



**ASSESSMENT OF THE TERRESTRIAL BIODIVERSITY ON THE
PROPERTIES PORTION 6 AND 7 OF THE FARM GAMS
No 367 IN NORTHERN CAPE PROVINCE**

July 2023



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SYNOPSIS Inspection of sites where prospecting bore holes may be drilled was undertaken and impacts on the terrestrial biodiversity are considered. Expected impacts are minor but management recommendations are put forward.				
KEY WORDS: Biodiversity, Prospecting, Boreholes, Northern Cape Province				
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QUALITY VERIFICATION This report has been prepared under the controls established by a quality management system that meets the requirements of ISO 9001: 2015 which has been independently certified by DEKRA Certification.				
				
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1. INTRODUCTION AND BACKGROUND

1.1 Document Background

JG Afrika (Pty) Ltd has been appointed by the Greenmined (Pty) Ltd to undertake specialist studies in regard to aquatic ecosystems and the terrestrial biodiversity on the properties Portion 6 And 7 of the Farm Gams No 367 in the Northern Cape Province. The studies will form components of the application for a Prospecting Right by African Exploration Mining and Finance Corporation Soc Ltd. This document presents the findings of a study of the terrestrial fauna and flora in and around the project footprint. It is submitted in terms of the National Environmental Management Act (Act No. 107 of 1998): Environmental Impact Assessment Regulations (2014), as amended, as well as in terms of the National Water Act (Act No. 36 of 1998).

1.2 Project Description

The following information has been provided by the project proponent:

“The proposed prospecting activities will include the following:

- a) Desktop study
- b) Remote sensing
- c) Field mapping
- d) Geochemical survey
- e) Geophysical survey
- f) Trenching
- g) Drilling
- h) Geological modelling and resource estimation

Drilling/Trenching

The implementation of trenching and/or drilling will be determined based on the results from initial exploratory work. Either technique will be implemented at spacing grid capable of providing an Inferred Mineral Resource. This Resource is defined at a low degree of confidence but is sufficient to be used to complete a Scoping Study and to evaluate the economic feasibility of the project to advise the decision to continue to feasibility study work.

Drilling will be to a maximum depth of 500 m.

Drilling/Trenching will be carried out to provide sample material from intersections of the targeted strata or geological features. A small excavator or tractor-loader-backhoe will be

used for trenching. On the other hand, the preferred method to employ for drilling is Reverse Circulation (RC) and/or diamond drill techniques. The objective of drilling/trenching programme is to assess the presence of potentially economic mineralisation. The number of drill holes to be dug and their depths to the top will depend on the results of Phase 1 and initial act2. Once favourable geological or geomorphological features such as channel lag gravel is encountered, then a detailed drilling grid will be prepared to focus on establishing the extent (and/or potential available volume) of the gravel deposit.

At this stage of the project, it is impossible to define the exact locations of drill sites or number of drillholes to be dug. However, the detailed drilling spacing will be planned to allow the defining of an Inferred Mineral Resources as per the SAMREC code.”

2. TERMS OF REFERENCE

The terms of reference for this assessment are based on the requirements for a biodiversity assessment as defined in Regulation 267 (Regulations Regarding the Procedural Requirements for Water Use Licence Applications and Appeals) under the National Water Act (Act No. 36 of 1998). Attention is also given the requirements of the Animal and Plant Species Protocol in GN 1150 (30 October 2020) for features of Very High or High Sensitivity. Table 1 below indicates the compliance with the various requirements.

Table 1: Compliance with the Animal and Plant Species Protocol in GN 1150.

Requirements of Animal and Plant Species Protocol – GN. 1150 for Very High or High Site Sensitivity	Section of This Report
This report must include as a minimum the following information:	
Contact details and relevant experience as well as the SACNASP registration number of the specialist preparing the assessment including a curriculum vitae;	Annexure A
A signed statement of independence by the specialist;	Annexure B
A statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;	Section 9
A description of the methodology used to undertake the site sensitivity verification, impact assessment and site inspection, including equipment and modelling used where relevant;	Section 9
A description of the mean density of observations/number of sample sites per unit area and the site inspection observations;	Section 9
A description of the assumptions made and any uncertainties or gaps in knowledge or data;	Section 3
Details of all SCC found or suspected to occur on site, ensuring sensitive species are appropriately reported;	Section 9
The online database name, hyperlink and record accession numbers for disseminated evidence of SCC found within the study area;	n/a
The location of areas not suitable for development and to be avoided during construction where relevant;	Section 12
A discussion on the cumulative impacts;	n/a
Impact management actions and impact management outcomes proposed by the specialist for inclusion in the Environmental Management Programme (EMPr);	Section 12
A reasoned opinion, based on the findings of the specialist assessment, regarding the acceptability or not of the development and if the development should receive approval or not, related to the specific theme	Section 14

Requirements of Animal and Plant Species Protocol – GN. 1150 for Very High or High Site Sensitivity	Section of This Report
being considered, and any conditions to which the opinion is subjected if relevant; and	
A motivation must be provided if there were any development footprints identified as per paragraph above that were identified as having “low” or “medium” terrestrial animal species sensitivity and were not considered appropriate.	n/a

However, since this is an initial report, based partly on desktop studies certain of the above will be excluded to await implementation in a final report should it be decided that the proposed prospecting may be considered further.

3. UNCERTAINTIES AND KNOWLEDGE GAPS

- The study reported on here presents the findings of an investigation of conditions at the project site and is based partly on desktop investigations since only three of the borehole sites could be accessed due to property restrictions. It is recognised that a further field study may have to be undertaken in order to develop a thorough understanding of the area and possible consequences of the prospecting activities. However, the general pattern of the region reduces the need for such action as the unseen areas are probably similar to those which were visited.
- It is recorded that the timing of the survey was sub-optimal. The site lies in the Nama-Karoo Biome and the optimum survey times for the area are indicated in Figure 1 below.

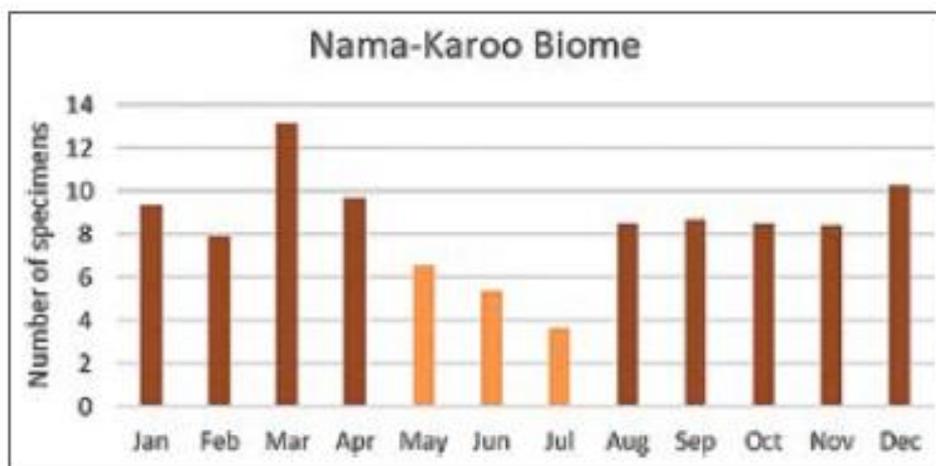


Figure 1: Suitability of survey months in the Nama-Karoo Biome

- The month of July is the least suitable for vegetation and other surveys but the timing of this study was dictated by various project application processes and their deadlines.

4. STUDY AREA

The project site which makes up the study area is located in the Northern Cape Province and lies on either side of road R 360 approximately 41 Km north of the town of Upington. See Figure 2 and Figure 3. It is situated within the Local Municipality NCDMA08 of the Siyanda District Municipality. The Water Management Area is the Lower Orange WMA and it is in Quaternary Catchments D42D, D42E and D73E.

5. EXPERTISE OF THE SPECIALISTS

The *curriculum vitae* of the specialist, Mr J. Alletson is attached in Annexure A.

Mr Alletson is a SACNASP (No.125697) registered Ecological Scientist and is a member of IAIASA (No. 035). He holds a BSc Honours degree in Zoology from Rhodes University and a BSc degree in Biological Sciences from the University of Natal. He joined the (then) Natal Parks Board in 1975 and served as the aquatic ecologist before leaving to become an environmental consultant in 1997. Mr Alletson has in excess of 45 years' experience in the fields of aquatic and terrestrial ecological studies in Southern Africa.

In this study Mr Alletson was assisted by Ms M. Holder who undertook the terrestrial plant survey as well as participating in the wetland study. She has received training at the Bews Herbarium (University of KwaZulu-Natal) and is a member of CREW¹ (Custodians of Rare and Endangered Wild Flowers). She has more than 20 years of experience in such surveys.

6. AIMS AND OBJECTIVES

The aims and objectives of this preliminary study may be summarised as follows:

- Statement of the methods to be used and the techniques used to assess the site;
- Collection of background information by means of database searches;
- Assessment, based on professional opinion of the environmental risks posed by the project and an assessment of the potential impacts that could arise out of the project;
- Assessment of the specific sensitivity of the site related to the proposed activity or activities;
- An identification of any areas that are to be avoided, including consideration of buffers;
- A description of any assumptions made and any uncertainties or gaps in knowledge;
- Any mitigation measures, including possible offsetting, for inclusion in the Environmental Management Programme Report (EMPr); and
- Recommendations for the way forward.

¹ CREW: The Custodians of Rare and Endangered Wildflowers (CREW) programme is a citizen science initiative that involves members of the South African public in the surveying, monitoring and conservation of plants.

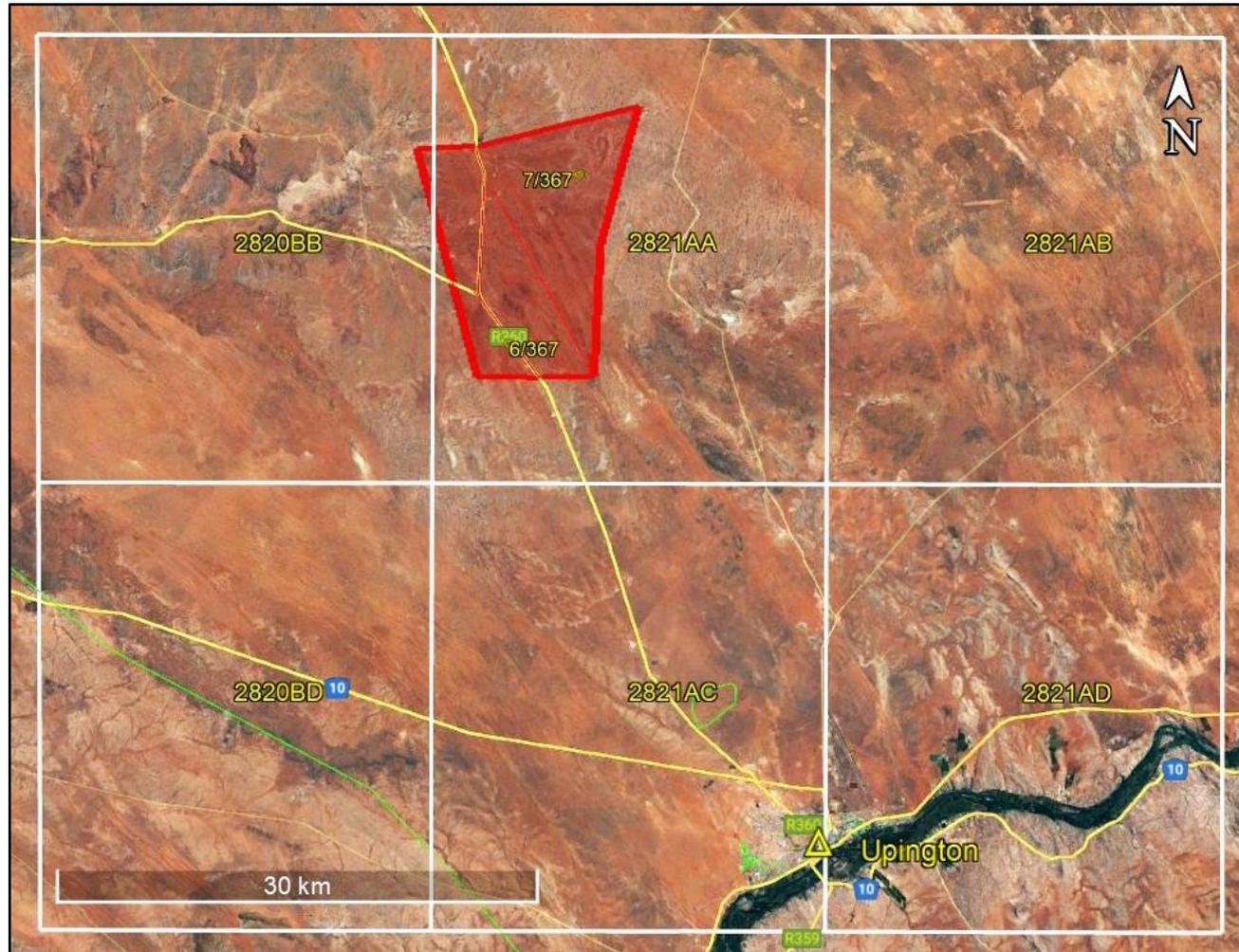


Figure 2: Location of the Gams project area

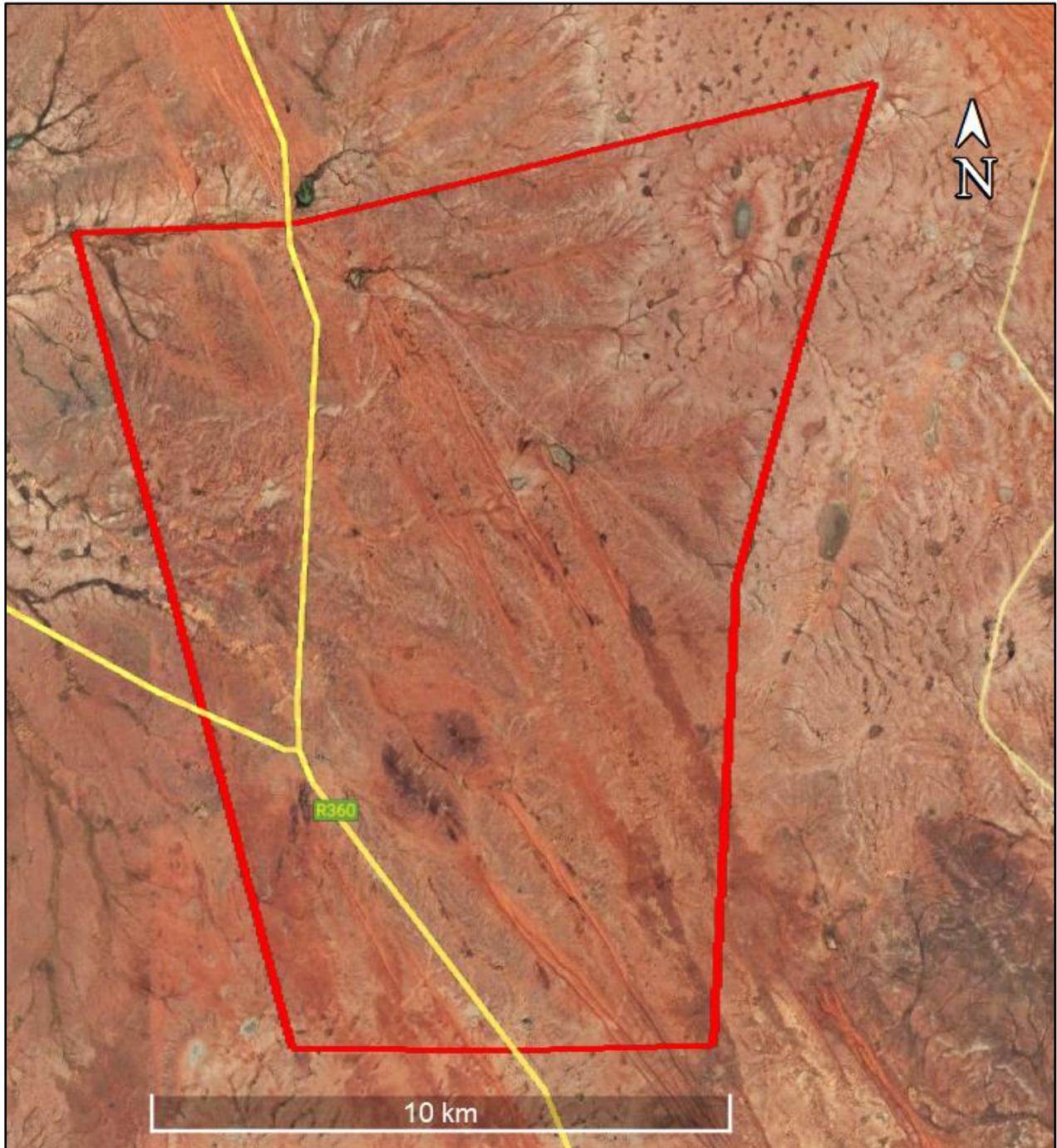


Figure 3: View of the Gams project area land surface

7. METHODOLOGY USED AND DATA SOURCES

The methodology that was followed in completing this study was to obtain information from a number of data sources and then to consider the probable impacts and risks based on professional opinion. The first phase consisted of a desktop study.

The following data sets were referred to:

- The SANBI Screening Report for the project EIA was interrogated for any features of aquatic relevance.
- SABAP 2 Bird data.
- Animal Demographic Unit databases: Mammals, Reptiles, Frogs, Various Invertebrates.
- The Northern Cape Province Critical Biodiversity Areas Map (SANBI BGIS).
- The EWT Threatened Species No-Go Map.
- The NFEPA Wetland Map 4.
- The South African Inventory of Inland Aquatic Ecosystems (SAIIAE) Wetland Map 5.
- The NFEPA rivers database was checked to ascertain the listed status of the river systems which were included in the project area.
- The Freshwater Biodiversity Information System (FBIS) was consulted for records and species data from the vicinity of the project site.
- Google Earth images dating from 2008 to the present time were examined for visual information relating to wetlands and watercourses.
- Historic aerial survey images were examined to give a further perspective on the project area.
- Vegetation types in the area based on Mucina and Rutherford (2006) and SANBI (2018) Vegetation Types of South Africa.
- Various plant and animal reference books.
- Physical climate data.

The desktop study was followed by a site visit over the period of 3 to 5 July 2023. Because of the extent of the properties (15000 ha), and because access to three of the borehole sites was closed, the entire area could not be visited. Therefore, attention was given mostly to the accessible borehole areas and to areas around a concentration of pans since such sites would be likely to be of the most ecological importance in an arid area.

8. RESULTS OF THE DESKTOP STUDY

The results presented below are based on the findings of the desktop assessment as well as the field investigations conducted for the study.

8.1 History of the Site

The history of the site was investigated since the information gained can contribute to an understanding of observations made and so contribute to setting out guidelines for future observations and management interventions. The oldest aerial survey photographs that could be found for the study area are dated 2017 but, although relatively modern, and in colour, the resolution is so poor that they are virtually unusable. Therefore, greater dependence was placed on Google Earth imagery dating back to 2004. It appears that the area has changed very little in the time period for which images are available. This is to be expected as no

industrial or agricultural development has taken place since the aridity of the climate tends to make conditions inhospitable. Rough grazing of livestock is practiced but stocking densities are low.

8.2 Climatic Data

Modelled meteorological data was obtained from Meteoblue for the Kurees area which is situated some eight kilometres to the east of the project area. The climate in the area is classified as BSh (Hot semi-arid climate) by the Koppen Climate System. Summer rainfall events are usually derived from south-westerly frontal systems or from locally generated convective thunderstorms. See Figure 4. However, the frequency and extent of rainfall events varies greatly between years. The winters are dry with the rare precipitation events being due to frontal systems. The temperate range is from hot summers (>40°C) through to cold winters when sub-freezing conditions are experienced on many nights.

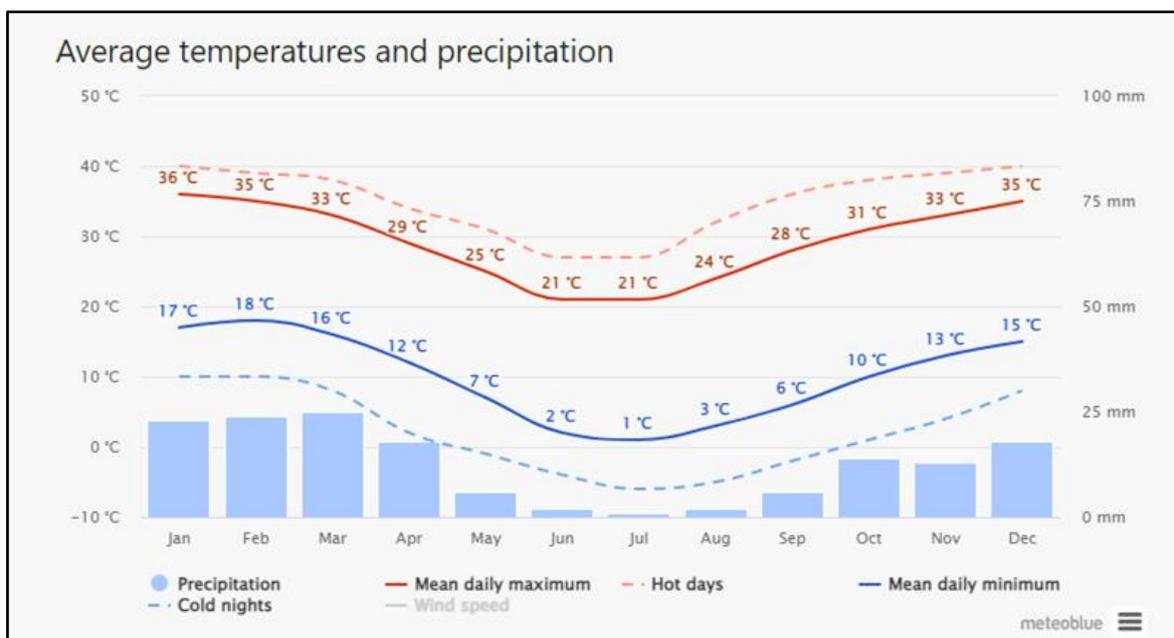


Figure 4: Modelled climatic data from the Kurees area.

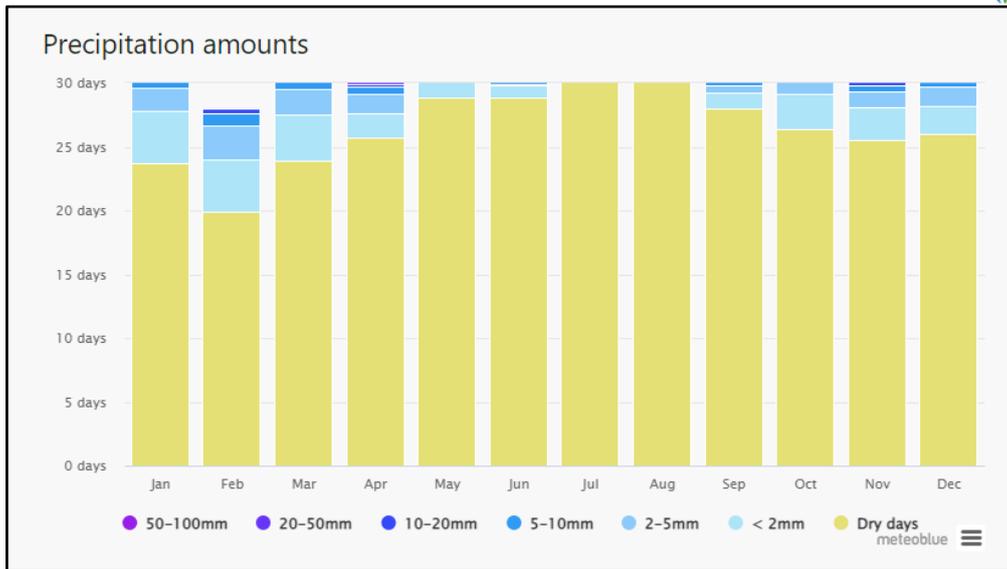


Figure 5: Precipitation pattern in the Kurees area

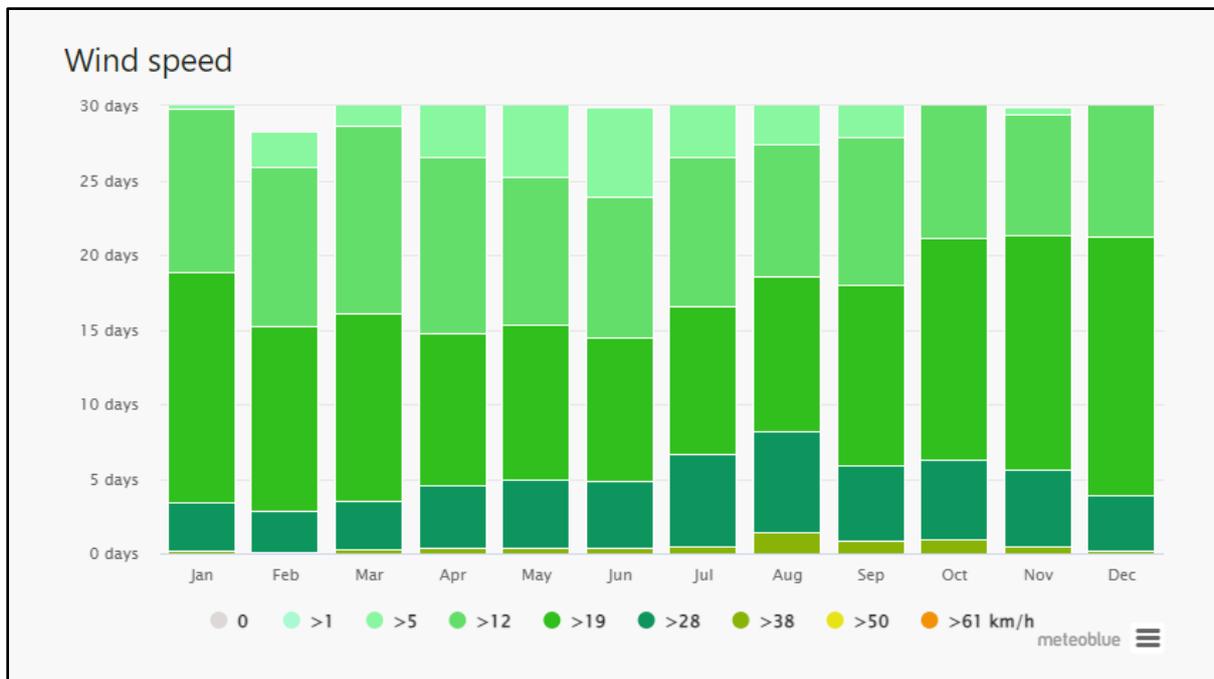


Figure 6: Monthly wind patterns in the Kurees area

8.3 Vegetation

The study area includes three vegetation types after Mucina and Rutherford, (2006) and SANBI (2018). See Figure 7 below.

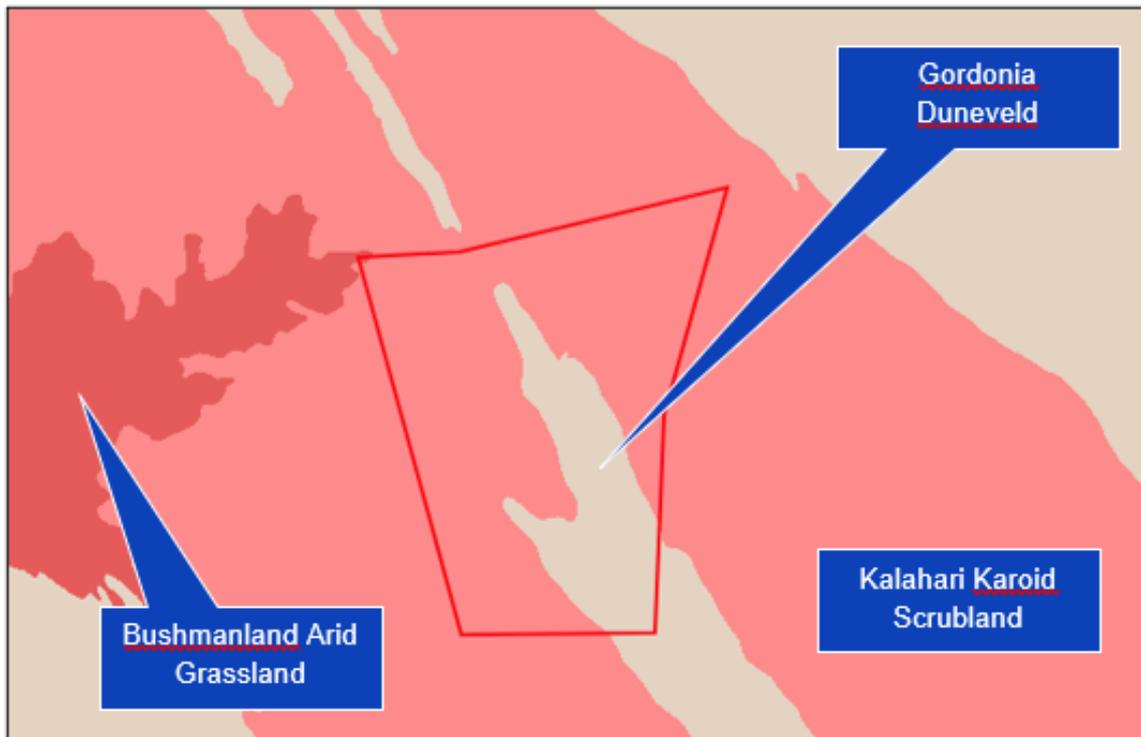


Figure 7: Vegetation types in the study area

Bushmanland Arid Grassland (Type NKb 3)

This grassland type occurs on extensive plains in the Northern Cape Province in the area between Aggenys, Prieska, and Pofadder. It extends slightly north of Upington where it intermingles with areas of Lower Gariiep Broken Veld, Kalahari Karroid Shrubland, and Gordonia Duneveld. Sparsely vegetated grassland dominated by white grasses such as *Stipagrostis* species and low shubs including *Salsola* species.

Kalahari Karroid Shrubland (Type NKb 5)

This type occurs in the Northern Cape Province especially north-west of Upington. Low karroid shrubland on flat gravel plains. Karroo-related shrubs merging with species characteristic of the Kalahari Region and sandy soils. Transitional between the Savanna Biome and the Nama-Karoo Biome.

Gordonia Duneveld (Type SVkd1)

Typical of sand dunes in the Northern Cape Province as either dune fields or loose dune cordons. Aeolian sand dunes underlain by silcretes and calcretes. Parallel dunes 3 – 8 m high with open shrubland dominated by *Stipagrostis* grasses on the crests and *Acacia haematoxylon* and *A. mellifera* on the slopes. *Rhigozum trichotomum* in the interdune spaces.

8.4 Wetlands

The wetlands in the project area have been assessed in a separate report (JGA, 2023) which includes the following material:

The extents of the study area wetlands mapped in the NFEPA Map 4 and SAIIE Wetland Map 5 datasets are shown in Figure 8 and Figure 9. It is apparent that there is a high degree of commonality between the two systems.

The study area is included within three Quaternary Catchments. See Figure 10.

The greater part of the study area lies within Catchment D42E which includes the Doringdam Spruit. This spruit has a part of its source area in the project area and then passes on down to the Molopo River. It is NFEPA listed as being an Orange River tributary.

In the south-eastern corner of the study area is Catchment D73E. This area includes the headwaters of an unnamed watercourse which flows southwards to enter the Orange River near Upington. The catchment is small and is probably of very low significance. Finally, the north-eastern corner of the study area just reaches into Catchment D42D. This catchment flows around the northern side of Catchment D42E and enters the Molopo River.

While Catchments D42E and D73E have clear evidence of channels with erosion features, Catchment D42D appears to have no clear drainage line. Its surface topography tends to have very low gradients and it consists primarily of dune fields and plains with numerous depressions (pans). See **Error! Reference source not found.** Therefore, any rainfall into its area is likely to be held and then to either evaporate away, or else to percolate down into the soil. An implication of this is that it may contribute some ground water to the other two catchments and so is of considerable local importance.

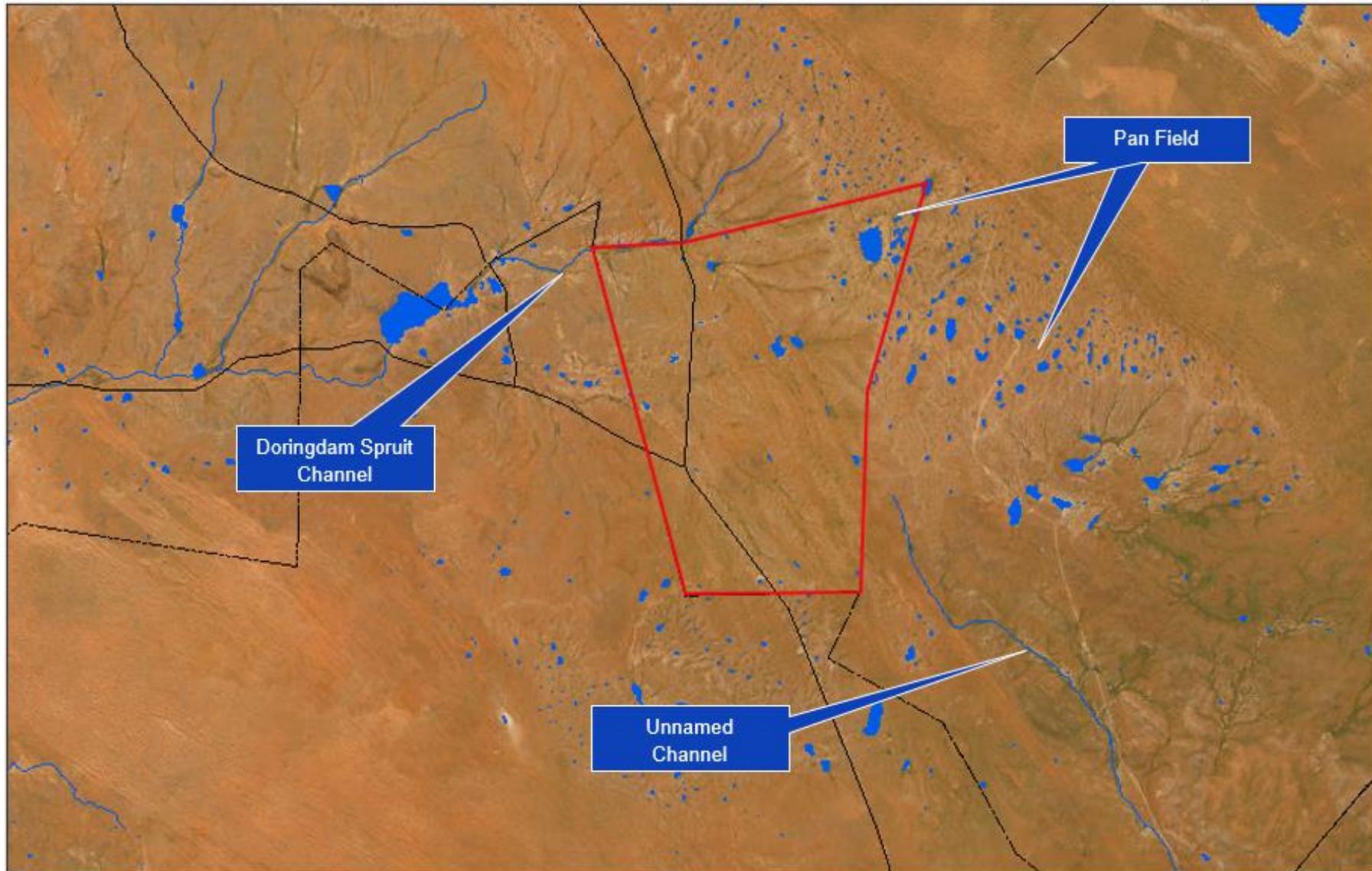


Figure 8: NFEPA Wetland Map 4 sites around the project area

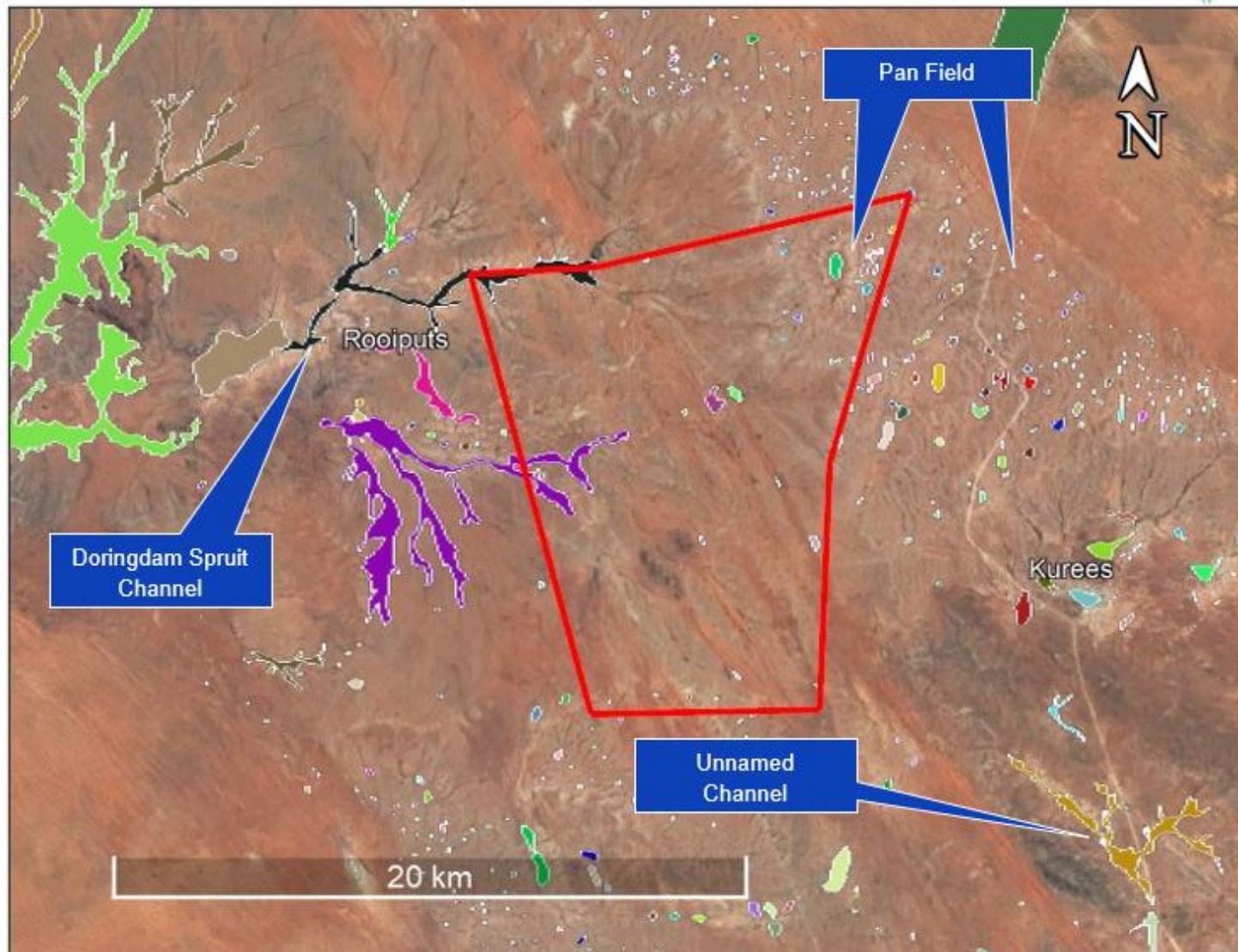


Figure 9: Wetland Map 5 sites around the project area

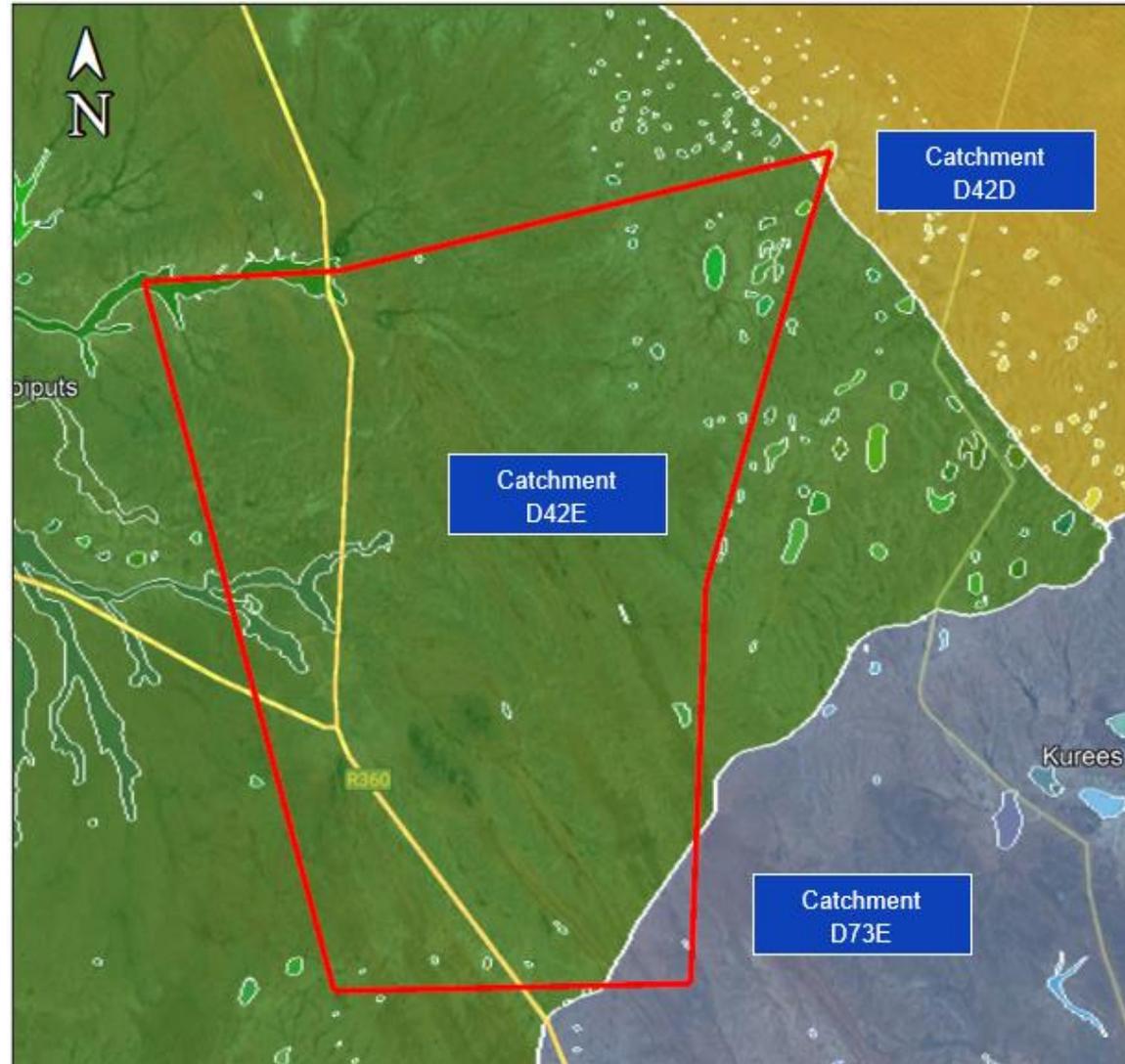


Figure 10: Quaternary Catchments in the project area

8.5 DFFE Screening Tool Report

8.5.1 Content of the DFFE Screening Tool Report

The DFFE Screening Report for the project was generated on 22 September 2022. The various sensitivities for the defined standard themes relevant to this study are shown in **Error! Reference source not found. Error! Reference source not found.** and the four biodiversity-related themes in Tables 9 to 12 and Figures 8 to 11.

Table 2: Sensitivities of relevant themes in the DFFE Screening Report

Theme	Very High Sensitivity	High Sensitivity	Medium Sensitivity	Low Sensitivity
Animal Species		▲		
Aquatic Biodiversity	▲			
Plant Species				▲
Terrestrial Biodiversity	▲			

Table 3: Sensitivities in the Animal Species Theme (After Taylor *et al*, 2015)

Sensitivity	Feature(s)	Status	Common Name
High	Neotis ludwigii	Endangered	Ludwig's Bustard
Medium	Falco biarmicus	Vulnerable	Lanner Falcon
Medium	Polemaetus bellicosus	Endangered	Martial Eagle
Medium	Aquila rapax	Endangered	Tawny Eagle
Medium	Neotis ludwigii	Endangered	Ludwig's Bustard

Table 4: Sensitivities in the Aquatic Biodiversity Theme

Sensitivity	Feature(s)
Very High	Wetlands and Estuaries

Table 5: Sensitivities in the Plant Species Theme

Sensitivity	Feature(s)
Low	Low Sensitivity

Table 6: Sensitivities in the Terrestrial Biodiversity Theme

Sensitivity	Feature(s)
Very High	Ecological Support Area
Low	Low Sensitivity

8.5.2 Comment arising from the DFFE Screening Tool Report

The following comments are derived from the Screening Tool tables:

- *Animal Species Theme.* The Ludwig's Bustard (*Neotis ludwigii*) is listed as being of High and medium sensitivity. The species is recorded from the area as it is listed in the SABAP observation lists. It was not seen during the course of the site visit while the Northern Black Korhaan (*Afrotis afraoides*) was commonly seen. Since the major threat to the species is documented as collisions with power and telephone lines, the proposed drilling of six boreholes is unlikely to pose any new level of threat in the project area other than for some temporary disturbance from the drilling sites.
- *Aquatic Biodiversity Theme.* The project area does include a large number of pans which are classified as Depressions. The sites indicated in the report are as for Wetland Map 5 and shown in Figure 9. These features are dry for much of the time and only hold water after the rare occurrence of heavy rainfall. It is known that they are of considerable importance in regard to the hydrology of the area, and to birds as a number of species move into the area to take advantage of the feeding opportunities they provide. A separate report (JGA, 2023) on the wetlands and watercourses of the project area has been prepared.
- *Terrestrial Biodiversity Theme.* The area indicated as Ecological Support Area matches that of the Aquatic Biodiversity Theme. This correlation is considered to be realistic since the areas which may contain water would be the most important in that arid landscape. The pans were the only place where animals such as Springbok were seen and it was also noticed that they contain numerous Ground Squirrel as well as a smaller number of Bat-eared Fox burrows.

9. RESULTS OF THE FIELD STUDIES

The overall study area is large (> 15000 ha) and so the field studies which were undertaken over the period 3rd to 6th July 2023 were largely restricted to the areas around the boreholes which could be accessed i.e. only on Portion 7 of the Farm Gams 367. See Figure 11. Farm tracks could be used in places but elsewhere it was necessary to walk in the site and then to walk around within it. Ground photographs were taken and use was made of a drone for further photographic purposes. Conditions for a biodiversity survey were sub-optimal due to the season and to the extremely dryness of the conditions at the time. A local farmer reported as having received only some 30 mm of rain during the course of this year and having experienced dry conditions prior to that.

On the ground at each site a search was made for plant species which could be identified and for animals, or for traces of animals such as burrows, bones, shells, and the like which could be identified.

The terrain in the area is extremely flat which the only obvious high points being lines of sand dunes which rise up to about five metres above the surrounds. The pans are only very shallow depressions of down to about one metre in depth.

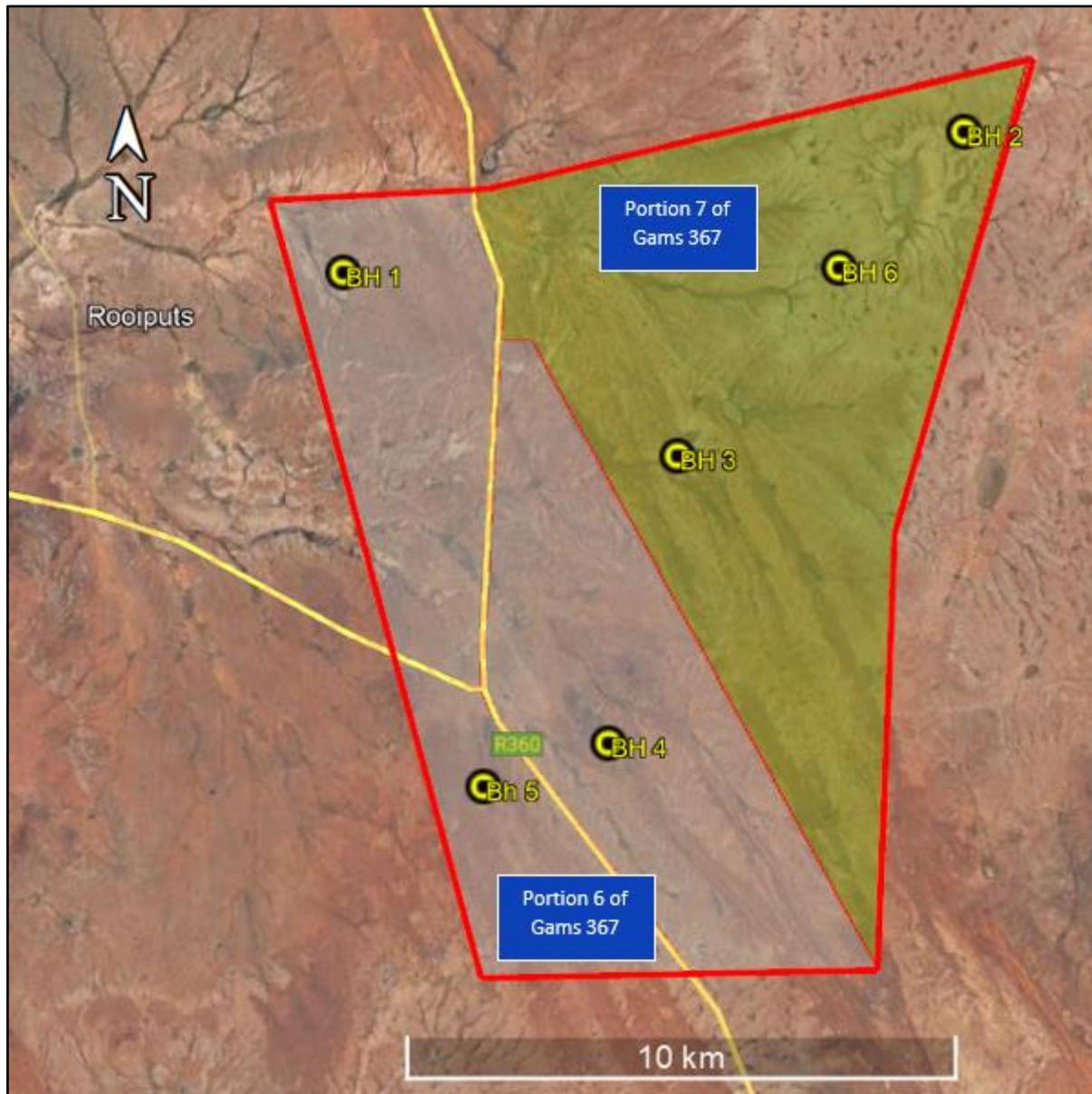


Figure 11: Locations of borehole sites in the project area

9.1 Vegetation

The vegetation is moderately diverse in its structure and consists of grasses, low bushes, some small trees, and also bare or stony ground with a few small grass tufts. There is considerable evidence of grazing by either livestock or by ungulates such as Springbok. The plant species which were seen, and which could be identified, are listed in [Tables 7 to 9](#). Undoubtedly more species would be found during an optimal sampling season.

Table 7: Indigenous plant species identified

Scientific Name	Common Name	Status
<i>Aptosimum spinescens</i>	Doringviooltjie	LC
<i>Asparagus cf bechuanicus</i>	Wild asparagus	LC
<i>Asparagus cooperi</i>	Wild asparagus	LC
<i>Eriocephalus spinescens</i>	Doringkapok	LC
<i>Euphorbia braunsii</i>	Vingerpol	LC
<i>Euryops asparagoides</i>	Bultdraaibos	LC
<i>Podaxis pistillaris</i>	False Ink Cap	LC
<i>Galenia cf sarcophylla</i>	Brakbossie	LC
<i>Gazania krebsiana</i>	Common gazania	LC
<i>Geigeria pectidea</i>	Riviervermeerbos	LC
<i>Hoodia cf gordonii</i>	Ghaap (not flowering)	DD
<i>Kleinia longiflora</i>	Sambokbos	LC
<i>Leucosphaera bainesii</i>	Perdebossie	LC
<i>Mesembryanthemum longipapillosum</i>	Soutslaai	LC
<i>Monechma cf divaricatum</i>	Wild lucerne	LC
<i>Monechma incanum</i>	Blouganna	LC
<i>Oropetum capense</i>	Haasgras	LC
<i>Pergulia daemia</i>	Milkweed family	LC
<i>Psilocaulon cf junceum</i>	Asbos	LC
<i>Radyera urens</i>	Karoo pumpkin	LC
<i>Rhigozum trichotomum</i>	Driedoring	LC
<i>Salsola cf tuberculata</i>	Cauliflower ganna	LC
<i>Stipagrostis amabilis</i>	Dune Bushman grass	LC
<i>Stipagrostis cf obtusa</i>	Small Bushman grass	LC
<i>Sutherlandii frutescens</i>	Kankerbos	LC
<i>Tapinanthus oleifolius</i>	Vuurhoutjies	LC
<i>Zygophyllum simplex</i>	<i>Prostrate spekbos</i>	LC

Table 8: Indigenous tree species identified

Scientific Name	Common Name	Status
<i>Vachellia erioloba</i>	Camel thorn	Protected Tree
<i>Vachellia haematoxylon</i>	Grey camel thorn	Protected Tree
<i>Senegalia mellifera</i>	Black thorn	LC
<i>Boscia albitrunca</i>	Shepherd's tree	Protected Tree
<i>Boscia foetida</i>	Stinkbos	LC
<i>Parkinsonia africana</i>	Wild green-hair tree	LC
<i>Searsia lancea</i>	Karree	LC
<i>Ziziphus mucronata</i>	Buffalo-thorn	LC

Table 9: Alien weed species identified

Scientific Name	Common Name	Status
<i>Atriplex lindeyi subs. inflata</i>	Australian saltbush	Cat. 1b
<i>Prosopis glandulosa var glandulosa</i>	Mesquite	Cat. 3
<i>Salsola kali</i>	Russian tumbleweed	Cat. 1b

The majority of the species noted are indigenous with only three species being alien and invasive. Three protected species are noted but will not be affected by the boreholes.



Plate 1: Aerial view of the flat terrain in the project area



Plate 2: Grassy vegetation within a pan but surrounded by bushes



Plate 3: Low sand dune ridge



Plate 4: Grassy vegetation within a pan depression



Plate 5: Mixed grass and woody vegetation



Plate 6: Trees along a watercourse



Plate 7: Bare stony ground



Plate 8: Flat sandy surface but not within a pan

On the basis of the field observations, it is thought that the very numerous pans indicated in the Wetland Map 5 database may be an overestimation of the real number.

9.2 Terrestrial Fauna

The field study was only able to make a limited number of actual field observations. The explanations for this are that many faunal species in the area are crepuscular or nocturnal, and so are difficult to see, or that they are migratory and so were not present at the time. The latter is particularly the case for birds as they are highly mobile and follow conditions which are optimal for either breeding or for feeding. The species seen and otherwise reported are shown in Tables 10 to 14. The data sources referenced are as follows:

- ✓ SABAP 2 Bird records: The SABAP records list 165 species for Pentads 2800-2100, 2800-2105, 2805-2055, 2805-2105. Only the Red Data listed species are shown below.
- ✓ Seen: Seen during this study
- ✓ Museum Records: Animal Demography Unit for map sheets 2820BB, 2821AA, 2821AB
- ✓ Verbal: Reported by a local resident

Table 10: List of mammal species

Scientific Name	Common Name	Status	Source of Observation
<i>Otocyon megalotis</i>	Bat-eared Fox	Least Concern	Seen Museum Records
<i>Cynictis penicillata</i>	Yellow Mongoose	Least Concern	Seen Museum Records
<i>Herpestes pulverulentus</i>	Cape Gray Mongoose	Least Concern	Seen Museum Records
<i>Lepus saxatilis</i>	Scrub Hare	Least Concern	Seen Museum Records
<i>Pronolagus crassicaudatus</i>	Natal Red Rock Hare	Least Concern	Museum Records
<i>Gerbilliscus sp.</i>	Gerbils	Least Concern	Seen Museum Records
<i>Procavia capensis capensis</i>	Cape Rock Hyrax	Least Concern	Museum Records
<i>Xerus inauris</i>	South African Ground Squirrel	Least Concern	Seen Museum Records
<i>Proteles cristata</i>	Aardwolf	Least Concern	Verbal Museum Records
<i>Oreotragus oreotragus</i>	Klipspringer	Least Concern	Museum Records
<i>Antidorcas marsupialis</i>	Springbok	Least Concern	Seen Museum Records
<i>Oryx gazella</i>	Gemsbok	Least Concern	Seen Museum Records
<i>Felis nigripes</i>	Black-footed Cat	Vulnerable	Verbal Museum Records
<i>Smutsia temminckii</i>	Pangolin	Vulnerable	Verbal
<i>Elephantulus rupestris</i>	Western Rock Elephant Shrew	Least Concern	Museum Records
<i>Aethomys namaquensis</i>	Namaqua Rock Mouse	Least Concern	Museum Records

Scientific Name	Common Name	Status	Source of Observation
<i>Mastomys coucha</i>	Southern African Mastomys	Least Concern	Museum Records
<i>Mus musculus</i>	Unlisted Mouse	Least Concern	Museum Records
<i>Parotomys brantsii</i>	Brants's Whistling Rat	Least Concern	Museum Records
<i>Parotomys littledalei</i>	Littledale's Whistling Rat	Least Concern	Museum Records
<i>Rhabdomys pumilio</i>	Xeric Four-striped Grass Rat	Least Concern	Museum Records
<i>Saccostomus campestris</i>	Southern African Pouched Mouse	Least Concern	Museum Records

Table 11: Red Data listed bird species

Scientific Name	Common Name	Status	Source of Observation
<i>Ardeotis kori</i>	Kori Bustard	Near Threatened	Seen Museum Records
<i>Neotis ludwigii</i>	Ludwig's Bustard	Endangered	Museum Records
<i>Aquila verreauxii</i>	Verreaux's eagle	Vulnerable	Museum Records
<i>Aquila rapax</i>	Tawny Eagle	Endangered	Museum Records
<i>Polemaetus bellicosus</i>	Martial Eagle	Endangered	Museum Records
<i>Falco biarmicus</i>	Lanner Falcon	Vulnerable	Seen Museum Records
<i>Eupodotis vigorsii</i>	Karoo Korhaan	Near Threatened	Museum Records
<i>Gyps africanus</i>	White-backed Vulture	Critically Endangered	Museum Records

Table 12: List of reptile species

Scientific Name	Common Name	Status	Source of Observation
<i>Agama aculeata</i>	Common Ground Agama	Least Concern	Museum Records
<i>Agama anchietae</i>	Anchieta's Agama	Least Concern	Museum Records
<i>Agama atra</i>	Southern Rock Agama	Least Concern	Museum Records
<i>Agama knobeli</i>	Knobel's Rock Agama	Least Concern	Museum Records
<i>Chondrodactylus angulifer</i>	Giant Ground Gecko	Least Concern	Museum Records
<i>Chondrodactylus bibronii</i>	Bibron's Gecko	Least Concern	Museum Records
<i>Lygodactylus bradfieldi</i>	Bradfield's Dwarf Gecko	Least Concern	Museum Records
<i>Cordylus subdorsalis</i>	Dwarf Plated Lizard	Least Concern	Museum Records

Scientific Name	Common Name	Status	Source of Observation
<i>Varanus albigularis albigularis</i>	Rock Monitor	Least Concern	Museum Records
<i>Bitis arietans arietans</i>	Puff Adder	Least Concern	Verbal Museum Records
<i>Naja nivea</i>	Cape Cobra	Least Concern	Verbal Museum Records
<i>Trachylepis variegata</i>	Variegated Skink	Least Concern	Museum Records
<i>Trachylepis sparsa</i>	Karasburg Tree Skink	Least Concern	Museum Records
<i>Pedioplanis namaquensis</i>	Namaqua Sand Lizard	Least Concern	Museum Records

Table 13: List of amphibian species

Scientific Name	Common Name	Status	Source of Observation
<i>Cacosternum boettgeri</i>	Common Caco	Least Concern	Museum Records
<i>Tomopterna cryptotis</i>	Tremelo Sand Frog	Least Concern	Museum Records
<i>Sclerophrys capensis</i>	Raucous Toad	Least Concern	Museum Records
<i>Sclerophrys garmani</i>	Olive Toad	Least Concern	Museum Records
<i>Sclerophrys poweri</i>	Power's Toad	Least Concern	Museum Records
<i>Xenopus laevis</i>	Common Platanna	Least Concern	Museum Records
<i>Amietia delalandii</i>	Delalande's River Frog	Least Concern	Museum Records
<i>Amietia fuscigula</i>	Cape River Frog	Least Concern	Museum Records
<i>Stigmochelys pardalis</i>	Leopard Tortoise	Least Concern	Seen

Table 14: Other Faunal species

Scientific Name	Common Name	Status	Source of Observation
<i>Parabuthus laevifrons</i>	Black-tailed Thickettail Scorpion	Least Concern	Museum Records
<i>Odonata</i>	Dragonflies and Damselflies. 8 Species	All Least Concern	Museum Records
<i>Lepidoptera</i>	Butterflies. 27 Species	All Least Concern	Museum Records
<i>Pamphagidae</i>	Stone Grasshopper	Unknown	Seen
<i>Spiders</i>	None	Least Concern	Museum Records
<i>Dungbeetles</i>	None	Least Concern	Museum Records

9.2 Aquatic Fauna

The museum records in Tables 13 and 14 list aquatic species which include both vertebrates (Amphibia) and invertebrates (Odonata) which are associated with aquatic habitats. Some of these species were noted but they are able to survive around livestock, drinking troughs, water reservoirs and the like and so are not counted as being dependent on natural conditions. However, it is not known whether or not the pans in the study area contain invertebrate faunas which are adapted to periods of desiccation. Nkabeng *et al* (2022) report a diversity of macro- invertebrate taxa in ephemeral pans in the Nama-Karoo region south of the project area. Families represented included Branchipodidae, Notonectidae, Chironomidae, Libellulidae and Corixidae. Of these, most will not stand dehydration but the Branchipodidae (Fairy Shrimps) are the most specialised and include a phase (eggs) in their life cycle where desiccation is readily tolerated. There is considerable species diversity and endemism within the group and so it is possible, or even probable that they will be present in at least the larger pans (depressions) in the area. Supporting this is the fact that large numbers of birds come to the pans when there is water and that they must feed while there. Therefore it is possible that the fairy shrimps are a primary food source for the birds at such times.

10. ASSESSMENT OF THE BIODIVERSITY

The biodiversity was assessed using a template where biodiversity value is rated along a sigmoidal line scoring from 0 to ten (0 – 10). See Annexure C. This system is preferred to a more commonly used scale which scores values along a straight line ranging from 0 to 5 (0 – 5). For each criterion the user selects a major category and may then modify the score upwards toward the next major category. Thus, if a score lower than that of a major category is needed, the user must select the next lower category and modify that value upwards. This procedure “smooths” the scores as the assessor can assign a greater range of intermediate values. See Table 16. A similar template is used to assign values to the site integrity. This value is intended to give a numeric score to the value of the site in the larger landscape. See Table 17. Finally, the functionality of the site is assessed through a ranking of the ecosystem services which it provides for both biodiversity functions, and for human benefits. See Table 18.

The scores from the above three assessments are categorized as shown in Table 15.

Table 15: Biodiversity assessment categories

Score	0 - 0,5	0,6 - 2,3	2,4 - 5,2	5,3 - 8,7	8,8 - 10,0
Site/Service Value	Low	Moderately Low	Intermediate	Moderately High	High

Figure 12 shows the results of the assessments in graphic form. The relative importance of each criterion is clearly shown.

Table 16: Assessment of biodiversity criteria in the project area

Biodiversity Values	A	B	C	D	E	Category Selected	Category Refinement	Refined Score	Site Value	
Species Diversity	Low	Med-Low	Medium	Med-High	High	C	2	4.20	INTERMEDIATE	
Rarity	Low	Med-Low	Medium	Med-High	High	D	2	7.50	MODERATELY HIGH	
Provincial Conservation Status	Least Concern	Near-Threatened	Vulnerable	Endangered	Critically Endangered	C	3	5.2	INTERMEDIATE	
Red Data	No Species	1 Species	2 Species	3 Species	>3 Species	E	2	9.80	HIGH	
Uniqueness / Special features	None	Med-Low	Medium	Med-High	High	D	3	8.70	MODERATELY HIGH	
								Average:	7.08	MODERATELY HIGH

Table 17: Assessment of site integrity criteria in the project area

Site Integrity	A	B	C	D	E	Category Selected	Category Refinement	Refined Score	Site Integrity	
Buffer	Low	Med-Low	Medium	Med-High	High	D	1	6.30	INTERMEDIATE	
Connectivity	Low	Med-Low	Medium	Med-High	High	D	2	7.50	MODERATELY HIGH	
Alteration	>50%	25-50%	5-25%	1-5%	<1%	C	1	3.30	MODERATELY LOW	
Invasive / Pioneers	>50%	25-50%	5-25%	1-5%	<1%	E	1	9.50	HIGH	
Size	<1 ha	1 – 2 ha	3 - 15 ha	15 – 50 ha	>50 ha	E	3	10.00	HIGH	
Distance to Protected Areas	> 5 km		< 5 km		< 1 km	A	1	0.10	LOW	
								Average:	6.12	INTERMEDIATE

Table 18: Assessment of site functionality in the project area

	Ecosystem Services / Site Functionality	Markers	A	B	C	D	E	Category Selected	Service Performance	Service Provision
Biodiversity Services	Carbon Sequestration	Presence of trees. Presence of worm casts, termite mounds, animal dung, plant detritus layer showing signs of decomposition. Infrequent fires.	No provision of this service	No traces of decomposer species. Fires are common (annual)	Scattered evidence of decomposer species. Fire used to remove waste matter after harvesting crops.	Strong evidence of decomposer species. Fires every 2 years.	High level provision of this service	A	0.00	NO SERVICE PROVIDED
	Indigenous Biodiversity	Species diversity, trophic diversity (predators and prey). Good vegetation cover and diversity	No provision of this service	Indigenous biodiversity severely degraded	Indigenous biodiversity rated as "Intermediate "	Indigenous biodiversity rated as "Moderately High"	High level provision of this service	C	3.30	INTERMEDIATE SERVICE
	Vegetation Seed Source	Evidence of seeds/fruit on plants Few alien species.	No provision of this service	Sparse and depauperate indigenous vegetation assemblage. Alien species > 50% cover.	Indigenous plant species > 50% cover. Alien species < 5% cover.	Dense and diverse indigenous vegetation. Few alien species.	High level provision of this service	D	6.30	MODERATELY HIGH SERVICE
	Nutrient Cycling	Presence of worm casts, termite mounds, animal dung, plant detritus layer showing signs of decomposition	No traces of decomposer species	Scattered evidence of decomposer species	Moderate evidence of decomposer species	Strong evidence of decomposer species	Abundant evidence of decomposer species	B	1.00	MODERATELY LOW SERVICE

	Ecosystem Services / Site Functionality	Markers	A	B	C	D	E	Category Selected	Service Performance	Service Provision
	Erosion Control	Good vegetation cover and good basal cover	No provision of this service	Erosion gullies and sheet erosion dominate the area.	Erosion gullies common. Some sheet erosion.	Erosion gullies uncommon. Limited gully braiding.	No evidence of any soil erosion	D	6.30	MODERATELY HIGH SERVICE
	Soil Functionality	No present or past cultivation, no erosion, presence of worm casts, termite mounds, animal dung, plant detritus layer showing signs of decomposition. Minimal erosion.	No provision of this service	Soil is cultivated annually or bi-annually. Extensive use of artificial fertilisers.	Soil is cultivated on a multi-year cycle. Use of artificial fertilisers limited.	Zero-tillage practised. Crop wastes left on ground to form a mulch.	High level provision of this service	A	0.00	NO SERVICE PROVIDED
	Flood Attenuation	Low lying land near watercourses. EG Floodplain	No provision of this service	Very Narrow < 30 m	Scattered Oxbows etc	Functional but limited floodplain due to infrequent inundation of the area.	High level provision of this service	A	0.00	NO SERVICE PROVIDED
	Streamflow Regulation	Good vegetation cover and good basal cover	Extensive bare ground	Med-Low Ground Cover	Medium Ground Cover	Med-High Ground Cover	Dense ground cover	B	1.00	MODERATELY LOW SERVICE
							Average Biodiversity Services		2.2	MODERATELY LOW SERVICE

	Ecosystem Services / Site Functionality	Markers	A	B	C	D	E	Category Selected	Service Performance	Service Provision
Human Benefits	Resources for Humans	Fruits, hay, wood/timber, grazing of livestock, medicinal plants, hunting	No provision of this service	Few resources used or few users of resources	Resource use important but to a limited number of people	Several users - possibly community based	High level provision of this service	B	1.00	MODERATELY LOW SERVICE
	Clean Water Release	Lack of soil erosion, good vegetation cover, robust riparian zone	No provision of this service	Soil erodes easily. Poor vegetation cover.	Soil stable but vegetation not dense	Soil stable with good vegetation cover	High level provision of this service	A	0.00	NO SERVICE PROVIDED
	Recreation/ Research	Species assemblages include charismatic species and species diversity. Scenic. Trails, Tourism facilities.	No provision of this service	Site has potential but has limited access	Site has potential but access is difficult	Site has easy access and is supported by good roads etc.	High level provision of this service	C	3.30	INTERMEDIATE SERVICE
	Special & Unusual Benefits	Special & unusual benefits. EG Guano, Birds eating pest species, Botanic Gardens in a city. <u>To be listed.</u>	No provision of this service					A	0.00	NO SERVICE PROVIDED
							Average Human Benefits		1.1	MODERATELY LOW SERVICE

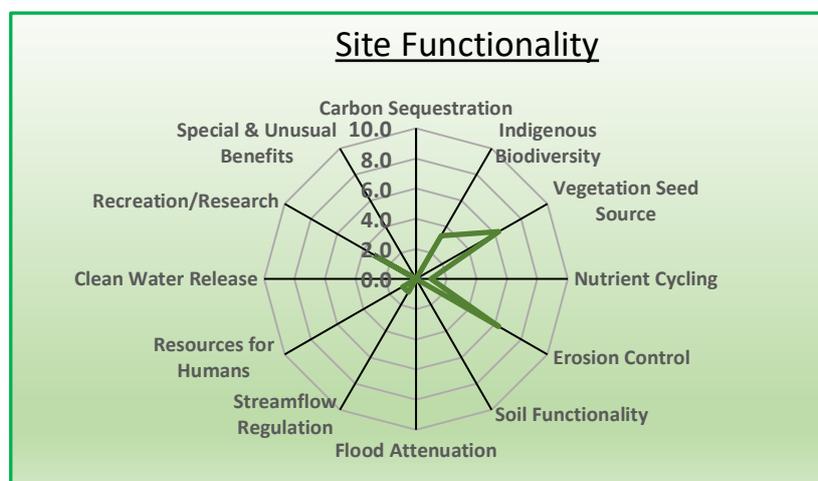
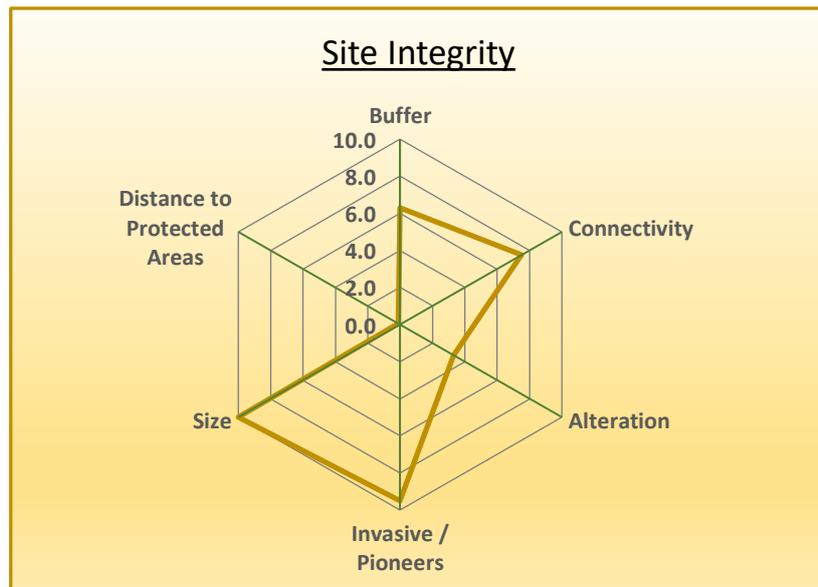
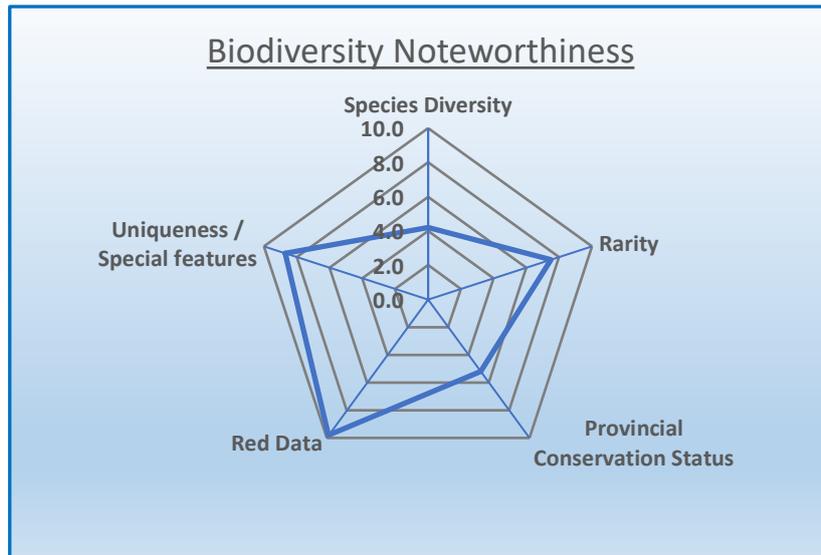


Figure 12: Graphic representation of the biodiversity assessments

11. ASSESSMENT OF IMPACTS

The potential impacts which might arise from the proposed prospecting operations are assessed below. In doing so the process was guided by reference to the Mitigation Hierarchy which, in turn, is supported by the draft National Biodiversity Offset Policy (RSA, 2017). This concept is illustrated in

Figure 13 which indicates the flow of the decision-making process. It entails iterative consideration of the impacts of a proposed development and means of reducing those impacts. It starts at the top level (“Avoid/Prevent”) and only when the options in that level are considered and exhausted, does the process move progressively down to the next lower level with the intention of limiting impacts to that extent.

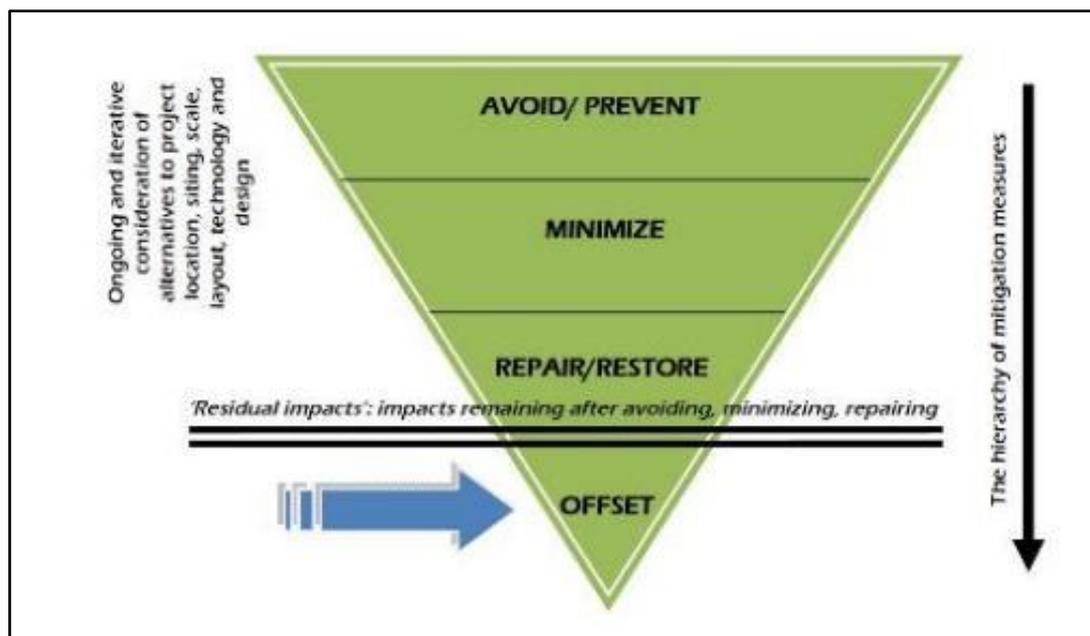


Figure 13: Schematic representation of the Mitigation Hierarchy

Despite the aridity of the area there is considerable indigenous biodiversity present. There is a diverse flora, some of which was observed although more would be present in the flowering season. While the area may not be as spectacular as the Namaqualand region to the west, the author has, in the months of January and February, personally seen the veld at the site with large patches of flowers in bloom and with dense grass growths. The extent of such conditions is closely related to the rainfall distributions. There are game animals such as Springbok and Gemsbok and numerous small mammal species including some of high biodiversity concern. As with the domestic stock, these animals were almost entirely restricted to pans. Even when conditions are wetter the pans would still be of importance to them.



Plate 9: Springbok seen in a pan

11.4 Identification of Impacts

The broad activities of the proposed prospecting survey, along with some finer detail and explanation are listed in Table 19 and listing of the impacts follows. Mitigatory measures are provided in Section 12.

The following potential impacts which could arise from the preliminary prospecting activities have been identified:

- *Construction of access roads and/or tracks to service the drilling sites.* In order to reach and operate the various drilling sites it will be necessary to establish a series of roads or tracks which may be used by vehicles and machines. These will originate from existing farm roads or tracks but will then enter areas of original (greenfields) veld in order to reach the identified drilling sites. It is possible that the routes could pass through watercourse or wetland sites and so be potentially damaging to aquatic systems. The principal concern will be that of establishing unnatural bare areas which could become prone to erosion of the soil at times of rainfall.
- *Establishment and operation of the drilling sites.* Each drilling site will consist of a drilling area which will hold the drilling rig as well as laydown areas for equipment, and stores. Nearby the drilling area will be a site camp which will form the residence for the workers while they are active at that site. The principal concern will be that of crushing of the vegetation and so establishing bare areas which could lead to erosion of the soil at times of rainfall.

Table 19: Preliminary exploration activities

Proposed Prospecting Activities	Implications for Preliminary Phase of Exploration	Site Activities
Desktop study	None	n/a
Remote sensing	None	n/a
Field mapping	None	n/a
Geological modelling and resource estimation	None	n/a
Geochemical survey	None in the early stages of prospecting	n/a
Geophysical survey	None in the early stages of prospecting	n/a
Trenching	None in the early stages of prospecting	n/a
Test Drilling	Size of a drilling site	25 m x 20 m
	Number of drilling sites	Not yet decided. Restricted to six in the initial phase but possibly 20 – 100 at a later stage
	Site camp at each drilling site. The camp will be moved to each drilling site	25 m x 20 m
	Infrastructure to be developed in the area	<ul style="list-style-type: none"> • Access roads. Use will be made of existing roads but tracks to individual drilling sites will be required. • Drilling rigs • Water supplies
	Nature of infrastructure	<ul style="list-style-type: none"> • In a greenfield area • Temporary
	Personnel resident on the property	Drill operators will live on the property at the drill sites.
	Hazardous materials or substances on site	<ul style="list-style-type: none"> • Petrol, diesel, and oils • No explosives

The activities at the sites could also lead to the production of a variety of wastes which may consist of broken drill parts or other scrap iron, rock material from the drill hole, domestic wastes such as food packaging and the like, waste water, and human wastes. All of these wastes could be residual for a long period of time due to the aridity of the area and there is a possibility that some may pose a threat to both livestock and to the indigenous fauna.

- *Spillage of hydrocarbon (fuels and oils).* The drilling activities will entail the use of a variety of transport vehicles as well as the actual drilling machinery. Spillage of fuels and oils could happen and, if the quantity is large enough, the spilled materials could percolate into either a pan or watercourse, or the soil where they might enter the groundwater. Hydrocarbons are highly toxic in the aquatic environment and could be transported for a considerable distance. Wild animals or domestic livestock could be affected when drinking from pans, dams, or a watercourse.
- *Damage to the hydrology of the area.* The hydrology of the area is based largely on rain water being collected in the endorheic pans in the east and then percolating into the soil where it can enter subterranean aquifers which transport the water westwards. Discussion with the landowners suggests that such aquifers, which are sufficiently developed to be tapped for agricultural purposes, are very limited in extent. In addition, they are very probably providing water for deep-rooted plants. While it is unlikely that only the six boreholes indicated will have any effect on the aquifers, it is possible that a larger number of boreholes, or other survey procedures, could have an impact on the hydrology and hence on agriculture and terrestrial biodiversity in the area.
- *Damage to the faunal biodiversity of the area.* The fauna of the area will be disturbed by the human presence and drilling activity. While this will not be of relevance to the more common species such as Springbok, other species and especially smaller burrowing species which will not move very freely due to either specialised habitat requirements or to territorial restrictions, could be affected. Activity near pans during the wet season could have significant impacts on the birds which utilise them.
- *Damage to the specialised vegetation associated with pans, dams, or watercourses.* Although the region has a very arid climate, there are some waterbodies which have a surrounding riparian vegetation. This vegetation provides habitat for a number of animal species but also includes plant species which are not found in the surrounding spaces. Although the plant species are unlikely to be listed as being threatened, they are relatively uncommon in the region and so should not be impacted on. It is possible that drilling activities, including establishment of roads or tracks, or the establishment of drill sites could impact on this vegetation type and so cause environmental harm.

11.5 Assessment of Impacts

Definitions of the terms used in the impact assessment are shown in Table 20.

The potential impacts arising from the construction of roads or tracks, and from the damage to hydrophilic vegetation are rated as being Low Significance prior to any implementation of mitigatory measures and as being Very Low Significance after mitigation. However, the impacts arising from establishment and operation of the drilling sites, and from possible contamination of aquatic features as a result of hydrocarbon spillage are rated as being of Medium Significance prior to mitigation. The reasons for the higher assessments arise from the fact that the impacts could either be spread over a large area, contaminate water supplies, or could persist for a longer time period. However, with mitigation these impacts can also be reduced to being of Low or Very Low Significance.

It is to be noted that the above impacts are assessed in relation to only the preliminary prospecting operation which is to be undertaken through drilling of just six test holes. Therefore, the usual consideration of impacts in the construction, operational, and decommissioning phases of an operation are not considered. In addition, later stages of prospecting, such as trenching or other activities which will have a greater effect on the ground surface and the biodiversity, have not been taken into account since their *modus operandi* remains unknown at present.

Table 20: Assessment of possible impacts arising from the prospecting activities

With/ Without Mitigation	Activity/Impact	Consequences of the Impact	Spatial extent	Severity / Magnitude	Duration	Resource Loss	Reversibility	Probability	Significance
Pre-mitigation	Construction of access roads and/or tracks to service the drilling sites.	In regard to aquatic systems and biodiversity in the area, the activity could lead to gullies or other erosion and to soil deposition which could cause sedimentation and also infilling of dams. Animal burrows will be crushed possibly either killing the animals or forcing them into the open where they could be exposed to predators.	2	3	3	4	3	0.4	6.0 Negative Low
Post-mitigation			1	2	1	2	1	0.2	1.4 Negative Very Low
Pre-mitigation	Establishment and operation of the drilling sites.	The establishment and operation of the drilling sites will require clearance of vegetation and so could lead to loss of biodiversity through either habitat destruction or through reduction of resources. In addition, there will be production of a variety of	2	5	3	4	1	0.8	12.0 Negative Medium
Post-mitigation			1	2	1	2	1	0.3	2.1 Negative Very Low

With/ Without Mitigation	Activity/Impact	Consequences of the Impact	Spatial extent	Severity / Magnitude	Duration	Resource Loss	Reversibility	Probability	Significance
		wastes including rock from the drill hole, broken machinery, and domestic and human wastes. It is possible that some of these could contain toxic substances. A risk of runaway fires is possible.							
Pre- mitigation	Contamination of the aquatic features by the spillage or leakage of hydrocarbons originating from the activities around the drilling rig, or from the site camp.	It is not known where the drilling sites will be established, but the associated site camp will be storing potentially hazardous goods such as fuel and oils. Such goods, if spilled could pose a contamination risk to the fauna in the wetland areas. Both domestic and wild animals could be affected through drinking the water.	2	5	3	3	3	0.7	11.2 Negative Medium
Post- mitigation			2	4	3	2	3	0.3	4.2 Negative Low

With/ Without Mitigation	Activity/Impact	Consequences of the Impact	Spatial extent	Severity / Magnitude	Duration	Resource Loss	Reversibility	Probability	Significance
Pre-mitigation	Damage to the specialised vegetation associated with pans, dams, or watercourses.	Some drilling sites may need to be placed in areas which are close to aquatic features. In such places there is a risk that the specialised hydrophilic vegetation could be damaged. Although the plant species are unlikely to be threatened, they are relatively uncommon in the region and so should not be impacted on.	2	3	3	4	3	0.3	4.5 Negative Low
Post-mitigation			2	2	3	3	1	0.2	2.2 Negative Very Low
Pre-mitigation	Damage to the hydrology of the area	Disturbance in the pan field could affect the water resources to the west. This could affect the availability of water for some plant species,	2	3	3	4	1	0.2	2.6 Negative Very Low
Post-mitigation			2	2	1	3	1	0.1	0.9 Negative Very Low
Pre-mitigation	Damage to the faunal biodiversity of the area	Disturbance due to human presence and noise and vehicles. Destruction of habitat of burrowing animals and prevention of birds using the pans when water is present.	2	5	1	4	3	0.5	7.5 Negative Medium
Post-mitigation			1	3	1	3	1	0.3	2.7 Negative Very Low

12. DISCUSSION OF MITIGATORY AND MANAGEMENT MEASURES

Although the prospecting operation which is currently planned is very limited in its scope and duration, it will still be necessary for some mitigatory measures to be set in place in order to reduce the impacts and risks which have been foreseen. These measures are divided into two categories which are:

- Measures to be applied in relation to all six borehole sites
- Measures which are site specific to particular boreholes

It is essential that the drilling contractor(s) be made aware of these measures prior to the start of any work and a copy of the measures must be kept on each site at all times.

12.1 Measures to Applied in Relation to all Boreholes

The following are to be applied at all sites:

- i. Ideally no drilling should be undertaken at times when rain has fallen and the pans are holding water. This measure is recommended to both minimise the possibility of contamination of the surface and ground water, and to minimise disturbance of the important bird populations around the pans.
- ii. The access to the site must be planned together with the relevant land owner and be approved by the land owner.
- iii. The land owner may stop operations at any site if the conditions of the approval are ignored or otherwise bypassed.
- iv. Access roads and tracks must make use as far as is possible of existing farm roads and tracks. Ideally, the routes will be approved and documented by an Environmental Control Officer (ECO).
- v. To the greatest possible extent, the access roads and tracks must avoid passing through watercourses or pans or other environmentally sensitive areas. Such areas could include known home ranges of species of especial biodiversity conservation concern.
- vi. Preparation of the drilling site must avoid damage to the vegetation as far as is possible.
- vii. The size of the drilling sites must be restricted to a practical minimum and must be approved by the land owner and ECO. An extent of 20 m x 25 m is suggested but may be changed after discussion between the drilling contractor and the land owner. Once decided, the boundary of the site must be demarcated with a temporary fence which may consist of poles and hazard tape, plastic mesh, or shade cloth.
- viii. If needed, a lay-down area for pipes may be established close by the drilling site but its boundary must also be demarcated.

- ix. Since the drill operators may live on the site while working there, provision must be made for ablution and toilet facilities. Grey water may be disposed of on site but chemical toilets must be provided and be properly serviced. Pit latrines may not be used.
- x. Provision must be made for proper retention of all garbage, domestic wastes, and drilling wastes. Bins with lids or skips must be provided and these must be emptied at an approved disposal site. No refuse of any sort may be buried or burned at the site.
- xi. Fuels and oils must be held in leak-free containers and must be kept on drip trays when not in use.
- xii. Waste oils and the like, including items such as used oil filters and oil-soaked paper or rags, must be retained in sealed containers and be kept on drip trays.
- xiii. Vehicles and machines must be refuelled or serviced over drip trays. Any soil contaminated by fuel or oil spills must be collected and be held in a suitable sealed container prior to removal to an approved disposal site. A hazmat kit of appropriate capacity must be kept on the site at all times.
- xiv. On completion of drilling operations at each site, all materials, including wastes or litter, must be removed for re-use at another site or for disposal as may be relevant. The site must be cleaned and tidied and its condition must be approved by the land owner before the contractor may leave the site.
- xv. Any roads or tracks that were prepared or used for access to the site must be returned to their prior state and their condition must be approved by the land owner.

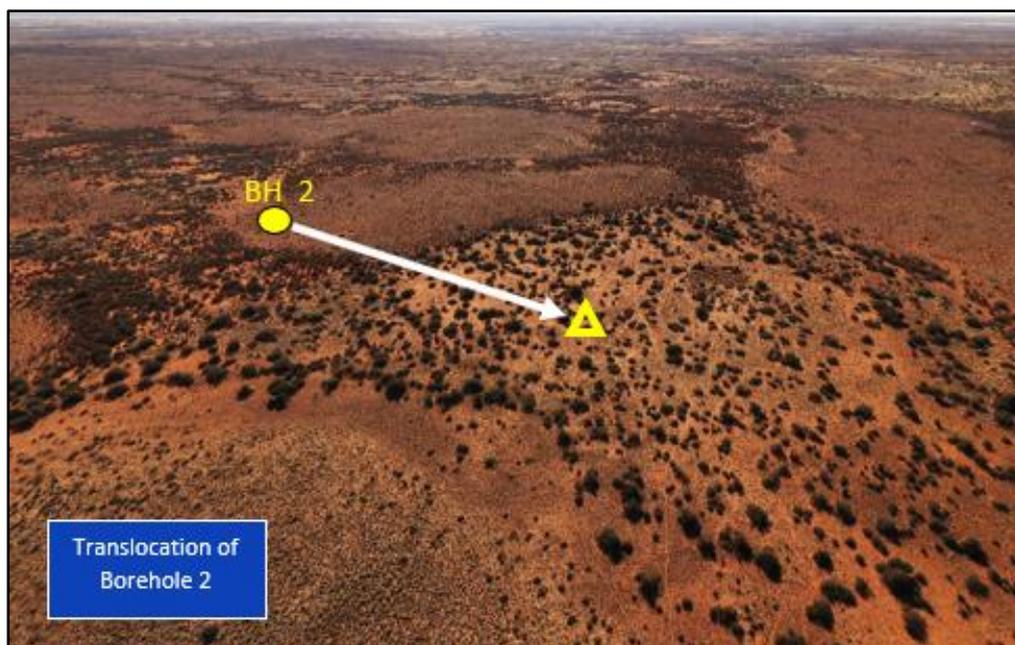
12.2 Measures to Applied at Particular Borehole Sites

Reference is made to Figure 11 for the borehole site numbers. It is to be noted that the sites of Boreholes 1, 4, and 5 have not been visited and checked on the ground, and so the recommendations put forward are made on the basis of only Google Earth imagery and Google Earth ground elevation profiles.

- Borehole 1. This site appears to be on a dividing ridge between two watercourses. The closest such channel is approximately 45 m away from the site. It is therefore suggested that the site be moved to a location approximately 175 m north-westward to a point where it will be at least 60m from any watercourse. The new site remains within the same lithological unit.



- Boreholes 4 and 5. These boreholes may remain in their present locations unless an actual site visit and inspection suggests otherwise
- Borehole 2. Bore hole 2 is located at the site indicated below. Since it is in a pan area it is recommended that it be moved approximately 100 m south-eastwards to where it will be away from any pan as shown below. The new site remains within the same lithological unit.



- Borehole 3. Borehole 3 is located in a flat stony plain area to the west of two small dune cordons. It is away from any pan or watercourse and so may remain where its position has been indicated.
- Borehole 6. Borehole 6 is located on a low ridge in a grassy area which forms the divide between two pans. It is located more than 100 m away from either pan and so may remain in the position which has been indicated.

13. MONITORING

It is not known for how long the drilling rig will remain at each site but it is recommended that an ECO should visit each at least twice during its operation. Ideally one such visit will be done when the site is first being established since that will also allow opportunity for the person to also check on the site which has just been left.

14. CONCLUSION

14.1 Background

African Exploration Mining and Finance Corporation Soc Ltd is proposing to undertake exploratory prospecting on Portions 6 and 7 of the property Gams 367 located in Local Municipality NCDMA08 of the Siyanda District Municipality in Northern Cape Province. See Figures 2 and 3. As a part of the application for prospecting rights, the company intends to drill six exploratory boreholes, one of which will be located in each of the major geological formations on the properties. However, prior to doing so, it is necessary to undertake certain environmental studies. Amongst these studies are an assessment of any wetlands and watercourses in the area, and an assessment of the biodiversity. This document reports on the biodiversity and a second report (JGA, 2023) covers the aquatic systems.

16.2 Study Procedures and Findings

The project area was visited over the period 3 to 6 July 2023. Only the three sites on Portion 7 were accessible and could be visited. However, a detailed desktop study was undertaken to get information on the area and, during the course of the site visit, it was possible to meet with some land owners and to get further information on the general area from them.

It was found that the primary landuse in the area is stock farming with sheep and goats. The animals are either grazed on open veld or are held in feedlot pens. Water for the animals is a very scarce resource and is usually obtained from boreholes except for the rare occasions when there is some rainfall which can temporarily fill pans or dams. At such times the area may attract large numbers of birds which are assumed to come in for feeding and, possibly, breeding reasons. Farming may be supplemented with a limited amount of tourism which is usually in the form of hunting.

In regard to aquatic systems and hence the biodiversity, the project area is heavily dependent on a pan field in the east. The pans trap rain water and feed it to the ground water system from where it may be extracted by boreholes located further west. Surface flows are very rare but there is drainage into the Doringdam Spruit. The flows can be substantial for short periods.

16.3 Impacts

Borehole sites 2, 3, and 6 are all located in the vicinity of pans and so have the possibility of being able to contaminate the ground water should there be any spillage of hydrocarbons (fuels and oils) or use of drilling chemicals, although the use of such chemicals is not planned at present.

The foreseen possible impacts from the borehole drilling are mostly Medium or Low and can be easily mitigated through careful measures taken at the time. See Table 20. Leakage of hydrocarbons in the form of fuels and oils is the possible impact and risk with the highest score but is one that can easily be avoided through careful management procedures which are common in the construction industry. Mitigatory measures are provided for this and all other impacts. See Section 12.

16.4 Summation

The proposed drilling of six test boreholes will probably have little long-term effect on the aquatic and terrestrial biodiversity in the project area provided that the recommended mitigatory measures are adhered to. However, this statement is made subject to the following conditions:

- The area around the three borehole sites on Portion 6 of Gams 367 has not been visited and so comment is made only on the basis of Google Earth imagery, and on an assumption that conditions at the sites are likely to be similar to those on Portion 7 of Gams 367.
- The assessments are made with reference to only the six indicated boreholes. Should more boreholes be proposed, or further forms of prospecting be planned, then further environmental assessment must be undertaken. The extent of such assessment will be determined by the new activities proposed.

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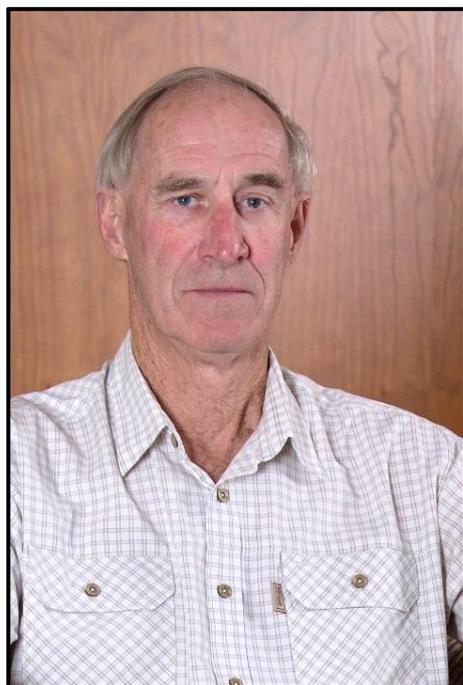
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ANNEXURE A – CURRICULUM VITAE: D.J. ALLETSON

DACRE JAMES ALLETSON



Profession	ENVIRONMENTAL SCIENTIST
Position in Firm	Wetland and Biodiversity Specialist
Area of Specialisation	PRELIMINARY ENVIRONMENTAL ASSESSMENT, TERRESTRIAL FAUNA AND FLORA SURVEYS, AQUATIC BIODIVERSITY SURVEYS, WETLAND DELINEATION AND ASSESSMENT, ENVIRONMENTAL CONTROL OFFICER DUTIES; ENVIRONMENTAL MANAGEMENT PROGRAMMES, ENVIRONMENTAL IMPACT ASSESSMENTS, SCOPING REPORTS
Qualifications	BSc, BSc (Hons)
Years of Experience	50
Years with Firm	11

SUMMARY OF EXPERIENCE

Mr Alletson has long experience in the fields of conservation and management of the natural environment and has specialised in aquatic species and systems. After graduating he was employed at the Oceanographic Research Institute in Durban where he worked on a number of projects in both the estuarine and marine environments. In 1975 he joined to the Natal Parks Board where he served for 21 years in a number of positions. His activities in this time included research and management of certain fish species, management of a trout hatchery, provision of an extension service relating to wetlands and rivers, and participation in management of game and nature reserves, including drafting of management plans. From 1984 onwards he served as the Board’s River and wetland specialist ecologist and was involved in wetland-related research and management activities.

In 1997 he formed Alletson Ecologicals, an environmental consultancy and has undertaken a wide variety of environmental investigation and monitoring programmes. Amongst these are some 100 Environmental Impact Assessments which ranged from developments such as timber planting permits, gravel pits, and irrigation dams, through to coal mines, large state dams, housing schemes, private property developments, and pipelines.

Mr Alletson has also taken part in regional planning studies for the Town and Regional Planning Commission and has contributed toward integrated management plans for conservation areas and projects.

Since 2012 Mr Alletson has worked with JG Afrika (previously Jeffares & Green (Pty) Ltd) and has, amongst other activities undertaken numerous wetland delineations and assessments, and also aquatic surveys for river health assessments and Water Use Licence applications. He also undertakes

terrestrial biodiversity surveys as components of impact assessments, planning projects, and monitoring programmes.

EDUCATION

Date (from – to):	1966-1969
Degree/Institution:	BSc – Biological Sciences (University of Natal – now University of KwaZulu-Natal)
Date (from – to):	1972
Degree/Institution:	B.Sc Honours – Zoology (Rhodes University)
Other Training:	<p>1974: Basic Business Management - Durban Technical College</p> <p>1983: Public Speaking and Visual Aid Preparation - Natal Parks Board.</p> <p>1985: Grassland Management and Assessment - Natal Parks Board.</p> <p>1998: SASS Biomonitoring Procedure for Assessment of River Health - Umgeni Water.</p> <p>1970: Small Craft Skipper’s Certificate, and Port of Durban Operators Certificate.</p> <p>2015: Wetland Buffer Determination Course – Water Research Commission.</p> <p>2018: Biodiversity Offset Training Course – South African National Biodiversity Institute.</p> <p>2020 – 2023: Webinars from IAIAAsa, SACNASP, and various scientific specialists</p>

EMPLOYMENT RECORD

Date (from – to)	1966 - 1968
Location	Durban, South Africa
Employer	Oceanographic Research Institute
Position(s)	Student Assistant/Intern during university vacations
Description	Assistant on marine and estuarine research programmes.
Date (from – to)	1969 - 1971
Location	Durban, South Africa
Employer	Oceanographic Research Institute
Position(s)	Research Technician
Description	Provision of technical assistance on marine and estuarine research programmes. Also took part in collection of live specimens for display in the Durban Oceanarium.

Date (from – to)	1972
Location	Rhodes University, Grahamstown, South Africa
Position(s)	Student
Description	BSc Honours
Date (from – to)	1973 - 1975
Location	Durban, South Africa
Employer	Oceanographic Research Institute
Position(s)	Research Officer
Description	Conducted research on commercially exploited deep sea crustaceans and assisted with other marine research programmes.
Date (from – to)	1975 – 1996
Location	KwaZulu-Natal, South Africa
Employer	Natal Parks Board
Position(s)	Research Officer
Description	Research and management relating to conservation of rivers, wetlands, and aquatic species. Contribution relevant inputs to an extension programme for landowners, and to management of aquatic systems in game and nature reserves. Also undertook conservation planning and developed the KwaZulu-Natal Environmental Atlas.
Date (from – to)	1997 – present
Location	Pietermaritzburg, KwaZulu-Natal, South Africa
Employer	Alletson Ecologicals
Position(s)	Environmental Scientist
Description	The consultancy has undertaken many environmental consulting projects for various clients, and provides almost full time biodiversity and wetland related service to JG Afrika (Pty) Ltd

SPECIFIC EXPERIENCE

Name of Project:	Assessment of the Terrestrial Biodiversity at the site of the proposed Umzimkhulu Bulk Water Supply Scheme near Underberg, Kwazulu-Natal
Client:	(Final Client) Umgeni Water, Pietermaritzburg
Project duration/date:	2022 - 2023
Job Title and Duties:	Terrestrial Biodiversity Specialist. Undertook terrestrial faunal and floral surveys in relation to the construction of a dam on the Umzimkhulu River, and the associated

	water treatment works and bulk potable water pipeline. Study included impact assessments and management/mitigation recommendations.
Name of Project:	Assessment of the aquatic ecosystems at the site of the proposed Umzimkhulu Bulk Water Supply Scheme near Underberg, Kwazulu-Natal
Client:	(Final Client) Umgeni Water, Pietermaritzburg
Project duration/date:	2022 - 2023
Job Title and Duties:	<p>Aquatic Specialist.</p> <p>Undertook aquatic faunal and floral surveys in relation to the construction of a dam on the Umzimkhulu River, and the associated water treatment works and bulk potable water pipeline. Study included impact assessments and management/mitigation recommendations. The Department of Water Affairs and Sanitation Risk Assessment Matrix was included.</p>
Name of Project:	Assessment of the terrestrial biodiversity at the site of a proposed new dam on the Farm Glen Locky Near Franklin, Kwazulu-Natal
Client:	Memeza Farming (Pty) Ltd, Franklin
Project duration/date:	2022 - 2023
Job Title and Duties:	<p>Terrestrial Biodiversity Specialist.</p> <p>Undertook terrestrial faunal and floral surveys in relation to the construction of a dam on the Mzintlava River. Study included specialist species of conservation concern assessments, impact assessments, and management/mitigation recommendations.</p>
Name of Project:	Assessment Of The Wetlands At The Site Of A Proposed New Dam On The Farm Glen Locky Near Franklin, Kwazulu-Natal
Client:	Memeza Farming (Pty) Ltd, Franklin
Project duration/date:	2022 - 2023
Job Title and Duties:	Aquatic Specialist.

	Undertook aquatic faunal and floral surveys in relation to the construction of a dam on the Mzintlava River. Study included impact assessments and management/mitigation recommendations. The Department of Water Affairs and Sanitation Risk Assessment matrix was included.
Name of Project:	Desktop wetland screening and classification assessment on various properties within the Umdloti, Tongaat and Umhlali Catchment Areas for suitability to meet offsite wetland mitigation obligations for Dube Tradezone 2, Agrizone 2, Support Zone 2 And Tradezone 3
Client:	Dube TradePort Corporation
Project duration/date:	2020 to 2021 Ongoing
Job Title and Duties:	Wetland and Biodiversity Specialist Screening of three wetland sites for possible use in offsetting wetland loss at the Dube TradePort Complex and then putting forward selection recommendations.
Name of Project:	Assessment of the wetlands in the vicinity of the Lafarge Cement Factory In Lichtenburg together with management recommendations
Client:	Greenmined Environmental
Project duration/date:	January April 2021
Job Title and Duties:	Wetland and Biodiversity Specialist A section of wetland that has been infilled is to be rehabilitated or the damage repaired. The findings of a survey and management recommendations are put forward.
Name of Project:	Assessment of two wetlands in the vicinity of the Lafarge Tswana Limestone Mine near Bodibe in relation to a Water Use Licence Application
Client:	Greenmined Environmental
Project duration/date:	January April 2021
Job Title and Duties:	Wetland and Biodiversity Specialist

	The wetlands in and around the mine, including a small river, were assessed and modelled. The findings of the survey included management recommendations which were partly based on the DWS Risk Assessment Matrix.
Name of Project:	Findings of an aquatic survey done in regard to the upgrading of a rural water supply scheme on the Ibisi River, KwaZulu-Natal
Client:	SiVEST SA (Pty) Ltd
Project duration/date:	April - May 2021
Job Title and Duties:	Wetland Specialist Undertaking the wetland specialist study in support of the application for environmental authorisation for a water scheme upgrade.
Name of Project:	Consideration of the possible risks to wetlands and watercourses along the routes of the bulk pipelines of the proposed Gunjana Community Water Scheme upgrade
Client:	JG Afrika (Pty) Ltd
Project duration/date:	June to July 2020
Job Title and Duties:	Wetland Specialist Construction and upgrade of a rural potable water scheme near Pomeroy, KwaZulu-Natal, is planned. In terms of the National Water Act, 1998 (Act No. 36 of 1998) attention must be given to wetlands and watercourses as a Water Use Licence may be necessary. This study assesses the watercourse crossings and the risks posed to the aquatic systems. It then puts forward a series of management recommendations.
Name of Project:	Consideration of the possible risks to wetlands and watercourses as a result of upgrading two sections of Road P419 Near Bulwer, Kwazulu-Natal
Client:	Ilifa Africa Engineers (Pty) Ltd
Project duration/date:	March – April 2020
Job Title and Duties:	Wetland Specialist

	<p>A total of 10 km of road which was to be upgraded from a gravel surface to a tar surface were surveyed. Some 19 watercourse crossings were found although most were small seasonal channels. No wetlands were crossed but, in keeping with the National Water Act (Act No. 36 of 1998), wetlands within 500 m of the site were examined and one required management recommendations for the road construction phase.</p>
Name of Project:	Southport Housing Project Vegetation and Estuarine Survey
Client:	Private landowner
Project duration/date:	2019
Job Title and Duties:	<p>Wetland and Vegetation Specialist.</p> <p>The vegetation at the site of a proposed housing project, as well as a nearby stream and the Umhlangamkulu River Estuary were surveyed and assessed. Management recommendations were put forward.</p>
Name of Project:	Assessment of the terrestrial biodiversity in relation to the upgrade of a treatment works and a new potable water pipeline near Moyeni/Zwelisha, Kwazulu-Natal
Client:	JG Afrika (Pty) Ltd
Project duration/date:	April 2021 - ongoing
Job Title and Duties:	<p>Biodiversity and Wetland Specialist</p> <p>The terrestrial and aquatic biodiversity in the vicinity of a water treatment works and along a new bulk main pipeline have been assessed and management recommendations are put forward.</p>
Name of Project:	Road R61 Upgrade
Client:	SANRAL SOC
Project duration/date:	2019
Job Title and Duties:	<p>Wetland and Biodiversity Specialist.</p> <p>The rivers, wetlands, and vegetation along a 24 km section of Road R61 were surveyed and assessed together with a vegetation specialist. Especial attention was given to the larger rivers as their nearby estuaries</p>

	are of high importance. Management recommendations were put forward.
Name of Project:	Widening of the N2 Freeway between the Isipingo Interchange and the Edwin Swales Interchange
Client:	SANRAL SOC
Project duration/date:	2020
Job Title and Duties:	<p>Wetland and Biodiversity Specialist.</p> <p>The rivers, wetlands, and vegetation along a 12 km section of National Road N2 (Section 25), including the Higginson Highway Interchange, were surveyed and assessed. Especial attention was given to watercourse crossings and to the Umhlatuzana and Mbilo Rivers as they are of high importance since they discharge into Durban Bay. Management recommendations were put forward.</p>
Name of Project:	Assessment of the possible risks to Wetlands and Watercourses as a result of the construction of the Greater Kilimon Water Scheme near Coleford, Kwazulu-Natal
Client:	iMvula Engineers
Project duration/date:	December 2019 – April 2020
Job Title and Duties:	<p>Biodiversity, Wetland and River Specialist.</p> <p>The routes of some 82 km of pipelines as well as the sites of 11 reservoirs, a water abstraction works, and a water treatment works were assessed in regard to biodiversity, wetlands and watercourses. The work was done for both EIA and Water Use Licence purposes. The report included management recommendations as well as risk assessment.</p>
Name of Project:	Consideration of Impacts, and Determination of a Possible Offset Area, in Relation to the Proposed Sokhulu Agricultural Project
Client:	Department of Rural Development and Land Affairs
Project duration/date:	2018
Job Title and Duties:	Wetland Specialist.

	<p>Surveys of wetlands on the Mfolozi/Umsunduze rivers floodplain were undertaken in relation to rehabilitation of an old agricultural project. Management recommendations were prepared and wetlands offsets were proposed.</p>
Name of Project:	Biodiversity, River and Wetland Assessments associated with the proposed upgrade of housing and services in Ngwelezane, KwaZulu-Natal
Client:	City of Mhlatuze
Project duration/date:	2018
Job Title and Duties:	<p>Wetland and Biodiversity Specialist.</p> <p>Surveys were done on the wetlands and river in the vicinity of Ngwelezane in relation to the provision of new housing and municipal infrastructure.</p>
Name of Project:	Biodiversity and Wetland Survey for a Bulk Water Supply Upgrade for the Estcourt Industrial Area
Client:	uThukela District Municipality
Project duration/date:	2017 - 2018
Job Title and Duties:	<p>Wetland and Biodiversity Specialist.</p> <p>Conducted surveys along the routes of several pipelines. The wetlands were assessed, and management recommendations were put forward.</p>
Name of Project:	Wetlands Search and Delineation Along the Route of a Proposed New Bulk Raw Water Supply Pipeline from Spioenkop Dam to Ladysmith Water Treatment Works
Client:	uThukela District Municipality
Project duration/date:	2015
Job Title and Duties:	<p>Wetland Specialist.</p> <p>Searches for wetlands along the proposed pipeline route were undertaken and the systems found were delineated and assessed. Terrestrial biodiversity surveys were also undertaken at the same time.</p>

Name of Project:	Biodiversity Assessment – Proposed New Durban Dig-out Container Port
Client:	Transnet SOE
Project duration/date:	2012 - 2013
Job Title and Duties:	Survey Team Leader. Assembled a team of biodiversity specialist to undertake surveys of the terrestrial biodiversity (mammals, birds, reptiles, amphibians, vegetation) and wetland biodiversity at the site of the old Durban Airport in relation to the proposed excavation of a new container shipping terminal. Also undertook wetland and biodiversity surveys and

ANNEXURE B – STATEMENT OF INDEPENDENCE: D.J. ALLETSON

I, Dacre James Alletson as the appointed independent specialist, in terms of the 2014 EIA Regulations, hereby declare that I:

- act as the independent specialist in this application;
- perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- 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;
- declare that there are no circumstances that may compromise my objectivity in performing such work;
- have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- will comply with the Act, Regulations and all other applicable legislation;
- have no, and will not engage in, conflicting interests in the undertaking of the activity;
- have no vested interest in the proposed activity proceeding;
- undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- all the particulars furnished by me in this specialist input/study are true and correct; and
- realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.



Signature of specialist:

Name of specialist:

D.J. Alletson

Date:

15 July 2023

ANNEXURE C – SCHEMATIC SHOWING SIGMOIDAL DEVELOPMENT OF AN IMPACT

The figure below illustrates the non-straight linear fashion in which an impact develops in response to an increasing activity. After a slow starting phase, the rate of impact will increase when a tipping point or region is passed. An interim phase of rapid increase in impact then follows. However, the impact rate will decrease again once a further tipping point is reached. Increased activity beyond this point results in progressively slower increase in impact but ultimately a point of total loss of the affected will still be attained if the activity continues to increase.

