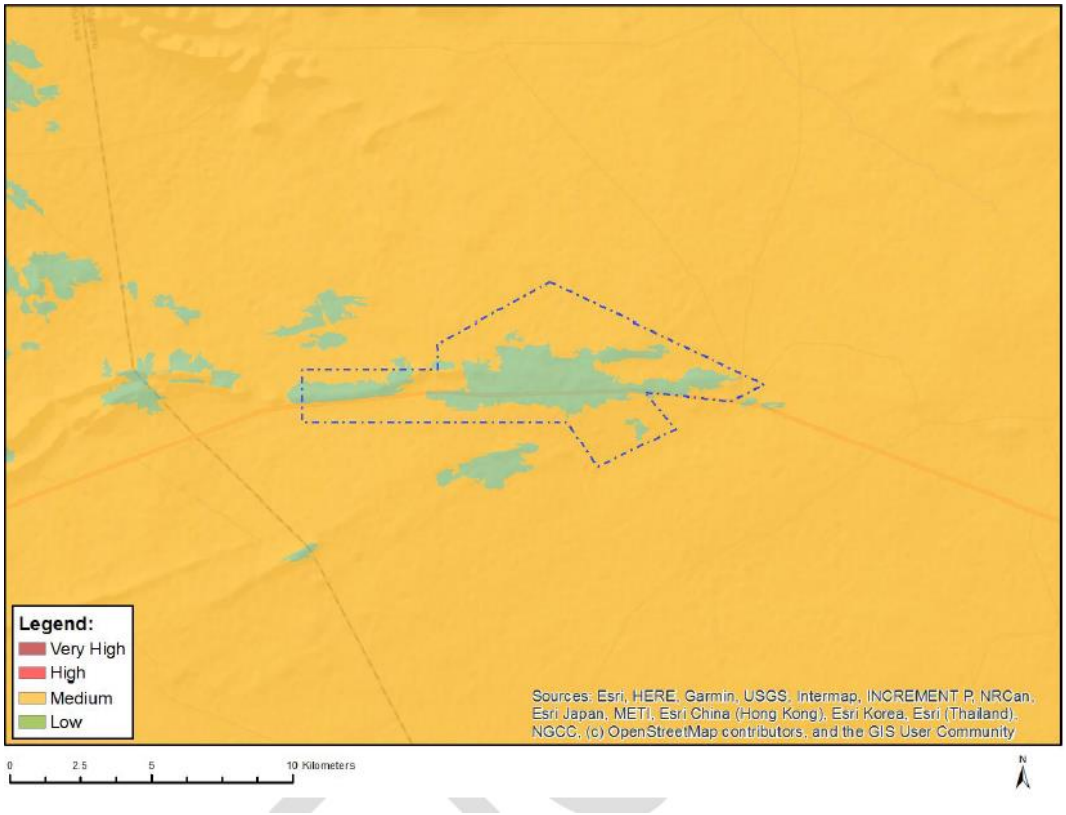
- Mammalian: Black-footed Cat – *Felis nigripes* (Near Threatened);
- Mammalian: Brown Hyena – *Parahyaena brunnea* (Near Threatened);
- Mammalian: Spectacled Dormouse – Graphiurus ocularis (Near Threatened);
- Mammalian: Littledale's Whistling Rat – Parotomys littledalei (Near Threatened);
- Reptilian: Karoo Tent Tortoise – *Psammobates tentorius tentorius* (Near Threatened); and

Based on findings of a desktop and in-field survey of the property the majority of the project area can be classified as Medium Sensitivity and provide some potential habitat for SCC. However, the larger ephemeral washes along with their associated alluvial floodplains should be considered high sensitive, due to its structural and micro-habitat complexity and uniqueness, lateral and longitudinal connectivity and the important functions and services these habitats provide towards the biodiversity of the region. This habitat has furthermore been confirmed to contain suitable habitat for the above-mentioned SCC. The quartz, boulder and rocky outcrops are furthermore considered as medium-high sensitive due to these area's moderately-high structural and micro-habitat complexity and uniqueness.

Recommendations and additional requirements: All very high and high sensitivity features should be excluded from the project footprint and be considered as No-Go Areas. A detailed survey of the development site should occur during the EIA phase. Pre-Construction Faunal Walk-Through will have to be conducted in order to identify any sensitive species (protected and SCC) that may occupy/inhabit the development footprint of the WEF and to assist in the biodiversity permitting processes.

Through the avoidance/exclusion of sensitive faunal habitats and the implementation of mitigation measures, regional faunal populations will likely not be significantly impacted and impacts on any faunal SCC should be successfully avoided.

Plant Species Theme: Sensitivity



Feature	Sensitivity
Low Sensitivity	**Low Sensitivity**
Sensitive species 1157	**Medium**
Sensitive species 854	**Medium**
Crotalaria pearsonii	**Medium**
Sensitive species 144	**Medium**

DISCUSSION OF SENSITIVITY FEATURES BASED ON ON-SITE FINDINGS (FOLLOWING A SITE-VISIT)

No floral species of conservation concern (SCC) were observed during the screening site-visit. However, due to the largely natural/undisturbed nature of the area as well as the relative wide range of environmental gradients present, creating various macro- and micro habitats, sufficient suitable habitat persists for the presence of floral SCC.

In terms of individual Plant SCC and/or important populations of Plant SCC, potential suitable habitats persist within the project site and surroundings, and as such the classification of the development area as Medium Sensitivity, in terms of Plant SCC, within the Screening Tool, is consistent with the on-site findings.

In terms of ecosystems/plant habitats/phyto-communities and general plant biodiversity, the majority of the site is considered as Medium sensitive and coincides with the Bushmanland Arid Grassland vegetation type (refer to section 5.1.1 as well as **Error! Reference source not found.**extent of occurrence (SANBI, 2018), and are regarded as least concern, comprising of a fairly low diversity of plants, mainly general species with a wide distribution throughout the region. Development within this plant habitat is regarded as acceptable. A total of fifteen wind turbines are planned within this vegetation type.

The larger and more prominent ephemeral washes and their alluvial floodplains have not been delineated and mapped within the national vegetation map (SANBI, 2018), however these features were determined to be largely consistent with the Namaqualand Riviere vegetation type, and are considered to be very high sensitive due to these areas being structurally more complex, contributing to plant species, habitat, and niche diversity, as well as acting as potential important biodiversity corridors. Subsequently these plant habitats along with their preliminary determined 100m buffer areas, should be considered as "No-Go" apart from the use/upgrade of existing watercourse crossings. According to the current turbine layout, only one turbine is planned within a freshwater resource feature. Preliminary buffer areas have also been recommended for all wetlands, smaller washes and drainage features. Activities allowed within these smaller, less prominent freshwater resource features as well as their associated buffer areas include;

- » the use/upgrade of existing access roads and where no viable existing access road exist, new roads may be considered; and
- » the lying of underground cabling, which should preferably occur adjacent or within the planned access routes;

for all other activities and infrastructure associated with the development, these areas should be considered as "No-Go" areas, e.g. turbines, crane pads, substations, laydown areas and any building infrastructure.

The vegetation of the more undulating hills, slopes, outcrops and inselberg areas coincides with the Bushmanland Inselberg Shrubland, Bushmanland Basin Shrubland, Eastern Gariep Rocky Desert and Namaqualand Klipkoppe Shrubland vegetation types. These vegetation types have a patchy distribution within the Bushmanland Arid Grassland (SANBI, 2018). Even though these vegetation types, combined, only cover a fairly small portion of the affected properties, a fair amount of the turbines are planned within some patches of these vegetation types (ten turbines planned within a narrow quartz ridge consistent with Bushmanland Inselberg Shrubland as well five turbines planned within a broken plain consistent with Bushmanland Basin Shrubland). These undulating areas are considered as medium-highly sensitive due to these areas' moderately high structural complexity, creating various small and fairly unique micro-habitats for "habitat specialist" plant species, especially geophytes and succulents. It is important to keep in mind that not all areas/micro-habitats within these undulating patches are regarded equally

structurally complex, species diverse and ecologically sensitive. Areas that slope more gradually, and that are less diverse and structurally complex are regarded as Medium sensitive and are suitable for development. Steeper slopes, especially south facing slopes as well as areas that are highly structurally complex are regarded as High sensitive. The placement of turbines, crane pads, access roads and underground cabling within these Medium sensitive areas are regarded as acceptable. However, these areas are not suitable for the construction of any building infrastructure. All High sensitive areas should, on the other hand, be regarded as "No-Go" areas for all activities apart from the use/upgrade of existing access routes.

A more in-depth/extensive assessment during the EIA phase may confirm the presence of SCC and the size and vitality of potential populations. However, the presence of these species/populations will likely not result in the abandonment of this development within the inspected area, as "sensitive" areas with associated buffers/corridors, as identified during the EIA phase, can be successfully avoided and impacts on SCC successfully mitigated.

Recommendations and additional requirements: The entire project site has been preliminary surveyed, and during this screening survey no plant SCC were identified within the project site. However, a more in-depth/extensive assessment during the EIA phase may confirm the presence of SCC within the development footprints. The following activities are allowed/not allowed within the identified habitat features:

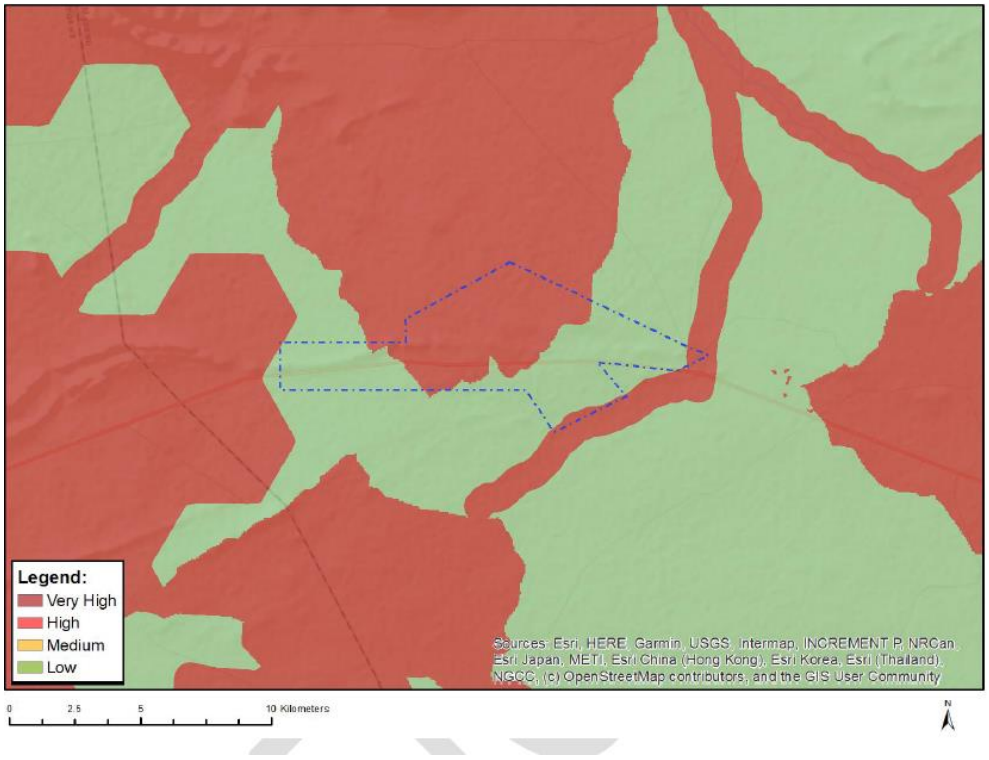
- Plains covered by the Bushmanland Arid Grassland (Medium Sensitive): This habitat is regarded as the most suitable for the proposed development and all activities associated with the development of the proposed WEF is acceptable within this habitat.
- Primary ephemeral washes and alluvial floodplains along with buffer areas (Very High Sensitive): "No-Go" area for activities apart from the use/upgrade of existing access routes.
- Larger ephemeral washes and alluvial floodplains along with buffer areas (High Sensitive): "No-Go" area for activities apart from the use/upgrade of existing access routes, the construction of new access routes where no viable existing route exists and the laying of underground cabling (only allowed along or within access routes).
- Small ephemeral washes and drainage features along with buffer areas (Medium Sensitive): "No-Go" area for activities apart from the use/upgrade of existing access routes, the construction of new access routes where no viable existing route exists and the laying of underground cabling (only allowed along or within access routes).
- More gradual sloping and less structurally complex and diverse outcrops, hills, inselbergs and broken plains (Bushmanland Inselberg Shrubland and Bushmanland Basin Shrubland vegetation types) (Medium Sensitive): The placement of turbines, crane pads, access roads and underground cabling are regarded as acceptable. However, the construction of any building infrastructure may not be allowed within these areas.

» Steeper slopes, south facing aspects and more structurally complex and diverse portions of outcrops, hills and inselbergs (Bushmanland Inselberg Shrubland and Eastern Gariep Rocky Desert and Namaqualand Klipkoppe vegetation types) (High Sensitive): "No-Go" area for activities apart from the use/upgrade of existing access routes, the construction of new access routes where no viable existing route exists and the laying of underground cabling (only allowed along or within access routes).

A Pre-Construction Botanical Walk-Through will furthermore have to be conducted in order to determine the numbers/population sizes of sensitive plant species (protected and SCC) that may occupy/inhabit the development footprints of the SEFs and to assist in the biodiversity permitting processes.

Through the avoidance/exclusion of sensitive floral habitats and the implementation of mitigation measures, regional plant populations will likely not be significantly impacted and impacts on any plant SCC should be successfully avoided.

Terrestrial Biodiversity Theme: Sensitivity



Feature	Sensitivity
Low Sensitivity	**Low Sensitivity**
Critical Biodiversity Area 1	**Very High Sensitivity**
Critical Biodiversity Area 2	**Very High Sensitivity**
Ecological Support Area	**Very High Sensitivity**
FEPA Sub-catchments	**Very High Sensitivity**
Protected Areas Expansion Strategy	**Very High Sensitivity**

DISCUSSION OF SENSITIVITY FEATURES BASED ON ON-SITE FINDINGS (FOLLOWING A SITE-VISIT)

The majority of the "Very High Sensitive" areas identified within the affected properties are based primarily on the NFEPA coverage (mainly FEPA and Upstream Catchments) and Northern Cape CBA coverage (mainly ESA and CBA2).

The underlying features associated with the CBAs and ESAs within the property can be summarised as follow:

Table 31: Reasons underlying the CBA1 and CBA2 status of the affected property.

Feature	CBA 1	CBA 2	ESA	Other	Remarks
Larger River Features (1:500 000) and 500m Buffers			**X**		» The Non-FEPA river flowing in a north-eastern direction (across the eastern portion of the project site), as well as its 500m buffer areas. » According to the current layout, very limited infrastructure is planned within this ESA, as well as any other freshwater resource features: • Only one pylon planned within the non-FEPA (ESA) watercourse; and • Only one pylon planned within the associated 500m buffer area. » Furthermore, a small portion of ESA will be impacted through the use/construction of access routes and the lying of underground cabling.
FEPA-River and 500m Buffers	**X**			»	» The large ephemeral wash to the south-west, listed as a FEPA-River as well as a 500m buffer area. » According to the current layout, very limited infrastructure is planned within this CBA1; • No pylons or crane pads planned within this watercourse as well as the 500m buffer area; • The only infrastructure planned within this CBA1 include a small section of access road (crossing) and underground cabling.
Sub-Quaternary Catchment of FEPA-Rivers		**X**		**X**	» The bulk of the FEPA1 prioritized and Upstream catchments have been classified as Other Natural Areas whilst approximately 50% of the FEPA1 prioritized catchment associated with the FEPA-river to the south-west of the project site have been classified as CBA2. • Most of the development will occur outside of these FEPA1 prioritized catchments, whilst no activities and infrastructure are planned within the portion of the FEPA1 prioritized catchment classified as CBA2.

Wetlands (Non-FEPA)			**X**		» All Non-FEPA Wetlands have been classified as ESAs. » A few Wetland ESAs have been mapped within the south-western portion of the project site. » According to the current layout, no infrastructure is planned within any of these wetland features.
NPAES Focus Areas			**X**	**X**	» Portions of the project site are included within two NPAES Focus Areas. » The majority of these Focus Areas have been classified as Other Natural Areas whilst, only very small portions (within the project site) have been classified as ESAs. » Almost the entire project site will occur outside of these ESAs.
Important structural and landscape elements and areas of moderate to high climate resilience (SKEP & NDBSP:CBA1&2)		**X**			» The inselberg located within the top right corner of the project site has been listed as an important structural landscape element, important for biodiversity within both the Succulent Karoo Ecosystem Plan (SKEP, 2003) as well as the Namakwa District Biodiversity Sector Plan (2008). Within the Namakwa DBSP this inselberg has been listed as CBA2. » Subsequently this feature has been incorporated into the Northern Cape Critical Biodiversity Map (2016), where it is similarly listed as a CBA2. » According to the current layout, no activities or infrastructure is planned within this habitat.

With the exclusion of sensitive areas, as specified within the above-mentioned sections, and with the meticulous implementation of mitigation measures the proposed development of the Pofadder 1 WEF will not have an impact on the province's biodiversity targets.

Recommendations and additional requirements:

» The following buffer areas have been recommended, and are regarded as suitable for maintaining the freshwater resource features REC (Recommended Ecological Category) allowing the persistence of the current present ecological status as well as their functions and services.
  - Primary and large ephemeral washes (including associated alluvial floodplains: 100m buffers from the outer edge of the freshwater resource features.
  - Minor ephemeral washes: 50m buffers from the outer edge of the freshwater resource features.
  - Endorheic depression wetlands (pans): 50m buffers from the outer edge of the freshwater resource features.
  - Small drainage lines: 35m buffers.

» All ephemeral washes and alluvial floodplains with their buffer areas have been classified as either Very High- or High sensitive and should be regarded as "No-Go"

areas apart from the following activities and infrastructure which may be allowed (although restricted to an absolute minimum footprint):

- only activities relating to the route access and cabling:
  - the use/upgrade of existing roads and watercourse crossings are the preferred options;
  - Where no suitable existing roads and watercourse crossings exist, the construction of new access roads and watercourse crossings can be allowed, however this should be deemed as a last resort.
  - All underground cabling should be laid either within access roads or next to access roads (as close as possible).

» All depression wetlands with their buffer areas have been classified as High sensitive and should be regarded as "No-Go" areas for all activities associate with the proposed development.

» All drainage lines with their buffer areas have been classified as Medium sensitive and should be regarded as "No-Go" areas apart from the following activities and infrastructure which may be allowed (although restricted to an absolute minimum footprint):

- only activities relating to the route access and cabling:
  - the use/upgrade of existing roads and watercourse crossings are the preferred options;
  - Where no suitable existing roads and watercourse crossings exist, the construction of new access roads and watercourse crossings can be allowed, however this should be deemed as a last resort.
  - All underground cabling should be laid either within access roads or next to access roads (as close as possible).

» In terms of activities and infrastructure planned within the FEPA1 prioritized- and Upstream Catchments: Even though no activities and infrastructure are planned within these areas that have been classified as CBA2, mitigation measures should still be considered for the development of the WEF within the remaining catchment portions, as careless and uncontrolled activities may lead to indirect negative impacts on the lower lying watercourses. Thus, the following mitigation measures should be considered;

- During the planning and design phase the following aspects should be considered and addressed:
  - Natural runoff patterns within the catchments: Provide mitigation measures that will manage/simulate these natural runoff patterns and prevent erosion.
  - Natural/normal water inputs, flow patterns and flood peaks associated with the lower lying watercourses: Provide mitigation measures in order to maintain these hydrological characteristics (drivers).
  - Landscape/Ecological Connectivity: Provide mitigation measures that will prevent the fracturing of landscape (maintain connectivity between upland terrestrial habitats and downstream freshwater resource features)

- Recommended Ecological Categories (RECs) of downstream freshwater resource features: Maintain these RECs.

» The inselberg regarded as an important structural element within and classified as a CBA2 within the NC-CBA Map (also within SKEP and Namaqua District Biodiversity Spatial Plan (NDBSP)) should be regarded as a "No-Go" area apart from the following activities;
  - the use of existing roads.

» In terms of activities and infrastructure planned within the NPAES Focus Areas: Even though no activities and infrastructure are planned within these Focus Areas that have been classified as ESA, mitigation measures should still be considered for the development of the WEF within the remaining portion of the focus areas, as these areas may still be considered as valuable and contribute to the national conservation targets (even with the development of the WEF): Thus, the following management plans and mitigation measures should be considered;
  - Storm Water and Erosion Management Plan;
  - A Plant Rehabilitation and Invasive Alien Plant Management Plan;
  - Mitigation measures that allow/maintain landscape connectivity.

Appendix 4 Specialist Curriculum Vitae

CURRICULUM VITAE:

Gerhard Botha

Name:	:	Gerhardus Alfred Botha
Date of Birth	:	11 April 1986
Identity Number	:	860411 5136 088
Postal Address	:	PO Box 12500 Brandhof 9324
Residential Address	:	3 Jock Meiring Street Park West Bloemfontein 9301
Cell Phone Number	:	084 207 3454
Email Address	:	gabotha11@gmail.com
Profession/Specialisation	:	Ecological and Biodiversity Consultant
Nationality:	:	South African
Years Experience:	:	8
Bilingualism	:	Very good – English and Afrikaans

Professional Profile:

Gerhard is a Managing Director of Nkurenkuru Ecology and Biodiversity (Pty) Ltd. He has a BSc Honours degree in Botany from the University of the Free State Province and is currently completing a MSc Degree in Botany. He began working as an environmental specialist in 2010 and has since gained extensive experience in conducting ecological and biodiversity assessments in various development field, especially in the fields of conventional as well as renewable energy generation, mining and infrastructure development. Gerhard is a registered Professional Natural Scientist (Pr. Sci. Nat.)

Key Responsibilities:

Specific responsibilities as an Ecological and Biodiversity Specialist include, inter alia, professional execution of specialist consulting services (including flora, wetland and fauna studies, where required), impact assessment reporting, walk through surveys/ground-truthing to inform final design, compilation of management plans, compliance monitoring and audit reporting, in-house ecological awareness training to on-site personnel, and the development of project proposals for procuring new work/projects.

Skills Base and Core Competencies

- Research Project Management
- Botanical researcher in projects involving the description of terrestrial and coastal ecosystems.
- Broad expertise in the ecology and conservation of grasslands, savannahs, karroid wetland, and aquatic ecosystems.
- Ecological and Biodiversity assessments for developmental purposes (BAR, EIA), with extensive knowledge and experience in the renewable energy field (Refer to Work Experiences and References)
- Over 3 years of avifaunal monitoring and assessment experience.
- Mapping and Infield delineation of wetlands, riparian zones and aquatic habitats (according to methods stipulated by DWA, 2008) within various South African provinces of KwaZulu-Natal, Mpumalanga, Free State, Gauteng and Northern Cape Province for inventory and management purposes.
- Wetland and aquatic buffer allocations according to industry best practice guidelines.
- Working knowledge of environmental planning policies, regulatory frameworks, and legislation
- Identification and assessment of potential environmental impacts and benefits.
- Assessment of various wetland ecosystems to highlight potential impacts, within current and proposed landscape settings, and recommend appropriate mitigation and offsets based on assessing wetland ecosystem service delivery (functions) and ecological health/integrity.
- Development of practical and achievable mitigation measures and management plans and evaluation of risk to execution
- Qualitative and Quantitative Research
- Experienced in field research and monitoring
- Working knowledge of GIS applications and analysis of satellite imagery data
- Completed projects in several Provinces of South Africa and include a number of projects located in sensitive and ecological unique regions.

Education and Professional Status

Degrees:

- *2015:* Currently completing a M.Sc. degree in Botany (Vegetation Ecology), University of the Free State, Bloemfontein, RSA.
- *2009:* B.Sc. Hons in Botany (Vegetation Ecology), University of the Free State, Bloemfontein, RSA.
- *2008:* B.Sc. in Zoology and Botany, University of the Free State, University of the Free State, Bloemfontein, RSA.

Courses:

- *2013*: Wetland Management (ecology, hydrology, biodiversity, and delineation) – University of the Free State accredited course.
- *2014*: Introduction to GIS and GPS (Code: GISA 1500S) – University of the Free State accredited course.

Professional Society Affiliations:

- The South African Council of Natural Scientific Professions: Pr. Sci. Nat. Reg. No. 400502/14 (Botany and Ecology).

Employment History

- December 2017 – Current: Nkurenkuru Ecology and Biodiversity (Pty) Ltd
- 2016 – November 2017: ECO-CARE Consultancy
- *2015 - 2016*: Ecologist, Savannah Environmental (Pty) Ltd
- *2013 – 2014*: Working as ecologist on a freelance basis, involved in part-time and contractual positions for the following companies
  - Enviroworks (Pty) Ltd
  - GreenMined (Pty) Ltd
  - Eco-Care Consultancy (Pty) Ltd
  - Enviro-Niche Consulting (Pty) Ltd
  - Savannah Environmental (Pty) Ltd
  - Esicongweni Environmental Services (EES) cc
- *2010 - 2012*: Enviroworks (Pty) Ltd

Publications

Publications:

- Botha, G.A. & Du Preez, P.J. 2015. A description of the wetland and riparian vegetation of the Nxamasere palaeo-river's backflooded section, Okavango Delta, Botswana. S. *Afr. J. Bot*., **98**: 172-173.

Congress papers/posters/presentations:

- Botha, G.A. 2015. A description of the wetland and riparian vegetation of the Nxamasere palaeo-river's backflooded section, Okavango Delta, Botswana. 41st Annual Congress of South African Association of Botanists (SAAB). Tshipise, 11-15 Jan. 2015.
- Botha, G.A. 2014. A description of the vegetation of the Nxamasere floodplain, Okavango Delta, Botswana. 10st Annual University of Johannesburg (UJ) Postgraduate Botany Symposium. Johannesburg, 28 Oct. 2014.

Other

- Guest speaker at IAIAsa Free State Branch Event (29 March 2017)
- Guest speaker at the University of the Free State Province: Department of Plant Sciences (3 March 2017):

References:

- Christine Fouché
  Manager: GreenMined (Pty) LTD
  Cell: 084 663 2399

- Professor J du Preez
  Senior lecturer: Department of Plant Sciences
  University of the Free State
  Cell: 082 376 4404

Appendix 5 Specialist Work Experience and References

WORK EXPERIENCES

&

References

Gerhard Botha

ECOLOGICAL RELATED STUDIES AND SURVEYS

Date Completed	Project Description	Type of Assessment/Study	Client
2019	Sirius Three Solar PV Facility near Upington, Northern Cape	Ecological Assessment (Basic Assessment)	Aurora Power Solutions
2019	Sirius Four Solar PV Facility near Upington, Northern Cape	Ecological Assessment (Basic Assessment)	Aurora Power Solutions
2019	Lichtenburg 1 100MW Solar PV Facility, Lichtenburg, North-West Province	Ecological Assessment (Scoping and EIA Phase Assessments)	Atlantic Renewable Energy Partners
2019	Lichtenburg 2 100MW Solar PV Facility, Lichtenburg, North-West Province	Ecological Assessment (Scoping and EIA Phase Assessments)	Atlantic Renewable Energy Partners
2019	Lichtenburg 3 100MW Solar PV Facility, Lichtenburg, North-West Province	Ecological Assessment (Scoping and EIA Phase Assessments)	Atlantic Renewable Energy Partners
2019	Moeding Solar PV Facility near Vryburg, North-West Province	Ecological Assessment (Basic Assessment)	Moeding Solar
2019	Expansion of the Raumix Aliwal North Quarry, Eastern Cape Province	Fauna and Flora Pre-Construction Walk-Through Assessment	GreenMined
2018	Kruisvallei Hydroelectric 22kV Overhead Power Line, Clarens, Free State Province	Faunal and Flora Rescue and Protection Plan	Zevobuzz
2018	Kruisvallei Hydroelectric 22kV Overhead Power Line, Clarens, Free State Province	Fauna and Flora Pre-Construction Walk-Through Assessment	Zevobuzz
2018	Proposed Kruisvallei Hydroelectric Power Generation Scheme in the Ash River, Free State Province	Ecological Assessment (Basic Assessment)	Zevobuzz
2018	Proposed Zonnebloem Switching Station (132/22kV) and 2X Loop-in Loop-out Power Lines (132kV), Mpumalanga Province	Ecological Assessment (Basic Assessment)	Eskom
2018	Clayville Thermal Plant within the Clayville Industrial Area, Gauteng Province	Ecological Comments Letter	Savannah Environmental
2018	Iziduli Emoyeni Wind Farm near Bedford, Eastern Cape Province	Ecological Assessment (Re-assessment)	Emoyeni Wid Farm Renewable Energy
2018	Msenge Wind Farm near Bedford, Eastern Cape Province	Ecological Assessment (Re-assessment)	Amakhala Emoyeni Renewable Energy

2017	H2 Energy Power Station near Kwamhlanga, Mpumalanga Province	Ecological Assessment (Scoping and EIA phase assessments)	Eskom
2017	Karusa Wind Farm (Phase 1 of the Hidden Valley Wind Energy Facility near Sutherland, Northern Cape Province)	Ecological Assessment (Re-assessment)	ACED Renewables Hidden Valley
2017	Soetwater Wind Farm (Phase 2 of the Hidden Valley Wind Energy Facility near Sutherland, Northern Cape Province)	Ecological Assessment (Re-assessment)	ACED Renewables Hidden Valley
2017	S24G for the unlawful commencement or continuation of activities within a watercourse, Honeydew, Gauteng Province	Ecological Assessment	Savannah Environmental
2016 - 2017	Noupoort CSP Facility near Noupoort, Northern Cape Province	Ecological Assessment (Scoping and EIA phase assessments)	Cresco
2016	Buffels Solar 2 PV Facility near Orkney, North West Province	Ecological Assessment (Scoping and EIA phase assessments)	Kabi Solar
2016	Buffels Solar 1 PV Facility near Orkney, North West Province	Ecological Assessment (Scoping and EIA phase assessments)	Kabi Solar
2016	132kV Power Line and On-Site Substation for the Authorised Golden Valley II Wind Energy Facility near Bedford, Eastern Cape Province	Ecological Assessment (Basic Assessment)	Terra Wind Energy
2016	Kalahari CSP Facility: 132kV Ferrum–Kalahari–UNTU & 132kV Kathu IPP–Kathu 1 Overhead Power Lines, Kathu, Northern Cape Province	Fauna and Flora Pre-Construction Walk-Through Assessment	Kathu Solar Park
2016	Kalahari CSP Facility: Access Roads, Kathu, Northern Cape Province	Fauna and Flora Pre-Construction Walk-Through Assessment	Kathu Solar Park
2016	Karoshoek Solar Valley Development – Additional CSP Facility including tower infrastructure associated with authorised CSP Site 2 near Upington, Northern Cape Province	Ecological Assessment (Scoping Assessment)	Emvelo
2016	Karoshoek Solar Valley Development –Ilanga CSP 7 and 8 Facilities near Upington, Northern Cape Province	Ecological Assessment (Scoping Assessment)	Emvelo
2016	Karoshoek Solar Valley Development –Ilanga CSP 9 Facility near Upington, Northern Cape Province	Ecological Assessment (Scoping Assessment)	Emvelo
2016	Lehae Training Academy and Fire Station, Gauteng Province	Ecological Assessment	Savannah Environmental
2016	Metal Industrial Cluster and Associated Infrastructure near Kuruman, Northern Cape Province	Ecological Assessment (Scoping Assessment)	Northern Cape Department of Economic Development and Tourism
2016	Semonkong Wind Energy Facility near Semonkong, Maseru District, Lesotho	Ecological Pre-Feasibility Study	Savannah Environmental
2015 - 2016	Orkney Solar PV Facility near Orkney, North West Province	Ecological Assessment (Scoping and EIA phase assessments)	Genesis Eco-Energy
2015 - 2016	Woodhouse 1 and Woodhouse 2 PV Facilities near Vryburg, North West Province	Ecological Assessment (Scoping and EIA phase assessments)	Genesis Eco-Energy
2015	CAMCO Clean Energy 100kW PV Solar Facility, Thaba Eco Lodge near Johannesburg, Gauteng Province	Ecological Assessment (Basic Assessment)	CAMCO Clean Energy
2015	CAMCO Clean Energy 100kW PV Solar Facility, Thaba Eco Lodge near Johannesburg, Gauteng Province	Ecological Assessment (Basic Assessment)	CAMCO Clean Energy
2015	Sirius 1 Solar PV Project near Upington, Northern Cape Province	Fauna and Flora Pre-Construction Walk-Through Assessment	Aurora Power Solutions

2015	Sirius 2 Solar PV Project near Upington, Northern Cape Province	Fauna and Flora Pre-Construction Walk-Through Assessment	Aurora Power Solutions
2015	Sirius 1 Solar PV Project near Upington, Northern Cape Province	Invasive Plant Management Plan	Aurora Power Solutions
2015	Sirius 2 Solar PV Project near Upington, Northern Cape Province	Invasive Plant Management Plan	Aurora Power Solutions
2015	Sirius 1 Solar PV Project near Upington, Northern Cape Province	Plant Rehabilitation Management Plan	Aurora Power Solutions
2015	Sirius Phase 2 Solar PV Project near Upington, Northern Cape Province	Plant Rehabilitation Management Plan	Aurora Power Solutions
2015	Sirius 1 Solar PV Project near Upington, Northern Cape Province	Plant Rescue and Protection Plan	Aurora Power Solutions
2015	Sirius Phase 2 Solar PV Project near Upington, Northern Cape Province	Plant Rescue and Protection Plan	Aurora Power Solutions
2015	Expansion of the existing Komsberg Main Transmission Substation near Sutherland, Northern Cape Province	Ecological Assessment (Basic Assessment)	ESKOM
2015	Karusa Wind Farm near Sutherland, Northern Cape Province)	Invasive Plant Management Plan	ACED Renewables Hidden Valley
2015	Proposed Karusa Facility Substation and Ancillaries near Sutherland, Northern Cape Province	Ecological Assessment (Basic Assessment)	ACED Renewables Hidden Valley
2015	Eskom Karusa Switching Station and 132kV Double Circuit Overhead Power Line near Sutherland, Northern Cape Province	Ecological Assessment (Basic Assessment)	ESKOM
2015	Karusa Wind Farm near Sutherland, Northern Cape Province)	Plant Search and Rescue and Rehabilitation Management Plan	ACED Renewables Hidden Valley
2015	Karusa Wind Energy Facility near Sutherland, Northern Cape Province	Fauna and Flora Pre-Construction Walk-Through Assessment	ACED Renewables Hidden Valley
2015	Soetwater Facility Substation, 132kV Overhead Power Line and Ancillaries, near Sutherland, Northern Cape Province	Ecological Assessment (Basic Assessment)	ACED Renewables Hidden Valley
2015	Soetwater Wind Farm near Sutherland, Northern Cape Province)	Invasive Plant Management Plan	ACED Renewables Hidden Valley
2015	Soetwater Wind Energy Facility near Sutherland, Northern Cape Province	Fauna and Flora Pre-Construction Walk-Through Assessment	ACED Renewables Hidden Valley
2015	Soetwater Wind Farm near Sutherland, Northern Cape Province	Plant Search and Rescue and Rehabilitation Management Plan	ACED Renewables Hidden Valley
2015	Expansion of the existing Scottburgh quarry near Amandawe, KwaZulu-Natal	Botanical Assessment (for EIA)	GreenMined Environmental
2015	Expansion of the existing AFRIMAT quarry near Hluhluwe, KwaZulu-Natal	Botanical Assessment (for EIA)	GreenMined Environmental
2014	Tshepong 5MW PV facility within Harmony Gold's mining rights areas, Odendaalsrus	Ecological Assessment (Basic Assessment)	BBEnergy
2014	Nyala 5MW PV facility within Harmony Gold's mining rights areas, Odendaalsrus	Ecological Assessment (Basic Assessment)	BBEnergy
2014	Eland 5MW PV facility within Harmony Gold's mining rights areas, Odendaalsrus	Ecological Assessment (Basic Assessment)	BBEnergy
2014	Transalloys circulating fluidised bed power station near Emalahleni, Mpumalanga Province	Ecological Assessment (for EIA)	Trans-Alloys
2014	Umbani circulating fluidised bed power station near Kriel, Mpumalanga Province	Ecological Assessment (Scoping and EIA)	Eskom
2014	Gihon 75MW Solar Farm: Bela-Bela, Limpopo Province	Ecological Assessment (for EIA)	NETWORX Renewables
2014	Steelpoort Integration Project & Steelpoort to Wolwekraal 400kV Power Line	Fauna and Flora Pre-Construction Walk-Through Assessment	Eskom
2014	Audit of protected *Acacia erioloba* trees within the Assmang Wrenchville housing development footprint area	Botanical Audit	Eco-Care Consultancy

2014	Rehabilitation of the N1 National Road between Sydenham and Glen Lyon	Peer review of the ecological report	EKO Environmental
2014	Rehabilitation of the N6 National Road between Onze Rust and Bloemfontein	Peer review of the ecological report	EKO Environmental
2011	Illegally ploughed land on the Farm Wolwekop 2353, Bloemfontein	Vegetation Rehabilitation Plan	EnviroWorks
2011	Rocks Farm chicken broiler houses	Botanical Assessment (for EIA)	EnviroWorks
2011	Botshabelo 132 kV line	Ecological Assessment (for EIA)	CENTLEC
2011	De Aar Freight Transport Hub	Ecological Scoping and Feasibility Study	EnviroWorks
2011	The proposed establishment of the Tugela Ridge Eco Estate on the farm Kruisfontein, Bergville	Ecological Assessment (for EIA)	EnviroWorks
2010 - 2011	National long-haul optic fibre infrastructure network project, Bloemfontein to Beaufort West	Vegetation Rehabilitation Plan for illegally cleared areas	NEOTEL
2010 - 2011	National long-haul optic fibre infrastructure network project, Bloemfontein to Beaufort West	Invasive Plant Management Plan	NEOTEL
2010 - 2011	National long-haul optic fibre infrastructure network project, Bloemfontein to Beaufort West	Protected and Endangered Species Walk-Through Survey	NEOTEL
2011	Optic Fibre Infrastructure Network, Swartland Municipality	Botanical Assessment (for EIA) - Assisted Dr. Dave McDonald	Dark Fibre Africa
2011	Optic Fibre Infrastructure Network, City of Cape Town Municipality	Botanical Assessment (for EIA) - Assisted Dr. Dave McDonald	Dark Fibre Africa
2010	Construction of an icon at the southernmost tip of Africa, Agulhas National Park	Botanical Assessment (for EIA)	SANPARKS
2010	New boardwalk from Suiderstrand Gravel Road to Rasperpunt, Agulhas National Park	Botanical Assessment (for EIA)	SANPARKS
2010	Farm development for academic purposes (Maluti FET College) on the Farm Rosedale 107, Harrismith	Ecological Assessment (Screening and Feasibility Study)	Agri Development Solutions
2010	Basic Assessment: Barcelona 88/11kV substation and 88kV loop-in lines	Botanical Assessment (for EIA)	Eskom Distribution
2011	Illegally ploughed land on the Farm Wolwekop 2353, Bloemfontein	Vegetation Rehabilitation Plan	EnviroWorks

WETLAND DELINEATION AND HYDROLOGICAL ASSESSMENTS

Date Completed	Project Description	Type of Assessment/Study	Client
In progress	Steynsrus PV 1 & 2 Solar Energy Facilities near Steynsrus, Free State Province	Wetland Assessment	Cronimet Mining Power Solutions
2019	Lichtenburg 1 100MW Solar PV Facility, Lichtenburg, North-West Province	Surface Hydrological Assessment (Scoping and EIA Phase)	Atlantic Renewable Energy Partners
2019	Lichtenburg 2 100MW Solar PV Facility, Lichtenburg, North-West Province	Surface Hydrological Assessment (Scoping and EIA Phase)	Atlantic Renewable Energy Partners
2019	Lichtenburg 3 100MW Solar PV Facility, Lichtenburg, North-West Province	Surface Hydrological Assessment (Scoping and EIA Phase)	Atlantic Renewable Energy Partners
2019	Moeding Solar PV Facility near Vryburg, North-West Province	Wetland Assessment (Basic Assessment)	Moeding Solar
2018	Kruisvallei Hydroelectric 22kV Overhead Power Line, Clarens, Free State Province	Wetland Assessment (Basic Assessment	Zevobuzz
2017	Nyala 5MW PV facility within Harmony Gold's mining rights areas, Odendaalsrus	Wetland Assessment	BBEnergy
2017	Eland 5MW PV facility within Harmony Gold's mining rights areas, Odendaalsrus	Wetland Assessment	BBEnergy
2017	Olifantshoek 10MVA 132/11kV Substation and 31km Power Line	Surface Hydrological Assessment (Basic Assessment)	Eskom

2017	Expansion of the Elandspruit Quarry near Ladysmith, KwaZulu-Natal Province	Wetland Assessment	Raumix
2017	S24G for the unlawful commencement or continuation of activities within a watercourse, Honeydew, Gauteng Province	Aquatic Assessment & Flood Plain Delineation	Savannah Environmental
2017	Noupoort CSP Facility near Noupoort, Northern Cape Province	Surface Hydrological Assessment (EIA phase)	Cresco
2016	Wolmaransstad Municipality 75MW PV Solar Energy Facility in the North West Province	Wetland Assessment (Basic Assessment)	BlueWave Capital
2016	BlueWave 75MW PV Plant near Welkom Free State Province	Wetland Delineation	BlueWave Capital
2016	Harmony Solar Energy Facilities: Amendment of Pipeline and Overhead Power Line Route	Wetland Assessment (Basic Assessment)	BBEnergy

AVIFAUNAL ASSESSMENTS

Date Completed	Project Description	Type of Assessment/Study	Client
2019	Sirius Three Solar PV Facility near Upington, Northern Cape	Avifauna Assessment (Basic Assessment)	Aurora Power Solutions
2019	Sirius Four Solar PV Facility near Upington, Northern Cape	Avifauna Assessment (Basic Assessment)	Aurora Power Solutions
2019	Moeding Solar PV Facility near Vryburg, North-West Province	Avifauna Assessment (Basic Assessment)	Moeding Solar
2018	Proposed Zonnebloem Switching Station (132/22kV) and 2X Loop-in Loop-out Power Lines (132kV), Mpumalanga Province	Avifauna Assessment (Basic Assessment)	Eskom
2017	Olifantshoek 10MVA 132/11kV Substation and 31km Power Line	Avifauna Assessment (Basic Assessment)	Eskom
2016	TEWA Solar 1 Facility, east of Upington, Northern Cape Province	Wetland Assessment (Basic Assessment	Tewa Isitha Solar 1
2016	TEWA Solar 2 Facility, east of Upington, Northern Cape Province	Wetland Assessment	Tewa Isitha Solar 2

ENVIRONMENTAL IMPACT ASSESSMENT

- Barcelona 88/11kV substation and 88kV loop-in lines – BA (for Eskom).
- Thabong Bulk 132kV sub-transmission inter-connector line – EIA (for Eskom).
- Groenwater 45 000 unit chicken broiler farm – BA (for Areemeng Mmogo Cooperative).
- Optic Fibre Infrastructure Network, City of Cape Town Municipality – BA (for Dark Fibre Africa (Pty) Ltd).
- Optic Fibre Infrastructure Network, Swartland Municipality – BA (for Dark Fibre Africa).
- Construction and refurbishment of the existing 66kV network between Ruigtevallei Substation and Reddersburg Substation – EMP (for Eskom).
- Lower Kruisvallei Hydroelectric Power Scheme (Ash river) – EIA (for Kruisvallei Hydro (Pty) Ltd).
- Construction of egg hatchery and associated infrastructure – BA (For Supreme Poultry).
- Construction of the Klipplaatdrif flow gauging (Vaal river) – EMP (DWAF).

ENVIRONMENTAL COMPLIANCE AUDITING AND ECO

- National long haul optic fibre infrastructure network project, Bloemfontein to Laingsburg – ECO (for Enviroworks (Pty) Ltd.).
- National long haul optic fibre infrastructure network project, Wolmaransstad to Klerksdorp – ECO (for Enviroworks (Pty) Ltd.).
- Construction and refurbishment of the existing 66kV network between Ruigtevallei Substation and Reddersburg Substation – ECO (for Enviroworks (Pty) Ltd.).
- Construction and refurbishment of the Vredefort/Nooitgedacht 11kV power line – ECO (for Enviroworks (Pty) Ltd.).
- Mining of Dolerite (Stone Aggregate) by Raumix (Pty) Ltd. on a portion of Portion 0 of the farm Hillside 2830, Bloemfontein – ECO (for GreenMined Environmental (Pty) Ltd.).
- Construction of an Egg Production Facility by Bainsvlei Poultry (Pty) Ltd on Portions 9 & 10 of the farm, Mooivlakte, Bloemfontein – ECO (for Enviro-Niche Consulting (Pty) Ltd.).
- Environmental compliance audit and botanical account of Afrisam's premises in Bloemfontein – Environmental Compliance Auditing (for Enviroworks (Pty) Ltd.).

OTHER PROJECTS:

- Keeping and breeding of lions (*Panthera leo*) on the farm Maxico 135, Ficksburg – Management and Business Plan (for Enviroworks (Pty) Ltd.)
- Keeping and breeding of lions (*Panthera leo*) on the farm Mooihoek 292, Theunissen – Management and Business Plan (for Enviroworks (Pty) Ltd.)
- Keeping and breeding of wild dogs (*Lycaon pictus*) on the farm Mooihoek 292, Theunissen – Management and Business Plan (for Enviroworks (Pty) Ltd.)
- Existing underground and aboveground fuel storage tanks, TWK AGRI: Pongola – Environmental Management Plan (for TWK Agricultural Ltd).
- Existing underground fuel storage tanks on Erf 171, TWK AGRI: Amsterdam – Environmental Management Plan (for TWK Agricultural Ltd).
- Proposed storage of 14 000 L of fuel (diesel) aboveground on Erf 32, TWK AGRI: Carolina – Environmental Management Plan (for TWK Agricultural Ltd).
- Proposed storage of 23 000 L of fuel (diesel) above ground on Portion 10 of the Farm Oude Bosch, Humansdorp – Environmental Management Plan (for TWK Agricultural Ltd).
- Proposed storage of 16 000 L of fuel (diesel) aboveground at Panbult Depot – Environmental Management Plan (for TWK Agricultural Ltd).
- Existing underground fuel storage tanks, TWK AGRI: Mechanisation and Engineering, Piet Retief – Environmental Management Plan (for TWK Agricultural Ltd).
- Existing underground fuel storage tanks on Portion 38 of the Farm Lothair, TWK AGRI: Lothair – Environmental Management Plan (for TWK Agricultural Ltd).